ESTIMATING THE VALUE OF STATISTICAL LIFE AND EVALUATING QUALITY OF LIFE OUTCOMES AMONG MOTORCYCLE CRASH SURVIVORS AT SELECTED PUBLIC HEALTH PROVIDERS

SHAMSINAR BINTI IBRAHIM

UNIVERSITI KEBANGSAAN MALAYSIA

UNIVERSITI KEBANGSAAN MALAYSIA *The National University of Malaysia*	UKM-SPKPPP-PT(PdP)-05-AK04-BO07	No. Semakan: 02	Tarikh Kuat Kuasa: 27/01/2026
	BORANG DAN SENARAI SEMAK PENYERAHAN TESIS/DISERTASI SELEPAS PEMBETULAN *FORM AND CHECKLIST OF AMENDED THESIS/DISSERTATION SUBMISSION*		

F. KELULUSAN DEKAN/PENGARAH / *APPROVAL FROM DEAN/DIRECTOR*

Tandatangan:
Signature

Tarikh:
Date

26/5/2026

Nama dan Cap Rasmi:
Name and Official Stamp

PROFESOR DATO' DR MARINA MAT BAKI
MD (UKM), MS ORL-HNS (UKM), PhD (UCL)
Dekan Fakulti Perubatan
Pakar Perunding Kanan ORL-HNS
Universiti Kebangsaan Malaysia

G. PERAKUAN TESIS/ DISERTASI SARJANA / DOKTOR FALSAFAH (*CERTIFICATION OF MASTER'S / DOCTORAL THESIS / DISSERTATION*)

Nama penuh pengarang (*Author's Full Name*)	Shamsinar Ibrahim		
No. Pendaftaran Pelajar (Student's Registration No.)	P86534	Sesi Akademik (*Academic Session*)	SEM 1 2017/2018
Tajuk Tesis / Disertasi (*Thesis / Dissertation Title*)	Estimating the Value of Statistical Life and Evaluating Quality Of Life Outcomes among Motorcycle Accident Survivors at Selected Public Health Providers		

Semua tesis/disertasi dan penerbitan berkaitan hasil penyelidikan pelajar adalah tertakluk kepada Dasar Harta Intelek Universiti Kebangsaan Malaysia.
All theses/ dissertations and publications relating to the research work of a student are subject to the Intellectual Property Policy of Universiti Kebangsaan Malaysia.

Saya mengaku bahawa tahap akses tesis/disertasi ini sebagai (*Tandakan ✓ dalam kotak bagi maklumat yang berkaitan; tandakan satu (1) kotak di bawah sahaja):
I hereby declare the level of access for this thesis/dissertation as follows (tick ✓ the relevant box below; tick only one option).

Pilihan Tahap Akses *Access Level Selection*		Tafsiran Tahap Akses Tesis/Disertasi *Definition of Thesis/Dissertation Access Level*
☐	**RAHSIA (*CONFIDENTIAL*)**	Mengandungi maklumat rahsia sepertimana yang diperuntukan bawah Akta Rahsia Rasmi 1972. *Contains classified information as stipulated under the Official Secrets Act 1972.*
☐	**TERHAD (*RESTRICTED*)**	Mengandungi maklumat yang hanya boleh diakses oleh pihak yang mempunyai kebenaran atau keperluan tertentu untuk mengetahuinya yang ditentukan oleh organisasi/ badan di mana penyelidikan dijalankan. *Contains information that may only be accessed by parties with specific authorization*

		or a defined need to know, as determined by the organization or body where the research is conducted.
☑	**AKSES TERBUKA** ***(OPEN ACCESS)***	Tesis/disertasi versi akhir dalam format PDF yang boleh diakses secara percuma secara dalam talian dan bebas dari isu hak cipta dan pelesenan *The final version of the thesis/dissertation in PDF format that is freely accessible online and free from copyright and licensing issues.* Kementerian Pendidikan Tinggi melalui surat bertarikh 27 Mac 2025 memutuskan bahawa kebenaran akses tesis / disertasi dalam borang serahan akses terbuka ditentukan oleh penyelia (bukan pelajar). *The Ministry of Higher Education, through a letter dated 27 March 2025, has decided that permission for thesis / dissertation access in the open access submission form shall be determined by the supervisor (not the student).*
☐	**EMBARGO**	Tempoh masa di mana akses kepada tesis/disertasi disekat (ditutup) selama dua (2) tahun atas sebab-sebab tertentu sebagai contoh kerahsiaan atau hak cipta. Tesis/disertasi akan berstatus akses terbuka selepas tamat tempoh *embargo.* *The period during which access to the thesis/dissertation is restricted for two (2) years due to specific reasons, such as confidentiality or copyright. The thesis/dissertation will be granted open-access status upon the expiry of the embargo period.*

PENGESAHAN PELAJAR *(STUDENT VERIFICATION)*	**PENGESAHAN PENYELIA *(SUPERVISOR VERIFICATION)***
TANDATANGAN PELAJAR ***(STUDENT'S SIGNATURE)***	**TANDATANGAN PENYELIA / PENGERUSI JK SISWAZAH** ***(SUPERVISOR'S / CHAIRPERSON SUPERVISION COMMITTEE SIGNATURE)***
Nama Pelajar *(Student name)*: Shamsinar Ibrahim No. Pendaftaran Pelajar *(Student's Registration No.)* P86534	Nama Penyelia / Pengerusi JK Siswazah *(Supervisor's / Chairperson Supervision Committee Name)* PROFESSOR DR. SHARIFA EZAT BT WAN PUTEH Dis (UiTm), MD (UKM), MMC NU 34033) PhD (UNU-IIGH, UKM) Hospital & Health Management, Health Economics Community Health Consultant Department of Community Health Faculty of Medical UKM Medical Centre
Tarikh: 10-5-2026 *(Date)*	Tarikh: 22/5/2026 *(Date)*

ESTIMATING THE VALUE OF STATISTICAL LIFE AND EVALUATING QUALITY OF LIFE OUTCOMES AMONG MOTORCYCLE CRASH SURVIVORS AT SELECTED PUBLIC HEALTH PROVIDERS

SHAMSINAR BINTI IBRAHIM

THESIS SUBMITTED IN FULFILMENT FOR THE DEGREE OF DOCTOR OF PHILOSOPHY (COMMUNITY HEALTH)

FACULTY MEDICINE
UNIVERSITI KEBANGSAAN MALAYSIA
KUALA LUMPUR

2026

ANGGARAN NILAI KEHIDUPAN STATISTIK DAN PENILAIAN KUALITI HIDUP DALAM KALANGAN MANGSA KEMALANGAN MOTOSIKAL DI BEBERAPA PENYEDIA PERKHIDMATAN KESIHATAN AWAM TERPILIH

SHAMSINAR BINTI IBRAHIM

TESIS YANG DIKEMUKAKAN UNTUK MEMPEROLEH IJAZAH DOKTOR FALSAFAH (KESIHATAN MASYARAKAT)

FAKULTI PERUBATAN
UNIVERSITI KEBANGSAAN MALAYSIA
KUALA LUMPUR

2026

DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged.

25 May 2026

SHAMSINAR IBRAHIM
P86534

ACKNOWLEDGMENT

Alhamdulilah! I would like to thank Allah SWT for His mercy and guidance, without which this journey would not have happened. To begin with, I would like to offer my significant appreciation to my primary supervisor, Professor Dr. Sharifa Ezat, who has been extremely helpful and supportive and provided me with limitless advice along with guidance that immensely changed me in the whole process of postgraduate learning as a student. Her guidance has played an important role in providing direction to this research and its success.

I want to extend my sincere gratitude to my co-supervisors, Associate Professor Dr. Azimatunnoor Aizuddin and Associate Professor Dr. Hanizah Yusoff, for supporting me, giving constructive advice, and encouraging me throughout the entire period of conducting this study and the preparation of this thesis. Understanding and patience have been very important in successfully accomplishing this task.

I would like to take this opportunity to sincerely thank the collaborators at Hospital Sultanah Bahiyah, Alor Setar, Dr Hazwanie and Puan Azniza, and Hospital Sungai Buloh, Dr Syah Jahan and Dr Rosman, who provided me with important direction and help during the data collection process. I would also like to thank Dr. Azad Abd Rahman and Puan Normala of MIROS, who have actively assisted in formulating the Contingent Valuation (CV) questionnaire, and Puan Atiqah, who helped in the AIS coding process. I would like to express my great gratitude to all the people who took part in the research voluntarily and devoted their time and experience to making this research possible.

Thanks to my beloved family who have always phenomenally supported me. First of all, thanks to my mom, Puan Sharipah Mohamed, who always loved and supported me unconditionally, along with my late father, Al-Marhum Ibrahim Mohamad, with his encouraging words and expression of belief in me, he still inspires me.

Since I am working full-time as I undertake this PhD journey, I would like to acknowledge the courtesy and encouragement of Puan Hanani Hussin, my department coordinator, and Cik Azlyantiny Mohammad, who helped to organize my academic timetable. I would also like to express my gratitude to Puan Norafiza Mohd Hardi, who helped me with Excel formulations involved in injury cost calculations and creative innovation on presentation materials. Lastly, I would like to mention my special thanks to Hasyimah Razali, Siti Nurul Akma Ahmad, and NorAzmaniza Azizam due to their unending emotional support, sound advice, and help along the way.

Most importantly, I am grateful to Allah SWT since he has blessed me all over again. Without His guidance and the support of all these individuals, this PhD journey would not have been possible. May Allah reward each of you abundantly and ease your paths ahead.

ABSTRAK

Kecederaan kemalangan jalan raya (RTI) kekal sebagai isu kesihatan awam yang kritikal, terutamanya dalam penilaian kualiti hidup (QoL) dan anggaran ekonomi mangsa yang terselamat. Kajian keratan rentas ini menganggar Nilai Statistik Kehidupan (VOSL) melalui kesanggupan membayar (WTP) setahun, bagi pengurangan risiko kematian dan kecederaan, program keselamatan jalan raya kebangsaan, serta rawatan perubatan (kecemasan dan susulan) di kalangan mangsa kemalangan motosikal. Kajian ini turut menilai QoL satu bulan selepas discaj. Data dikumpul antara Ogos 2022 - September 2023 di Jabatan Kecemasan Hospital Sultanah Bahiyah dan Hospital Sungai Buloh. Kaedah Penilaian Kontinjen (CVM) digunakan untuk menganggarkan VOSL berdasarkan nilai WTP, manakala instrumen Revised Trauma Quality of Life (RT-QoL) digunakan untuk menilai QoL. Statistik deskriptif, Model Linear Umum Gamma (GLM), dan regresi logistik binari (BLR) digunakan dalam analisis data. Daripada 546 responden, 81% merupakan pembonceng dan 364 adalah lelaki. Min WTP setahun ialah RM28 bagi pengurangan risiko kematian, RM53 bagi risiko kecederaan, RM36 bagi program keselamatan, RM64 bagi rawatan kecemasan, dan RM59 bagi rawatan susulan. Kos kematian dianggarkan RM94,058 - RM101,294, manakala kecederaan, RM24,495 - RM28,850. WTP program keselamatan jalan raya dinilai RM725,333 - RM768,000. Faktor-faktor yang mempengaruhi WTP bagi pengurangan risiko kematian termasuk tahap pendidikan, pendapatan, perlindungan insurans dan tujuan perjalanan; manakala WTP bagi risiko kecederaan dipengaruhi oleh umur, pendidikan, pekerjaan, insurans, tujuan perjalanan dan sejarah kemalangan. WTP untuk program keselamatan pula turut dipengaruhi oleh faktor-faktor serupa seperti risiko kecedeeraan. WTP untuk rawatan kecemasan lebih tinggi dalam kalangan individu muda, berpendidikan tinggi, pekerja mahir sederhana dan lebih rendah, kumpulan B40, mencerminkan jurang akses terhadap penjagaan kesihatan. WTP bagi rawatan susulan pula dipengaruhi oleh pekerjaan, pendapatan, jenis kecederaan, insurans, status lesen, dan tujuan perjalanan. QoL dipengaruhi oleh pendidikan, etnik dan pekerjaan bagi ketiga-tiga domain: emosi, fungsi dan fizikal. QoL emosi menurun dalam kalangan berpendapatan rendah, tiada lesen atau insurans, serta yang mengalami patah tulang (dengan 38.3% kurang kebarangkalian untuk mencapai kesejahteraan emosi tinggi). QoL fungsi berkait dengan tahap kecederaan (MAIS), status lesen, sebagai pembonceng, perlindungan insurans, dan sejarah kemalangan. QoL fizikal dipengaruhi oleh pendapatan, saiz isi rumah, insurans, tujuan perjalanan dan pembonceng yang melaporkan kualiti hidup lebih baik. Secara keseluruhan, kajian ini menekankan peranan faktor sosiodemografi dan pra-kemalangan dalam membentuk corak WTP dan QoL, serta keperluan dasar yang menyasarkan golongan rentan melalui akses kesihatan dan pendidikan yang lebih adil.

ABSTRACT

Road Traffic Injuries (RTIs) remain a pressing public health concern, particularly in assessing survivors' Quality of Life (QoL) and economic valuations. This cross-sectional study estimated the Value of Statistical Life (VOSL) through Willingness to Pay (WTP) per year for reductions in fatality and injury risk, national road safety programs, and medical treatment (initial and follow-up) among motorcycle crash survivors. It also evaluated QoL one month post-discharge. Data were collected between August 2022 and September 2023 at the emergency departments of Hospital Sultanah Bahiyah (Alor Setar) and Hospital Sungai Buloh (Selangor). The Contingent Valuation Method (CVM) estimated VOSL from WTP, while the Revised Trauma Quality of Life (RT-QoL) instrument assessed QoL. Descriptive statistics, Generalized Linear Models (GLM) with Gamma distribution, and Binary Logistic Regression (BLR) were used. Of 546 respondents, 81% were pillion riders and 364 were male. Mean WTP per year was RM28 for fatality risk reduction, RM53 for injury risk, RM36 for safety programs, RM64 for emergency care, and RM59 for follow-up treatment, estimating fatality costs at RM94,058 - RM101,294 and injury at RM24,495 - RM28,850. WTP for national safety programs was valued at RM725,333 - RM768,000. WTP for fatality risk reduction was influenced by education, income, insurance, and travel purpose; injury risk WTP by age, education, occupation, insurance, travel purpose, and crash history; and WTP for safety programs by similar factors as injury risk. Emergency treatment WTP was higher among younger individuals, those with higher education, mid-skilled workers, and lower among B40 groups, reflecting healthcare access disparities. Follow-up WTP was shaped by occupation, income, injury type, insurance, license status, and travel purpose. QoL outcomes were predicted by education, ethnicity, and occupation across emotional, functional, and physical domains. Emotional QoL was reduced by low income, lack of license or insurance, and fractures, with fractures associated with 38.3% lower odds of high emotional well-being. Functional QoL was linked to injury severity (MAIS), license status, pillion riding, insurance, and crash history. Physical QoL was associated with income, household size, insurance, travel purpose, and rider type, with pillion riders reporting better outcomes. Overall, the study emphasizes the role of socio-demographic and pre-crash factors in shaping both WTP and QoL, highlighting the need for targeted policies, equitable healthcare, and educational interventions for vulnerable road users.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

Figure No.		Page

CHAPTER I

INTRODUCTION

1.1 BACKGROUND OF STUDY

Every day, thousands of people are killed and injured in traffic. Men, women, or children, walking or riding to school or work, playing in the streets, or setting out on long trips, will never return home, leaving behind shattered families and communities (Peden et al., 2004). Millions of people each year will spend long weeks in hospital after severe crashes, and many will never be able to live, work, or play as they used to. Road Traffic Injuries (RTI) are an increasing public health issue, disproportionately affecting vulnerable groups of road users, including the poor. Other than that, mortality is projected to increase from 1.2 million in 2002 to 2.1 million in 2030, primarily due to the increasing motor vehicle fatalities associated with economic growth in low- and middle-income countries. Road traffic crashs have become the third leading cause under the optimistic scenario, ahead of ischemic heart diseases and cerebrovascular diseases (Mathers & Loncar 2000 ; Sherin 2021)

Road crashes are recognised as one of the major contributors to global mortality and morbidity, accounting for a substantial proportion of injury-related deaths worldwide. According to the World Health Organization (WHO), road traffic injuries result in approximately 1.19 million deaths annually and are among the leading causes of death, particularly for individuals aged 5–29 years (WHO, 2023). The burden is disproportionately higher in low- and middle-income countries compared to developed nations, where stronger enforcement and safety systems have contributed to lower fatality trends. Note that many developing countries are making significant improvements in road safety. However, challenges such as underdeveloped facilities, fragmented data between police and hospitals, insufficient evidence-based data, and a lack of evaluation of current road safety methods persist in these countries. According to the World Health Organization (WHO, 2023) middle-income countries such as Thailand and Malaysia are still struggling to curb the crash issue. Meanwhile, other low-income countries such as Vietnam, Myanmar, Sudan, and other African countries, which experienced inadequacy of road safety interventions and facilities, faced continuous challenges and burden in their efforts to halt the crash outcomes .

Road crashes can also be known in many works of literature as a traffic collision, in which one or more vehicles collide or crash into each other, people, or other obstructions on the road, or a road crash that happens crashally without any announcements or signs. Patrick Daniel (2021) explained from a legal perspective that an crash and a crash are both different in that an crash is unforeseen circumstances that happen unexpectedly without anyone's fault, whereas a crash, otherwise, happens due to one's negligence on the road. In another perspective, Stewart & Lord (2002) stressed the differences between these two terms, in which the key distinction between these terms is that crash describes the event without implying the presence or absence of driver responsibilities. Crash simply describes the event, whereas crash confuses, often incorrectly, what happened, often due to the driver's lack of intentionality or legal responsibility. Furthermore, crash is a more logically inclusive term because it includes both intentionally or negligently caused events as well as those that were truly crashal (Stewart & Lord, 2002).

In short, it can be understood in a way that a crash is an event that can be prevented, and an crash see□ s □ i□ □ i□ u□ □ □ o □ revencrash□uena□ouire s □□ o□ a□ □ □ □ in whatever term is used to describe the catastrophic condition, the outcomes still resulted in physical injury or even death. RTIs are under the umbrella of unintentional injuries. Road injury is classified as an unintentional injury resulting from road crashes with one or more vehicles or persons, which might sometimes result in fatality. Among unintentional injuries, RTIs are the most common cause of deaths worldwide (Onainor, 2019). Globally, approximately 1.3 million people were involved in road crashes, resulting in 20 to 50 million people suffering from non-fatal injuries. Pedestrians, cyclists, motorcyclists, and pillion riders are considered at-risk groups who contribute to half of the road traffic fatality and injuries. About 93% of these road fatalities were from low and middle-income countries, which eventually injure their countries' economic well-being. Other than that, The WHO (2021) Fact Sheet on Road Traffic Injuries indicates that over 93% of road fatalities occur in low- and middle-income countries, adversely affecting their economic stability. Road crashs significantly contribute to the premature mortality of individuals aged 5 to 29 years, consequently affecting national economic development. Moreover, they create a significant financial strain on households as a result of diminished output.

Traffic safety regulations attempt to lower the risk of death and injury from vehicle crashs. However, government policies designed to protect life and health also come with substantial costs, many of which are not immediately apparent. Therefore, understanding the incentives of researchers, government agencies, and individuals can shed light on the government's appropriate role in mitigating risks to life and health.

Both governments and individuals must make trade-offs between income and risk because understanding these trade-offs is essential for comprehending the value of public policies designed to protect life and health. Thus, allocating the proper amount of resources to government health and safety programs requires an understanding of the value that individuals place on changes in risk levels for threats to life and health. Subsequently, many government policies are directly or indirectly based on the amount of these trade-offs, as estimated in the academic literature (Bosworth, Hunter & Kibria, 2017).

1.1.1 The burden of road traffic injuries: economic valuation through VOSL and quality of life outcomes

RTIs remain a significant public health concern, not only due to their contribution to mortality and morbidity but also because of their profound and lasting effects on in□ivi□ua□s' Quality of Life (QoL). It encompasses a broad spectrum of well-being, including physical, emotional, social, and functional dimensions (Juan Pablo Herrera-Escobar et al., 2020; Wanner et al., 2015). Survivors of RTIs often face persistent pain, reduced mobility, emotional distress, and limitations in performing daily or occupational activities (Barnes, □□□□□ □ovačevi□ 2020; Tournier et al., 2016). These effects indicate that QoL should be assessed as a multidimensional outcome when studying RTI and that its primary purpose is to recognize the extent of injury, taking into account its effect on the unrelated life factor other than direct clinical recovery (Barnes, 2006; Cubi-Mollá, 2008; Tournier et al., 2016).

According to the World Health Organization (World Health Organization, 2023), road traffic injuries (RTIs) result in both mortality and a substantial number of non-fatal injuries, with an estimated 20 to 50 million people suffering non-fatal outcomes annually, many of which lead to long-term disability. These injuries create both immediate and long-term consequences for survivors. Beyond the physical harm, RTIs are associated with ongoing functional limitations, psychological distress, and reduced capacity in daily activities, which may collectively contribute to a decline in quality of life.

In addition to the health burden, the broader societal impact of RTIs can be examined through economic valuation approaches. The Value of Statistical Life (VOSL) is widely recognised in transport and health economics as a monetary measure used to value redu□ □ions in □or□a□i□ □ ris□ □ □o□ □on□ □ □erive□ □ro□ in□ willingness to pay (WTP) for risk reduction (OECD, 2012; Viscusi, 1993). VOSL provides an important basis for evaluating the benefits of road safety interventions. However, it primarily focuses on fatal risk reduction and does not fully capture the broader non-fatal consequences experienced by survivors.

Therefore, integrating VOSL with quality of life (QoL) assessment provides a more comprehensive understanding of the burden of RTIs, capturing both the economic value of preventing death and the lived experiences of survivors with long-term impairments. This combined approach strengthens evidence for policy formulation, prioritisation of road safety programmes, and evaluation of post-crash outcomes.

In addressing the broader impact of road traffic injuries, the Value of Statistical □ □ □ □ is an e□ ono□ i□ □ easure use□ □o □uan□ i□ □ in□ ivi□ ua□ s’ □ i□ □ ingness □ o for marginal reductions in mortality risk. Rather than assigning value to an individual li□ e□ □ □ □ □ re□ □ e□ □ s so□ ie□ □ ’s aggrega□ e va□ ua□ ion o□ ris□ re□ u□ □ ion □ □ in safety measures and health-related interventions. VOSL serves as a crucial input in policy decisions involving cost-benefit analyses, such as evaluating the economic justification of road safety programs or insurance coverage schemes. In high-income countries, VOSL is well-documented and routinely used in transport and health economics. Nonetheless, in Low- and Middle-Income Countries (LMICs), including Malaysia, local VOSL estimates remain sparse and often rely on transferred values from other contexts, which may not accurately reflect local socioeconomic and cultural conditions (Hammitt & Robinson, 2011).

1.1.2 Research gaps in VOSL and QoL studies on road traffic injuries

While VOSL provides an economic lens to evaluate life-saving interventions, it does not capture the ongoing consequences experienced by crash survivors who live with injury-related impairments. Hence, QoL has emerged as a critical measure for understanding post-injury outcomes from a psychosocial and functional perspective. QoL encompasses a wide range of domains, including physical functioning, emotional well-being, social integration, and daily activity performance. In the context of RTIs, motorcycle users who survive crashes often face physical disabilities, psychological trauma, and challenges reintegrating into work and community life (Allen Ingabire et al., 2024; Pélissier et al., 2017). Nevertheless, studies on QoL among motorcycle crash survivors in Malaysia remain limited in scope, with many focusing either on hospital-based clinical outcomes or long-term recovery, while neglecting the short-term post-discharge period that can be pivotal in shaping recovery trajectories.

Another research gap observed in the current literature is the absence of measures that are used to study both VOSL (Bahamonde-Birke et al. 2015; Nankunda & Evdorides 2023) and QoL (Rissanen et al. 2017) in a common frame. It is observed in most of these studies that they focus on either economic valuation or post-injury quality of life, thus missing the chance of giving a comprehensive report on the burden of motorcycle-related RTIs. Furthermore, the time-sensitive dimension of QoL□ especially within the first month post-discharge□ is underexplored, despite being a critical period for early rehabilitation, risk of complications, and emotional adaptation. This highlights a significant gap in knowledge, especially within the Malaysian context, where culturally nuanced perceptions of injury, recovery, and risk may affect both QoL assessments and WTP responses.

Moreover, motorcycle users often come from lower-income households, work in informal sectors, and lack adequate insurance coverage□ factors that have been associated in global road safety literature with increased vulnerability to road traffic injury and reduced financial resilience following crashes (World Health Organization, 2023). These socioeconomic conditions may influence both willingness to pay (WTP) for safety and the ability to recover from injury outcomes, particularly in settings with limited social protection systems. Thus, socioeconomic and behavioural dimensions must be considered when evaluating both VOSL and QoL. Pre-crash conditions, such as possessing a valid licence, insurance coverage, and a history of previous crashes, have also been identified in injury epidemiology as factors associated with differential crash exposure and injury outcomes (World Health Organization, 2023; Gopinath et al., 2017). However, limited studies have examined these pre-crash behavioural factors in shaping post-injury trajectories among motorcyclists. Existing systematic evidence on road traffic injury outcomes shows that quality of life is significantly reduced following injury, but most studies focus on clinical recovery rather than behavioural pre-crash predictors of long-term outcomes (Rissanen et al., 2017; Hung et al., 2022).

Given these gaps, this study aims to (1) estimate the VOSL through respondents' WTP for fatal and injury risk reduction, estimating value for road safety program and both emergency and follow up medical treatment due to injury treatment and (2) evaluate the QoL among motorcycle crash survivors one month after discharge, focusing on emotional, functional, and physical domains. By integrating these two dimensions, the study seeks to inform policy-makers, healthcare providers, and road safety agencies about both the economic and humanistic consequences of motorcycle injuries. It ultimately supports better-informed decisions regarding prevention, rehabilitation, and compensation mechanisms.

1.2 RESEARCH PROBLEM

Road crashes in Malaysia continue to exhibit a consistent pattern, despite improvements in road safety programs, innovations, and inventions aimed at curbing the increasing rates (Traffic Enforcement Department, 2020; Road Safety Department of Malaysia (RSDM), 2018; Ministry of Transport Malaysia, 2017). As estimated in PDRM traffic statistic in 2019, in estimation eleven people died everyday with the average of every two hours each there will be one death. Regardless of the concerning statistic, road traffic injuries often receive less public interest and are not acknowledged as a significant public health issue because we are not being exposed to how many cases occur per day. This indicates that road crashes among public health concerns are unimportant (Ainy et al., 2014; Subhan et al., 2021). The issue remains that individuals who have been directly involved in RTIs are isolated. Policies continue to change for years based on the current condition of RTIs, while views from involved individuals are lacking in determining the reduction of risk to be made. Note that the prevention value of traffic injuries is the amount of money that society is willing to pay to avoid injuries. These two strategies are consistent with United Nations Road Safety Collaboration (UNRSC,) activities number one and two, which encourage funding for road safety where appropriate and advocate collaboration among related stakeholders, respectively United Nations Conference on Trade and Development [UNCTAD], 2017). Although it may appear hypothetical, it is a more accurate reflection of the true economic costs of death and injury (T. Litman 2008). The value of risk can be a fundamental estimation that demonstrates that policymakers' adopted decisions on resource allocation should reflect citizens' demands and preferences (Chhotu & Kumar 2014; Litman 2013)

The condition underlines the urgent need for an effective policy response, as well as tapping into evidence-based costing analysis. Be it safety programme, innovation or other invention, a cost benefit analysis is important so that any road improvements of innovation to reduce the risk of fatality and injury will be done with better financial planning due to scarcity of resources (Ainy et al., 2014; Faudzi & Yusof, 2004; Mofadal & Kanitpong, 2010; Mon et al., 2018; Puttawong & Chaturabong, 2020; Yang et al., 2016). However, to proceed with this process, a value of statistical life estimation can be used to better display the value estimation. The value can represent individual preferences and society as a whole, allowing for further funding of improvements and saving lives if needed in the future.

Other than that, studies from many countries have proven that the usage of VOSL is considered one of the approaches that can help in reducing the cost and risk of RTIs (Mohd Faudzi Mohd Yusoff, Nor Ghani Md Nor, 2011; Mon et al., 2018, 2019). This additional effort might provide another perspective on either how to curb the increase in RTIs or empower road users to become more seriously aware of its importance. Hence, it is recommended by Gibson et al. (2007) that every country should manage to conduct RTIs VOSL before any road safety investments are made. This is because it is challenging to compare VOSL estimates across countries, as the valuation depends on many factors that differ significantly from those in other countries, such as local conditions. Hence, it is strongly recommended that VOSL be evaluated separately for each country and updated regularly (Eusofe & Evdorides, 2017; Wijnen et al., 2009). VOSL through the WTP approach has been widely used in many developed countries (Ainy et al., 2014; Rizzi & Ortúzar, 2006; Wijnen et al., 2009; Yang et al., 2016). However, efforts to apply the WtP approach in estimating the costs of road crashs in Malaysia have been scarce. Until now, the related VOSL studies that have been published were dated a long time ago, which were researched by Mohd Faudzi Mohd Yusoff, Nor Ghani Md Nor (2011); Nor & Yusoff (2003). Even in ASEAN countries, there are several attempts, like in Thailand and Myanmar (Ainy et al. 2014; Chaturabong, Kanitpong & Jiwattanakulpaisarn, 2011; Mon et al., 2019, 2018; Puttawong & Chaturabong, 2020), respectively.

1.2.1 Gaps in Malaysia's road safety plan: integrating VOSL and QoL perspectives

The Road Safety Plan of Malaysia 2014–2020 (Malaysia Road Safety Department 2014) has been formulated to address all matters related to road safety in the country. The framework has been developed based on the five road safety pillars, namely Road Safety Management, Safer Mobility and Roads, Safer Vehicles, Safer Road Users, and Post-Crash Management, as recommended in Decade of Actions for Road Safety 2021-2030 coordinated by the World Health Organization (WHO, 2021). The Road Transport Department (RTD), Royal Malaysia Police (PDRM), Ministry of Health (MOH), Public Works Department (PWD), and other road safety related government agencies, as well as private sector entities and Non-Governmental Organisations (NGO), collaboratively formulated the Malaysia Road Safety Plan (MRSP, 2014-2020). Under this road safety plan, various efforts have been implemented to achieve the primary objective of reducing road fatalities. Hence, it would be an added value if the value of statistical life of road users is included in the attempt to reduce the number of crashes or injuries as a guide to cost-benefit analysis for each of the prevention measures intended to be introduced to the public (Patenaude et al., 2019). From the MRSP 2014–2020 report, lots of efforts have been made in the area of Road Safety Management (Pillar 1), Safer Mobility and Roads (Pillar 2), and Safer Vehicles (Pillar 3). Note that many road-related agencies have produced several studies to justify the implementation. However, there are certain rooms that can be explored and improved in terms of Road User Safety and Involvement in Pillar 4, which might be appropriate to further explore by the VOSL approach. This provides evidence-based costing for road prevention planning, as well as Post-Crash Management at Pillar 5, which may consider utilising QoL to add new information regarding post-injury.

The PDRM (2019) reported an increase in the total number of road crashs from 2010 to 2018, across the fourteen states in Malaysia. This number is consistent with the report provided by the Department of Statistics Malaysia, stating that transport crashs remain the principal causes of death in Malaysia. Crashs were mostly believed to have resulted in various injuries and have been ranked as the fourth cause of death for the past three years (Department of Statistics Malaysia 2020a, 2018, 2019), followed by other deadly diseases. However, with such statistical data that possibly exposes a public health issue, this matter remains to be treated with low priority, especially in LMICs. The increase in the total number affects the loss of life and reduced productivity with premature mortality and age morbidity (Department of Statistics Malaysia 2018, 2019, 2020b) and affects the cost that health providers have to bear in providing treatment. It has been suggested that further research should be conducted to gain a better understanding of the types of crashs and the types of users involved in traffic crashs, while also considering the representation of road injuries when calculating healthcare provider costs (Saperi et al., 2017). Nonetheless, these suggestions are yet to be seen in domestic road injury-related studies.

In summary, motorcyclists and pillion riders account for a significant proportion of road crash victims, making them one of the most vulnerable groups (Rahman et al.

2015) on the road in Malaysia. The impacts of RTIs do not only involve medical effects in the short term, but they can also involve long-term burdens, physical, emotional, as well as economic. Even though there is a constant road safety campaign, evidence-based policy planning is still informed by a lack of localized information on the economy as well as the health effects of RTIs.

The estimation of the VOSL is one of the key areas to be explored, as the latter is a measure that indicates how people are WTP to minimize the chance of such injuries becoming fatal. VOSL is popularly applied in cost-benefit analysis of public safety as well as transportation policies. However, empirical VOSL studies are limited mainly to those who are at higher risk, for example, in Malaysia, pillion as well as motorcyclists. Estimates are usually based on international models where adequate considerations are not given to local conditions regarding socioeconomic, cultural, as well as behavioral approaches that affect risk perception and WTP. This context-specific dearth of VOSL data poses a very big gap, which restricts the government from making an informed decision on how it can allocate its resources to road safety programs as well as health issues. Without robust local VOSL estimates, there is a risk that investments may not align with societal preferences or cost-effectiveness goals.

Another way to understand the burden of disease is by measuring QoL, which is relevant when the measurement of morbidity and mortality cannot be assessed accurately. Many studies have recorded several types of trauma analysis using QoL. Nevertheless, few have attempted to assess road traffic injuries (Rissanen et al. 2017). It can also be seen from a study by Rissanen et al. (2017) that most RTI quality was conducted in HICs compared to LMICs. This condition also included Malaysia, where the exploration of RTI QoL is still in paucity. Hence, regular updates on patient well-being for RTI post-treatment are lacking.

Similarly, the QoL investigation lacks current data regarding the well-being of RTI patients, particularly after discharge. The short-term and long-term effects after the crashs are not properly recorded and are difficult to retrieve. Other than that, insufficient local data forbade comparison with other countries' outcomes, which might contribute to learning a new approach to this matter under study. This insufficiency also somewhat overlooks the important information that can be gained from the patient, which might help improve healthcare delivery and prevent further damage in the long run. Additionally, this effort can also reduce costs. At the same time, the QoL of crash survivors is another dimension that warrants greater attention. While survival rates may be improving, many individuals suffer consequences that impact their emotional, physical, and functional well-being. However, QoL data are not routinely captured in post-crash assessments, and studies focusing specifically on motorcycle-related injuries in Malaysia are limited. Understanding how survivors live and cope after a crash is essential for designing patient-centered rehabilitation programs and long-term support services.

Similarly, Rissanen et al. (2017) listed out the type of tools used in examining RTI patient quality of life, in which the usage of QoL measures, such as the SF-36 (Fitzharris et al., 2010; Lugo et al., 2013), WHOQoL-Bref (Tournier et al., 2014), and HRQoL (Vu et al., 2019), has been recorded vigorously in previous studies, yet the use of trauma specific QoL measurements, such as the Revised Trauma Quality of Life (RT-QoL) has not yet been evident (Herrera-Escobar et al., 2020). Thus, the study will incorporate these tools in the effort to investigate RTI patient well-being. The subject matter of this study is the public, in which RTI patients involved in road crashes and suffered injuries are the focus. Hence, the main aims of this study are to estimate the VoSL, the cost of fatality and injury based on □ a□ ien□'s WTP, and the QoL of the patients.

Besides, adding economic value to the improvements can inform policymakers of the social costs from direct road users and utilise scarce resources in other demanding areas. As Profesor Dr Kulanthayan Mani in his keynote message at The Launch of the Global Plan for the Second Decade of Action for Road Safety 2021 □2030, mentioned that any road interventions must be accepted and understand by publics so that they are into it to implement them with the policy makers thus making road safety more sound among them (Suresh 2022). The involvement of society as a whole may bring another insight into road safety improvements aimed at reducing the risk of road fatalities and injuries in the future.

The outcome of the study will be a significant help, particularly in decision-making efforts, for policymakers focused on road safety and healthcare improvement, aiming to further prevent long-term damage due to crash injuries. It will also aid forecasting efforts in the future, enabling the efficient use of scarce resources.

Although VOSL and QoL represent distinct outcomes□ economic and health-related, respectively□ both are vital to comprehensively assessing the burden of RTIs. Nevertheless, few studies have examined these outcomes concurrently within the same target population. This lack of integrated evidence prevents a more holistic understanding of both societal values (in terms of risk reduction) and individual experiences (in terms of recovery). Therefore, this study aims to address these gaps by (1) estimating the VOSL based on WTP responses specific to Malaysian motorcyclists and pillion riders, and (2) evaluating their QoL using a trauma-specific tool after hospital discharge. By examining both economic valuation and survivor well-being, this study will provide a more complete picture of the impact of RTIs and support the development of informed, evidence-based policies in both road safety and public health domains.

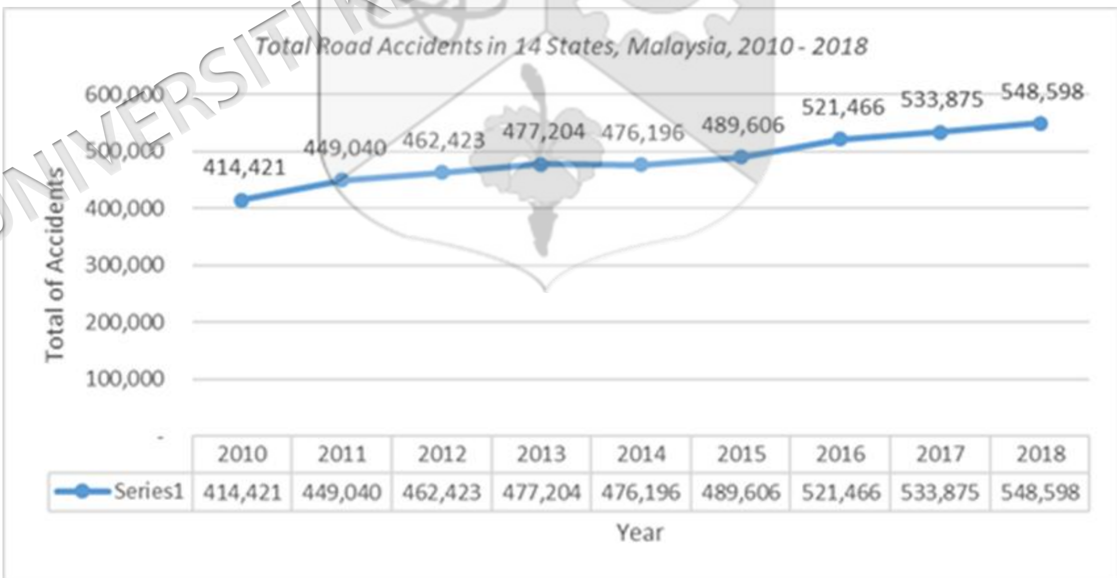


Figure 1.1 Total Road Crashes in Malaysia, 2010 - 2018

Source: PDRM 2018

1.3 RESEARCH QUESTION

1. What are the sociodemographic profile, socioeconomic status, injury status, and pre-crash conditions of RTI respondents in 2019?

2. What is the estimated VOSL among respondents for both fatality and injury risk reduction.

3. What is the estimated VOSL among respondents for the national road safety program?

4. What is the estimated VOSL among respondents for injury-related medical treatment?

5. What is the estimated economic cost of road fatalities and injuries among the respondents?

6. What is the res□on□en□s' □□□ and its influencing factors?

7. □□a□ is □□e res□on□en□s' □o□ an□ i□s in□□uen□ing □a□□ors□

1.4 RESEARCH OBJECTIVES

To estimate the value of statistical life and evaluate the QoL of survivors of RTI (motorcycle crash survivors).

1.4.1 Specific research objectives

1. To determine the sociodemographic profile, socioeconomic status, injury status, and pre-crash conditions of RTI respondents.

2. To estimate respondents' VOSL for both the fatality and injury risk reduction.

3. To estimate respondents' VOSL for the national road safety program.

4. To estimate respondents' VOSL for injury medical treatment.

5. To estimate the cost of road fatality risk and injury risk.

6. To investigate the factors associated with respondents' VOSL.

7. To determine respondents' QoL after one month of hospital discharge.

8. To determine the factors associated with respondents' QoL after one month of hospital discharge.

1.5 RESEARCH HYPOTHESES

1. B40 income level has a significant association with VOSL, both in fatality and injury risk reduction, road safety program, and WTP medical treatment

2. Younger male has a significant association with WTP both in fatality and injury risk reduction, road safety programs, and WTP medical treatment

3. The cost of injury risk reduction is higher than the cost of fatality risk reduction

4. Respondent with severe injury reported having a poor (low) QoL

5. An older, male respondent has a poor (low) QoL

1.6 OPERATIONAL DEFINITION

To ensure clarity and consistency, the principal variables utilized in this study are defined both conceptually and operationally. Operational definitions offer precise elucidations of the measurement, categorization, and application of each variable within the research framework. This methodology eliminates uncertainty and guarantees that the study may be reproduced and compared with analogous research. The operational definitions of the study variables are encapsulated in Table 1.1. For clarity and consistency, the following operational definitions were used in this study.

Table 1.1 Operations Definition

Term	**Literature Definition**	**Operational Definition**	**Descriptions**
Value of Statistical Life (VOSL)	The trade-off between fatality risk and money measures the □ o□ u□ a□ ion willingness to pay for risk reduction in increasing the cost of safety (Kniesner & Viscusi, 2019)	The value that the patient is willing to pay for risk reduction (fatality, injury) and medical treatment.	VOSL is being used as a risk reduction estimation for fatality, injury, and road safety programs
Road Traffic Injuries (RTIs)	Unintentional injuries, which pose a significant economic and societal burden (Abdalla et al., 2017)	Injuries respondents suffered from road crashs occur on the road only, regardless of the type of road.	
Road Crash (RC)	is a collision involving at least one road vehicle on a public or private road that results in injury or death. Motorcycles are included as one category of road vehicles involved in these crashes (WHO, 2023).	This study defines a road crash (RC)/crashes as a road collision involving motorcycle users (motorcyclists or pillion riders) that resulted in injuries necessitating treatment and as recorded in hospital record information system.	
Contingent Valuation Method (CVM)	The contingent value method (CVM) is extensively utilized in environmental, health, and road safety economics to ascertain individuals' monetary valuing of non-market commodities. Through the development of plausible yet hypothetical policy or program scenarios, CVM permits respondents to express their willingness-to-pay (WTP) or willingness-to-accept (WTA), therefore facilitating researchers in quantifying advantages that are not discernible using traditional market statistics ((Zainudin et al. 2016)	In this study, the Contingent Valuation Method (CVM) is applied through a structured survey administered to motorcycle crash survivors. Respondents are presented with hypothetical scenarios involving road safety interventions (fatality risk reduction, injury risk reduction, medical treatment, and national road safety programs) and are asked to state their maximum willingness-to-pay (WTP) for each. The elicited WTP values are then used to estimate the Value of Statistical Life (VOSL) by dividing stated WTP by the corresponding risk change values.	

□ o □ e □ on□ inu

□ □ on□ inua□ ion

Willingness to Pay (WTP)	The maximum amount of money the people are willing to pay for a situation where they gain a positive change (Hasan-Basri, Rawi & Bakar, 2015)	The value that RTI victims are willing to pay for risk reduction is either for fatality risk reduction or injury risk reduction, road safety programs, or medical injury treatment.	Using the WTP approach to estimate VOSL in this study
Quality of Life (QoL)	□ n□ ivi□ ua□ s’ vie□ on □ position in life in terms of culture, value, and system which they live in, and the relation to their goals, expectations, standards, and concerns (WHO, 2021)	□ a□ ien□ s’ -being and condition post-crashs after one (1) month.	Respondents' quality of life in terms of physical, functional, and emotional domains was assessed
Socio Demographic		□ a□ ien□ ’s in□ or□ a□ ion including age, gender, ethnicity, education, marriage status, and occupation.	
Socio economic		□ a□ ien□ ’s e□ ono□ i□ information, inclusive of self□income, household income, and size of their household.	
Injury status		Respondent's injury, which was coded by using the Abbreviated Injuries Scales (AIS) and Multiple Abbreviated Injuries Scales (MAIS).	Respondents' injuries level ranges from minor, moderate, and severe; and types of injury, which are divided into fractures and non-fractures
		□ a□ ien□ ’s in□□□ derived from the calculation of AIS and MAIS.	Injury severity (1=minor, 2=moderate, 3=serious, 4=severe, 5=critical, 6=maximal, 9=unknown
Pre-crash status		Patients who are motorcyclists and pillion, license and insurance ownership, travel purpose, and have had a recent crash in the past 1 year.	

□ o □ e □ on□ inu

□ □ on□ inua□ ion

	Patient who was admitted to the hospital one year ago due to RTC.	Hospitalization history

1.7 RESEARCH SCOPE

This study estimates the Value of Statistical Life (VOSL) using the Contingent Valuation Method (CVM) through the willingness-to-pay (WTP) approach. It is a cross-sectional study that examines quality of life (QoL) among road traffic injury (RTI) patients, including both inpatients and outpatients attending the Trauma and Emergency Departments of Hospital Sultanah Bahiyah, Alor Setar, Kedah, and Hospital Sungai Buloh, Selangor. The study population consists of patients who have sustained RTIs resulting from motor vehicle crashs, with a focus on motorcyclists and pillions, who represent the most common and vulnerable group in such injuries in Malaysia. The Emergency Department setting was chosen because it is the primary point of care for acute trauma cases, ensuring access to eligible RTI patients at the time of treatment. These hospitals were selected due to their consistent exposure to RTI cases within their respective service catchment areas, allowing for appropriate data collection.

1.8 RESEARCH SIGNIFICANCE AND JUSTIFICATION

The study's outcome can provide decision-makers with a sound understanding of health economics by presenting results in terms of cost estimation.

1.8.1 Significance to policy and decision making

This effort can assist in evidence-based costing and forecasting, reducing unnecessary spending due to scarce resources. Additionally, this study aims to make meaningful progress toward reducing road crash fatalities and injuries. It focuses on future efforts that involve society and would be beneficial to it.

1.8.2 Contribution to road safety in developing countries

As a developing country with limited resources, the key to making roads safer for vulnerable road users will be the ability to develop and scale innovative road safety so□u□ions □□a□ are □ai□ore□ □o □□e na□iona□ an□ □u□□ura□ □on□e□□ outcome is essential for planning and evaluating local decisions, especially for the cost-benefit analysis related to any intervention programme or innovation for RTIs. The study profiling the RTI pattern lacks a local context for reference. □□e s□u□□'s ou□□o□e was to be able to flag the WTP estimation in other developing countries and permit value comparison for future study extension. Last but not least, the current research will produce a validated WTP□CV questionnaire which can be utilized regularly by similar local studies in the future and adapted by other developing countries, especially the Association of Southeast Asian Nations (ASEAN) countries or other LMICs which might share similarities in road safety policy. This effort can also promote regular, similar studies in other road users and other VOSL-related studies. Furthermore, by understanding the value of statistical life for motorcycle riders, policymakers can better prioritize and justify targeted investments in effective motorcycle safety interventions, such as infrastructure improvements, enhanced rider training and education programs, and strengthened enforcement of traffic laws and regulations. This evidence-based approach can lead to a substantial reduction in the devastating human and economic consequences of preventable motorcycle-related fatalities and serious injuries, which have far-reaching impacts on individuals, families, communities, and society as a whole.

1.8.3 Importance for motorcycle users and vulnerable road users

This study is also significant as it highlights the substantial impact of RTIs on the QoL of motorcyclists and pillion riders, who represent a vulnerable group in road transportation systems, particularly in LMICs. While RTIs are typically assessed through mortality and injury statistics, such indicators do not adequately reflect the short-term physical, emotional, and functional impairments experienced by survivors. Motorcyclists and pillion riders have a higher chance of incurring serious injuries, causing long-term disability, low mobility, mental distress, as well as impairments in daily and work lives. This study will give a more in-depth description of the post-injury experiences of this high-risk group by emphasizing QoL. The outcomes can inform specific rehabilitation services, support programs, as well as policy solutions to improve the life and social position of the injured riders. Finally, the research leads to a better assessment of the burden of RTIs as well as contributes to designing responsive strategies to improve the lifestyle of motorcyclists and passengers after injury.

1.8.4 Addressing Quality of Life (QoL) gaps in RTI research

Typically, a longitudinal study or cohort design is used to assess QoL in the survivors of RTI: a medium-, long-term follow-up period (3, 6, or 12 months after injury) is traditionally selected (Rissanen et al., 2017). The studies are valuable to understand the recovery trend and the chronic disability. Nevertheless, the current literature has underemphasized the immediate post-discharge time, or the first month following the hospitalization, in particular. This is one of the essential knowledge gaps, which are related to the short-term role of injuries on the emotional, functional, as well as physical well-being of survivors.

The recovery process has a one-month period after the injury as an important phase. In this period, the patient might be afflicted by acute symptoms like immobility, pain, psychological distress, as well as dependency in everyday activities. These initial difficulties may have a major impact on both emotional and functional results, but are easily overlooked if QoL is only assessed at later stages. In most situations, complications can occur within this small time duration, including missed diagnosis of fractures, slowed healing, as well as psychological responses or decreased functionalities, among others, which will not be reported without a follow-up evaluation. Such early QoL measurement may therefore avert aggravation of conditions, concealed or under-reported injuries, and provide information in order to initiate early clinical or psychological support.

Besides, the initial month after a motorcycle crash has specific significance to improve healthcare responses, especially in low- and middle-income nations such as Malaysia, where the number of RTIs is disproportionately high among motorcyclists and pillion riders in the country (Abdul Manan & Várhelyi, 2012; Akmal, 2016). Measurement of QoL at this time can aid in executing pre-planning rehabilitation, insurance, and compensation decisions, as well as assist in government planning of public health measures to prevent exposure to long-term disability. It comes in handy to enable healthcare professionals to strategically distribute resources and attend to the urgent needs of the survivors, increasing continuity in care and patient satisfaction.

Accordingly, the research will vary the follow-up period to one month to evaluate QoL along emotional, functional, as well as physical dimensions, to enable a broad view of the survivors to have early feelings about being crashed. In this way, it also fills one of the major knowledge gaps observed in available literature and highlights the role of short-term QoL indicators in early intervention and rehabilitation, as well as preventing secondary injuries that lead to long-term disability.

1.8.5 Integrating VOSL and QoL for comprehensive assessment

Everything in this study is valuable in dealing with the greater effect of RTIs through an inclusive approach of the VOSL combined with the QoL. Whereas VOSL estimates individual's WTP to prevent the probability of death and injury, as well as implies the WTP of the general population for the national road safety program and medical remedy, QoL finds the long-term physical, emotional, as well as functional impacts on the survivors. By combining these approaches, the study provides a more comprehensive understanding of the societal and personal burden of RTIs, supporting evidence-based policymaking and the prioritization of effective road safety interventions.

1.9 SUMMARY

This chapter summarizes the background of the study, study objectives, questions, and hypotheses. Other than that, the problem of the study is presented here as well. The study scope and its significance are also discussed. Chapter II will outline the previous literatures related to VOSL and QoL.

CHAPTER II

LITERATURE REVIEW

2.1 INTRODUCTION

The following discussion will explore the general and specific scenarios of Road Traffic Injuries (RTIs) caused by road crashs and the explanation of dependent variables, Value of Statistical Life (VOSL) and Quality of Life (QoL), and independent variables, which consist of socio-demographic, socio-economic, injury status, and pre-crash status. A Theory of Planned Behaviour (TPB) was also applied here in the context of VOSL studies that utilized the Willingness to Pay (WTP) approach.

2.2 THEORY OF PLANNED BEHAVIOUR

The Theory of Planned Behavior (TPB), developed by Ajzen (1991), is one of the most influential behavioural theories used to explain and predict human decision-making across various contexts, including health and road safety behaviour. The theory proposes that behavioural intention is determined by attitudes, subjective norms, and perceived behavioural control. Its robustness has been widely supported in empirical and meta-analytic studies (Ajzen, 1991; Armitage & Conner, 2001). In road safety research, TPB has been applied to understand behavioural intentions related to risk-taking and safety compliance. Subhan et al. (2021), for example, applied the TPB framework in a road safety context, including economic-related behavioural considerations such as willingness to pay for risk reduction. This application demonstrates the relevance of TPB in explaining behavioural decision-making in road safety contexts, where psychological and social factors may also influence risk-related choices and safety valuation behaviours.

Subhan et al. (2021) utilized the Theory of Planned Behavior (TPB) to investigate the public's willingness to pay for enhancements in road safety, thereby expanding the model beyond its fundamental components of attitude, subjective norms, and perceived behavioral control. Their comprehensive Theory of Planned Behavior encompassed risk perception, attitudes toward traffic safety responsibilities, perceived fairness, and perceived efficacy. These aspects are critically pertinent to VOSL research, which depends on individuals' willingness-to-pay (WTP) to deduce the monetary value assigned to mitigating fatality or injury risks.In VOSL investigations, attitudes about road safety measures significantly affect respondents' evaluations of their willingness to pay for safety enhancements, hence directly influencing their reported willingness to pay (WTP). Perceived behavioral control encompasses affordability and the capacity to pay, influencing the extent to which individuals' willingness-to-pay reactions accurately convert into economic valuation. Although subjective standards are less prominent in Subhan et al.'s study, they may nevertheless influence VOSL by mirroring societal expectations for contributions to safety measures. The extended TPB variables align closely with VOSL assumptions: risk perception influences individuals' assessment of the likelihood of death or injury reduction; safety responsibility affects whether respondents consider funding safety programs as their obligation; and perceived fairness and effectiveness determine if WTP responses accurately reflect the valuation of life-saving interventions.Integrating the Theory of Planned Behavior (TPB) into Value of a Statistical Life (VOSL) studies facilitates a more nuanced understanding of willingness to pay (WTP) responses by contextualizing economic valuation within the extensive psychosocial and behavioral framework of road users, especially in low- and middle-income countries (LMICs) where cultural, economic, and social factors significantly influence safety-related decision-making (Subhan et al., 2021).

Additinally, the Theory of Planned Behavior (TPB) offers a valuable framework for comprehending the impact of psychosocial factors on post-injury Quality of Life (QoL) in survivors of road traffic crashes. TPB asserts that intention, influenced by attitude, subjective norms, and perceived behavioral control, serves as the principal predictor of behavior. In the context of motorcycle crash survivors, these constructs are directly associated with rehabilitation practices and lifestyle modifications that ultimately influence quality of life. Survivors with a positive outlook on recovery, support from family or peers, and a sense of control over their limitations are more inclined to actively participate in rehabilitation, resulting in enhanced physical, functional, and emotional outcomes. Extensions of the Theory of Planned Behavior (TPB), including risk perception, safety responsibility, and perceived effectiveness (Subhan et al., 2021), further solidify this connection by elucidating the reasons some survivors engage in protective behaviors and comply with treatment, thereby improving both functional recovery and emotional well-being.

Simultaneously, QoL studies are frequently based on established theoretical frameworks. The Wilson and Cleary model of health-related quality of life establishes a connection between clinical factors, symptoms, and functional status to overall well-being (Wilson & Cleary, 1995). The revision by Ferrans et al. enhances this model by integrating socio-demographic and socio-economic factors, rendering it especially pertinent to the Malaysian context, where a significant number of motorcycle users are from lower-income demographics (Ferrans et al., 2005). The World Health Organization's QoL framework also stresses the importance of looking at QoL as a whole, including physical, psychological, and social areas (WHO, 1995; WHO, 2020). This is in line with this study's focus on the physical, functional, and emotional aspects of survivors' well-being. Together, these frameworks make sure that QoL assessments go beyond just looking at clinical recovery to include the bigger psychosocial, functional, and economic effects of road traffic injuries.

This study integrates the Theory of Planned Behavior (TPB) with established Quality of Life (QoL) frameworks, positioning its examination of motorcycle crash survivors within a behavioral context (to elucidate how intentions and perceptions affect recovery behaviors) and a multidimensional health model (to assess the consequences of those behaviors regarding physical, functional, and emotional QoL). This comprehensive approach establishes a more robust theoretical framework for comprehending the impact of road traffic injuries (RTIs) and validates the study's contribution to evidence-based policymaking in the realms of road safety and rehabilitation.

2.3 VALUE OF STATISTICAL LIFE (VOSL)

Thomas Schelling first introduced VO□□ in □□□□ in □is □on□roversia□ essa□ □□□□e□ □ou □ave □a□ □e □our □□n□□ □ven □□oug□ □□□e□□ing's □ra□e□or□ □as □o□u□ a va□ue on a □erson's □i□e□ □□e □er□ □va□ue o□ s□a□is□i□a□ □i□e□ led to an understanding among non-economists that VOSL is a tool developed to value human life. However, instead of questioning what a life is worth, Schelling clarified by as□ing□ □□□a□ is □□e □ene□i□ o□ re□u□ing □□e the statistical □ o□ □ea□ □ro□a□i□i□□ o□ □ea□□□□ people might be willing to trade in life savings, goods, or services to pay for a public programme that can reduce the likelihood of death (Bosworth et al., 2017). However, this definition might be too technical for laymen to understand the concept VOSL brings to road risk reduction. Literature has produced numerous publications that have simplified the definition to a more understandable meaning.

The term Value of Statistical Life (VOSL) is used interchangeably in many previous studies. It is also commonly referred to as VSL, Value of Preventing a Fatality (VPF), and willingness-to-pay (WTP) for mortality risk reduction, although these terms share the same underlying economic principle of valuing marginal changes in mortality risk rather than the value of an identifiable human life (OECD, 2012; Viscusi & Aldy, 2003). The term VSL is most widely used in economic literature, particularly in meta-analytical work examining wage-risk trade-offs (Viscusi & Aldy, 2003). In contrast, the term Value of Preventing a Fatality (VPF) is more commonly used in road safety and transport policy applications, particularly in infrastructure safety assessments and cost□benefit evaluations (Dahdah & McMahon, 2008). Meanwhile, willingness-to-pay (WTP) approaches are often used as the empirical method to estimate VOSL, particularly in stated preference studies where individuals are directly asked their monetary valuation for small risk reductions (Obermeyer & Hirte 2021). In this study, the term VOSL is utilized for consistency.

VOSL represents a trade-off between monetary resources and small changes in fatality risk. It is derived from market-based or stated preference contexts, where individuals make implicit or explicit trade-offs between income and mortality risk reduction. Accordingly, VOSL is widely interpreted as an indicator of willingness to pay (WTP) for marginal risk reductions and the implicit cost of improving safety outcomes (Kniesner & Viscusi, 2019). From this perspective, VOSL is not a valuation of an individual life, but rather a measure of how much society is willing to pay for small reductions in the probability of death. Equally, Banzhaf (2021) and Sánchez-Martínez et al. (2021) emphasise that VOSL reflects the monetary amount individuals are willing to contribute for marginal reductions in mortality risk, typically derived from stated preference approaches. It does not represent the intrinsic value of a human life but instead captures the marginal trade-off individuals are willing to make between income and risk reduction. This interpretation is widely used in cost benefit analysis for public policy evaluation, particularly in road safety, health, and environmental interventions, where monetising risk reduction is necessary for policy comparison and prioritisation.

The Human Capital (HC) approach and WTP are the methods of estimating VOSL. HC approach operates on the aggregate of the costs of the individual level, where the direct medical costs, indirect loss of productivity, and intangible costs such as pain and suffering are computed. However, using HC failed to reflect the intangible costs; hence, most researchers abandoned this method (Milligan et al., 2014; Abdalla et al., 2017). The other methods, which include WTP, include the elements that HC failed to address. WTP estimates the value of pain and suffering by asking people if they are willing to pay for a lower risk of injury in exchange for a better QoL. This technique can be used to place a dollar amount on the cost of pain and discomfort to calculate the cost of injuries in relation to the preferences made by the consumers (Abdalla et al., 2017). The WTP techniques may then be subpopulated into other classifications, which include Stated Preferences (SP) as well as Revealed Preferences (RP).

In addition, VOSL and the cost of injuries can be estimated by using the WTP approach (Ainy et al., 2014). Wijnen et al. (2009) described VOSL as expressing what individuals are willing to pay to reduce death risk. They further explained that VOSL is not about valuing a specific individual's life, but about the value of the decrease in crash rate. Note that VOSL can be calculated by dividing WTP by risk change value - which merely the chance of dying that was avoided because of the safety program or other intervention (Milligan et al., 2014).

To determine the monetary value of this decrease in the crash rate, the welfare economic concept WTP is used. This is the maximum amount that people are prepared to pay for a given reduction in crash rate. In the concept of WTP, people made the trade-off between crash rate and money (Wijnen et al., 2017). WTP is also considered by many as a social death reduction (Ainy et al., 2014) as the costs extracted from this are not represented as individual preferences but instead, people as a whole, in which WTP approach minimizes the risk for an individual or a limited number of individuals and people in the community (Ahadi & Razi-ardakani 2015). It is a subjective preference whereby individuals are given an amount of money that they are willing to pay to reduce the risk of premature death while performing a particular risky activity (Rizzi & Ortúzar, 2006). To better understand this concept in a simple way, this method is used to assess the value of a person who is willing to pay for risk reduction (safety) (Puttawong & Chaturabong, 2020) in this context to reduce injury.

Estimates of the WTP for mortality risk reduction can be used to calculate the VOSL, which is a significant component in many economic evaluations of environmental and safety policies (Svensson & Vredin, 2010). WTP includes the SP involved in hypothetical scenarios for all road users (public transport drivers, motorcyclists, pedestrians, and occupants, separately). The RP method elicits value from real evidence, such as □ □e i□ □or□ an□ e o□ ve□ i□ □e sa□ e□ □ TP also for□ on one's □ increasing safety for one's □ a□□i□ or □ or a□ □ ing □ ore sa□ e□ □ □ ea□ ures □ o one's ve□ (Ainy et al., 2014; Mon et al., 2018). Crash costing research is inclined to estimate the VOSL of the general road users through giving a principle to estimate the road safety intervention in cost-benefit analysis (Mofadal et al., 2015). In order to offer a platform for evaluating road safety interventions within a cost-benefit analysis, most of the historical crash cost research studies estimate the VOSL of the road user. The method demands making an estimation of the quantity of fatality risk reduction, the measure is the price that a person will pay in order to receive this reduction, and is characterized by the loss of revenues and well-being of the rest of their life (Bhattacharya et al., 2007).

VOSL is a monetary unit that can be applied to measure the benefit of mitigating mortality risks. It is what people would be prepared to pay per small decreases in their likelihood of dying, which all adds up to a single death avoided. In the cost-benefit analysis of safety regulations and any policy that seeks to mitigate fatalities, this is a key concept. WTP determines VOSL and concerns individuals with regard to risk reductions. As an illustration, contingent valuation methods and the compensating wage differentials have been used to maintain VOSL. Government agencies deploy VOSL to measure the benefits of regulations that decrease the risk of death. This comes in the form of transportation, environmental, as well as occupational safety precautions.

2.4 VOSL VALUATION METHODS

WTP as a method is widely applied in estimating the VOSL in road safety issues, most often through Contingent Valuation (CV) questionnaires, stated preference questionnaires, and discrete choice models (Champahom et al. 2023; Mekonnen et al. 2022; Mon et al. 2018). Methodologically, quite a number of studies implement econometric models, such as log-logistic, log-normal, and Weibull distributions, to estimate VOSL on the basis of WTP data (Mekonnen et al. 2022). Other researchers apply such a Structural Equation Modeling (SEM) framework to examine the factors determining WTP (Champahom et al. 2023) or conjoint analysis methods to examine preferences over safety attributes (Yusoff et al. 2013). They involve interviews conducted with motorcycle users (Pangestika et al. 2021; Chaturabong et al. 2011) through questionnaires to determine the levels of risk reduction they are willing to spend their money on. The most common study design is observational, whereby researchers are likely to compare it with regression analysis/meta-analytic synthesis to analyze the heterogeneity in VOSL estimations (Lindhjem et al. 2011). Outcome measures across studies consist of monetary estimates of VOSL, conversions of fatal and non-fatal injury costs, and WTP to improve safety, which are of essential interest to transport policy and economic analysis of the cost-benefit of road safety investments.

Literature on the VOSL, as it applies to motorcycle crashs, provides a reflection on the different estimation methods and findings in different countries. On the one side, in Malaysia, Yusoff et al. (2013) have calculated the VOSL of motorcyclists at

RM1,150,000 per year. On the other side, Mohd Fauzi et al. (2004) have suggested an even higher estimation of RM1.1 million according to WTP approaches. Empirical estimation of the Value of Statistical Life (VOSL) in Malaysia remains relatively limited. Early studies such as Fauzi et al. (2004) and Yusoff et al. (2013) continue to serve as foundational references in the Malaysian context, particularly in the absence of a substantial number of recent full-scale empirical VOSL studies. These studies provide important baseline evidence for understanding the monetary valuation of fatal risk reduction in road safety research.

More recent local evidence is available from Maslina Musa et al. (2023), Value of Statistical Life (VOSL) and Its Association with the Use of Road Safety Devices, only published in the MIROS Book of Abstracts. This study defines VOSL as an economic measure used to quantify the benefit of avoiding fatalities resulting from road crashes, and applies the willingness-to-pay (WTP) approach to estimate the monetary value individuals are willing to pay to reduce fatal crash risk. The study involved 1,000 respondents across four regions in Malaysia using face-to-face interviews. The estimated VOSL ranged between RM3.2 million and RM4.1 million. In relation to road safety devices, the study reported no significant association between VOSL and the use of child restraint systems and helmet usage, but found a significant association with rear seat belt usage. It should be noted that the abstract does not explicitly detail the valuation method in depth, as it is primarily intended to share emerging findings from ongoing work. As such, it is used in this review as indicative and supplementary evidence rather than as a fully detailed valuation method reference.

In addition, international studies as referred to Chaturabong et al. (2011), study in Thailand, VOSL estimation ranges from 5.5 million to THB 7.0 million, and it is said that WTP is far more important than the conventional methods. In the same way, Pangestika et al. (2021) discovered that the VOSL in Indonesia amounted to Rp. 2.3 billion, containing human costs. Bahamonde-Birke et al. (2015) surveyed evaluation procedures of VOSL, and they recommend WTP as a top procedure. As an example, the study by Champahom et al. (2023) applied a structural equation model to analyze the variables that determine the WTP towards motorcycle safety, where they estimated VOSL between US$0.055 and 0.062 million. De Blaeij et al. (2003) argued over the use of stated choice procedure in VOSL estimation in the Netherlands, where they noted socio-economic differences.

2.5 STATED PREFERENCES AND REVEAL PREFERENCES

Willingness to Pay (WTP) can be estimated using two main approaches, namely revealed preference (RP) and stated preference (SP) methods, depending on the nature of the study and data availability. RP methods derive WTP from actual observed behaviour in real markets, such as purchasing decisions or wage–risk trade-offs, and therefore reflect real-world choices made by individuals (Viscusi & Aldy, 2003). However, RP approaches are often limited in the context of road safety, as safety improvements and risk reductions are not directly traded in observable markets, making behavioural data difficult to obtain or interpret in this setting.

In contrast, SP methods involve the use of hypothetical scenarios where respondents are directly asked about their willingness to pay for specific goods or risk reductions. This is typically done through survey-based techniques such as contingent valuation (CV) or choice experiments, which are particularly suitable for valuing non-market goods such as safety and mortality risk reduction (Bateman et al., 2002). In this study, the stated preference approach was adopted, specifically using a contingent valuation method (CVM) with a payment card (PC) format to elicit [illegible] for fatality risk reduction.

The choice of this approach for the this study is consistent with the study by Mon et al. (2019) in Myanmar, which also employed a stated preference contingent valuation method due to several contextual limitations. First, the respondents in Myanmar were found to have limited familiarity with the concepts of WTP and the value of statistical life (VOSL), making direct valuation through complex bidding or abstract questioning difficult. As a result, a modified payment card format was used to reduce cognitive burden and improve respondents' understanding of the hypothetical valuation tasks. In the present study, a face-to-face interview approach was not feasible due to data collection being conducted during the COVID-19 period. Instead, telephone-based interviews were conducted, where respondents were guided step-by-step through the questionnaire, including the payment card valuation task, to ensure clarity and accurate understanding of the hypothetical scenarios.

Second, the study highlighted the limitations of revealed preference methods in road safety valuation, as reliable market-based behavioural data related to safety improvements are often unavailable in low- and middle-income country contexts (OECD, 2012). Third, given the absence of observable market transactions for risk re□u□□ion□ □□e □□ a□□roa□□ □as □onsi□ere□ □ore sui□a□□e □or □a□□ valuation of safety improvements in a structured and policy-relevant manner. The study therefore demonstrates that contingent valuation is particularly appropriate in contexts where respondents have limited exposure to valuation concepts and where RP data are not readily available.

Based on these considerations, the present study similarly adopts the stated preference approach using a contingent valuation framework, as it is more appropriate for eliciting hypothetical WTP for mortality risk reduction in the absence of real market data and in line with established practice in comparable developing country settings (Bateman et al., 2002; OECD, 2012).

Comparisons of SP and RP in a VOSL study have been obtained differently in research. Others come up with systematic differences, where RP is above SP (Viscusi, 2011). The latter, however, have reported promising similarities between the SP and RP models, especially with regard to in-vehicle time valuation (Wardman & Shires, 2001). The SP techniques will be able to meet the weaknesses of the RP techniques, including investigating risk latency and age effects (Alberini, 2019). The use of the SP and RP data in combination may make improvements in estimation and provide small differences in values (Adamowicz et al., 1994; Li et al., 2018). Some of the factors leading to differences in SP-RP concerns study design, risk characteristics, as well as socio-economic variables (Braathen et al., 2009). Other works point to similarities between SP and RP, which might be due to the choice of the frame (McDaniels, 1988; Gschwandtner et al. 2021). McDaniels (1988) posited that the SP and RP methodologies might produce analogous preference estimates when the SP framing closely mirrors real-world scenarios, eliciting more authentic answers. Recent empirical research corroborates this perspective. Gschwandtner et al. (2021) executed a collaborative SP□ RP model to assess customer willingness to pay. They showed that both techniques represented similar underlying desires by generating SP choice scenarios with attribute values that matched real market data. Furthermore, when SP and RP data were combined in a single estimating framework, the resulting WTP estimates were more reliable. This evidence shows that aligning the framing between SP and RP leads to similar results. In sum, although the problems exist, SP options can be used to supplement RP solutions in VOSL estimation and give important insights on policy evaluation (Alberini, 2019; Viscusi, 2011).

2.6 WILLINGNESS TO PAY (WTP) AND CONTINGENT VALUATION METHOD (CVM) FOR ROAD FATALITY AND INJURY RISK REDUCTION AND ROAD SAFETY PROGRAM.

The Contingent Valuation Method (CVM) is a survey-based economic method that measures the importance people put on non-market goods, especially environmental and public health-related outcomes. It is the most pertinent in contexts where markets have no data, e.g., when pricing risk reduction in mortality, environmental conservation, or □u□□i□ servi□e en□an□e□en□□ □□□ □i□□ □ire□□□□ □ring in□o□□a□ i Willingness to Accept (WTA) compensation for changes in the provision or quality of a non-market good by developing a hypothetical market (FAO, 2000).

CVM stands out as a valuation technique due to its ability to estimate both the use and the non-use values, which makes CVM an excellent tool to analyze environmental and health policies (Zainudin et al., 2016; Carson 2000). It allows legislators to determine what the citizens want and allocate money to the value of public goods like clean air, conservation of biodiversity, or safety measures. CVM, first used extensively by Davis (1963) and since then by more recent litigation such as the Exxon Valdez oil spill, has been empirically tested and methodologically criticized, and improvements suggested (e.g., the NOAA Panel) (Mitchell & Carson, 1989; Arrow et al., 1993). One common application of CVM is estimating the VOSL, which reflects the trade-off individuals are willing to make between money and small reductions in the risk of death. In this context, contingent valuation is considered advantageous over revealed preference methods (such as labor market data). Note that it allows for direct valuation of a specified risk reduction scenario, even among populations not typically represented in wage-risk studies, such as the elderly or non-working individuals (Alberini, 2004).

The application of willingness-to-pay (WTP) approaches and contingent valuation methods in road safety research has continued to gain attention in recent years, particularly in the estimation of the economic value of risk reductions associated with road traffic injuries and fatalities. These approaches are widely used in contexts where □ar□e□ □a□a are no□ avai□a□□e□ a□□o□ing resear□□ers □o □a□□ure in□ivi□ valuation of safety improvements through hypothetical scenarios. A growing body of empirical literature has applied these methods across different countries and settings, reflecting their continued relevance in transportation safety valuation and policy analysis.

Recent empirical studies continue to demonstrate the application of stated preference approaches, particularly willingness-to-pay (WTP) and contingent valuation methods, in valuing road traffic risk reduction across diverse contexts. For instance, studies conducted in urban and rural environments (Antoniou, 2014), as well as in developing countries such as India and Myanmar (Balakrishnan & Karuppanagounder, 2019; Mon et al., 2018; Mon et al., 2019), consistently show that individuals are willing to assign monetary values to reductions in fatality risk despite differences in socioeconomic and contextual conditions. Similar applications have also been reported in more recent work examining the economic burden of motorcycle-related injuries in lower-middle-income countries (Oladeji et al., 2024), as well as studies focusing on □o□or□□□□is□s' su□□e□□ive □os□ va□ua□ion using □□□ a□□roa□□es □□i□ 2020). Collectively, these findings reinforce the continued relevance of stated preference methods in capturing non-market valuations of road safety improvements. More broadly, this evidence is further supported by the systematic review conducted by Nankunda and Evdorides (2023), which confirms that WTP-based stated preference methods remain widely applied in road safety valuation research, particularly in estimating the economic impact of road traffic injuries where market-based data are not available.

2.6.1 The challenges and importance of CVM

However, the method is not without challenges. Critics argue that CVM is vulnerable to hypothetical bias, strategic behavior, and information-related errors, especially when respondents are unfamiliar with probabilistic risk or when scenarios are not credibly presented. Moreover, researchers have responded to these issues through careful survey design, pre-testing, and validity checks to ensure that the WTP responses are internally consistent and theoretically grounded (FAO, 2000; Zainudin et al., 2016). As an example, dichotomous choice formats (simulating actual choices in the market, meaning asking open-ended questions at certain bid amounts) have since superseded open-ended questions as they are more reliable and better understood by respondents (FAO, 2000). In Malaysia, Norzalina et al. (2016) underlined the importance of logic foundations of the survey design of CVM studies and stated that the emphasis must focus on clarity, face validity, and realistic policy situations that should ensure the reliability of valuation results. Although empirical WTP data are not presented in this article, the study offers an elaborate guideline on how a sustainable CV survey can be developed to value environment-based goods, where the hypothetical questions are clear, believable, as well as policy-relevant.

The importance of valuing non-market goods like health improvements and environmental services in public policy decision-making has been on the increase, especially in developing countries where resource allocation needs to be efficient economically, and responsive socially. CVM has become a popular method of estimating how much people will be WTP in order to receive a hypothetical impact on non-market goods, so as to quantify in monetary terms intangible benefits. An early influential use of CVM in the developing country context is estimating the WTP to prevent recurrent bouts of mild respiratory illness by Alberini et al. (1997) in Taiwan. In their study, they came up with an illness-specific valuation method that enables the respondent to carry out a valuation of a health condition depending on their own experience. Results show that WTP was found to rise along with the severity and duration of illness, and also to increase with the level of income and education, with an elasticity of income estimated at 0.4. Nevertheless, the authors mentioned potential errors in independent variables because of self-defined illness reporting, which makes the question of model accuracy and the applicability of benefits transfer problematic.

To conclude, in spite of various methodological issues raised against contingent valuation, it is an important economic valuation method in situations where normal market-type data are not adequate or impossible to obtain. CVM has remained strongly influential in the minds of the citizens when it comes to making decisions concerning different environmental and other health issues. Combined, the studies indicate that in the field of CVM research, there must be a dedicated methodological rigor and sensitivity to the context. Although the empirical estimates may vary due to the different aspects of survey design, socio-economic context, and risk framing, the three studies enhance the promise of CVM application to guide health and environmental policy across the settings. Their results are a part of several findings that strongly support the applicability of CVM in developing nations, although limited by issues concerning the validity of the survey, scope sensitivity, and specification of the model.

2.6.2 The elicitation methods

WTP has been discussed the most in anchoring the value of road traffic risks in different countries through varied modalities and analyses. In Malaysia, the CVM has been applied in terms of both payment cards and open-ended surveys on a national level (Nor and Yusoff, 2003). The VOSL that they found for Malaysian motorists is RM1.26 million per year, and the results have shown that the most important predictors are education and income. The study, however, had limitations such as failure to include non-motorists and the omission of behavioral factors and/or psychological factors. In a similar manner, Chaturabong et al. (2011) ran a WTP survey via a face-to-face approach in Thailand and estimated a VOSL of USD 0.21 million per year among motorcycle users, with age and income emerging as influencing factors. Nonetheless, the study was not extensive in analyzing behavior variables and failed to make any distinction between the urban as well as rural respondents.

On the other hand, Ainy et al. (2014) utilized a combination elicitation methods of payment card, open-ended, and iterative bidding formats in Iran, estimating a VOSL of USD 116,000 per year. They noted significant variations in WTP based on injury type and income level. Nevertheless, the hospital-based nature of their sample limited the generalizability of their findings. In Singapore, Henry Le et al. (2014) used a payment card survey and adjusted foreign values with Gross Domestic Product (GDP) per capita to estimate VOSL, which served as a reference for policy-making. The primary limitation of this study was its reliance on secondary, international data rather than locally collected primary data.

Focusing on vulnerable road users, Adam et al. (2015) applied the WTP-CVM method in Sudan to assess pedestrian risk. Their study, based on a large sample, estimated the VOSL at USD 0.019 to 0.101 million and found age and income to be influential. However, the study only included pedestrian data and did not account for the severity of crashes. Ainy et al. (2016) expanded their earlier work in Iran to focus specifically on motorcyclists. Using a scenario-based survey analyzed with a Weibull model, they estimated a national VOSL of USD 104.8 million. Helmet use, trip distance, and prior crash experience significantly affected WTP, though their sample was limited to an educated population, excluding rural groups.

Alternatively, Ei Ei Mon et al. (2018) implemented the CVM-WTP approach involving payment cards in Myanmar and generated a VOSL of USD 98,385135 to USD 135,712 per year by examining the WTP of the motorcyclists using regressions. Significant associations were found between the socio-demographic factors of age, family, education, as well as risk perception and WTP. Ei Ei Mon et al. (2019) conducted a follow-up study concerning car drivers who used SEM to study determinants. Their results were that they had a VOSL of USD 86,805-163,142, and that risk perceptions and good driving behaviours were factors that influenced them positively. The study, however, did not include other drivers and did not show the cost of post-crash care.

Meanwhile, Puttawong & Chaturabong (2020) chose another target population that involved testing out the VOSL on the 15-39-year-old pedestrians in Bangkok. By means of the WTP-CVM approach and by undertaking a large sample, they derived 0.43 of fatality risk reduction and 0.014 of injury risk reduction, which translate to USD 0.43 million and USD 0.014 million per year respectively. They also stated that greater education levels and private employment added to WTP to reduce fatality risk. Interestingly, high-safety perception was connected negatively with WTP on injury risk. Champahom et al. (2023) lastly used SEM with the TPB to approximate the WTP to reduce the risk of motorcycle crashes in Thailand. The results expressed a relatively low VOSL of USD 0.055- 0.062 million per year and emphasized the role of attitude, behavioral intentions, and perceived behavioral control on the WTP. Nevertheless, the research did not include a real-world outcome measurement.

There are a couple of elements that can be identified as similar in all these studies. Payment cards using the CVM with WTP were mostly utilized, and this demonstrates the applicability of the CVM to diverse cultural economies. Age, income, education, and risk perception were time and again found to be important predictors of WTP, heavily laden with a socioeconomic flavor. Other than that, the priority of addressing vulnerable road users and the necessity of localized data are presented. Regardless of geographical, demographic variations, and context of the studies, the studies written in totality highlight the applicability of WTP-CV methods in the valuation of life and guiding the investment choices in road safety.

2.7 WTP IN MOTORCYCLE SAFETY AND RISK REDUCTION

The willingness-to-pay (WTP) method is extensively employed to quantify the amount people or households are prepared to spend to mitigate the risk of injury or fatality from motorcycle crashs. This method is crucial as it yields estimates of the Value of Statistical Life (VOSL), which may subsequently be utilized in the cost-benefit analysis of road safety legislation. Furthermore, VOSL has been utilized to examine individuals' willingness to pay for safety equipment, such as helmets, which is a crucial element in mitigating motorcycle-related crashs and fatalities. The outcomes of these studies fluctuate among countries due to variations in research design, methodologies employed, and the socio-economic circumstances of participants. This section examines eight studies on WTP among motorcycle users undertaken in Malaysia, Vietnam, Thailand, Iran, and Indonesia, which are significant contributions to the value of statistical life (VOSL) literature.

In Malaysia, Mohd Fauzi et al. (2004) performed one of the pioneering willingness-to-pay studies in Asia to assess the value of statistical life for motorcyclists. The research indicated that the willingness to pay (WTP) for mitigating fatality risks was around MYR 1.1 million per year, nearly fivefold greater than previous estimates derived from the human capital approach. This study contended that employing VOSL WTP-based estimations is more precise for policy formulation, as it accurately represents the genuine preferences of riders about safety enhancements.

During research conducted in Vietnam, as reported by Pham et al. (2008).Pham et al. examined households' readiness to pay for basic motorcycle helmets. The findings indicated that the average willingness to pay (WTP) was VND 163,794 (US$10.2) per year, somewhat exceeding the prevailing market price of a helmet at that time. The study indicated that a government subsidy of approximately VND 61,043 (US$3.8) per year would result in nearly universal adoption of standard helmets among riders (99%). Individuals with higher incomes and those aged 40 to 55 were more inclined to acquire helmets.

Thailand has produced two significant pieces of research pertaining to WTP motorcycles. Chaturabong et al. (2011) assessed the financial implications of motorbike crashs utilizing the willingness-to-pay (WTP) methodology. The reported Value of Statistical Life (VOSL) ranged from 5.5 to 7.0 million baht (US$0.17 to 0.21 million) per year, but the value of statistical injury was between 2.6 and 3.4 million baht (US$0.08 to 0.10 million) per year. Variables including age, gender, occupation, income, and helmet usage significantly affected riders' willingness to pay. A recent study by Champahom et al. (2023) employed a structural equation model based on the Theory of Planned Behavior (TPB). This study reported lower estimates the VOSL ranged from US$0.055 to 0.062 million per year, while the WTP for injury reduction was between US$23.49 and US$24.53. The research emphasized that individuals' views, behavioral intentions, and perceived control significantly affected their WTP.

Moreover, in Iran, two research studies offered contrasting viewpoints. Ainy et al. (2016) assessed the financial burden of motorcycle injuries by willingness to pay (WTP) and found a mean WTP of around 888,110 IRR. Utilizing national crash data, they estimated the total cost of fatalities at approximately US$105 million and the entire cost of injuries at almost US$230 million. Riders with prior crash experience, those who commuted large distances every day, and those who used helmets showed a higher willingness to pay (Ainy et al. 2016).Recently, Hosseini et al. (2024) examined the willingness to pay for helmet purchases in Saqqez, Kurdistan. The average willingness to pay for a conventional helmet was approximately 3.9 million IRR (US$15.6) per year. The research indicated that willingness to pay (WTP) was significantly affected by socio-economic position and helmet usage among peers, implying the importance of both financial capability and social norms.

Two Indonesian studies enhanced the comprehension of WTP. Widyastuti and Utanaka (2020) discovered that in Surabaya, the willingness to pay (WTP) for mitigating the risk of severe injuries was IDR 126.5 million, but for minor injuries it was IDR 13 million. The research indicated that older riders and individuals with higher salaries had a stronger willingness to pay (WTP); however, an increased number of children diminished WTP, presumably due to budgetary constraints (Widyastuti & Utanaka 2020). Kriswardhana et al. (2020) discovered in Jember that motorcyclists with prior crash experiences exhibited a markedly higher willingness to pay for risk mitigation against crashs. Riders with one prior crash exhibited approximately a 40% increased likelihood, whilst those with two crashes showed roughly a 57% heightened likelihood of being inclined to pay more. Gender, income, and marital status significantly influenced the outcome.

Additionally, a recent study in India, conducted in Patna examined □ o□ or□ □ □ □ is□ s' □ i□ □ ingness □ o □ a□ □ □ □ □ □ □ or re□ u□ □ ions in □ a□ a□ i□ improved helmet safety. WTP refers to the amount individuals are prepared to pay to reduce the probability of fatal injury, and it is also used to estimate the Value of Statistical Life (VSL), which reflects the monetary value of marginal reductions in mortality risk (Mon et al., 2018; Ainy et al., 2014). The study by Saurav et al. (2025) involved 541 motorcyclists in Patna, who were interviewed face-to-face using a payment card approach. Respondents were presented with hypothetical improved helmet scenarios and asked to state their WTP for five levels of risk reduction (20% to 80%), alongside data on socio-demographic characteristics, beliefs, and attitudes.

The results showed a consistent increase in WTP as risk reduction increased, from Rs. 390.96 at 20% to Rs. 1259.85 at 80%, indicating that individuals assign higher value to greater perceived safety benefits. The WTP distribution was right-skewed at lower levels of risk reduction and became more stable as risk reduction increased (Anderson et al., 2019). Based on the observed relationship, the estimated VSL was approximately USD 1,170,000, equivalent to about 52 times per capita income, which is consistent with findings from other low- and middle-income countries (Wijnen et al., 2025; Mon et al., 2018). Determinants analysis using a two-limit Tobit model indicated that income, education, and household size positively influenced WTP, while age had a negative effect, with mixed findings for gender and marital status (Mon et al., 2018; Widyastuti and Utanaka, 2020). In addition, the Theory of Planned Behavior framework showed that beliefs about helmet effectiveness and attitudes significantly influenced WTP, with social influence further shaping these behavioural responses (Champahom et al., 2020; Sharif et al., 2023). Overall, the study demonstrates that WTP for motorcycle safety is driven by both economic and behavioural factors, highlighting the need for interventions that integrate affordability with safety awareness and behavioural change strategies.

2.7.1 The studies comparison with WTP-CVM

The analyzed research consistently demonstrates that willingness to pay (WTP) is affected by socio-economic and behavioral factors; nevertheless, the magnitude of the estimations varies significantly across different contexts. Research conducted in Malaysia and Thailand (Chaturabong et al. 2011; Mohd Fauzi et al. 2004) indicated that the statistical VOSL is comparatively elevated relative to conventional human capital assessments, emphasizing that WTP reflects the authentic welfare value of life and safety, rather than merely lost productivity (Chaturabong et al. 2011; Mohd Fauzi et al. 2004). Conversely, recent Thai research conducted by Champahom et al. (2023) yielded much lower VOSL estimations when contextualized inside behavioral models. This disparity prompts a significant methodological inquiry: do individuals genuinely undervalue their lives in these models, or do the elicitation strategies, such as structural equation modeling with little monetary offers, result in consistently lower valuations?

These inconsistencies emphasize the necessity for careful evaluation of VOSL results, as the research design can profoundly influence policy outcomes.

A further issue of contention pertains to the extent of valuation. Iranian studies (Ainy et al. 2016; Hosseini et al. 2024) integrated willingness to pay for injury and mortality risks with total national expenditures, producing estimates that policymakers can directly utilize in cost-benefit calculations. This method effectively illustrates the magnitude of the load at the national level. Conversely, Indonesian studies (Kriswardhana et al. 2020; Widyastuti & Utanaka 2020) adopted a more injury-specific methodology, differentiating between minor and severe injuries. This is analytically significant, as it demonstrates that individuals assign greater value to reductions in severe hazards compared to minor ones, which has consequences for prioritizing interventions such as trauma care, helmet quality, and speed management enforcement. However, the limitation is that disaggregated valuations may not readily convert into a singular policy-relevant "life value" metric.

The significance of social standards warrants careful consideration. Research conducted in Iran and Vietnam indicates that helmet utilization is influenced not only by economic factors but also by social norms and regulatory enforcement (Hosseini et al. 2024; Pham et al. 2008). This underscores a possible vulnerability in exclusively prioritizing subsidies or price. Although consumers express a willingness to pay for helmets, real acquisition and regular utilization may significantly hinge on societal approval and enforcement. Consequently, WTP research should be seen not merely as economic preferences but also as reflections of societal preparedness for safety initiatives.

Moreover, there exists a fundamental equity concern. Numerous research studies have shown that low-income populations exhibit a reduced willingness to pay (Pham et al., 2008; Widyastuti & Utanaka, 2020). From an economic standpoint, this may imply that their lives possess a diminished monetary value, hence eliciting ethical dilemmas in policy implementation. If governments excessively depend on raw willingness to pay, they may underestimate the safety of economically disadvantaged communities, who are the most susceptible to motorcycle crashs. This tension indicates that WTP estimations should be integrated with equity-oriented policy modifications, such as subsidies or cross-subsidization frameworks, to guarantee that life-saving treatments are available to all riders, not solely to affluent groups.An equality issue emerges when low-income populations indicate a decreased willingness to pay, not due to a diminished value of their lives, but rather due to their reduced financial capacity. This poses a policy risk if WTP is accepted literally. Equity-based modifications, such as targeted subsidies, are crucial for safeguarding disadvantaged riders.

The historical and contextual significance of these investigations must be scrutinized. The 2004 study in Malaysia established a Value of Statistical Life (VOSL) at MYR 1.1 million per year (Mohd Fauzi et al. 2004); however, due to increasing incomes, inflation, and evolving traffic circumstances, this amount may no longer accurately represent current valuations. Likewise, Vietnam's 2008 investigation on helmets occurred immediately before the implementation of a stringent national helmet regulation (Pham et al. 2008); currently, the cultural and enforcement landscape has evolved. This indicates that WTP studies cannot be conducted as isolated events but must be regularly revised to maintain their relevance for policy.

The crux of the matter is why concentrating on WTP for motorcycle users is significant. Motorcyclists represent one of the most susceptible categories of road users, constituting an excessive proportion of traffic fatalities in numerous low- and middle-income countries (LMICs).In contrast to automobile occupants, they lack the structural safeguards of a vehicle, rendering them more vulnerable to fatal and severe injuries. Concentrating on WTP for motorcyclists is essential for three reasons.

Initially, policy prioritization through the quantification of societal valuation of risk reductions enables governments to appropriately allocate resources to motorcycle safety interventions relative to other public investments (Banzhaf 2021; Chaturabong et al. 2011; Mohd Fauzi et al. 2004; Sánchez-Martínez et al. 2021).Subsequent fairness and affordability, as shown by WTP, elucidate the presence of economic barriers□ such as helmets perceived as "too expensive" for economically disadvantaged riders in Vietnam and Iran (Hosseini et al. 2024; Pham et al. 2008)□ facilitating the development of subsidies or incentive programs that optimize adoption among the most vulnerable populations. Ultimately, behavioral insights, in addition to economic factors, indicate that willingness to pay (WTP) reflects the impact of previous crash experiences, societal norms, and safety attitudes, so offering a more profound comprehension of why riders either embrace or reject preventive measures (Kriswardhana et al. 2020).

In summary, emphasizing willingness to pay for motorcycle safety enhances the precision of economic assessments and guarantees that interventions correspond with the genuine requirements, preferences, and limitations of riders. This renders WTP an influential instrument for formulating effective, egalitarian, and evidence-driven road safety policy in motorcycle-dependent nations. Furthermore, Bahamonde-Birke et al. (2015) contend that WTP-based VOSL estimations provide more precise and consistent assessments of life and risk mitigation, which are essential for formulating effective and efficient policy interventions, particularly for high-risk populations such as motorcyclists.

2.8 WTP FOR MEDICAL TREATMENT

Studies on willingness to pay (WTP) for medical treatment among low-income patients with chronic illnesses in urban areas show mixed evidence. Some surveys report relatively low WTP for drugs and treatments, reflecting financial constraints among low-income groups (Puteh et al., 2017). Ghosh and Mondal (2011) examined willingness to pay for health insurance among urban poor households in India using a contingent valuation approach, which reflects affordability and financial preparedness for accessing healthcare services. In a related but broader context, Chua et al. (2022) reported that the proportion of patients willing to pay for telemedicine services ranged from 19% to 70% across different study settings.

WTP depends on the parameters of income, education, the existence of morbid conditions, and the experience of previous hospitalization (Ghosh & Mondal 2011; Audureau et al. 2019). It also depends on the age and distance to the healthcare facility, where older patients possess lower WTP and those farther away possess higher WTP (Chua et al., 2022). In low-income countries, overall healthcare demand tends to be inelastic with the range of -0.19 to 0.11 (Srivastava & McGuire, 2015). Suggestions to increase WTP are exposure to interventions, reduced costs, and education to the patient

(Chua et al., 2022). Most of the research indicates it requires state-subsidized insurance schemes (Ghosh and Mondal, 2011; Lavy and Quigley, 1991).

WTP for studies on medical treatment suggests that there are a number of factors affecting it. The socioeconomic factors, such as education, income, as well as employment, affect WTP through significant influence (Proniewicz, 2022; Almalki et al., 2024; Bosworth et al., 2015; Ghosh & Mondal, 2011). Health status and age are also important factors, with less healthy and older people depicting an overall low WTP (Jacobs-Lawson et al., 2010). The negative experiences we had in healthcare in the past may lead to higher WTP according to our previous experiences in terms of money spent out of pocket (Proniewicz, 2022; Ghosh & Mondal, 2011). Technical and functional dimensions of services are the sole predictors of satisfaction in insured patients, whereas uninsured patients pay more attention to the former despite their financial situation (Swain & Singh, 2021). Perceived value of treatment measures is one important factor that will determine WTP, as patients will be willing to pay higher prices when treatment measures are more effective (Wong et al., 2010). Moreover, WTP can be influenced by cultural reasons and the community structure (Bosworth et al., 2015). These results emphasize the complicated relationship between various considerations that have an impact on WTP for medical treatment among populations with and without health insurance.

The WTP of motorcyclists regarding safety and medical treatment shows that there are some significant controlling variables. The abilities that are crucially influential on WTP for injury risk reduction and community health insurance are identified as age, gender, income, as well as riding experience (Chaturabong et al., 2011; Basaza et al. 2022). The reasons that impact the severity of injuries are different in urban and rural settings, and some issues, such as road types and the type of a crash, have a greater significance than others (C. Se et al. 2021). The influence of behavioral intention, attitudes, and perceived behavioral control on WTP perceived safety improvement decisions is also present (Champahom et al., 2023). The factors that also determine the WTP are marital status and past experience with crashs (Kriswardhana et al. 2020). Research has calculated the monetary cost of injury and statistical life to give foundations to policymaking and budget allocations (Champahom et al. 2023;

Chaturabong et al., 2011). Binary choice models and structural equation modeling have been employed to analyze these factors and calculate WTP values for different injury severities (Widyastuti et al., 2007; Widyastuti & Utanaka, 2020).

2.9 QUALITY OF LIFE

The term 'quality of life' is also often [illegible] literature (Theofilou, 2013). The loss of QoL can signify that the individual has lost their ability to live a fulfilled life, including the opportunity to resume working and a meaningful existence following an injury (Ritva Rissanen et al., 2017). It is well established that QoL is a seemingly non-simplified multidimensional concept that integrates the well-being of an individual. In accordance with Paraskevi Theofilou (2013), QoL is a way of measuring the extent to which people assess the goodness of different aspects of their lives or how they feel towards or respond to life events, satisfaction with employment and personal relationships, as well as life fulfilment. It takes into consideration subjective indicators, including individual experiences of satisfaction and well-being, and objective measures, including health and socioeconomic status (Theofilou, [illegible]). Consequently, [illegible]ena further defined QoL in their research in the context of Road Traffic Accident (RTA) survivors as a harmonious and healthy state of life. This complex consists of the biopsychosocial as well as socioeconomic dimensions. They are physical and psychological health, the degree of independence, the social relationships, personal beliefs, as well as the interactions with the environment ([illegible]ovačević et al. [illegible]) [illegible] meantime, Hoang-Thy Nhac-Vu et al. (2013) do not provide a direct definition, but implicitly represent QoL through the lengthy effects seen in the RTA victims in terms of having the suffering of pain, mental or psychological, and in the disturbance of everyday, family, and professional lives. Collectively, these sources indicate that there is a common view of QoL as a whole-person construct, one vital in evaluating the effects of trauma and illness on human functioning as well as life satisfaction (Hours et al., 2013).

Unintentional injuries are conditions that happen and are not deliberate, and the cause is identifiable and can be prevented [illegible] [illegible] repeated similar occurrences and further severity. Among those unintentional injuries, those resulting from road traffic injuries were alarming and warranted proactive public health concern to step up preventive measures. This condition is transparent when, in fact, globally, each year about 1.3 million lives are lost and between 20 □30 million individuals suffered non-fatal injuries, with many suffering injury due to road traffic injuries (World Health Organization, 2022). Malaysia specifically, similarly, most of the injury cases were from road traffic crashs (Faizah et al. 2011). Additionally, reported by the Department of Statistics Malaysia (DOSM), road traffic crashs have consistently been listed among the five principal causes of death in which are one of the top five main cause of admission and death for the past more than a decade (Department of Statistics Malaysia 2018, 2019, 2020b, 2021) since 2018. This may be due to the annual increase in population (Department of Statistics Malaysia 2020a), coupled with the rise in vehicle ownership among the population (Malaysian Road Safety Department, 2018; Ministry of Transport Malaysia, 2019; Police, 2019; Traffic Enforcement Investigation Department, 2020). The outcomes of these injuries can sometimes inflict trauma on those affected, and some can have experienced a prolonged disturbance in their QoL.

As mentioned previously, globally, approximately 1.3 million people are involved in road crashes, resulting in 20 to 50 million people suffering from non-fatal injuries. Pedestrians, cyclists, motorcyclists, and pillion riders are considered at-risk groups contributing to half of the road traffic fatality and injuries. Note that about 93% of these road fatalities are from low and middle-income countries, which eventually nega□ ive□ □ i□ □ a□ □ □ □ eir □ oun□ ries'-being, as road crashes also cause the premature death of people aged 5 □ 29 years old. This condition affects national economic growth and the household financial burden due to a loss of productivity (World Health Organization, 2023a; World Health Organization, 2023b). Road crashes are ranked fourth in the principal causes of death in Malaysia (Department of Statistics Malaysia, 2019, 2020, 2021). The road crashes in Malaysia keep on showing a consistent pattern despite the road safety improvements, programmes, innovations, and inventions to curb the increasing rates (Traffic Enforcement Department, 2020; Road Safety Department of Malaysia (RSDM), 2018; Ministry of Transport Malaysia, 2017). These public health issues have recorded over 6,000 deaths and over 3,000 injuries for the past ten years (PDRM, 2019). While there are costing analyses and mathematical injury models that might project the burden of RTIs, there is another way to understand the burden: measuring the QoL. This measurement is relevant when the measurement of morbidity and mortality cannot be assessed accurately. While the health provider and policymakers are affected economically due to road crashes, the patients involved are also greatly affected by the crash aftermath. In many cases, road crashes are either fatal or non-fatal. However, non-fatal condition that precedes injuries commonly jeopardize both the patients' long-term well-being and psychological ability (Papadakaki et al., 2018). Many studies have recorded several types of trauma analysis using QoL and post-depression (PD). However, few have attempted to assess RTIs, especially in Low-Middle-Income Countries (LMICs) (Rissanen, Berg & Hasselberg, 2017). Unfortunately, this situation also applies to Malaysia, to date, there has been little or no exploration of QoL following RTIs. This situation may be due to the nature of the RTI patient, which is challenging to capture in this type of study. As a consequence, regular updates on patients' well-being for RTIs post-treatment, such as injury management, are lacking despite road crashes ranking as the fourth most concerning public health issue in the country, contributing to mortality (Department of Statistics Malaysia, 2019, 2020, 2021).

In order to realize the Sustainable Development Goals (SDG) 3.6.1 on reducing 50% of road crash mortality and injury, the attempts on QoL investigation are timely and essential. Currently, the local context lacks information on the latest developments regarding the well-being of RTI patients, particularly after discharge. The long-term effects after the crashes are not properly recorded and are difficult to retrieve due to the dynamic nature of RTI conditions. Moreover, it is hard to capture the casualties as part of the related studies. This challenge becomes a barrier to obtaining important information from the patient and to better assist in injury treatment, thereby preventing further damage in the long term. The unavailability of local QoL also prohibits comparison with situations in other countries, even though their approach to the issues can be a benchmark for resolving local conditions. The focus of QoL from the patient perspectives can not only assist in reducing road injury and mortality but also curb unnecessary spending on prevention and curative efforts.

Taken together, these insights highlight QoL as an overall entity, which is essential to measure the impact of trauma and illness on human functioning and life satisfaction at large. Therefore, QoL is not only an outcome measure because it is also an essential tool for interpreting the overall picture of trauma effects. It provides a measure of points of intersection between the health of the body, psychological hardiness, social resilience, as well as adaptive capacity to the environment. Thus, it is now an essential tool of clinical interventions, policymaking, and plans of action to restore whole-person well-being following illness or injury.

RTIs have been shown to influence individuals in great measure, examining the important aspects of a single life, including physical, socioeconomic, as well as mental problems. This has been argued out comprehensively in numerous studies (Lugo et al., 2013; Paiva et al. 2016; Rissanen et al. 2020; Tournier et al., 2016). Moreover, Lugo et al. (2013) concluded in their studies that patients with more severe injuries had higher levels of disability and a worse QoL. Other researchers have also transparently explored this by regarding the rate of QoL due to RTIs. For instance, on WHOQoL-BREF, 51% rated their overall satisfaction with life and a general sense of personal well-being as good or very good, while 42.8% were satisfied or very satisfied with their health status. By one year post-crash, 80% had not fully recovered. Furthermore, participants who reported being fully recovered informed of a significantly better QoL on the physical and psychological domain compared to those who had not fully recovered after one year post-crash (Tournier et al., 2014). Similarly, a majority of participants (61.9%) rated their QoL as good or very good, while half (50.7%) were satisfied or very satisfied with their health status. Groups 1 and 2 (less severe outcomes) significantly reported more satisfaction with life and a general sense of personal well-being than the three other groups. Groups with more adverse effects reported a lower quality of life (Barnes, 2006).

Previously, due to the paucity of instrument development in trauma-specific (Wanner et al., 2016), the QoL of those affected by trauma cases, such as road crashs, was being measured casually by the eminent Medical Outcomes Study 36-items Short Form Health Survey (SF-36) and 12 items (SF-12), European Quality of Life-5 Dimensions (EQ-5D-3L Scales) and the Quality of Well-Being Index (QWB) (Gopinath et al., 2020, 2021; Ohlin et al., 2017). While these instruments provided valuable information regarding the population in general, they, however, lack providing a specification of the knowledge that a specific population can gain. Thus, the Trauma-Specific Quality of Life (T-QoL) was developed by Wanner et al. (2016) to close these gaps. The T-QoL, due to its lengthy questions (43 questions), is the instrument. Nonetheless, it has been further revised by Herrera-Escobar et al. (2020), which reduced it to 18 questions from 43 questions. The Revised-Trauma Quality of Life (RT-QoL) developed by Herrera-Escobar et al. (2020) was tested among different injury and patient characteristics. It offers the specificity and validity that can be used by other trauma-specific condition populations, such as road traffic crashs, hence the usage of RT-QL in this current study.

The utilization of RT-QoL in the current study is to ease respondents' cognitive exhaustion without compromising the study objective and also to encourage res□on□en□s’ participation. Prior to this study, the outcomes of RTIs in local settings were commonly seen in costing (M.N. Amrizal, Y. Rohaizat, Zafar, 2005; Saperi et al., 2017) and evaluation studies (Mohd Faudzi Mohd Yusoff, Nor Ghani Md Nor, 2011; Mohd Fauzi et al., 2004; Nor & Yusoff, 1989, 2003; Yusof, 2013) compared to any investigation of □a□ien□s’ well-being due to the injury suffered. To date, there has not been a Malay Language version of RT-QoL, nor has RT-QoL been utilized in the English version. The RT-QoL was selected for use in this study due to its specific purpose of addressing the well-being of trauma patients, as compared to other types of quality of life surveys available to measure patient health outcomes. RT-QoL was also chosen due to its sound development and validation, shorter survey completion (18 items), which minimizes cognitive burden for trauma patients (Herrera-Escobar et al., 2020), such as those with RTIs, and its composite score, which is essential in research applications (Wanner et al., 2016).

Prior to this study, the outcomes of RTIs in local settings were more commonly observed in costing (Amrizal et al. 2005; Saperi et al., 2017) and evaluation studies (Mohd Faudzi Mohd Yusoff, Nor Ghani Md Nor, 2011; Mohd Fauzi et al. 2004; Nor & Yusoff, 1989, 2003; Yusof, 2013) □o□□are□ □o an□ inves□iga□ion o□ □a□ien□s’ □e□□-being due to the injury suffered. Hence, measuring the QoL among affected individuals is essential, as the burden of road traffic injuries has shifted from mortality to long-term disability and reduced QoL among survivors (Rissanen et al., 2017). This shift highlights the need to prioritize improving the quality of life for RTI survivors, to prevent fatalities, and to tailor interventions and enhance health outcomes for those most impacted (Allen Ingabire et al., 2024). There is as yet no Malay language form of the RT-QoL, and the English one has not been extensively used locally. RT-QoL was selected in this study due to its relevance to the well-being needs of trauma patients as compared to other general QoL tools that have been previously used to measure health outcomes. The rationale for adapting this questionnaire was to ensure that the core content of each survey item is clearly understood by all respondents, promoting a standardized level of comprehension and minimizing interpretation bias (Rafek et al., 2023). In relation to that, the development of a Malay version of the RT-QoL aims to increase its accessibility and encourage more local research on trauma-related QoL in the future. This adaptation helps address the current gap in trauma-specific QoL instruments that are culturally and linguistically appropriate for use in Malaysia (Puteh et al., 2025).

2.10 QUALITY OF LIFE AND ROAD TRAFFIC INJURIES (RTI)

A bibliometric analysis was done to see the trend of QoL and RTI in research, which was similarly produced. The countries, citation patterns, and source types were filtered using the PRISMA-Scr guidelines (Tricco et al. 2018) for bibliometric analysis. This bibliometric analysis illustrates that countries predominantly produce studies related to QoL-RTI, with a notable number of studies and topics commonly associated with QoL and RTI. Figure 2.1 illustrates the growth in publications from 1935 to 2022 in which prompting paucity of research. Meanwhile, Figure 2.2 displays the contributions of countries, and Figure 2.3 lists the related keywords commonly associated with QoL and RTI studies for instance pain, fear, anxiety, and psychological.

Figure 2.1 summarises the performance of QoL and RTI research publications from 1935 to 2022. From 1935 to 1994, publication activity remained consistently low, with only one publication per selected year, indicating minimal research output or limited indexing during that period. A slight increase began in the mid-1990s, reaching two publications annually between 1994 and 1996, before fluctuating through the late 1990s and early 2000s. Notably, in 2001 and 2003, 4 publications were recorded, each reflecting a gradual growth in research activity. A significant spike is observed in 2008, with eight publications marking the start of a more dynamic period. This is followed by a peak of 10 publications in 2017, the highest across the entire time frame. This suggests a period of heightened academic interest or improved indexing and access during the late 2000s and 2010s. In 2015 and 2016, 9 publications were also recorded, supporting this trend of increased productivity. However, from 2018 onwards, a declining trend is noticeable, with publications dropping to 3 in 2020, followed by a brief recovery to 6 in 2021, and then sharply decreasing to only one publication in 2022. This decline may reflect shifting research priorities, publication delays, or disruptions, such as the COVID-19 pandemic.

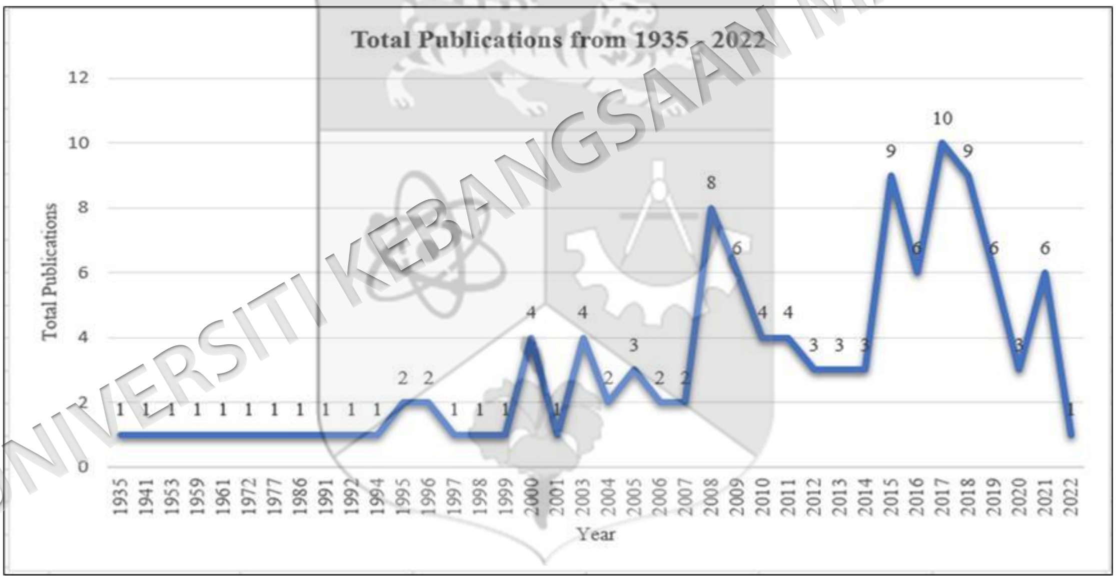


Figure 2.1 Publication Growth of QoL-RTI 1935 □2022

In summary, the publication trend demonstrates a long period of low activity followed by a surge in the 2000s and 2010s, peaking in 2017, before experiencing a decline in the early 2020s. The total amount of 117 publications across these years highlights sporadic but gradually increasing academic contributions, with notable variability in recent years.

The United States of America (USA) is the most active country in publishing QoL and RTI related research with a total of 45 total publications (38.4%), followed by Australia, (n= 18, 15%), Canada (n= 8, 7%), Sweden (n= 7, 6%), and France (n= 6, 5%), respectively while remaining 33 publications were from other countries. The figure highlights the concentration of research in high-income countries, with limited contributions from LMIC. The country showed a paucity of research production from LMICs, such as from Africa, as well as HMICs such as Thailand and Malaysia, which were among countries with high road fatality rates both in the African region and the Asian region. This trend can be seen in figure 2.2.

Figure 2.3 illustrates 222 unique authors' keywords as indicated by the same color are commonly listed together (Kushairi & Ahmi, 2021), with the top five keywords being Post-Traumatic Stress Disorder (PTSD) (22 occurrences), injuries (14 occurrences), quality of life (13 occurrences), pain (8 occurrences) and motor vehicle crashes (10 occurrences). In addition, the color also signifies the cluster of themes. Five themes were represented by the clusters in this visualisation, namely: (I) red - health ou□ □o□es □ □ □ i□e□s□ □or ins□an□e□ □in□ur□ □ur□en'□ □ □en□a□ □ea□ □ □ cord injur□ '□ □ □ □ □- stress (54 green items; for e□a□ □ □e□ □an□ie□ □'□ □ □e□ressi □ □isso□ia□ion'□ □ □is□ress'□ □ □ □- assessment (25 items; for example, □ □ long-term follow-u□ '□ □ □ogni□ive a□ □raisa□ '□ □ □re□i□ □ive - □a□ors'□ □ □ □ □er□ in□ur□ □ □ □ i□e□s□ □or ins□an□'e□ □ screening'□ □ □i□ □ □rau□a□i□ □ in□ur□ '□ □ an□ □as□ □ □- crash vi□ □iur group □ □ □ i□e□s□ □or e□a□ □ □e□ □ □ □e□ia□ri□ □rau□a'□ □ □ □e re□ □ □us□er on □ea□ □ □ ou□ □o□es an□ □ □e g were the two major clusters.

While empirical studies are important, a review paper such as a systematic review or scoping review is vital to assemble similar studies and show study growth globally, for example, a study by Rissanen et al. in 2017 en□i□ □e□ □ □ua□i□ □ o□ □ following road traffic injury: a systematic review. However, network visualization shows that this type of study is still lacking. From the review, it can be seen that there is much more research related to QoL and RTI that should be done to highlight its importance and to help with evidence-based research for policy decision-making, as one of the options to reduce crashs.

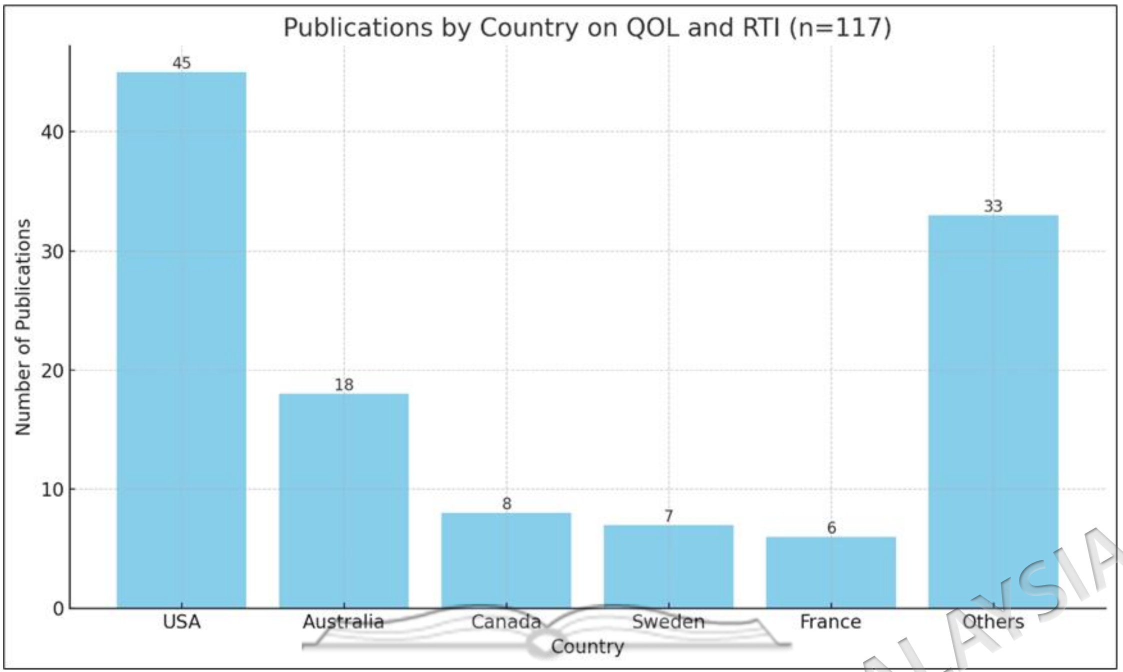


Figure 2.2 Productive Countries of QoL-RTI 1935 2022

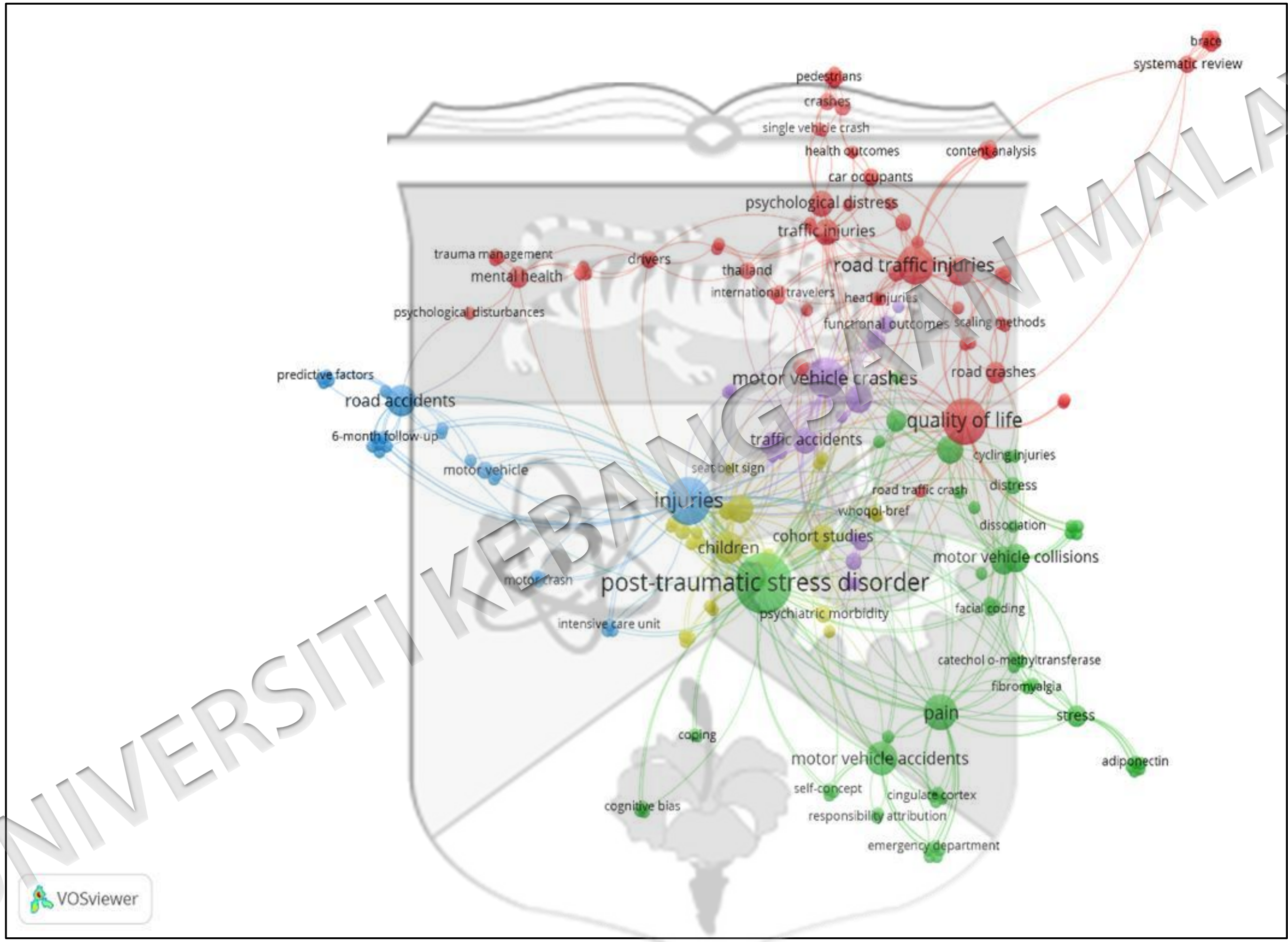


Figure 2.3 Bibliometric analysis of QoL following RTI 1935-2022

2.11 GLOBAL ROAD TRAFFIC INJURY (RTI)

Road traffic injuries have been neglected from the global health agenda for many years, despite being predictable and largely preventable. Evidence from many countries shows that dramatic successes in preventing road traffic crashes can be achieved through concerted efforts that involve, but are not limited to, the health sector (WHO, 2015). Most of the community's economic and social burdens significantly reflect the urge to address the rocketing cost of road traffic injuries. Statistics published by the World Health Organization (WHO, 2020) through their road traffic injuries disclose that, in estimation, about 1.35 million people die each year due to road crashes, with 30 to 50 million more people suffering non-fatal injuries, while others are left with disability due to the injury. Additionally, in this estimation, about 54% of road users in the world are considered vulnerable road users who are at risk of dying due to road crashes. Road traffic injuries not only bring economic losses to nations but also to individuals and their immediate families, which can cost up to 3% of a country's Gross Domestic Product (GDP). According to the WHO region and income level, LMIC had higher road fatality rates, which are 27.5 and 19.2 fatality rates per 100,000 population, respectively.

The high burden of road traffic injuries can be better understood in terms of exposure, vulnerability, and systemic safety gaps. Vulnerable road users such as motorcyclists, pedestrians, and cyclists face significantly higher risks due to limited physical protection during crashes. In many LMIC settings, rapid motorisation, mixed traffic conditions, and inconsistent enforcement of road safety regulations further intensify crash risks. Consequently, road traffic injuries extend beyond mortality and morbidity, contributing to long-term disability, productivity loss, and increased financial pressure on affected households and healthcare systems (WHO, 2023).

Recent global evidence continues to show that road traffic injuries remain a major public health challenge despite ongoing interventions. The World Health Organization (2023) reported approximately 1.19 million deaths annually, with between 20 to 50 million people sustaining non-fatal injuries. Road traffic injuries remain the leading cause of death among individuals aged 5 to 29 years, while more than half of all fatalities involve vulnerable road users. Furthermore, around 90% of road traffic deaths occur in LMICs, highlighting a persistent global inequality in road safety outcomes. In addition to health impacts, road crashes impose a substantial economic burden, costing countries approximately 3% of GDP. The OECD International Transport Forum (2023) further emphasises that road safety outcomes are strongly influenced by factors such as speed management, infrastructure design, and enforcement quality, highlighting the need for systemic and multi-sectoral interventions beyond the health sector.

Overall, these findings demonstrate that road traffic injuries represent not only a health burden but also a significant development and economic challenge. The persistence of high fatality rates, particularly among vulnerable road users in LMICs, underscores the urgent need for strengthened prevention strategies that integrate policy enforcement, infrastructure improvement, and behavioural change interventions.

2.12 SOUTHEAST ASIA ROAD TRAFFIC INJURY (RTI)

A study quantified the burden of RTIs in Thailand in 2004, incorporating new Thai data on mortality and the frequency and severity of long-term disability. The total loss of disability-adjusted life years (DALYs) due to RTIs was 673,000 having a predominant 88% attributable to premature mortality, and a significant impact from long-term impairment outcomes. (Ditsuwan et al. 2011). The use of local data led to a significantly higher estimate of the burden of long-term disability due to RTIs: 74,000 DALYs versus 43,000 using standard Global Burden of Disease methods. However, this difference constituted only a small proportion of the total burden. The burden of RTIs in 2004 remained at the same high level as in 1999. The use of local data on the long-term health consequences of RTIs enabled an estimate of this burden and its uncertainty, which is likely to be more valid (Ditsuwan et al., 2011).

A total of 86,608 deaths have been recorded in the Association of Southeast Asian Nations (ASEAN) countries (WHO, 2018), which warrant immediate attention. Hence, the ASEAN Declaration on Road Safety Strategy, adopted in 2004, has collectively adopted strategies to reduce road fatalities and injuries by 50%, working together to reduce the forecasted deaths by 2030. Other than that, it promotes collective efforts to cater to rapid motorization among member states and strategize to reduce the risk of crashes among vulnerable groups of road users. Malaysia is one of many other ASEAN countries that struggle due to the crash increment every year despite various reduction efforts. According to a local news report, Asia Insurance Review (2019), Malaysia had the third-highest number of road fatalities in Asia and ASEAN, trailing only Thailand and Vietnam, in which Thailand dominates road fatalities at 32.7/100,000, followed by Vietnam and Malaysia, which rank third. Singapore is the sole high-income country in ASEAN with the lowest rate of death, 2.8/100,000.

Table 2.1 The Scale of Road Traffic Crashes in ASEAN Countries up to 2019 Data

Countries	Total Registered Vehicles	Fatalities/ 100,000	Fatality Index	WHO fatality rate estimate /100,000	Trauma Registry	Income Group
Thailand	37,338,139	21,745	5.8	32.7	Some health facilities	UMiC
Vietnam	50,666,855	8,417	1.6	26.4	National	LMiC
Malaysia	27,613,120	7,152	2.5	23.6	Some health facilities	UMiC
Myanmar	6,381,136[c]	4,887	7.6	19.9	National	LMiC
Cambodia	3,751,715	1,852	4.9	17.8	National	LMiC
Laos	1,850,020	1,120	6	16.6	Non	LMiC
Philippines	9,251,565	10,012	1	12.3	National	LMiC
Indonesia	128,398,594	31,282	2.4	12.2	None	UMiC
Singapore	933,534	141	1.5	2.8	National	HiC

Crash survivors and their families are likely to experience significant difficulties in everyday life as a result of this economic pressure. These results in some ways □e□ons□ra□e □□e □on□e□□ o□ a □□□ isease □□oiser ase □□am□’’ in□ur□ □over□ □ra□’’□ □e disease or injury is expensive to treat, and many people face substantial difficulties in covering the required expenses. Severe traffic injuries can entail significant economic consequences on impacted households. Mowafi et al. (2021) discovered that households of RTI patients faced financial repercussions that were 37% greater than those of other emergency patients, equating to 6□16 weeks of lost income, contingent upon previous earnings. This underscores the notion of a "injury poverty trap," wherein sufferers and their families may endure extended financial distress due to healthcare expenses and loss of income, compromising their ability to sustain fundamental living conditions and achieve employment recovery.

Consequently, some people do not receive appropriate care, and others try to finance it by loans or by selling valuable assets such as land, cattle, and so on. Thus, expensive treatment following an injury may throw people into poverty, which may, in turn, be a risk factor for further injuries. This one issue should be addressed by other studies. It is clear that unintentional injuries impose a substantial economic burden on society, especially on the victims, and this principle certainly applies in resource-poor settings such as in Vietnam. Thus, there is a need for unintentional injury prevention programmes, particularly for home and traffic injuries, because they account for almost half of society's total cost (Thanh et al., 2003).

Nguyen et al. (2013) emphasized the significant economic impact of road traffic injuries (RTIs) in Vietnam. Their hospital-based study put the average cost of an RTI hospitalization at US$363, approximately comparable to six months of the typical pay at that time. In addition to this overarching burden, the study also pinpointed significant determinants of elevated expenditures. After adjusting for income and clinical factors, individuals with serious lower extremity injuries incurred costs 1.28 to 1.54 times more than those with facial injuries. Moreover, in motorcycle crashes, head injuries in riders without helmets incurred expenditures 1.41 times greater than those with helmet protection. The findings indicate that both the severity of injuries and protective behaviors significantly affect the financial repercussions of road traffic incidents, underscoring the critical importance of preventive strategies like helmet usage and policies designed to mitigate household susceptibility to catastrophic health costs.

2.13 MALAYSIA AND ROAD TRAFFIC INJURY (RTI)

WHO Global Status Report on Road Safety 2018 reported that Malaysia ranked third on the list with the highest number of road traffic deaths amongst countries in the Association of Southeast Asian Nations (ASEAN) and the Asia region in 2016. According to the 2018 report by the DOSM, transport crashes were the fourth leading cause of death in Malaysia (DOSM, 2019). In 2016, the death index was 2.59 per 10,000 registered vehicles, which showed an increase from the previous year's (Ministry of Transport, Malaysia). As of 2017, Malaysia had registered approximately 28,738,194 vehicles, with 533,875 road crashes resulting in 6,740 deaths, 3,310 serious injuries, and 6,539 minor injuries (Road Safety Department of Malaysia (RSDM), 2018). Additionally, data from the Royal Malaysian Police reported approximately 105,684 fatalities from road crashes throughout the states from 2003 to 2018 (Royal Malaysian Police, 2018). Kelsh (2019) mentioned that worldwide road traffic injuries, which caused death, ranked ninth after other causes such as heart diseases, cancers, cerebrovascular diseases, pulmonary diseases, HIV/AIDS, diarrheal diseases, and other infectious diseases. Similarly, in Malaysia, transport crashes ranked third after ischemic heart diseases, pneumonia, and cerebrovascular diseases (Dept of Statistics, 2015).

This data illustrates the scenario of crashes in Malaysia, which warrants an immediate remedy to reduce the number of fatalities resulting from road crashes. Of all causes of trauma, a substantial proportion is attributable to road traffic injuries, with pedestrians and motorcyclists consistently identified as the most vulnerable road users (WHO, 2023). While earlier national reports have highlighted a high contribution of motorcycle-related crashes to overall road traffic injuries, more recent evidence continues to confirm that motorcyclists remain disproportionately represented in fatal crash statistics due to their high exposure and limited physical protection (MIROS, □□□□□□ □u□ an error re□ains □□e □re□o□inan□ □ause o□ roa□ □ra□□i□ in□u attitudes and behavioural factors identified as key contributors to crash risk (Huertas-Leyva et al., 2021).

In Malaysia, trauma remains a leading cause of mortality and hospitalisation, with motorcycle-related road traffic injuries significantly contributing to the national injury burden (Rahman et al., 2015a). The Global Burden of Disease Study of Institute for Health Metrics and Evaluation (IHME, 2021) reported that Malaysia continues to experience a substantial road injury burden, with a high contribution to disability-adjusted life years (DALYs), reflecting both mortality and long-term disability effects. This indicates that road traffic injuries are not only fatal events but also a major source of lifelong health loss and productivity reduction. At the regional level, Malaysia continues to experience relatively high road traffic injury and mortality rates when expressed per 100,000 population, positioning the country among those with higher injury burdens in the ASEAN region (Tan Chor Lip et al., 2019), although more recent global burden estimates continue to provide updated cross-country comparisons

(IHME, 2021). More recent WHO global estimates further confirm that road traffic injuries remain a persistent challenge in low- and middle-income contexts, where the majority of deaths still occur (WHO, 2023). Within this context, motorcyclists continue to represent the largest proportion of road traffic fatalities in Malaysia, reinforcing their vulnerability in the national transport system. Earlier findings have also shown that motorcyclists accounted for a large proportion of injuries from blunt-force trauma, with most cases being unintentional and linked to road traffic crashes (Faizah et al., 2011). While these earlier studies provide important baseline evidence, more recent national data from MIROS (2023) continues to show that motorcyclists remain the highest-risk group in fatal and serious injury crashes in Malaysia. This consistency across time highlights the persistent nature of motorcycle-related road safety risks.

Overall, the convergence of evidence from WHO (2023), Institute for Health Metrics and Evaluation (IHME, 2021), and MIROS (2023) confirms that road traffic injuries in Malaysia remain a significant public health concern. The persistent dominance of motorcyclist involvement in severe crashes underscores the urgent need for strengthened behavioural, infrastructural, and enforcement-based interventions to reduce injury and mortality risks among vulnerable road users.

The Malaysian government and non-government agencies have to work together seriously to implement preventive measures to reduce the incidence and consequences of motorcycle-related road traffic injuries (RTIs). However, evidence in this area remains limited, highlighting the need to strengthen research output to support effective policy development (Rahman et al., 2015).

Malaysia is a multiracial, multicultural, and multi-religious country with an estimated population of approximately 33 million, with around 4% of total expenditure allocated to health (World Bank, 2023; WHO, 2023). Malaysia continues to experience sustained motorisation, reflected in increasing vehicle ownership over time. According to the Department of Statistics Malaysia (DOSM, 2024) and JPJ administrative records, total vehicle registrations have continued to rise in recent years, with motorcycles and passenger cars consistently representing the largest proportions of the national vehicle fleet.

Recent official transport statistics indicate that Malaysia recorded continued growth in new vehicle registrations into the 2024–2026 period, with more than 800,000 new vehicles registered in 2024, reflecting sustained demand for private transport (DOSM, 2024; JPJ, 2025–2026 updates). Motorcycle ownership remains the dominant category of registered vehicles, followed by passenger cars, indicating persistent reliance on two- and four-wheeled transport in daily mobility patterns.

From a transport safety perspective, this increasing motorisation contributes to higher road exposure, which is a recognised determinant of crash risk. The World Health Organization (2023) emphasises that exposure, alongside behavioural and infrastructural factors, plays a key role in road traffic injuries. Therefore, increasing vehicle numbers in Malaysia is associated with greater interaction between road users, which may elevate crash risk, particularly in mixed traffic environments.

In terms of health burden, trauma remains a leading cause of mortality and hospitalisation in Malaysia, with motorcycle-related road traffic injuries significantly contributing to national injury burden (Rahman et al., 2015a). The Global Burden of Disease Study (IHME, 2021) further shows that road injuries contribute substantially to disability-adjusted life years (DALYs) in Malaysia, reflecting both premature mortality and long-term disability outcomes.

Earlier national evidence indicated relatively high road traffic injury rates per 100,000 population in Malaysia compared to other ASEAN countries (Tan Chor Lip et al., 2019). However, more recent global burden estimates provide updated comparative evidence across countries, confirming that road traffic injuries remain a persistent issue in the region (IHME, 2021). Consistent with earlier findings, motorcyclists continue to be the most affected group in road traffic crashes, accounting for a large proportion of injuries and fatalities due to their high exposure and vulnerability (Faizah et al., 2011; MIROS, 2023).

2.13.1 Fatality index

Fatality index is a measure used to assess the severity of crashes, especially in transportation or occupational safety. It shows the proportion of crashes that result in death compared to the total number of crashes. This index helps evaluate how dangerous a situation is not just how often crashes happen, but how deadly they are (World Health Organization 2013, 2018). Table 2.1 presents the distribution of road crash fatalities across Malaysian states in 2019, alongside supporting indicators including total population, number of registered vehicles, number of deaths, and the fatalities index.

The total population for each state is expressed in millions of persons, based on the scale of the data source gathered from the PDRM in 2019. This means that the values represent population size in millions (e.g., Selangor = 1.78 million; Kuala Lumpur = 6.51 million; Perlis = 2.51 million). The use of this standardised unit allows for consistent comparison of population size across states of varying scale. The number of registered vehicles refers to the total number of motor vehicles officially registered within each state in 2019. The highest number of registered vehicles is observed in Kuala Lumpur (6,652,965 vehicles), followed by Selangor (3,066,513 vehicles) and Johor (3,734,503 vehicles). In contrast, Perlis recorded the lowest number of registered vehicles (122,924 vehicles), reflecting its smaller geographic and population size.

In terms of road crash fatalities, Selangor recorded the highest number of deaths (1,054 fatalities), followed closely by Johor (1,040 fatalities). Other states with relatively high fatality counts include Perak (667 deaths) and Pahang (454 deaths). In contrast, Kuala Lumpur recorded the lowest number of fatalities (200 deaths), despite having the highest number of registered vehicles, suggesting differences in exposure, traffic conditions, and urban driving environments. The fatalities index, which represents the number of deaths per 100,000 population, provides a standardised measure of road safety risk across states with different population sizes. Based on this index, Perlis recorded the highest fatality rate (6.1 per 100,000 population), followed by Pahang (4.1), Terengganu (4.0), and Kelantan (3.6). Selangor and Negeri Sembilan also recorded relatively high indices (3.4 and 3.3 respectively). In contrast, Penang recorded the lowest fatalities index (1.4 per 100,000 population), followed by Sarawak (1.9) and Sabah (2.1), indicating comparatively lower fatality risk. Overall, the table highlights clear inter-state variations in road crash fatalities. While highly urbanised and densely populated states such as Selangor and Johor recorded high absolute fatality numbers, smaller states such as Perlis demonstrated higher fatality risk when adjusted for population size. This demonstrates the importance of using a standardised fatalities index to enable meaningful comparison across states rather than relying solely on absolute fatality counts.

It can be seen that small population states may suffer more than large states due to the higher number of vehicle owners and the resulting number of deaths. This can impact the less productive GDP states such as Kedah, Kelantan, and Pahang (Ministry of Economic Affairs, 2019) as the burden of RTI impacts the states' economic and socio-economic condition, which the states cannot afford to bear. Hence, the country needs to keep the crash rate at two deaths per 10,000 to align with a 50% reduction of crash fatality of RSPM 2014 – 2020 (News Straits Times, 2015; The Borneo Post, 2014). Apart from the increment of vehicle ownership, environment, road condition, human, and vehicle are among the contributing factors for road crashes. MIROS used crash data from 2011 which indicated that among the causes of road crashes, 80% were attributed to human carelessness, 13% to road conditions, and the remainder to vehicle conditions. Harith & Mahmud (2018) have also laid out human risk among motorcyclists in their studies, in which violation of traffic regulations seems like a usual offence made by motorcyclists, apart from their reckless biking behavior and not paying attention to other road users.

Table 2.2 Road Crashes Fatalities 2019

States	Total Population (millions)	Number of Registered Vehicles	Number of Deaths (per 100,000)	Fatalities Index
Johor	3.76	3,734,503	1,040	2.7
Melaka	0.93	884,186	217	2.4
Negeri Sembilan	1.13	998,953	337	3.3
Selangor	1.78	3,066,513	1,054	3.4
Kuala Lumpur	6.51	6,652,965	200	3.0
Penang	1.77	2,747,781	392	1.4
Perak	2.17	2,331,100	667	2.8
Kedah	0.25	1,447,074	446	3.0
Perlis	2.51	122,924	76	6.1
Kelantan	1.88	922,856	338	3.6
Pahang	1.24	1,103,840	454	4.1

to be continued

(Continuation)

Terengganu	1.67	682,203	277	4.0
Sabah	3.9	1,301,712	284	2.1
Sarawak	2.81	1,875,479	369	1.9

According to the WHO (2021), road traffic injury caused nearly 1.3 million deaths worldwide. Malaysia ranks third in the highest mortality rate out of the WHO Western Pacific Region, and has marked visibility in the ASEAN region as well. Based on these data, road traffic injury is now one of the major concerns in Malaysia. It is the fourth leading cause of death after Ischemic Heart Disease (IHD), pneumonia, and cerebrovascular diseases, however, it is principal causes of death among children aged 0 – 14 (3.3%) and contributes to premature death and loss of productivity in the aged of 15 – 40 years (21%) (Department of Statistics Malaysia, 2018; Rohaida Mohamad, 2019). Note that individuals who are around 15 – 40 years old are prone to road crashes, which could result in injuries or even fatality. This local data is consistent with the WHO 2021 road traffic injury facts, which state that young adults are more susceptible to traffic injury. Notably, reflecting local data, countries lose many productive individuals, with up to 77% of road fatalities and injuries occurring in economically productive age groups (World Health Organization, 2018).

For the past five years (2015–2019), Malaysia has recorded a substantial trend of road crashes. The total number of road crashes was notably higher in 2019, with the number of crashes increasing by 74% compared to 2018, marking the highest level in the five-year period. Among the common contributing factors in 2019 were dangerous turning, speeding, careless driving, dangerous driving, failing to conform to traffic light changes, dangerous overtaking, driving too close to other vehicles, and improper parking (PDRM, 2020). The distribution of crashes across fourteen states in Malaysia, totalling 2,839,852 road crashes over the five-year period, is shown in Figure 2.4.

Most crashes occurred in Selangor, which recorded the highest number of incidents due to its high population density, urbanisation, and intensive economic and transport activities. These characteristics contribute to higher traffic volume and greater road user interaction, which increases exposure and consequently the likelihood of crashes. In contrast, Perlis, the smallest state in Malaysia, recorded the lowest total number of crashes due to its smaller population size and lower traffic exposure. However, despite having the lowest crash count, Perlis recorded a relatively high fatality rate of 29.9 per 100,000 population (Department of Statistics Malaysia, 2022) (Table 2.1). This indicates that crash frequency and crash severity do not necessarily follow the same pattern across states, as smaller states may still experience proportionally higher fatality outcomes depending on travel conditions, road environment, and accessibility of emergency response services. This pattern suggests that road safety outcomes should be interpreted beyond absolute crash numbers, as differences in exposure, population size, and contextual state-level characteristics influence both crash frequency and fatality risk.

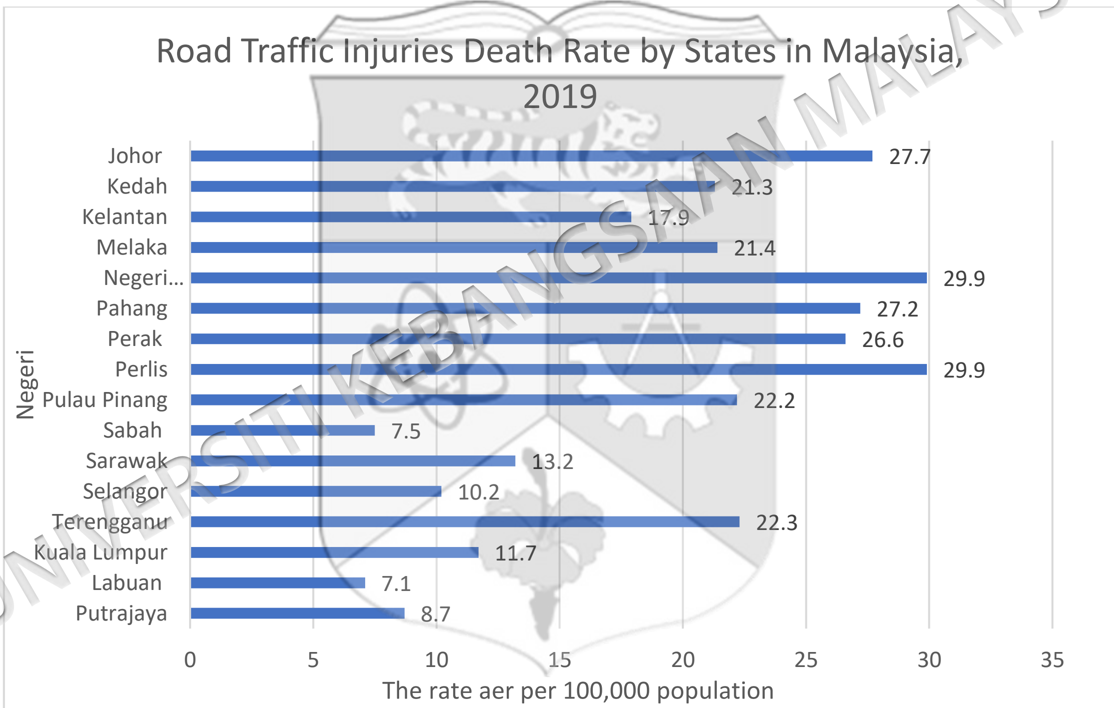


Figure 2.4 Road Traffic Injuries Deaths by States in Malaysia 2019

Source: Royal Police Malaysia 2019

According to a statistic from PDRM (2019), the total of death in fourteen states in Malaysia throughout the years were consistent at average of 6000 cases in even though a slight decreased of 1.2% of death cases in 2019 (PDRM, 2020), while WHO through Global Status Report on Road Safety (GSRRS, 2018), has estimated Malaysia to record about 7000 total deaths per year, which is equivalent to 23.6 per100,000 population. Even though there is a disparity, the figure shows that traffic injury, which eventually resulted in death, should be a concerning public health issue. This prediction is somewhat true by looking at the close gaps between those data.

In Malaysia, motorcar drivers and occupants, motorcyclists and pillion, and pedestrians are considered vulnerable road users who contribute to the high rate of crashes in the country (Road Safety Department of Malaysia (RSDM), 2018). The rapid vehicle ownership has been increasing for the past five years (2015 – 2019), continuously raising concerns about road traffic injury and fatality. A report by the PDRM (2020), reported that, for the past five years (2015 –2019), there were about 2,839,852 cases of road crashes with 33,089 deaths and 50,440 injuries, in which light injuries were reported to be high during this period. This figure represents fourteen states in Malaysia. On average, every year for the past five years, there were 6,761, 3,564, and 6,523 cases of death, severe injuries, and light injuries reported, respectively. It can also indicate the fact that every day there will be about 18 deaths, 10 suffer severe injuries, and about 18 individuals suffer light injuries due to road crashes.

Table 2.3 Motorcyclist Fatalities by State (2019–2025)

Year	Total Fatalities	Motorcyclist Deaths (%)	Avg. Deaths/Day	Death Rate (per 100,000)	Significant States (High Fatalities)
2020	4,634	3,118 (67.3%)	~13	14.1	Selangor, Johor, Perak
2021	4,539	3,548 (~78%)	~12	13.9	Selangor, Johor, Kedah
2022	6,080	4,000 (65.8%)	~17	18.00*	Selangor, Johor, Perak
2023	6,443	4,448 (69.0%)	~18	19.10*	Selangor, Johor, Perak
2024	6,420*	~4,365 (68.0%)	~18	18.90*	Selangor, Johor, Sarawak
2025	6,537	4,340 (66.4%)	~18	19.30*	Selangor, Sarawak, Johor

a u a e es i a es ase on o i ia ai averages an ... a a sia o i e

Table 2.3 reveals the trajectory of road traffic fatalities in Malaysia between 2020 and 2025 discloses a "rebound" effect, where the artificial safety gains seen during the pandemic were reversed as mobility returned to normal levels. In 2020 and 2021, road fatalities dropped to their lowest levels in a decade, hitting a floor of 4,539 deaths in 2021 due to the Movement Control Orders (MCO) which significantly reduced traffic exposure (Jabatan Perangkaan Malaysia 2022). However, as travel restrictions were fully lifted, a deductive analysis shows that the "danger baseline" resumed its upward path; fatalities surged to 6,080 in 2022 and climbed to 6,537 by 2025 (Ministry of Transport 2026). This data confirms that without the external suppression of traffic volume, the nation's baseline fatality rate remains high, averaging roughly 18 deaths per day (Ministry of Transport 2024).

The vulnerability of motorcyclists and pillions has fundamentally intensified throughout this period. While they have consistently accounted for the majority of deaths, their share of total fatalities remained disproportionately high, accounting for 66.4% of all fatalities (4,340 deaths) by 2025 (Ministry of Transport 2026). Deductively, the high mortality risk for these groups is not solely due to crash frequency□ as motorcycles were involved in only 13.7% of all crashes□ but rather due to their extreme physical vulnerability during impact (Ministry of Transport 2026). Furthermore, official data identifies transport crashes still maintained as the principal cause of death for Malaysians aged 15□40 (DOSM,20 highlighting a persistent threat to the nation's core workforce despite targeted interventions like the Malaysia Road Safety Plan 2022□2030 (Jabatan Perangkaan Malaysia 2025).

2.14 BURDEN OF MOTORCYCLE CRASHES IN MALAYSIA: PATTERNS, DETERMINANTS AND IMPLICATIONS FOR VOSL AND QUALITY OF LIFE

Motorcycle crashes constitute a significant public health and safety concern in Malaysia, disproportionately contributing to the incidence of road traffic injuries and fatalities. In the last ten years, researchers have analyzed motorcycle crash trends from various viewpoints, including epidemiological patterns, regional and temporal distributions, clinical consequences, and contributory behavioral and infrastructural elements. The research together indicates that, despite policy interventions and enforcement efforts, motorcycle crashes remain an increasing concern, with minimal evidence of significant long-term decreases in incidence or death. This synthesizes evidence from empirical research undertaken between 2012 and 2024, emphasizing consistent findings, emerging inconsistencies, and implications for road safety management.

A recurring theme in the literature is the disproportionately high involvement of motorcycles in road traffic injuries and fatalities in Malaysia. However, rather than relying solely on absolute figures, a more meaningful interpretation emerges when fatalities are standardised per 100,000 population, as presented in Table 2.1. This measure allows for consistent comparison over time and avoids distortion arising from population growth. In this context, Abdelfatah (2016) highlighted that Malaysia continues to experience a relatively high burden of road fatalities, particularly involving motorcyclists, although global comparisons should be interpreted cautiously due to differences in reporting frameworks. The persistence of this issue is further supported by Azami et al. (2024), who identified motorcycles as the dominant vehicle category in crash statistics, with young male riders forming the most vulnerable group.

Importantly, earlier findings by Nasaruddin et al. (2012) indicated that increases in motorcycle ownership were not matched by proportional reductions in fatalities. When interpreted alongside the fatality rates reported in Table 2.1, this suggests that the risk of death per population has not declined substantially despite increased mobility and exposure. At the sub-national level, data from Perak, which recorded 30,669 crashes and approximately 500 fatalities in a single year (Perak Crash Report, 2023), further reinforces the magnitude of the issue. While these absolute figures are informative, their implication becomes clearer when viewed through the lens of population-adjusted fatality rates, which reflect the actual risk faced by road users.

Taken together, both the literature and the population-standardised indicators in Table 2.1 suggest that motorcycle-related fatalities remain a significant and persistent road safety concern in Malaysia. Nevertheless, caution is required in interpreting whether the situation is improving or deteriorating, as this depends on consistent trends in fatality rates over multiple years rather than isolated figures.

Numerous research studies have investigated the spatial and temporal variations of motorcycle crashes. Spatial analysis conducted by Mohd Noor et al. (2015) indicated that urbanised states continuously recorded elevated crash rates, whilst rural regions demonstrated a heightened fatality risk attributable to inferior emergency response capabilities. Additionally, Selangor has been identified in empirical research as recording the highest number of road traffic fatalities in Malaysia, particularly in 2019, reflecting its high population density, level of urbanisation, and traffic exposure (Radzuan et al., 2021). However, it is important to interpret these findings cautiously, as higher absolute fatalities in Selangor are influenced by its larger population size. When standardised measures such as fatalities per 100,000 population are considered, the relative risk may differ across states. These findings underscore the necessity of acknowledging geographical discrepancies, since interventions in densely populated states may necessitate distinct techniques compared to rural areas. The consistency of these patterns across various studies suggests structural differences in transport exposure and access to post-crash care within Malaysia.

Motorcycle crashes in Malaysia are significantly influenced by behavioural patterns and infrastructural factors. Idris et al. (2018) identified excessive speed, risky overtaking, and alcohol use as key contributors to crash involvement. This is consistent with Abdul Manan and Várhelyi (2012), who demonstrated that motorcycle fatalities are strongly associated with both riding behaviour and road environment, particularly on primary and rural roads.

In addition, younger and less experienced riders have been consistently identified as a high-risk group. Borhan et al. (2018) found that younger motorcyclists exhibit a significantly higher tendency to engage in risk-taking behaviours, especially at signalised intersections, thereby increasing their likelihood of crash involvement. Similarly, Hassim et al. (2013) showed that many commuter motorcyclists involved in crashes were licensed and helmeted, yet remained vulnerable due to prolonged exposure, congestion, and fatigue during daily travel. The study further indicated that crash-involved riders were generally younger and had higher exposure levels, reinforcing the interaction between behavioural and environmental risk factors.

Collectively, these findings suggest that compliance with licensing and helmet regulations alone is insufficient to ensure safety. Instead, behavioural risks□ particularly those associated with younger riders and high-exposure commuting□ remain embedded in routine riding practices and are further influenced by infrastructural conditions.

Research on crash dynamics has yielded significant insights into prevalent collision events and associated injury profiles. Mohd Isa et al. (2020) indicated that approach-turn collisions were the predominant configuration resulting in severe injuries, especially at intersections. Injury pattern studies indicate that young males in their twenties and thirties are the most commonly afflicted demographic, frequently experiencing numerous injuries such as head trauma and fractures (Injury pattern study, 2020). Tan et al. (2018) corroborated these clinical results by establishing that head injuries, polytrauma, and delayed hospital attendance are the most significant predictors of mortality in wounded motorcyclists. These findings underscore the interplay between hazardous crash scenarios, demographic susceptibilities, and clinical outcomes, emphasizing the necessity for integrated preventative and post-crash interventions.

Motorcycle crashes place a significant strain on Malaysia's healthcare system. Rahman et al. (2015) showed that as much as 80% of trauma cases in emergency rooms were due to motorcycle crashes, a statistic subsequently validated by a related burden study (Rahman et al., 2015b). In addition to urgent medical attention, survivors encounter enduring disability and psychological distress, intensifying economic burdens for families and communities. The consistent theme in this research is the disparity between elevated case counts and constrained emergency and rehabilitation capacity, indicating that healthcare system strain is a major contributor to adverse post-crash outcomes. When combined with the findings of Tan et al. (2018), it is evident that both pre-hospital delays and overcrowded hospital systems exacerbate the mortality burden.

Although this research elucidates the epidemiological, clinical, and systemic aspects of motorcycle crashes, it rarely considers the economic price of life or the experiences of survivors. The disparity can be reconciled by employing Value of

Statistical Life (VOSL) and Quality of Life (QoL) frameworks. VOSL, based on individuals' willingness to pay for reductions in mortality risk, offers policymakers an economic standard for assessing safety improvements (Sánchez-Martínez et al., 2021). In Malaysia, where deaths are among the highest worldwide (Abdelfatah, 2016; Azami et al., 2024), VOSL figures could bolster the rationale for investing in safer infrastructure, enhanced enforcement, and sophisticated trauma systems.

Similarly, QoL assessments reflect the concealed burden of surviving, since crash victims experience enduring functional, psychological, and social deficits (Herrera-Escobar et al., 2020). Research by Tan et al. (2018) on severe injury predictions and Rahman et al. (2015) on trauma case strain highlights that death statistics fail to capture the actual social cost. Incorporating QoL evaluation guarantees that the perspectives and results of survivors□specifically their diminished productivity, emotional turmoil, and persistent care requirements□ are considered in policy formulation.

The VOSL and QoL frameworks collectively offer a dual perspective: VOSL quantifies safety in financial terms to influence legislators, whereas QoL emphasizes the human consequences necessitating extensive rehabilitation and social assistance. By integrating these methodologies, Malaysia can transcend mere enumeration of crashes and fatalities, advancing towards a comprehensive comprehension of the true cost of inaction, thus guiding road safety initiatives that mitigate both mortality and long-term disability.

2.15 SOCIODEMOGRAPHIC, SOCIOECONOMIC, INJURY STATUS AND PRE CRASH STATUS OF RTI PATIENTS

WTP was significantly associated with age, gender, income, and type of road user, as reported in several studies (Ainy et al., 2014; Svensson & Vredin, 2010), while QoL was reduced by age, gender, socioeconomic status, injury severity, and injury type. Additionally, patients with more severe injuries had higher levels of disability and a worse QoL (Lugo et al., 2013). Road traffic crashes contributed to the leading cause of fatal burden among males, followed by ischaemic heart diseases and cerebrovascular diseases. Among females, cerebrovascular diseases were the leading cause of fatal burden, followed by ischaemic heart diseases and lower respiratory infections (Institute for Public Health 2017). DOSH Malaysia reported the statistics on the cause of death from transport crashes in 2018 as 20.4% among the age group 15 □40 years.

Previous local research, which attempted VOSL, indicates that socio-economic and demographic variables play a crucial role in determining the VOSL and the WTP for enhancements in road safety within Malaysia. The level of income consistently stands out as a significant factor, with individuals of higher income exhibiting a greater ability and inclination to allocate resources towards safety measures, indicative of their valuation of life and aversion to risk (Nor Ghani, 2003; Faudzi, 2011; Nuura, 2010). The influence of gender is evident, with male respondents, particularly those who ride motorcycles, being disproportionately represented in crash statistics and demonstrating unique WTP behaviours, which may be associated with their increased exposure to road hazards (Faudzi, 2011). The interplay between age and economic activity reveals that younger and middle-aged individuals, positioned within their peak productive years, exhibit elevated safety valuations (Nuura, 2010).

Distinct ethnic variations are apparent, as certain studies indicate that Chinese respondents frequently express a greater WTP for safety, highlighting the cultural and economic disparities in risk perception (Faudzi, 2011). The socioeconomic challenges, including medical costs, income loss, and reliance on crash victims, significantly impact VOSL, especially within lower-income households. These groups might emphasise pressing financial requirements rather than investing in long-term safety measures, underscoring the necessity for focused interventions (Nor Ghani, 2003). Moreover, a familial background of crashes or fatalities influences willingness to pay, as those with such experiences often attribute a higher significance to enhancements in life and safety (Faudzi, 2011). These findings highlight the complex relationship between socio-economic and demographic factors in influencing public perceptions of road safety and the distribution of resources for crash prevention initiatives.

Table 2.4 The local VOSL research

Study	Year	Method	Approach	Limitations	Findings
Nor Ghani (2003)	2003	Contingent Valuation (CV)	Nationwide survey using stratified random sampling	Income-adjusted values are considered low compared to global standards	Mean VOSL estimated at RM 1.3 million
Faudzi (2011)	2011	Conjoint Analysis (CA)	WTP using conjoint profiles for risk reduction and safety device installation	Limited focus on car and motorcycle users; excludes pedestrians and cyclists	VOSL for fatal injury estimated at USD 0.31-0.53 million
Nuura (2010)	2010	Conjoint Analysis (CA)	Focused on the risk-money tradeoff for fatal injury reduction	Economic fluctuations during study time may affect WTP consistency	VOSL for fatal injury ranged RM 1.15-1.45 million
Faudzi Yusof (2008)	2008	Stated Preference Approach (CA & CV)	Combination of CV and CA for robust findings	Focuses only on fatal injury; excludes comprehensive crash costs	VOSL for motorcyclists at RM 1.2 million

Table 2.5 Quality of Life following RTI studies

Study	Year	Method	Approach	Limitations	Findings
Ruales et al.	2019	Longitudinal study, repeated surveys at 1 and 5 years, regression models	Tracks QoL over time to identify factors (e.g., whiplash, pain, PTSD) affecting long-term HRQoL	Potential attrition bias, complex statistical modeling	QoL improves or deteriorates over time; pain and PTSD significantly impair long-term QoL; targeted interventions are necessary

to be continued...

...continuation

Paiva et al	2015	EQ-5D-based questionnaire, conversion to utility scores, and injury severity classification	Uses the EQ-5D index to estimate HRQoL based on injury type, severity, and body part	May not capture all QoL dimensions, relies on population weights	Patients with oral, facial, and fractures have worse HRQoL; early rehabilitation and mental health support are needed
Hoang-Thy Nhac-Vu	2013	Cross-sectional study, convenience sampling, survey of RTI patients	Focus on injury pain, early rehabilitation, mental health, and using EQ-5D-5L for HRQoL	Cannot establish causality, recall bias, and limited generalizability	Low HRQoL in RTI patients; pain management and psychological support are essential; policies should prioritize healthcare resources for RTI recovery
Tournier et al.	2016	Analysis of HRQoL related to injury severity (MAIS), sex, age, injury location, and data from patient questionnaires	Examines HRQoL differences by injury severity, sex, and body part via statistical analyses and comparisons	Limited to specific injury types, potential reporting bias	Even minor injuries affect HRQoL, especially among women; injury severity and injury location significantly influence HRQoL, with women generally reporting lower HRQoL after injuries
Jo Barnes	2006	Comparative analysis using EQ-5D data, stratified by sex, age, and injury severity; statistical evaluation	Assesses HRQoL changes across severity, age, and sex using EQ-5D index scores	Cross-sectional design limits causal inference	HRQoL declines with injury severity; women report lower HRQoL than men, especially young women; older men tend to fare slightly better in some injury categories

2.16 VARIABLES DEFINITION

The following are the definitions of the variables and their categorization in this study. The Independent Variables (IVs) and Dependent Variables (DVs) are explained to align with the conceptual framework and ease the data analysis later. IV inclusive of res□ on□ en□ ’s so□ io □ e□ ogra□ □ i□ □ age□ gen□ er□ e□ □ ni□ i□ □ □, andu□ a□ ion□ □ o□ □ u□ a□ ion□ □ so□ io e□ ono□ i□ □ in□ o□ e□ □ ouse□ o□ □ ’s in□ o□ e□ an□ □ ouse status (types of injury and injury severity) and lastly, pre crash status (hospitalization history). In contrast, the outcomes of the study are VOSL and QoL of the respondents.

The categorisation of variables in this study (young and old for age, low and high for education, occupational levels, injury severity, and income-related variables) was based on established practices in epidemiological and health-related research, where variables are commonly grouped into meaningful categories to facilitate interpretation and analysis. Previous studies have similarly applied such structured classifications to enhance clarity in examining health and socioeconomic outcomes (Yuan et al., 2015; Shahar et al., 2019; Min et al., 2015).

In addition, similar categorisation approaches have also been applied in previous academic work, including the Cost-Effectiveness Analysis of Psoriasis Treatment Modalities in Malaysia, thesis by Azmaniza Azizam in 2019, which adopted comparable grouping strategies for interpretative purposes.

In particular, injury severity was classified based on the Abbreviated Injury Scale (AIS), 2016, which is a widely used anatomical scoring system for assessing trauma severity. In addition, household income and income categories were classified according to the official income classification framework by the Department of Statistics Malaysia (DOSM), which provides standardised income groupings for socioeconomic analysis (DOSM, 2023).

These classification approaches are widely accepted in health and socioeconomic research and allow for clearer interpretation of associations between demographic characteristics, injury severity, and study outcomes.

Table 2.6 Variables Definition

Variables	Definition	Description	Coding	Category
Socio demographic	Age	□ es□ on□ en□ 's age the time of the survey	0 = Young 1 = Old	Dichotomous
	Gender	Gender of respondent	0 = Male 1 = Female	Categorical
	Ethnicity	Race of respondent	0 = Malay 1 = Chinese 2 = Indian 3= Others	Categorical
	Education	Level of education of the respondent	0 = High level 1 = Low level	Categorical
	Marriage Status	□ es□ on□ en□ 's s□ at the time of the survey	0 = Married 1 = Single 2 = Divorce	Categorical
	Occupation	□ es□ on□ en□ 's □ the time of the survey	0 = High level 1 = Middle level 2 = Low level	Categorical
Socio economic	Income	□ es□ on□ en□ 's in□ at the time of the survey	0 = B40 1= M40 2 = T20	Categorical
	Household income	Accumulative income from the res□ on□ en□ family members	0 = B40 1 = M40 2=T20	Categorical
	Household size	The size of the respondent family	0 = Small 1 = Medium 2 = Big	Categorical
Injury status	Type of injury	Type of respondent injury	As reported in e-HIS	Categorical
	Injury severity	□ es□ on□ en□ 's in□ severity as mapped following the AIS and MAIS	0 = Minor 1 = Moderate 2 = serious 3= unknown (9)	Categorical

□ o □ e □ on□ inu

(Continuation)

Pre-crash status	Hospitalization history	Respondent's risk of being admitted to the hospital one (1) year before the study	0 = Yes 1 = No	Dichotomous
VOSL	WTP	WTP for injury risk reduction (RM)	As reported by the respondent	Continuous
		WTP for fatality risk reduction (RM)	As reported by the respondent	Continuous
		WTP for the national road safety program	As reported by the respondent	Continuous
		WTP for injury medical treatment (RM)	As reported by the respondent	Continuous
	Costs	Cost of injury	Injury reduction calculation	Continuous
		Cost of fatality	Fatality reduction calculation	Continuous
Quality of Life (QoL)	Revised Trauma Quality of Life	Functional	0 = Low level 1 = High level	Dichotomous
		Physical	0 = Low level 1 = High level	Dichotomous
		Emotional	0 = Low level 1 = High level	Dichotomous

2.17 CONCEPTUAL FRAMEWORK

Creating a conceptual framework that synthesizes the Value of Statistical Life (VOSL) and Quality of Life (QoL) is crucial for addressing the multifaceted effects of road traffic injuries (RTIs). Although numerous studies have explored VOSL in isolation, especially via the willingness-to-pay (WTP) method, less research has concurrently analyzed the interplay between post-crash quality of life outcomes and individuals' valuation of risk mitigation. This integration is essential as survivors' views of life and health risks are influenced not only by sociodemographic and socioeconomic factors but also by their lived experiences of injury, recovery, and pre-crash exposure. For instance, individuals from lower-income brackets may assess safety interventions differently than those from higher-income brackets, influenced not only by affordability but also by varying opportunity costs and household reliance on their productivity. Injury severity and pre-crash circumstances, such as prior crash involvement or insurance ownership, may influence survivors' inclination to engage in safety programs and their outlook on recovery chances.

The conceptual framework of this study is fundamentally anchored in the Theory of Planned Behaviour (TPB), which provides the core behavioural mechanism explaining how individuals form intentions that may translate into willingness to pay (WTP) for road safety improvements, as reflected in the Value of Statistical Life (VOSL) and Quality of Life (QoL). According to Ajzen (1991), behavioural intention is shaped by three central determinants: attitude toward the behaviour, subjective norms, and perceived behavioural control. These constructs collectively explain how individuals evaluate behavioural outcomes, social expectations, and perceived ability to act, which are essential in understanding valuation behaviour in risk-related decisions.

Empirical applications of TPB have consistently demonstrated its robustness in predicting safety-related and risk-taking behaviours, particularly in road transport □on□e□□s□ □or e□a□□□e□ s□u□ies on □rivers' □o□□□ian□e □i□□ s□ee□ □ TPB variables significantly predict behavioural intention and actual driving behaviour, while also showing that demographic variables such as age and gender exert their influence indirectly through TPB constructs (Elliott, Armitage & Baughan, 2003) . This provides strong empirical justification for positioning socio-demographic characteristics in this study as background variables that operate through TPB mechanisms rather than independent direct predictors.

In this study, the independent variables (IVs) are conceptually aligned and supported through the TPB framework. Socio-demographic factors such as income, age, education level, and household characteristics are not treated as standalone predictors but are integrated into TPB as background factors that indirectly shape attitude, subjective norms, and perceived behavioural control (Ajzen, 1991, 2006). This extension of TPB with background variables is widely supported in the literature, where demographic and contextual factors are shown to influence behaviour through TPB belief structures rather than directly (Ajzen, 2006; Armitage & Conner, 2001). For example, research has demonstrated that demographic variables such as age and gender influence behaviour through mediation by TPB constructs rather than exerting direct effects (Elliott et al., 2003). Further empirical studies in transport and environmental behaviour also support the inclusion of socio-demographic & economic and contextual variables as antecedents within TPB frameworks. Extended TPB models consistently show that external factors such as income, education, and experience influence behavioural intention through attitude formation and perceived behavioural control, rather than acting independently (Bamberg & Schmidt, 2003; Ajzen, 2011). This reinforces the theoretical appropriateness of positioning IVs in this study as distal determinants within a TPB-based behavioural pathway.

Additionally, previous research consistently demonstrates that the TPB effectively explains how previous crash experience, risk perception, WTP, insurance uptake, and pre-crash behaviors interrelate in the context of road safety and risk reduction study.

Pre-crash behaviors, such as speed management, and adherence to safety regulations, also influence behavioral attitudes and subjective norms□ core components of the TPB□ thereby affecting behavioral intentions and WTP (Champahom et al., 2023). Riders demonstrating safer pre-crash behavior tend to value safety more and exhibit higher WTP for accident mitigation measures. Moreover, prior crash experience may serve as a pivotal cue to action, reinforcing the importance of safety measures and strengthening both attitudes and perceived behavioral control. Additionally, previous crash experience has been shown to significantly influence WTP for road safety measures among motorcyclists, functioning as a key factor within the TPB framework. Studies such as Champahom et al. (2023), and Chaturabong et al. (2011), suggest that experiencing a crash or knowing someone involved in an accident heightens in□ivi□ua□s' ris□ □er□e□□ion□ □□i□□ in □urn □osi□ive□□ i□□a□□s □□ei safety investments and increases their behavioral intention to adopt protective measures. Specifically, motorcyclists with crash history may view safety gear such as helmet and accident prevention strategies as more effective, thus elevating their WTP to reduce crash risks.

Furthermore, risk perception; including personal belief about crash likelihood□ relates directly to WTP and is influenced by prior experience, as individuals who perceive a higher risk tend to be more willing to invest financially in safety (Zaal et al., 2015; Andersson & Lindberg, 2009). The perceived behavioral control component of TPB also interacts; riders who believe they can control their safety, perhaps through use of safety gear such as helmet and cautious riding, show higher WTP (Hendratmoko & Susilo, 2014).

Insurance coverage further regulates this, TPB connection. Motorcyclists with insurance may perceive less personal financial risk associated with crashes, potentially lowering their WTP, whereas uninsured motorcyclists or those with inadequate coverage might demonstrate a higher WTP due to perceived higher economic consequences from accidents (Fauzi et al., 2004). Conversely, some studies find that insurance can indirectly reinforce positive safety behaviors by reducing fear and risk perception, thus complicating the WTP connection (Fan Liu, 2019).

Therefore, integrating prior crash experiences with risk perception, insurance status, and pre-crash behaviors within the TPB framework provides a nuanced understanding of the determinants of WTP. These factors influence attitudes, subjective norms, and perceived behavioral control, ultimately shaping behavioral intentions to invest in safety and reducing crash risk (Champahom et al., 2023; Chaturabong et al., 2011; Zaal et al., 2015).

On the other hand, for the QoL component, TPB further supports the behavioural pathway by explaining how perceived behavioural control and attitudes □o□ar□ sa□e□□ an□ □ea□□□ □ro□e□□ion in□□uen□e in□ivi□ua□s' su□□e□□ life conditions. This aligns with the World Health Organization Quality of Life (WHOQoL) framework, which conceptualises Qo□ as an in□ivi□ua□'s □er□e□□ion o□ their position in life within their value system and environment (WHOQoL Group, 1998).

To strengthen the economic valuation dimension, the framework integrates TPB □i□□ □e□□are e□ono□i□s □□eor□ un□er□inning □□□□ an□ □□□□ □□er behavioural intentions are translated into monetary valuation of risk reduction (Viscusi & Aldy, 2003). Thus, TPB serves as the central behavioural backbone that connects socio-demographic IVs, risk perception, willingness to pay, and perceived quality of life into a coherent conceptual structure. Overall, TPB holds the conceptual framework together by acting as the behavioural theory that explains how IVs influence attitudes, norms, and perceived control, which in turn shape behaviour and ultimately inform VOSL and QoL outcomes. The TPB provides the underlying framework for understanding behavioural intention related to road safety decisions.

Additionally in this study, WTP reflects behavioural intention, which is shaped by individual attitudes towards risk reduction and safety. Risk perception is conceptually aligned with attitudes, as it represents individuals' s
likelihood and severity of road traffic injury. Insurance-related factors are associated with perceived behavioural control, as financial protection may in
perceived ability to manage potential risks and consequences. Pre-crash behaviour reflects prior behavioural tendencies that are consistent with the TPB assumption that behaviour is influenced by intention, attitudes, subjective norms, and perceived behavioural control (Ajzen, 1991, 2006).

For this study as well, incorporating evidence from adjacent nations like Thailand and Myanmar (Chaturabong et al. 2011; Mon et al. 2018, 2019; Puttawong & Chaturabong 2020) enhances the framework's validity, given that these contexts exhibit cultural, behavioral, and demographic parallels with Malaysia. However, although these studies provide significant insights, the Malaysian environment may exhibit distinct variances. Cultural perspectives on risk, accessibility to healthcare, enforcement of traffic safety legislation, and the prevalence of motorcycle riders can result in variations in both VOSL estimations and QoL trajectories. This underscores the necessity for a locally anchored framework that not only utilizes regional evidence but also rigorously assesses the applicability of these results to Malaysia. In doing so, the framework not only replicates existing models but also enhances them, enabling this study to contribute both methodologically and contextually to the expanding literature on VOSL and QoL in low- and middle-income countries.

Both VOSL and QoL are included in this study to represent different but complementary dimensions of the impact of road traffic injuries among motorcycle crash survivors□ □ □ □ □ □a□ □ures in□ ivi□ ua□ s' □ one□ ar□ va□ ua□ ion o□ ris□ re□ safety improvements, while QoL reflects the broader physical, emotional, and functional consequences experienced following injury. Together, these two measures provide a more comprehensive understanding of road traffic injury impacts by incorporating both economic valuation and post-injury wellbeing perspectives.

Finally, this conceptual framework (Figure 2.5) serves as a bridge between economic valuation (VOSL) and health outcomes (QoL), linking individual willingness-to-pay for risk reduction. While VOSL was investigated through WTP-CVM, QoL was used in the RT-QoL survey. Both of these DV was investigated through IV of socio-demographic factors, socio-economic factors, injury status, and pre-crash status.

2.18 SUMMARY

This chapter has examined the pertinent literature regarding road traffic injuries (RTIs), the VOSL, and QoL specifically within the Malaysian setting. Road traffic injuries (RTIs) are recognized as a significant public health issue globally and in Malaysia, disproportionately impacting young and economically active demographics, especially motorcyclists. The research emphasized that road traffic injuries (RTIs) not only lead to early mortality but also impose considerable economic and social burdens, evident in diminished productivity, healthcare expenses, and worse quality of life for survivors and their families.

The chapter subsequently analyzed the theoretical foundations of VOSL, highlighting the utilization of willingness-to-pay (WTP) methodologies in CVM research. Data from both high-income and low- to middle-income nations demonstrates that sociodemographic and socioeconomic factors□ such as age, gender, education, and income□ are reliable indicators of willingness to pay for road safety enhancements. Simultaneously, contextual variations between environments, encompassing cultural perspectives and enforcement methodologies, underscore the necessity of research rooted in local contexts.

Additionally, the chapter concurrently examined QoL frameworks which define QoL as a multidimensional construct encompassing physical, functional, and emotional domains. Previous research indicates that injury severity, injury type, and availability of rehabilitation treatments substantially affect quality of life outcomes after road traffic incidents. The amalgamation of VOSL and QoL viewpoints offers a more holistic comprehension of the whole cost of RTIs, encompassing both the economic assessment of life and the lived experiences of survivors.

Lastly, chapter introduced the conceptual framework (Figure 2.5) created for this study, integrating ideas from prior research in adjacent countries and tailoring them to the Malaysian context. The framework incorporates sociodemographic, socioeconomic, injury status, and pre-crash characteristics as essential predictors of both VOSL and QoL. This study aims to connect economic valuation with post-injury quality of life outcomes, providing pertinent information for policymaking, resource allocation, and road safety initiatives.

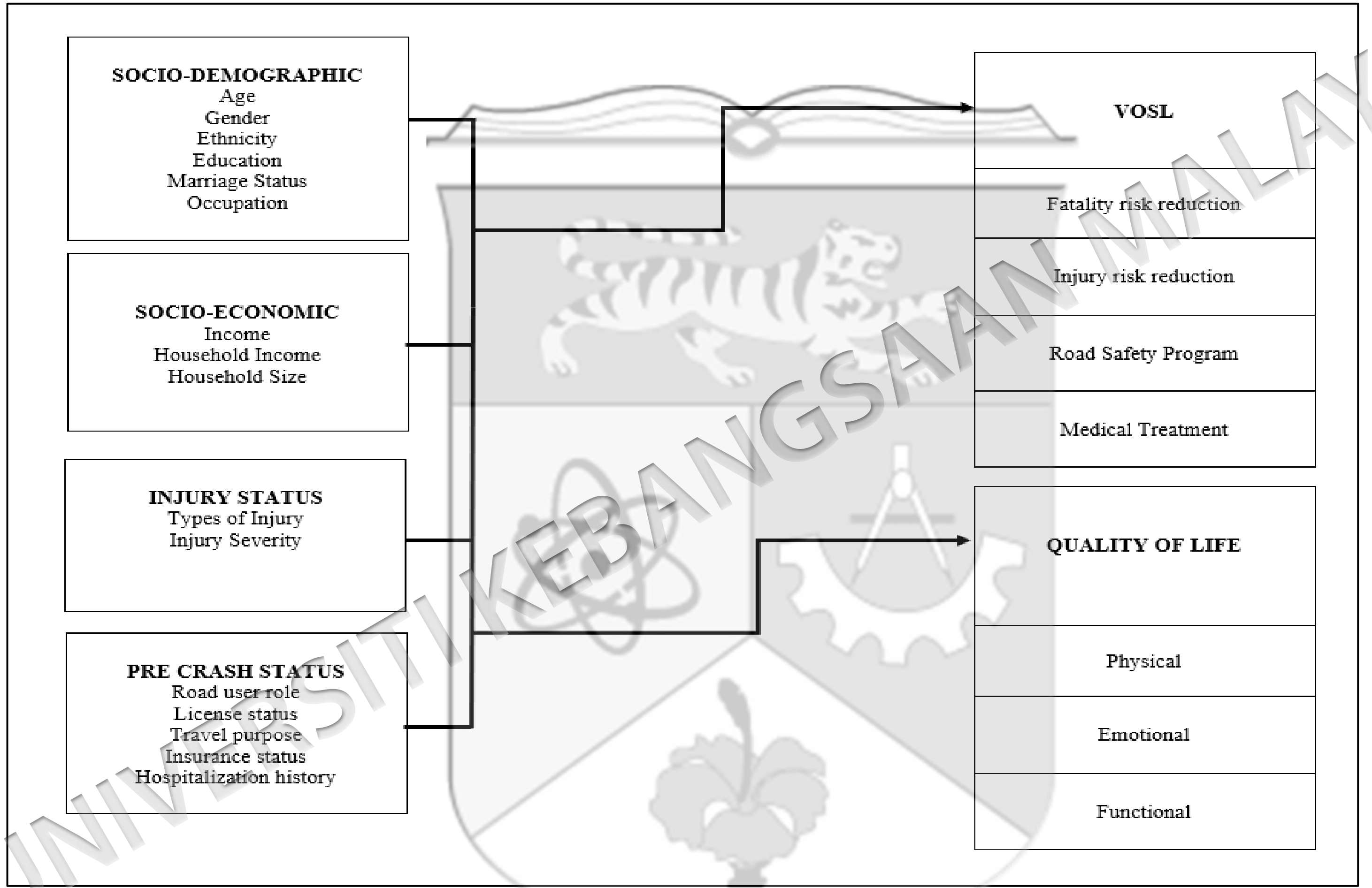


Figure 2.5 Conceptual Framework

CHAPTER III

METHODOLOGY

3.1 INTRODUCTION

This section discusses the study methodology. This chapter thoroughly explains the research design, including probable choices of setting, population, sample, and sampling technique, measurement tools, data collection procedures, and the data analysis process. The cost calculated in this study encompasses the current year and the data collection period from August 2022 to September 2023. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies are adapted as a primary reference for arranging and writing the methodology, which guides the study.

3.2 RESEARCH DESIGN

A prospective, quantitative, cross-sectional study was conducted using a hospital-based population from selected public hospitals from August 2022 to September 2023.

3.3 RESEARCH SETTING

The study was directly engaged with the Emergency and Trauma Department in Hospital Sultanah Bahiyah (HOSB), Alor Setar, and Hospital Sungai Buloh (HSB) for recruiting participants to serve the purpose of the study. Hospital settings are chosen because (a) there is evidence that, as far as this research is concerned, public hospitals are still untested so far as the main setting, at least in the local context, is concerned, (b) involvement of a hospital which is under the Malaysian Trauma Registry (MTR) is to date, is the first attempt and (c) to provide another significant outcome from hospital based perspective which can offer additional insight to the body of knowledge as per related to this research. Additionally, HSB and HOSB were selected as study sites because both hospitals are Ministry of Health Malaysia facilities that manage a substantial number of trauma cases, including road traffic injuries. National trauma surveillance data consistently show that road traffic crashes are the leading cause of major trauma in Malaysia, contributing significantly to hospital emergency admissions (Ministry of Health Malaysia 2014; Jamaluddin et al. 2025). As trauma cases are distributed across MOH hospitals according to regional population demand and service catchment areas (geographical population), both hospitals are appropriate settings for capturing road traffic injury cases relevant to the study.

Although the study involves only selected public hospitals, the study outcomes can still reflect the population's representation in those states, which have socio-demographic and economic characteristics similar to those of the population under study.

Additionally, due to the similar characteristics of the subject matter (road traffic injury patients), this study can serve as a basis for inference in similar studies in the future in other developed states, such as Selangor and Kuala Lumpur. Moreover, these two public hospitals were selected as they were available at the time the study commenced. Given that this study employed the Contingent Valuation Method (CVM), which is known to be a costly approach in estimating the Value of Statistical Life (VOSL), and considering that the study was conducted during the COVID-19 pandemic, expanding to multiple sites would have posed significant financial and logistical challenges, potentially jeopardizing the study's implementation. Therefore, the study proceeded with these two hospitals, which are well recognized for handling a high volume of road traffic crash cases.

3.3.1 National Trauma Database (NTrD) and Malaysian Trauma Registry (MTR)

In May 2006, the first Malaysian National Database for Trauma (NTrD) was launched, with five tertiary reference centres to analyse the fundamental data on major trauma, to determine the major management of trauma, and to provide recommendations for better treatment of trauma. The trauma database was also initiated for the purpose of facilitating and promoting research regarding trauma and its management (Sabariah et al. 2008). The NTrD is primarily funded by the Ministry of Health (MOH). The occurrence of trauma and its management provides vital information to the MOH, Non-Government Organisations (NGOs), and private sectors (Faizah et al. 2011). Then, NTrD was rebranding to Malaysian Trauma Registry (MTR) recently in 2020. There are seven participating hospitals which are the main feeder of the trauma data to the MTR. The hospitals are Hospital Sungai Buloh, Hospital Sultanah Bahiyah, Hospital Sultanah Aminah, Hospital Seberang Jaya, Hospital Sultan Abdul Halim, Hospital Raja Permaisuri Bainun dan Hospital Kuala Lumpur (Shah Jahan, 2020).

This database collected information from five referral sites and established a basic framework for major trauma surveillance. Recently, the Malaysian Trauma Registry (MTR) has been providing more complete data across the entire nation. This data includes response times, severity levels, hospital workflows, and outcomes, displaying both systematic challenges and potential for quality improvement.

3.3.2 Hospital Sultanah Bahiyah (HOSB) Alor Setar Kedah

HOSB began construction in August 2000, was completed in March 2007, and became fully operational on July 29, 2007. Located on a site of 28.33 hectares, 6 km from Alor Setar city center, with a construction cost of RM 552 million. The hospital complex spans an area of 110,200 m² and comprises four blocks: the Medical Support Block, Non-Medical Support Block, Main Block, and Ward Block. HOSB's operations involve two locations: Sultanah Bahiyah Hospital and Alor Setar Hospital (HAS, formerly known as the old hospital). At the time of its establishment, the hospital provided secondary and tertiary level medical services, encompassing 10 basic areas of expertise and 28 subspecialties.

Currently, the basic expertise area has expanded into 17 primary specialties, each with 45 international sub-specialties. In line with its role, the hospital is also equipped with IT system facilities through the implementation of Total Hospital Information System (THIS), which began to be fully implemented on 23 December 2008. The implementation of this electronic hospital information (e-HIS) system has also been expanded in HAS in 2018 in stages. This hospital has been part of the North Kedah Cluster, alongside Jitra Hospital and Kuala Nerang Hospital, since 2016. This hospital is also a reference center for 12 health clinics in Kota Setar and Pendang districts, as well as eight other hospitals in Kedah, Perlis, and Penang, and eleven other private hospitals. Currently, the hospital has about 1108 beds □or □a□ien□’s accommodation (Clinical Research Malaysia 2020; Malaria Eradication Scientific Alliance (MESA) 2024).

3.3.3 Hospital Sungai Buloh, Selangor (HSB)

On the other hand, HSB was built in 1999. The new hospital currently houses 620 beds, making it one of the largest hospitals in Malaysia. The hospital is situated in Gombak, Selangor, a location adjacent to Kuala Lumpur (Hospital Sungai Buloh, 2019). Sungai □u□o□ □os□i□a□’s □□ergen□□ an□ □rau□a □e□ ahour emergency cares □□ It is responsible for providing preliminary evaluations, treatments, rehabilitation, and emergency surgical and medical services to the community of Sungai Buloh and the surrounding areas. The Ambulance and Trauma Department also offers a secure atmosphere and effective emergency treatment, along with clinical audit and research management.

The services provided are extracted from a comprehensive plan that includes pre-hospital management, recovery, stabilise, definitive care delivery, One Stop Center Crisis (OSCC), and the medical team. Regarding management of medical treatment, the severity of pain and clinical status of the patient will dictate. The patient care planning is an integrated way of care, and care of the patient emphasized the priority, quality care, good health, an□ □□e □reserva□ion o□ □a□ien□s’ □igni□□□ □oreover□ □□e □ offered other modalities, such as health education, which may also be offered (Hospital Sungai Buloh, 2019).

3.4 RESEARCH PERIOD

This study employed a cross-sectional quantitative design conducted over a one-year period from August 2022 to September 2023. Data collection involved interviewer-administered structured questions for the Contingent Valuation Method (CVM) to elicit respon□en□s’ □i□□ingness □o □a□ □□□□□□ □□i□□ □as use□ □o es□i□a□ Statistical Life (VOSL). The questionnaire was administered via telephone to ensure accessibility (during COVID-19) and standardisation of responses. In addition, quality of life was measured using the Revised Trauma Quality of Life (RT-QoL) instrument, which both were administered to respondents approximately one month after crash injury. Both components produced quantitative data for statistical analysis. Although telephone interviews were used as a mode of data collection, the study did not involve qualitative data analysis; therefore, the study design remains strictly quantitative and cross-sectional in nature.

3.5 RESEARCH POPULATION AND SAMPLE

This resear□ □'s population is described as those involved in road crashes who suffered Road Traffic Injuries (RTIs). The targeted sample for this study consisted of patients who suffered injuries due to the crash, whether they were inpatients or outpatients, who visited either HOSB or HSB within the recruitment period from August 2022 to September 2023. The sample unit involves RTIs inpatients and outpatients who receive treatment from the ED. Such patients must fulfill the stated respondent inclusion criteria of the study to be appropriately selected as participants in the study. Note that the ED system was used to track respondents involved in road crashes. Meanwhile other previous study might choose general publics as the sample (Mohd Faudzi Mohd Yusoff, Nor Ghani Md Nor 2011; Mohd Fauzi et al. 2004; Pham et al. 2008).

These patients were selected as respondents due to the limited but growing evidence highlighting the importance of incorporating the perspectives of road traffic injury survivors in valuation and outcome studies. Existing valuation studies in road safety have largely focused on general road user populations, with fewer studies capturing the perspectives of actual injury survivors, particularly in hospital-based or post-crash contexts (OECD, 2012; Widyastuti & Utanaka, 2020). In addition, motorcycle users represent a high-risk group in road traffic injuries, especially in developing countries, where they account for a substantial proportion of crash-related morbidity and mortality (Mon et al., 2018; Mon et al., 2019). For instance in Malaysia VOSL was more focus on public aforementioned. Furthermore, evidence from road traffic injury research indicates that survivors often experience significant consequences affecting their quality of life, including physical limitations and functional impairment, which are not fully captured by mortality-based valuation alone (WHO, 2018). Systematic evidence also confirms that stated preference approaches, including WTP methods, remain widely used in road safety valuation to capture individual-level preferences where market data are not available (Nankunda & Evdorides, 2023). Therefore, incorporating the perspectives of injured motorcyclists and pillions are expected to provide additional insight into both economic valuation and post-injury burden, contributing to a more comprehensive understanding of road traffic injury impacts.

Most Value of Statistical Life (VOSL) studies traditionally rely on ex-ante (before crash occurs) populations, typically members of the general public who are asked about their willingness to pay (WTP) to reduce hypothetical future risks (Viscusi & Aldy, 2003; OECD, 2012). However, this study adopts an ex-post (post-crash) approach by engaging motorcycle crash survivors□ motorcyclists and pillion riders□ who have direct lived experience of the hazard in question. Although these individuals have already experienced road traffic injury, their exposure to risk does not end with the crash. Many survivors are required to return to work, travel for daily routines, or use public roadways for essential activities, continuing to face the same risk conditions. As such, their valuation of fatality and injury risk reductions is deeply informed by personal encounters with danger and recovery, offering a perspective that is both reflective and forward-looking. This approach offers a valuable alternative to conventional VOSL methods by capturing the risk perceptions and safety priorities of individuals who have already experienced the consequences of road safety outcomes. Moreover, stated preference methods remain widely used in VOSL estimation to capture individual valuation of non-market risk reductions where market data are not available (OECD, 2012; Nankunda & Evdorides, 2023). By incorporating these lived experiences, the study contributes to a more grounded and context-sensitive estimation of VOSL, which may better inform public health interventions and transportation policy planning.

3.5.1 Inclusion criteria

1. Respondents who are motorcyclists and pillion riders who had crashes, regardless of the type of road

2. Respondents who are inpatients or outpatients admitted to HOSB and HSB due to a road crash, treated in the yellow and green zones only

3. Respondents who are 18 years old and above

4. Respondents who are able to communicate with a sound mind in understanding the purpose of the study

5. Respondents who gave consent to the study

6. Respondents who are willing to comply with all study processes and be available for the duration of the study

7. Malaysian citizen

3.5.2 Exclusion criterias

1. Foreigners

2. Respondents who were pronounced dead upon arrival

3. Respondents who had crashes, but due to crashing into gates, electric poles or trees, or drugs

4. Respondents who are minors □18 years old

3.6 RESEARCH SAMPLE SIZE

A minimum sample size was estimated using the formula proposed by Mitchell and Carson (1989) for CVM studies, which accounts for the acceptable deviation of the sample mean WTP from the true population mean. The sample size was calculated based on a 95% confidence level (Z = 1.96), a relative variance (V) of 2.0, and an a□ □ e□ □ a□ □ e □ evia□ ion □ Δ □ o□la□is:□ □ □ □ □ e □ or□ u

Table 3.1 Sample Size Calculation

Description	Value
Formula	n □ □□² × □□ □
Z value (for 95% confidence level)	1.96
Relative variance (V)	2.0
□ □ □ e□ □ a□ □ e □ evia□ ion □	0.15
Z^2	3.8416
Δ^2	0.0225
Sample size (n)	683

$$n = ((1.96)^2 \times 2.0) / (0.15)^2 = (3.8416 \times 2.0) / 0.0225 = 683$$

Although no existing CVM studies related specifically to road traffic injuries have applied this sample size estimation method, reference to similar public health WTP studies is methodologically justified. For instance, Rajamoorthy et al. (2019) employed the Mitchell & Carson (1989) formula in their study on willingness to pay for hepatitis B vaccination in Malaysia, using similar assumptions. Given the shared and similar CVM framework and public health context, this approach is deemed appropriate for the present study. To account for potential non-response and incomplete data, a 20% was added to the minimum required sample size of 683. This adjustment resulted in a total target sample of approximately 820 respondents (683x0.20=136.6)+683=819.6, rounded up to the nearest whole number.

3.7 RESEARCH SAMPLING TECHNIQUE

Respondents were recruited from hospitals using purposive sampling, whereby only patients who met the predefined inclusion criteria were selected. This sampling approach is widely applied in health and clinical research where the study population is specific and not readily identifiable within a complete sampling frame (Etikan, Musa & Alkassim, 2016). In the context of this study, the target population comprised road traffic injury (RTI) patients, which made it impractical to establish a comprehensive sampling list in advance due to the unpredictable and case-based nature of hospital admissions.

Furthermore, purposive sampling is considered appropriate when the researcher aims to obtain information-rich cases that are directly relevant to the research objectives (Palinkas et al., 2015). Since this study focuses on estimating Value of Statistical Life (VOSL) and post-injury quality of life, only respondents with direct experience of road traffic injuries were deemed suitable to provide meaningful and context-specific responses.

In addition, practical constraints during the COVID-19 pandemic, including movement control measures and restricted hospital access, further limited the feasibility of probability-based sampling techniques. Therefore, purposive sampling provided a flexible yet targeted approach for timely data collection while ensuring that respondents met the study criteria. On average, approximately nine to ten respondents were recruited per week throughout the data collection period.

3.8 RESEARCH ANALYSIS COMPONENTS

The WTP data for risk reduction in fatalities and injuries, road safety services, and medical care were analysed. Furthermore, the average WTP for medical care was determined. Post-injury health status by respondent QoL was also assessed. The components of the analysis are shown in Table 3.2.

Table 3.2 Analysis Components

Analysis Components	**Outcomes**
Value of Statistical Life (VOSL)	▪ Fatality risk reduction ▪ Injury risk reduction ▪ Fatality cost ▪ Injury cost ▪ WTP for injury medical treatment
Revised Trauma Quality of Life (RT QoL)	▪ Health status/well-being (Emotional domain, Physical domain and Funcitional domain)

3.8.1 VOSL Calculation

The VOSL will be derived from the WTP survey with a Payment Card (PC) or Open-Ended (OE) format of elicitation. According to Bateman et al. (2012), PC and OE were what Bateman (2012) recommended to use for this CVM study. Therefore, it will be included in the study.

The formulas employed in the current study to calculate VOSL are derived from established methodologies that have been applied widely across previous studies (Mofadal et al., 2015; Mon et al., 2019; Puttawong & Chaturabong, 2020) to ensure comparability with the results, particularly for studies in other developing countries that estimate the VOSL. Table 3.3 calculates injury and fatality costs (modified from Mofadal et al. (2015) and Chaturabong et al. (2011). Meanwhile, Table 3.4 provides the formula to calculate VOSL, which is in line with Ainy et al. (2014), Mon et al. (2018, 2019), Nor and Yusoff (2003), and Subhan et al. (2021). The WTP for medical treatment for injuries among patients was extracted from survey questions, and the average WTP was calculated using the modification described by Abate et al. (2015).

Table 3.3 Cost of fatality and injury calculation

Number
Number of motorcycles (1)
Number of fatalities (2)
Number of injuries (3)
Number of motorcycle crashes (4)
Probabilities
Probability of crash (5) = (4/1)
Probability of fatality/injury (6) = (2+3)/4
Probability of fatal (7) = (2/2+3)
Probability of injury (8) = (3/2+3)
Risk
Risk of fatality (9) = 5x6x7
Risk of injury (10) = 5x6x8

Table 3.4 VOSL calculation equation

Terminology	Description	Formula
VOSL	Value of Statistical Life	
WTP	Willingness to Pay	
$\Delta\rho$	Change in risk	
VOSL (fatality and injury risk reduction) = MEAN or MEDIAN		WTP $\div$ $\Delta\rho$

3.8.2 Revised Trauma Quality of Life (RT-QoL)

The respondents' quality of life was assessed using the RT-QoL instrument, as recommended by Herrera-Escobar et al. (2020). This self-administered questionnaire requires participants to read each item and indicate their responses on a 5-point Likert scale. The RT-QoL measures three key domains: physical well-being, emotional well-being, and functional well-being. Each domain consists of six items designed to capture the trauma survivor's post-injury experience in terms of health status, psychological state, and ability to carry out daily activities.

Consequently, median scores were computed for each domain to assess the overall QoL. Higher scores indicate better QoL, whereas lower scores suggest greater impairment or reduced well-being in the respective domain. For scoring, a median cut-off point was used due to the non-normally Distributed Data (Boone & Boone, 2012) to categorize responses to higher and lower levels of quality of life by the respondents. Table 4.18 in Chapter IV shows the distribution of RT-QoL scores of the respondents and the applied cut-off points.

Previously, due to the paucity of instruments development in trauma-specific cases (Wanner et al. 2016) the QoL of those affected by trauma cases, such as road crashes, were measured commonly by the eminent Medical Outcomes Study 36-items Short Form Health Survey (SF-36) and 12 items (SF-12), European Quality of Life-5 Dimensions (EQ-5D-3L Scales) and The Quality of Well-Being Index (QWB) (Rissanen et al. 2017). While these instruments have provided valuable information regarding the population in general, they do not clearly address the knowledge that can be gained from specific groups, such as people involved in trauma cases, like crashes.

Thus, the Trauma Specific Quality of Life (T-QoL) was developed by Wanner et.al. (2016) to close these gaps. The T-QoL, due to its lengthy questions (43 questions), was further revised by Herrera-Escobar et al. (2020) decreasing the number to 18 questions. The Revised-Trauma Quality of Life (RT-QoL) developed by Herrera-Escobar et al. (2020) was tested among different injury and patient characteristics, offering the specificity and validity which can be used by other trauma-specific condition populations, such as road traffic crashes, and hence, the usage of RT-QoL in this current study. The utilization of RT-QoL in the curren□ s□u□□ ai□s □o re□u□e res□on□en□s cognitive burden (Herrera-Escobar et al. 2020) □i□□ou□ □o□□ro□ising □□e s□u□□ objectives, while also encouraging greater participation. Cross-cultural adaptation of the RT-QoL questionnaire has been conducted and is described in detail in Section 3.9.2.

3.8.3 The classification of injury status, AIS and MAIS

Data regarding the type and severity of injuries sustained by respondents was acquired from hospital medical records. In this study, injury status was categorized into two classifications: fracture and non-fracture. This binary classification has been utilized in prior research. Jacques et al. (2021) analyzed outcomes between a fracture cohort and a non-fracture cohort to investigate disparities in survival and mortality risk, whereas Lente et al. (2023), in a systematic review of artificial intelligence□assisted CT studies, indicated that most included studies utilized a fracture versus non-fracture classification. The binary approach demonstrated superior diagnosis accuracy relative to more intricate multi-class fracture classifications. Implementing this division in the current investigation guarantees conformity with recognized research methodologies and improves result comparability.

Meanwhile, the determinants of injury severity were assessed using the Abbreviated Injury Scale (AIS) 2015 Version (The Abbreviated Injury Scale [2015 Revision], 2016). Subsequent to Abbreviated Injury Scales (AIS) coding, the Maximum Abbreviated Injury Scale (MAIS) was established to address instances of numerous injuries and to identify the highest severity level experienced by each respondent. The classification of each injury was conducted with the aid of two trained coders from the

Malaysian Institute of Road Safety Research (MIROS) and one medical staff member, assuring consistency, precision, and dependability in the procedure.

3.9 RESEARCH QUESTIONNAIRES/INSTRUMENTS

The following questionnaires were used to capture the data for this study. Note that all of these instruments are adapted and modified from a previous study. They were translated into Bahasa Melayu for better understanding, as Bahasa Melayu is the main language locally. Hence, the study will employ both English and Bahasa Melayu to cater to respondents' needs.

3.9.1 RT-QoL Questionnaire

On the other hand, the QoL questionnaire was adapted from the specific survey for trauma patients, which is the RT-QoL for both inpatients and outpatients of RTIs. RT-QoL is a revised version of the lengthy 43-item Trauma Quality of Life (T-QoL). The current RT-QoL has 16 items after revision. The use of T-QoL instruments for a trauma-specific study may have boosted the true outcome of the study (Juan Pablo Herrera-Escobar et al. 2020). Nonetheless, there is yet no documentation of any RT-QoL that has been implemented and used in compliance with the local setup. As such, a cross-cultural adaptation of the RT-QoL to Bahasa Melayu was performed. Guidance from the Exercise Adherence Rating Scale (EARS) study was followed, incorporating expert committee review and professional knowledge to examine the validity and reliability of the RT-QoL (Adhikari et al., 2020). The developer of the survey, Herrera-Escobar et al. (2020), granted permission for the cross-cultural adaptation process.

3.9.2 Cross-cultural adaptation process

Cross-cultural adaptation (also referred to as translation and cultural adaptation) is a process of taking into account both linguistic translation and cultural adaptation factors in creating a questionnaire to be used in a different environment (Beaton et al. 2000). To compare the original questionnaire sources and target questionnaire, cross-cultural adaptation of self-administered health status measures is needed when these measures are used in a country, culture, or language other than the country of origin (Beaton et al., 2000; Guillemin et al., 1993). The process of translation and cross-cultural adaptation of RT-QoL followed Beaton’s (2000) guideline, a popular procedure in the literature. It is also called modified process, in which studies cross adaptation in cross adaptation from Nepali version of the EARS (Adhikari et al., 2020), cross cultural adaptation of 12-items Orebro Musculoskeletal Screening Questionnaire (OMSQ-12-J) into Japanese language (Takasaki & Gabel 2017) and cross cultural adaptation of the Quality of Life Index Spinal Cord Injury □Version III to Portuguese (Reis et al., 2015).

There were four stages in the translation and adaptation process. The first phase was the forward translation of the RT-QoL by two bilingual academicians who were experienced in health research. Their medical background could facilitate the precise translation of medical language with fewer errors. Two translators also made it possible for cross-verification of translations to reduce personal bias. This approach is consistent with the World Health Organization (WHO) (Shaw, 2023) advice to use a process of expert-led and collaborative translations to achieve both precision and cultural sensitivity. The application of thorough knowledge of the field, cross-method comparisons, and compliance with international criteria makes the resulting translated instrument more valid and reliable in both research and clinical use. Phase 2 furthered this process by combining the two translated versions obtained in Phase 1 into one final draft. In Phase 3, a backtranslation was performed by two independent bilingual professional translators. Forward and back translations were checked and adjusted by a bilingual academic who participated in the study and a bilingual medical physician by profession (an Emergency Specialist). These external experts were requested to assess the study instrument without any details on the study design and execution, and none of them participated in the study design, implementation, or analysis, in order to maintain an objective evaluation process. Their input helped confirm the content validity and relevance of the instrument within the study context.

The final version of the revised RT-QoL was drafted after the experts completed □□eir □as□s□ □□is session □as □o in□□u□e e□□er□ts' i□□u□ the practicality ons on (Takasaki & Gabel, 2017), which were suitable for addressing the topic of RTI. The final phase of the study involved a pilot test with patients who had sustained injuries from road traffic crashes. Figure 3.1 illustrates the step-by-step cross-cultural adaptation □ro□ess□ □ □i□ □ is □o□i□ie□ an□ a□a□□e□ □ro□ □ea□on's gui□e□ines□

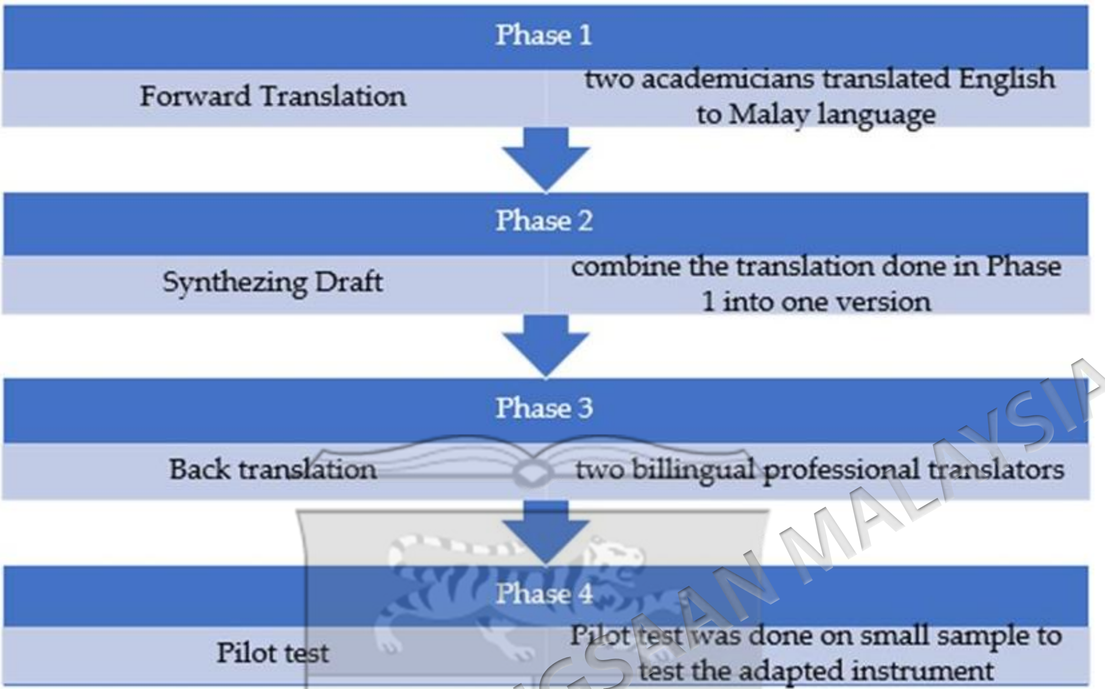


Figure 3.1 A modified step of the cross-cultural adaptation process guided by Beaton (Beaton et al., 2000)

3.9.3 Expert content reviewers

As a reference to a similar study by Takasaki et al., in 2017, a clinician's impression was included to preliminarily investigate the practicality of the OMSQ-12-J instrument. □onsi□ering □a□asa□i's a□, this study also implements the same approach to the RT-QoL Malay version., due to the reason which, apart from its internal consistency, expert opinion on the content which the questions are the most suitable to be used for the study sample which road injury patients is important; served the purpose of study is also vital. To add extra value to the review for this current study, two independent academicians (expert reviewers 1 and 2) with a healthcare background are also invited to review the content, along with the ED medical doctor (expert reviewer 3), who has trauma medical expertise. Table 3.5 summarizes the expert agreement and reconciliation done on the RT-QoL content. Based on the table, only question Q5 was modified, in which the statement *"jaringan keselamatan"* was accompanied by the e□a□□□e □□□□□□□□ □o ensure □e□□er un□ers□an□ing. Additionally, res□on□en for negative-tone items were identified and reverse-coded prior to data analysis to ensure consistency in scoring. This was done so that all items were aligned in the same direction before conducting statistical analysis.

Table 3.5 Expert agreement and reconciliation of RT-QoL English to Malay version

Items	Expert reviewer 1	Expert reviewer 2	Expert reviewer 3	Modification
Emotional Well-being ***Kesejahteraan Emosi***				
Q1: I have felt more "on edge" or "jumpy" lately. *Sejak kebelakangan ini, saya berasa lebih gelisah dan tidak tenteram*	□	□	□	-
Q2: My appetite has changed since the injury. *Selera makan saya telah berubah sejak kecederaan itu.*	□	□	□	-
Q3: My mood has worsened since the injury. *Mood saya semakin merosot sejak kecederaan itu.*	□	□	□	-
Q4: I am angry that I got injured. *Saya berasa marah kerana saya mengalami kecederaan.*	□	□	□	-
Q5: I have to rely on others, such as my family, friends, social security, or community support programs, because of my current financial limitations. *Saya terpaksa bergantung kepada orang lain seperti keluarga, rakan, jaringan keselamatan sosial (contoh SOCSO), atau program sokongan komuniti disebabkan oleh masalah kewangan saya.*	□	x	x	The social security utilization, when translated into Malay, is considered vague and may arouse questions for those unfamiliar with the term. Hence, an example should be provided for social security.
Q6: My injuries have negatively changed my relationships with my family, friends, or intimate partner. *Kecederaan saya telah mempengaruhi hubungan saya dengan keluarga, rakan atau pasangan secara negatif.*	□	□	□	-

□ o □ e □ on□ inu

□ □ on□ inua□ ion

Functional Engagement
Penglibatan Fungsi

Q7: I need help walking upstairs. *Saya memerlukan bantuan untuk menaiki tangga.*	□	□	□	-
Q8: I need help walking on flat surfaces. *Saya memerlukan bantuan untuk berjalan di permukaan yang rata.*	□	□	□	-
Q9: I need help: bathing/showering. *Saya memerlukan bantuan ketika mandi.*	□	□	□	-
Q10: I need help: eating. *Saya memerlukan bantuan ketika makan.*	□	□	□	-
Q11: I need help: going to the bathroom. *Saya memerlukan bantuan untuk pergi ke bilik air.*	□	□	□	-
Q12: I need help: cooking/preparing meals. *Saya memerlukan bantuan untuk memasak atau menyediakan makanan.*	□	□	□	-

Physical and Well-being Recovery
Pemulihan dan Kesejahteraan Fizikal

Q13: Even though I was injured, my life is better now than it was before the injury. *Walaupun saya mengalami kecederaan, kehidupan saya kini adalah lebih baik berbanding sebelumnya.*	□	□	□	-
Q14: My recovery was shorter than I expected. *Tempoh pemulihan saya adalah lebih singkat daripada yang saya jangkakan.*	□	□	□	-
Q15: I currently have physical limitations. *Keadaan fizikal saya terbatas pada ketika ini.*	□	□	□	-
Q16: I am able to exercise like I used to. *Saya boleh melakukan senaman seperti dahulu.*	□	□	□	-

□ o □ e □ on□ inu

□ □ on□ inua□ ion				
Q17: I am able to continue my normal leisure activities. *Saya boleh meneruskan aktiviti riadah saya seperti biasa.*	□	□	□	-
Q18: I have pain on a daily basis. *Saya mengalami kesakitan pada setiap hari.*	□	□	□	-

3.9.4 Pilot testing

This cross-cultural adaptation study was conducted using pilot data collected from March to June 2022 at one of the public hospitals in the state of Kedah, Malaysia. Of the 79 patients conveniently recruited for the study, only 51 were included in the final analysis due to missing data that affected the overall results. The suggested minimum sa□ □ □ e si□ es □ or □ ron□ a□ □ 's a□ □ □ a □ es□ □ □ ase□ on o□ □ i□ a□ e□ □ e□ □ si□ individuals, respectively. Taking the non-response rate of 20% into account, 30 respondents are considered sufficient to test the reliability of the questionnaire (Bujang et al., 2024; Takasaki & Gabel, 2017). Accordingly, the sample size of the pilot study is still large enough to have relevant statistical confidence in the significance of the present results. Expert content validity and construct consistency analysis for the appropriateness of the questioned translation and adaptation were both conducted. The □ o□ □ ina□ ion o□ e□ □ er□ va□ i□ i□ □ an□ □ ron□ a□ □ 's a□ □ □ a □ an □ e □ ee□ e□ under specific conditions, such as during the initial adaptation of a well-established tool in a new language or culture, particularly if the original version presented good psychometric properties (Theofilou, 2013), as does the RT-QoL questionnaire.

The study was conducted at a public hospital with a high daily volume of ED patient admissions. Note that participants were recruited through purposive sampling at □ □ e □ os□ ED, as this setting offers immediate access to trauma patients involved in crashes. Unlike other clinical departments, the ED serves as the primary point of care for individuals who have recently sustained crash-related injuries, making it an a□ □ ro□ ria□ e se□ □ ing □ or i□ en□ i□ □ ing □ ar□ i□ i□ an□ s re□ evan□ □ o □ □ e s□ u□ and post-crash quality of life.

Due to the unique and dynamic nature of road crash injuries, the researchers did not interfere with the hospital's standard treatment procedures collection did not delay emergency care provided by the doctors. To minimize disruption to patient care during the pilot data collection, the research team conducted discussions with key ED personnel, including emergency physicians, medical assistants, patient registrars, nurses, and housemen. These discussions aimed to identify the most appropriate and feasible strategies for participant recruitment without compromising the study's objectives. Based on the consensus reached, were approached at their final point of contact, usually during discharge after completing treatment. A modified patient flow pathway was then created together with the ED team, as shown in Figure 3.2. According to this modified flowchart, the patient was first identified during triage as a motorcyclist or pillion rider, and crash forms were provided for patient registration. A yellow sticker containing patient information was noted on the patient's crash form. Second, after the treatment and diagnosis were delivered to the patient by emergency physicians, the patient was briefly informed about the study, and a colored study slip was given to them to confirm their participation in the study. Third, once agreed, a copy of the colored study slip was given to the patient. The patient who agreed received a telephone call after 30 days of in-hospital treatment to answer the survey questions.

Severeal trained enumerators sent the patient a Research Electronic Data Capture (REDCap) link of RT-QoL questions through WhatsApp. The patient was reassessed after 1 week for an early response. The research study was conducted with data collected using REDCap electronic data capture tools hosted at Universiti Sains Malaysia (USM) (Harris et al., 2009, 2019). This platform is designed for research data management and includes: a) a clear interface for the correct collection of data; b) an audit trail to monitor changes and provide export reports; c) automated export processes in the most extended statistical program; and d) tools for integration and interoperability with external data systems. Data and cross-cultural analyses with Statistical Package for the Social Sciences (SPSS), version 28, were performed, and the content of the RT-QoL was determined by the independent academicians in the medical and ED colleagues.

However, for the actual data collection, Google Form (GF) was used instead of REDCap due to feedback from respondents regarding accessibility issues. Several respondents reported difficulties in accessing the REDCap link, which appeared to be incompatible with certain phone brands and required a stable, high-speed internet connection. As a result, a prompt adjustment was made to switch to Google Form for data collection. Google Forms is widely acknowledged as a dependable and effective platform for administering online surveys. It offers researchers a free, accessible, and user-friendly platform for fast data collection, rendering it especially beneficial in academic and healthcare research contexts (de Sá-Caputo et al., 2020). In addition to its cost-effectiveness, systematic evidence indicates its overall efficacy a recent meta-analysis found that around 90% of studies deemed Google Forms effective, usable, recommended, or highly practical for research and assessment purposes (Manggaberani & Darlis, 2024). These findings collectively underscore Google Forms as a powerful and adaptable instrument for data collection across many study contexts. Note that all enumerators were subsequently briefed to ensure consistency and accuracy in the revised data collection procedure.

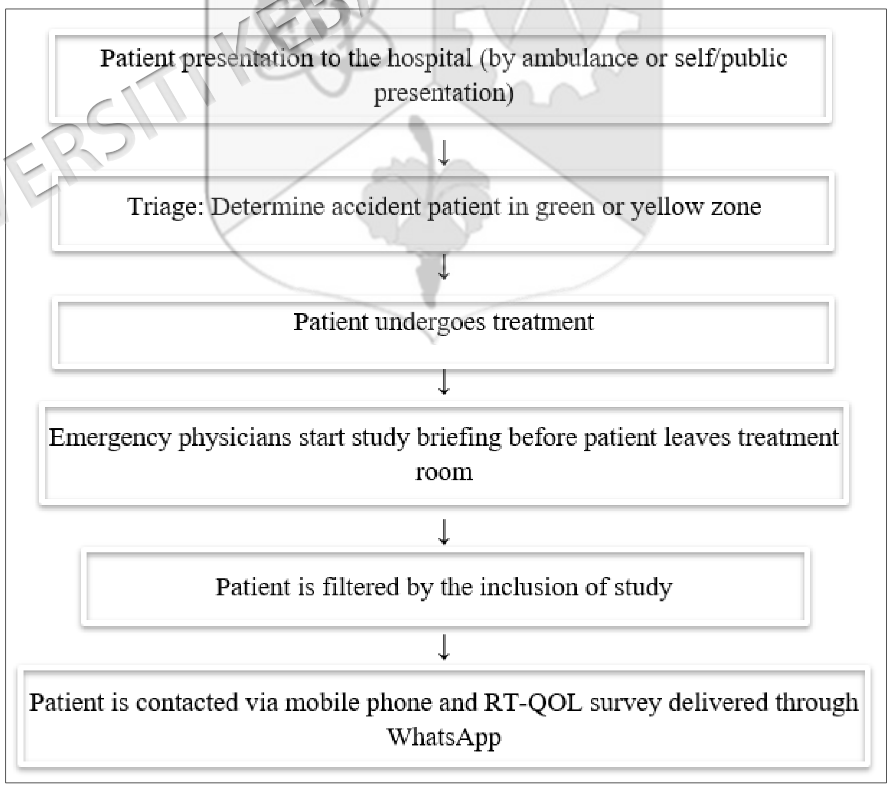


Figure 3.2 Modified Patient Recruitment and Data Collection Process flowcart (pilot)

Following a similar approach by Takasaki et al. (2017), who used clinician impressions to assess the practicality of the OMSQ-12-J instrument, this study adopted a comparable strategy to evaluate the Malay version of the RT-QoL. In addition to assessing internal consistency, expert reviewers were consulted to evaluate the content validity of the instrument. They considered the relevance, clarity, and acceptability of each item to ensure its appropriateness for the intended population of RTI patients. The content of the study instrument was reviewed by three independent expert reviewers in order to increase its credibility and content validity: two external academicians from the healthcare fields (Expert Reviewers 1 and 2) and one trauma care expert specializing in the ED (Expert Reviewer 3). Since these reviewers participated neither in the design, nor in the data collection, nor in the statistical analysis, their assessment can be considered without bias. Table 3.4 presents the agreement of the experts and the process of reconciliation, which was carried out on the RT-QoL content. To that end, internal consistency of the Malay version of the RT-QoL was evaluated with Cronbach's alpha value to test the reliability. A sample of 51 respondents was successfully recruited to support reliability testing and revision of questionnaire items following expert comment.

Table 3.6 gives the internal consistency of the Malay version of the RT-QoL □ i□ □ □ron□ a□ □'s a□ □ □ a □ oe□ □ i□ ien□ s □ e□ □ een □ □ □ □ an□ -□ □ □ □ □ □ QoL Malay and English versions as well the Cronbach Alpha Classification (Gliem & Gliem 2003) were presented in Table 3.7. These are trended around similar values to what we have with the ones observed by (Juan Pablo Herrera-Escobar et al., 2020), whose study yielded alpha values between 0.80 and 0.87. While the physical well-being sub-scale had a relatively lower alpha of 0.68, it is still acceptable, and reflects adequate internal consistency for use in health-related QoL studies (George & Mallery 2003; Ursachi et al. 2015).

Table 3.6 Internal Consistency RT-QOL Malay Version

Constructs	**No of Items**	**Cronbach's Alpha (α)**
Emotional well-being	6	0.721
Functional Engagement	6	0.936
Physical well-being	6	0.686

Table 3.7 RT-QoL English and Malay Version

RT-QoL English Version	RT-QoL Malay Version
0.80 □0.87	0.68 □0.90
Cronbach Alpha Classification	
α □ □ □ □	Excellent
□ □ □α <□0.9	Good
□ □ □α <□0.7	Acceptable
0.5 < α <0.6	Poor

This cultural adaptation, as well as the expert opinion of the RT-QoL Malay version, was successfully established (Ezat et al., 2025).

3.10 THE CONTINGENT VALUATION METHOD (CVM)

The CVM was chosen for this study due to its directness and simplicity, especially for unfamiliar respondents in a risk reduction study (Mon et al., 2018, 2019). It is also recommended because of the low cognitive pressure on respondents when answering the survey (Chaturabong et al., 2011). These conditions apply to the current respondents who were selected to participate in the study. The hypothetical scenario, modified from a previous study, was designed based on the local context, utilizing CVM recommendations from several studies mentioned in Table 3.8.

3.10.1 VOSL Willingness to Pay (WTP) – Contingent Valuation Method (CVM)

For the estimation of VOSL, the questionnaire instrument was adapted and modified from similar studies conducted in Southeast Asian (SEA) countries such as Myanmar, Thailand, and Vietnam, as well as from other relevant VOSL instruments developed in Low- and Middle-Income Countries (LMICs), including Sudan. The VOSL literature consistently recommends comparing results with those from comparable economic settings, particularly LMICs. However, due to the limited availability of validated instruments from developing countries, references from selected studies in developed countries were also consulted. Nonetheless, the primary sources guiding the adaptation of the questionnaire were studies conducted in LMICs. The VOSL questionnaire used in this study was developed and adapted from multiple established sources, as summarised in Table 3.8. The final version of the instrument, which incorporates all modifications and contextual adjustments for the study population, is provided in Appendix A. Due to its length (22 pages), the full questionnaire is not included within this chapter.

Table 3.8 VOSL Questionnaire adaptation and modification

Authors	Year	Country	Type of road user
▪ Ainy et al., 2014	2014	Iran	Motorcycle
▪ Chaturabong et al., 2011	2011	Thailand	Motorcycle
▪ Faudzi & Yusof, 2004; Mohd Faudzi Mohd Yusoff, Nor Ghani Md Nor, 2011	2004; 2011	Malaysia	Motorcycle
▪ Mon et al., 2019	2019	Thailand	Car
▪ Ainy et al., 2014	2014	Iran	Car
▪ Faudzi & Yusof, 2004; Mohd Faudzi Mohd Yusoff, Nor Ghani Md Nor, 2011	2004; 2011	Malaysia	Car

3.11 DESIGNING A CONTINGENT VALUATION METHOD – WILLINGNESS TO PAY QUESTIONNAIRE (CVM-WTP)

According to Bateman et al. (2002), the CVM questionnaire needs to be designed to get respondents to think seriously about the topic of interest by providing necessary information in order for them to make an informed decision. The aim of the CVM - WTP questionnaire is to elicit individual preferences in monetary terms and encourage them to voluntarily disclose their monetary valuations on the matters questioned.

For the respondents to provide a valid and reliable value to the CVM questions, it is essential to consider the following when designing the CVM questionnaire: developing sufficiently understandable, reasonable, and meaningful scenarios for respondents to provide a valid and reliable value to each CVM question. Bateman (2002) recommended three stages of CVM questionnaire design.

The first stage comprises identifying the valued good for the study, designing and constructing a hypothetical valuation scenario, and eliciting monetary values. In the second stage, it is suggested to include attitudes, opinions, knowledge, and inquire about the valued good familiarity and use of the good related to the study. Demographic and debriefing questions are also added at this stage. Finally, the last step involves pre-testing the questionnaire draft for its content, design, and language used to ensure a general understanding. The structure and format of the question are also considered. Correspondingly, the pilot activity took place.

These stages can be simplified as follows in Figure 3.3. These stages are also suggested by the economic panel that prepared the National Oceanic and Atmospheric Administration (NOAA) report, which was tasked with evaluating the use of contingent valuation, originally proposed as a guideline for damage assessment in the USA (Arrow et al., 1993). Although NOAA is most widely used to guide environmental WTP studies, its guidelines can generally be applied to other Stated Preferences (SP) studies in other fields as well. These stages have also been elaborated in many of the previous CVMs done in developing countries (Bhattacharya, Alberini & Cropper, 2007; Chaturabong et al., 2011; Mofadal et al., 2015; Mon et al., 2019, 2018; Nor & Yusoff, 2003; Puttawong & Chaturabong, 2020) and other developed countries (Ainy et al., 2014; Mohamed, 2015; Yang et al., 2016) who attempted VOSL. The questionnaires were arranged accordingly to ensure a logical flow that would facilitate ease of response for the participants.

Additionally, the information provided in the CVM survey was designed to be sufficient for respondents to elicit their preferences, while avoiding overwhelming them with unnecessary technical details (Zainudin et al., 2016). Therefore, this study followed the recommended guidelines for CVM questionnaire design as proposed by Bateman et al. (2002), the NOAA Panel (1993), and Zainudin, Nordin, and Begum (2016). The study of Zainudin, Nordin, and Begum (2016) was chosen to make sure the design of the questionnaire is properly adjusted to the local context, and guidelines from Bateman et al. (2002) and NOAA (1993) were incorporated for the sake of internal validity and methodological strictness of the questionnaire.

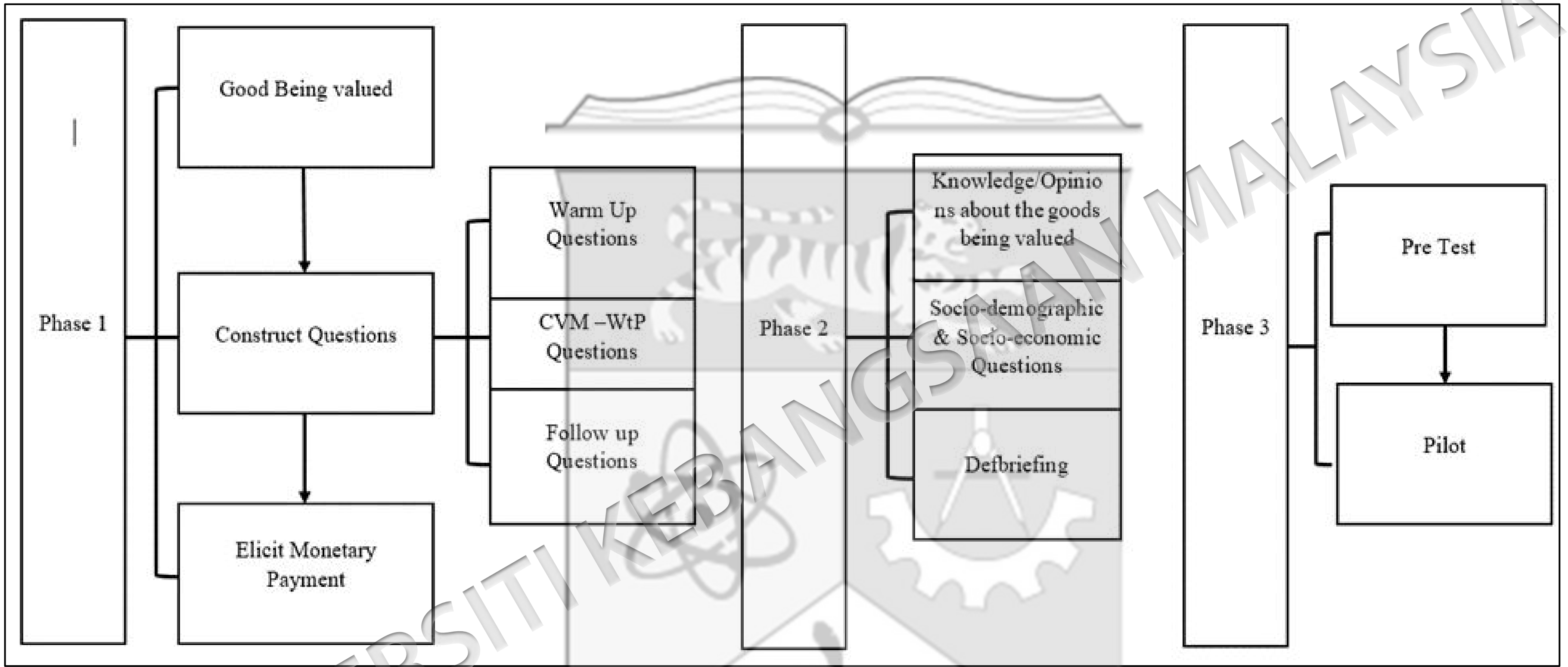


Figure 3.3 The Phases of CVM □WTP Questionnaire Design

3.11.1 Structure of CVM questionnaire

The CVM questionnaire was first copied from relevant studies, as shown in Table 3.8, and adapted. In collaboration with an expert in CVM environment studies from UNISZA and the Chief Research Officer (CFO) from Malaysian Institute of Road Safety Research (MIROS), a CVM questionnaire with inclusion of both the Payment card (PC) and Open ended (OE) formats was finalised. Multiple discussions were held, and several revisions were made to refine the CVM instrument. The primary concern was to ensure that the hypothetical scenarios reflected the local context, allowing respondents to easily understand and relate to them.

The involvement of MIROS was crucial in ensuring that the core component of the questionnaire□ the CVM scenarios□ was carefully developed to be consistent, practical, and representative of road safety, fatality, and injury conditions in the local setting, and expertise from UNISZA is to oversee the questionnaire to follow the CVM requirement optimally. This was one of the main reasons why a direct adoption of CV scenarios from previous studies was not feasible. The following section outlines the phases involved in simplifying and designing the CVM questionnaire for this study.

a Phase 1- Identifying the goods being valued, designing CVM – WTP questions and scenarios, and payment elicitation method

A CVM questionnaire with an introduction of the goods or policy being valued is recommended. It means that what matters to the respondents needs to be evaluated and is what they are willing to pay for. In this case, it is a public good, specifically road fatality and injury risk reduction, as well as road safety. Before the introduction of CVM scenarios, a snippet of current road traffic injury and fatality statistics was mentioned to indicate the severity and seriousness of the condition. The statistic was specifically mentioned for motorcyclists and pillion riders. The statistics were presented using figures and percentages to increase the respondents' understanding. From here, the respondents were also reminded of their income limitations, the rationale for stating their payments, and the hypothetical scenarios. This brief statement aims to ensure that the respondent understands and is aware of the main objectives of the survey.

Next, the CVM questions will be designed, and payment elicitation methods will be decided. As this is a CVM question, the scenarios designed must be straightforward to minimize cognitive exhaustion for the respondents (Mon et al. 2019). This is also why payment (PC) and Open Ended (OE) were chosen for this study, using the CVM elicitation method. The hypothetical scenarios from the previous study were examined thoroughly and modified accordingly. Modifications were made to the scenarios with the help of MIROS CFO (Dr Mohd Azad Ab Rashid). Dr Mohd Azad was involved in ensuring that the safety measures in the scenarios, even if hypothetical, were also practical. The scenarios were drafted a total of five times to ensure sufficient CVM scenarios, with modifications made from March 2021 to July 2021. The scenarios are then sent to the content and CVM experts from UNISZA, who have experience with CVM surveys, to double-check the content and ensure it is consistent with the CVM survey requirements. Table 3.9 displays the order of CVM questions in the actual survey, which was carefully arranged to facilitate respondents' ability to answer all questions.

□ n □ □ is s□ u□ □ □ □ □ o e□ i□ i□ a□ ion □ or□ a□ s □ ere e□ □ □ o□ e□ □ o es□ WTP for the proposed road safety program: the Open ended (OE) format and the Payment card (PC) method. The open-ended format permitted respondents to express the exact amount of money they were personally willing to pay without any predefinition imposed. On the other hand, the PC approach provided a predetermined range, a set of innovative maximum monetary values from which the respondent selects the preferred amount (Ye et al. 2021).

It was important to ensure that the two methods applied could allow for an in-depth analysis of WTP. The OE constraint is helpful for a wider spectrum of values, including large estimates that may indicate high personal valuation. However, this could also introduce heterogeneity for differences in personal interpretation. The PC method, however, reduces excessive responses, as well as a starting point bias by directing respondents through a fixed series of plausible values. The approach has been linked to more conservative and stable WTP estimates because of the anchoring effect and potential restrictiveness of responses. By incorporating both formats, the research attempted to mitigate their respective weakness and strengths in valuation results.

Accordingly, the PC values would typically be seen to be slightly less than the OE values because the PC format included a structured, or restricted, range (Chaturabong et al., 2011; Puttawong & Chaturabong, 2020).

The prices in the PC o□□ions □i□e□ □ □ro□ □ □ □ □o □ □e□i□ □ari□ a□ a □ annum) was finalised following pilot testing among 10 motorcyclists and expert input in public health and health economics. This small focus group, tested with social distancing and other COVID-19 risk control measures, had the dual purpose of ascertaining whether the respondents understood the risk reduction scenario used to elicit the fatality risk reduction. This confirms whether the respondents were valuing the amounts represented on the payment card.

Participants were queried specifically about the initial price (RM5) and the concept of escalating prices of RM5 increments in the session. Most agreed that RM5 was an acceptable pick as a starting point □not too low to be unserious, and not too high to prohibit an honest discussion. The interval of RM5 was also perceived to be manageable and simple to comprehend, especially among those with lower financial literacy. Participants also reported that this structure led them to find it easier to concentrate and be less muddled by selecting a price that reflected their WTP. Drawing from these findings, the last value of RM5 was kept as a starting point, and also the same RM5 intervals, and one additional category, □ □e□i□ □ari□ a□ a □ □ □ □ □ □as a□ □ to cater to those who greatly valued the reduction in fatality risk. Expert reviewers also confirmed the validity of this design, which follows typical contingent valuation procedures in lower-middle-income contexts, yet remains clear and retains responder focus. In addition, the design of the payment card was consistent with previous practice in contingent valuation and VOSL studies. Reports by, for example (Alberini, 2004; Hoffmann et al., 2017; Mofadal & Kanitpong, 2010), have shown that visual aids such as PCs can reduce cognitive load, reduce the number of protest zeros, and improve the reliability of WTP responses□ especially in LMICs.

Informed by the feedback from the target population and the experts in the subject, the method made the payment card context-specified, intuitive, and theoretically rigorous, enhancing the appropriate and reliable WTP to obtain the VOSL.

Table 3.9 The order of CVM WTP questions

Order of CVM –WTP questions arrangement	
Introduction Section	▪ Brief introduction about the study ▪ Knowledge and Attitudes questions
Valuation Section	▪ Willingness to Pay questions ▪ Debriefing questions
Profiling Section	▪ Socio-demographic ▪ Socio economic ▪ Injury status ▪ Hospitalization history

Based on Table 3.9, the *Introduction section* of the brief study consists of the objectives of the study and simple statistics to familiarize the respondents with the realities of introducing current motorcycle crash statistics. From this section, as well as the context of the questionnaire, the respondent was thoroughly explained. The interviewer explains the purpose of the questionnaire, the significance of road safety, and the consequences of traffic crashes using statistics derived from Laporan Statistik Kemalangan Jalan Raya Malaysia (2019). This background information allows respondents to understand the relevance of the scenario and the potential benefits of investing in safety measures (Mon et al., 2018). Here, there are a couple of attitude questions which show what respondents say about present road safety in terms of being a road user. Attitude questions were adapted and modified from (Mofadal & Kanitpong, 2010).

The next part of the *valuation section* is WTP questions, including fatality risk and injury risk reduction scenarios, and WTP for medical treatment. The survey included rating inquiries that prompted respondents to consider hypothetical situations regarding risk of death and risk of serious injury. The participants were asked to state the highest and lowest value they are willing to pay to avoid risk (Ainy et al., 2016; Chaturabong et al., 2011). The questions were designed to be simple and easy to comprehend, allowing for meaningful responses from numerous participants. There is also a debrief section in the current session on how sure they are of their WTP payment, the right ways to make a commitment to the payment, and who is appropriate to manage these public funds. The WTP section closes with a debriefing to end their consideration of the payment they had stated.

The third section is the *profiling*; it is divided into socio-demographic, socio-economic, and injury status, hospitalization history profiling, which is mandatory for the respondents to answer. Socio-demographic characteristics include age, gender, ethnicity, education, marital status, and occupation of respondents, while socio-economic characteristics comprise their income, household income, and household size. □n □□e o□□er □an□□ res□on□en□s' in□ur□ s□a□he types of injury and □□ □ the severity of the injury. Pre-crash on the hands, stated the respondents' possible hospitalization history prior to the study. Some of these questions some was adapted from (Aizuddin, 2017; Mofadal & Kanitpong, 2010; NorAzmaniza Azizam, 2019).

b Phase 2 – Knowledge and attitude questions, profiling questions, and debriefing questions

This section is essential □ or assessing □□e res□on□en□'s un□ers□an□ing o□ □□e roa□ sa measures currently implemented in the country. The risk reduction in road fatality and injury probability is also being assessed to determine if the respondent understands the basic intention of the following survey questions. As mentioned above, respondents' perceptions after deciding on the payment were assessed, and personal information was recorded. Noted that all questions asked via Google Form survey.

c Phase 3 – Pre-testing and pilot study

A pre-test was launched once the questionnaire was designed and arranged accordingly. The pre-test was conducted in October 2021, involving a total of 10 participants selected based on their age and type of road user to evaluate the first draft of the questionnaire design. A small focus group discussion, consisting of participants similar to those in the inclusion criteria, was invited to discuss improvements to the questionnaire. The rationale behind this is to ensure a response from different age groups and road users regarding the questionnaire. The purpose of pre-testing is to check whether the questionnaire is clear enough for local respondents to understand. According to the pre-testing results, the questionnaire was then improved accordingly. Pilot test, then proceed after the pre-testing process.

More than to improve the questionnaire for respondents' understanding during actual data collection, the purpose of the pilot test is to collect information on payment card values, which can then be improved based on local values. To date, no previous studies have attempted to clearly explain the process of determining the payment card value. Hence, this pilot needs to collect that information in order to reduce bias in the PC elicitation method. The pilot is also essential in determining the feasibility of the design of CVM scenarios. A pilot test was conducted in HOSB Alor Setar, whose process of data collection accurately reflects the actual data collection.

3.11.2 The importance of valuation questions

Valuation questions are critically important across these studies because they provide a □ eans □ o □ uan□ i□ □ in□ ivi□ ua□ s' □ □ □ □ or sa□ e□ □ i□ □ rove□ en□ s an□ ris□ re□ are otherwise difficult to measure through market data. Valuation questions are fundamental as they directly capture how much individuals value safety enhancements, allowing policymakers to incorporate socioeconomic factors into safety investments. Similarly, these questions help elicit accurate preferences for risk reduction by ensuring respondents understand the concepts of safety and probability, thus leading to more reliable estimates of WTP (Nor & Yusoff, 2003).

Additionally, the importance lies in translating subjective safety valuations into monetary terms that reflect underlying social and economic conditions, making the results useful for policy evaluation and resource allocation, especially in settings where formal markets for safety are absent. Valuation questions enable the measurement of how much individuals prioritize risk reduction, capturing variations in perception and income levels that influence safety preferences (Chaturabong et al., 2011). Chaturabong et al. (2011) further argued in their study that while valuation questions are very important, they are essential in putting a value on human life and injuries (non-market goods) through quantifying the trade-offs individuals are willing to accept and, as such, constitute an important tool in general safety assessments.

Lastly, a VOSL study focusing on pedestrians emphasizes the importance of valuation questions themselves for the derivation of the value of statistical life and injury risk reduction, as only through them can abstract safety benefits become a quantifiable amount of money necessary to gain a foothold for meaningful cost-benefit analysis and policy-making (Mofadal et al., 2015). In summary, these WTP questions provide a cornerstone for knowing societal preferences for safety and thereby for evidence-based policy making on safety issues.

3.11.3 Valuation questions scenarios

An additional aspect of the literature reviewing WTP for fatality reduction, injury reduction, and road safety measures is the protection scenarios presented in the valuation question, such as the use of helmets (Ainy et al., 2016; Chaturabong et al., 2011; Jazdzik-Osmolska, 2021) and protective gear or estimated mortality in a colored grid table (Mofadal & Kanitpong, 2010). As mentioned in Table 3.10, a Valuation Question Section was included in the questionnaire, which asked respondents for their WTP. These WTP questions were hypothetical scenarios designed to gauge how much respondents value reductions in the risk of injuries and fatalities (Jazdzik-Osmolska 2021). The followings explain in detail the scenarios used in this study.

Table 3.10 WTP □CVM Scenarios

WTP	Scenarios
Fatality risk reduction	OE: How much (RM) are you willing to pay per year to install *retroreflective marking* tape that is expected to reduce the risk of road crash deaths by 50%? PC: Choose the highest amount (RM) in the box that you are willing to pay, per year, for *retrospective marking* tape. Please select the Payment Card.
Injury risk reduction	OE: How much (RM) are you willing to pay for a *Helmet B* per year to reduce the risk of head injury from road crashes by 50%? PC: Choose the highest amount (RM) you are willing to pay per year for *Helmet B*. Please select the Payment Card.
National safety program fatality reduction	OE: How much (RM) are you willing to pay to public funds per year for the implementation of a *national safety program* that can save 50% of the lives of road users?

□ o □ e □ on□ inu

□ □ on□ inua□ ion

	PC: CHOOSE the highest amount (RM) you are willing to pay per year, for the *National Safety Program*. Please select the Payment Card.
Medical treatment (1st treatment)	OE: How much (RM) are you willing to pay per year to get the first *medical aid treatment*?
	PC: Choose the highest amount (RM) you are willing to pay per year, to get the *first medical aid treatment*. Please select the payment card.
Medical treatment (follow-up treatment)	OE: How much (RM) are you willing to pay per year to get this follow-up treatment to prevent your condition from getting worse?
	PC: Choose the highest amount (RM) you are willing to pay per year, to get follow-up treatment. Please select the payment card.

Notes: Refer to the complete WTP □CVM in the appendices

3.11.4 Debriefing questions

This section typically follows the hypothetical WTP□CVM scenarios and includes debriefing questions, also known as follow-up questions, as recommended by Bateman e□ a□ □ □ □ □ □ □ □ □ □ □ ese □ues□ions ai□ □o assess □ □e res□on□en□s' □on□ i□ amount they stated. Additionally, respondents were asked about the perceived importance of their involvement in road safety improvement and how they would prefer to contribute to a public fund. Contribution mechanisms included monthly salary deductions, tax-based deductions, payments through toll systems, voluntary donations, or Out-of-Pocket (OOP) expenses. Correspondingly, respondents were also asked to indicate which entities they believe should be entrusted with managing the public fund□ such as government agencies, private sectors, statutory bodies, non-statutory bodies, or any other relevant institutions□ based on their personal views.

3.12 WTP - CVM QUESTIONNAIRE VALIDATION

The CVM□WTP questionnaire underwent several stages of validation before the actual data collection commenced. Once the study was finalized in terms of design, scenario, and content, the questionnaire was sent for proofreading and back-to-back translation from English to Bahasa Melayu, following the same process as the RT-QoL questionnaire. However, the validation of the WTP-CVM questionnaire primarily focused on expert review to assess the appropriateness of the questions and the suitability of the scenarios within the local context, despite some adaptations from previous similar studies.

The face and content validity of the questionnaire was established through expert review. The developed instrument was assessed by subject matter experts to ensure the relevance, clarity, and appropriateness of the items in measuring willingness-to-pay (WTP) for risk reduction. Feedback from the experts was incorporated to refine the wording and structure of the questionnaire.

A pretesting and pilot study was subsequently conducted among respondents with similar characteristics to the target population to evaluate the clarity, comprehension, and feasibility of the instrument. Minor revisions were made based both on the pretesting and pilot findings to improve the overall flow and understanding of the questionnaire.

In terms of construct validity, the study employed a contingent valuation approach based on hypothetical scenarios rather than multi-item latent constructs. Therefore, formal construct validation techniques such as factor analysis were not applied. Instead, construct validity was supported through the careful design of valuation scenarios adapted from established studies (refer Table 3.8). The following section further elaborates on the validation procedures undertaken for the WTP□CVM questionnaire.

3.12.1 Face and content validity

Both content and face validity were assessed by industry and academic experts in the relevant field. First, an expert who was directly involved in VOSL studies conducted in 2010 and 2018 was consulted to provide input. Additionally, experts in CVM survey design from Universiti Sultan Zainal Abidin (UNISZA), who had experience in environmental valuation studies, were also consulted, and their feedback contributed to the content validation process. The validation was directly carried out by two expert road safety officers of the MIROS who are familiar with the local road safety situation. In addition, two academic statisticians and an economics lecturer were requested for consultation on aspects relating to the questionnaire design.

This validation was necessary to confirm that the CVM survey was methodologically correct to replicate and compare with another. The questionnaire also needed to be practicable for the respondents, relatable to the local road safety situation, easy to understand, and implementable to minimize the response bias. Six revisions are made to the WTP-CV instrument, with the final pre-test conducted with a small sample of motorcyclists.

3.12.2 Pretesting

The WTP-CVM questionnaire was pre-tested using a small Focus Group Discussion (FGD) including pillion riders and motorcyclists. Because of the COVID-19 pandemic situation at that time, the FGD was limited to 10 participants. The researcher led a pilot session that took place as a one-hour Webex meeting. The primary goal of conducting the FGD was to determine potential areas for improvement for the questionnaire content material, arrive at a common understanding of the CVM case scenarios, to get feedback on the understanding by the respondents of the purpose of the study and to test whether the average time taken to complete the writ-up of the FGD was as per expectations. Feedback from respondents was obtained after the training was done, which was used to modify and refine the questionnaire. Upon completion of the session, feedback from participants was collected and used to revise and improve the questionnaire. The revised version was then resubmitted to the panel of experts for further comments and validation before proceeding with the pilot testing phase.

3.12.3 Pilot testing

A pilot test was conducted at the ED of HOSB, Alor Setar, Kedah. Similar to the actual study, the pilot test employed the same methodology. A total of 79 participants were successfully recruited to assess the condition and functionality of the questionnaire. However, only 51 responses were available for analysis due to missing data. The pilot test was essential to ensure that the questionnaire was in good condition, served the intended purpose of the study, and facilitated preparation for the actual data collection. In addition, responses from the pilot test were used to improve the VOSL scenarios further. Overall, the questionnaire did not require major revisions, as respondents reported that the language and content were easy to understand during the debriefing. □ □ is □ on□ ir□ e□ □ □ e □ ues□ ionnaire's sui□ a□ i□ i□ □ □ or use in □ □ e □ ain s□ u□ □

3.13 RESEARCH DATA COLLECTION PROCEDURES

Due to the restrictions imposed by the COVID-19 pandemic, face-to-face communication and access to individuals, particularly within hospital settings, were limited. As a result, a phone interview approach was adopted for participant recruitment and data collection. Recruitment was conducted through the HOSB and HSB, using the MTR Log Book and the electronic Health Information System (e-HIS). Data collection was carried out via phone interviews and an online web-based survey, utilizing GF to capture and store respondents' responses. This approach was deemed the most appropriate and safest mechanism to ensure the protection of both the researcher and □ □ e res□ on□ en□ s □ □ i□ e ena□ □ ing □ □ e su□ □ ess□ u□ □ on□ inua□ ion o□ □ □ e s□ u process.

Data collection for this study was divided into two parts. The first part was a structured telephone-a□ □ inis□ ere□ □ ues□ ionnaire on res□ on□ en□ s' □ □ □ □ or □ □ □ □ second part was an administration of the RT-QoL questionnaire..

Component 1, which focused on the WTP□CVM survey, was conducted via telephone interviews using a structured questionnaire format. Section C contained the □ □ □ s□ enarios use□ □ o e□ i□ i□ res□ on□ en□ s' □ i□ ingness □ o □ a□ This section needed interviewer prompting because of the difficulty of the risk reduction questions, which respondents might not be readily familiar with. The instructions were necessary to ensure participants fully comprehended the hypothetical situations and were able to give informed responses. The estimated duration for completing this component was approximately 15 to 20 minutes.

In Component 2, the QoL survey was administered to respondents immediately after they completed the first survey. The QoL questions were more direct, utilizing closed-ended Likert scale items that were easier for respondents to understand. Note that all questions were pre-programmed into the system and shared with respondents through the provided link, similar to VOSL.

The survey link was sent via the respondents' mobile phones. The Google Form (GF) did not require respondents to sign in to any account. Instead, respondents were directly guided to the questionnaire via the shared link. To enhance the respondent experience and ensure smooth functionality, the researcher conducted several pre-tests of the GF. These tests included verifying that the link was accessible upon clicking and that the survey operated as intended. This effort was crucial to ensure that both the pilot and actual data collection phases proceeded as planned and to minimize the risk of technical errors that could potentially delay the study timeline.

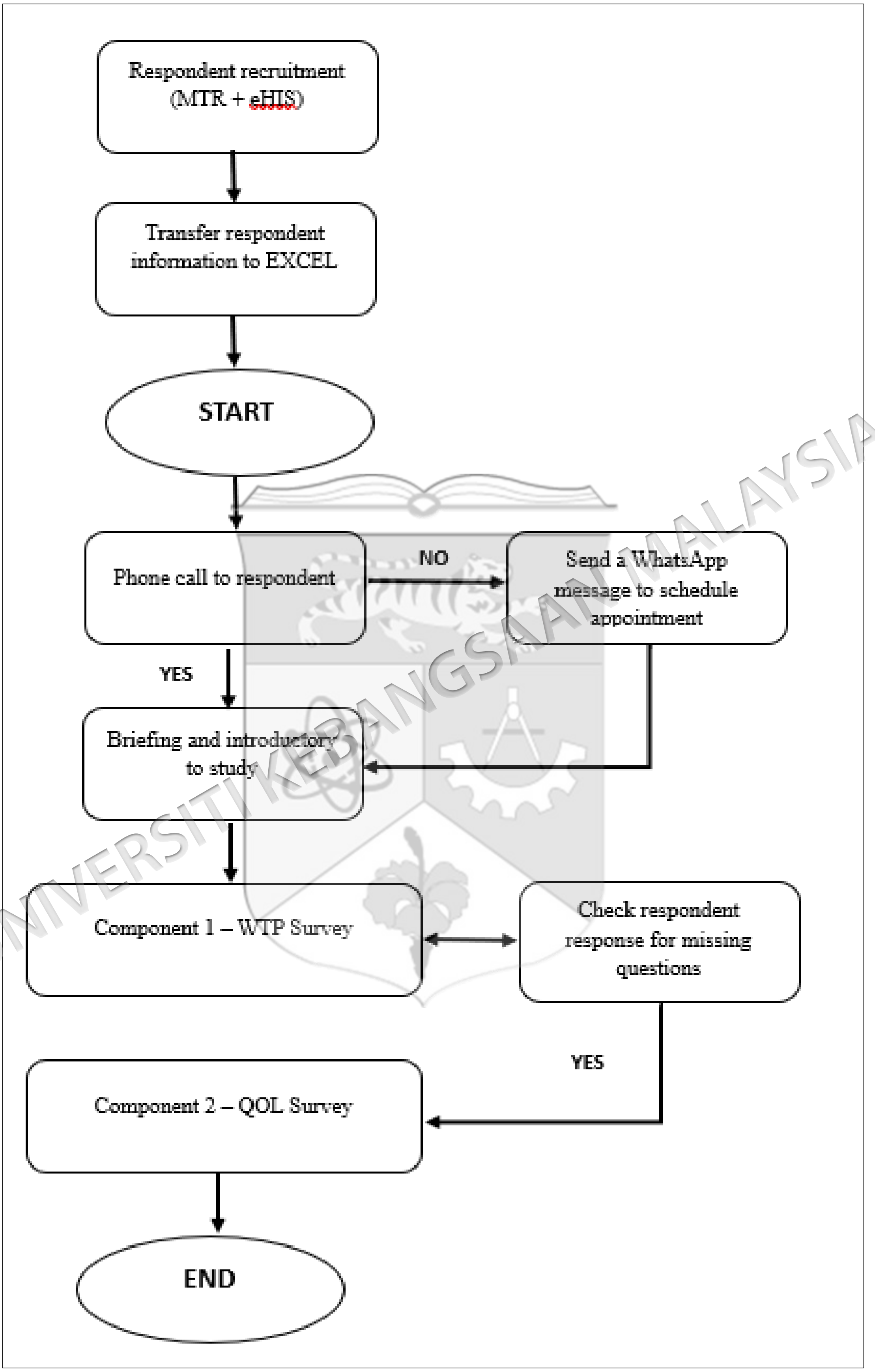


Figure 3.4 Recruitment and data collection process

As the data collection for this study involved individuals who sustained injuries due to RTIs and was conducted during the COVID-19 pandemic, it was particularly challenging to identify and recruit respondents. Therefore, after thorough discussions with the ED physicians and consultants, it was decided that the process outlined in Figure 3.4 would better facilitate data collection. The simplified process of respondent recruitment and data collection was as follows:

1. Respondent identification and recruitment were conducted at the ED through the patient Malaysian Trauma Registry (MTR) to the registration system, electronic Hospital Information System (e-HIS). This process aimed to ensure that the recruitment of Motor Vehicle Accident (MVA) cases complied with the s□u□□'s □e□ini□ion□ □□i□□ in□□u□e□ on□□ □o□or□□□□is□s an□ □i□□ o□□er □re□e□ine□ in□□usion □ri□eria□ □n□or□a□ion su□□ as □□ phone number, patient ID (identification), type of injuries, and triage zone (yellow and green) was recorded in a separate Excel file. During this stage, a filtering process was carried out to ensure that all selected patients met the s□u□□'s inclusion and exclusion criteria. This file served as the primary reference for the subsequent data collection process.

2. Once the identification of potential respondents was completed, selected information was shared with the enumerators for data collection purposes. Only s□e□i□i□ □e□ai□s□ su□□ as □□e res□on□en□'s na□e an□ □□one nu provided to the enumerators to ensure that the respondents' privacy was maintained throughout the process.

3. Enumerators contacted the respective respondents via phone. If the respondents agreed to participate immediately, the study proceeded without delay. However, if they were unable to participate at that moment, a WhatsApp (WA) message was sent to schedule an appointment for the survey. The survey began with a brief introduction to the study, including an explanation of its objectives. Informed consent was also presented and explained to the respondents prior to proceeding with the interview.

4. For respondents who agreed to participate, a detailed explanation of the first survey□ the WTP survey (Component 1)□ was provided. Patients were guided through the survey process by trained enumerators to ensure clarity.

5. Once the phone interview was completed, patients were reminded about the second part of the study, which involved the QoL survey (Component 2).

6. The survey concluded once the respondents had successfully completed both the WTP and QoL survey questionnaires.

The total number of questionnaires distributed and returned was recorded to determine the response rate. Follow-up were also implemented to enhance participation (those who were not available during first contact) and ensure completeness of responses. The response rate presented in Chapter IV is based on this documented recruitment and data collection process.

All participants in the study participated voluntarily and were not subjected to any form of coercion. The researcher took the initiative to invite eligible patients to participate in the study, ensuring that informed consent was clearly presented and explained prior to the commencement of data collection. Note that participation in the study was anonymous, with no names or identifiable information recorded in any part of the study documentation. An information sheet and informed consent form were provided a□ □□e □eginning o□ □□e s□u□□ □o en□an□e □ar□i□i□an□s' un□ers□ s□u□□'s o□□e□□ives□ □ro□e□ures□ an□ □□-related information was□ a□ien□ treated as private and confidential and was used solely for research purposes. The information sheet and informed consent were included at the beginning of the survey. Participants were given sufficient time to read the documents and make an informed decision regarding their participation. Once the patients agreed to participate and signed the consent form, they were considered to have voluntarily joined the study and were expected to participate from start to finish. However, participants were informed of their right to withdraw from the study at any point, including during data collection, without any consequence.

3.13.1 Involvement of vulnerable subjects

No minors or vulnerable subjects are involved in the study.

3.13.2 Research assistants

Research assistants were hired as enumerators to assist in the data collection process. Since data collection was conducted through phone interviews and involved a questionnaire containing CV scenarios, structured training sessions were provided to ensure a standardized and consistent approach to administering the survey. The training covered several key areas, including an understanding of the CV-WTP risk reduction scenarios, responses to Frequently Asked Questions (FAQs) from respondents, procedures for obtaining informed consent, and the standardized study introduction to be used by all enumerators. Training sessions were conducted three times via Google Meet, and additional discussions were held through a WA group to address any further queries or clarifications required by the enumerators.

3.14 RESEARCH DATA ANALYSIS

Descriptive and inferential analysis of GLM for WTP determinants was conducted using SPSS 28 version, and the WTP cost was calculated using a formulated Excel sheet. In contrast, the QoL descriptive and inferential analysis, as well as Binary Logistic Regression (BLR), were also analyzed using SPSS 28 version. Table 3.11 simplifies the planning for the current study data analysis.

Table 3.11 Data analysis planning

Variables	Descriptions	Analysis
Socio demographic	▪ Age ▪ Gender ▪ Ethnicity ▪ Education ▪ Marriage Status ▪ Occupation	▪ Descriptive ▪ Inferential
Socio economic	▪ Income ▪ Household income ▪ Household size	▪ Descriptive ▪ Inferential

To be continued

□ □ on□ inua□ ion

Injury Status	▪ Types of injury ▪ Injury severity	▪ Descriptive ▪ Inferential
Pre-Crash status	▪ Hospitalization history	▪ Descriptive ▪ Inferential
Value of Statistical Life (VOSL)	▪ Willingness to pay for injury risk reduction (RM) ▪ Willingness to pay for fatality risk reduction (RM) ▪ Willingness to pay for national road safety ▪ Willingness to pay for injury medical treatment (RM) ▪ Fatality cost (RM) ▪ Injury cost (RM)	▪ Descriptive ▪ Inferential
Quality of Life	▪ Functional ▪ Physical ▪ Emotional	▪ Descriptive ▪ Inferential

3.14.1 VOSL Test of normality

For the VOSL- dependent variable, normality assessment was conducted to determine the appropriate statistical technique for further analysis. Initially, One-Way Multivariate Analysis of Variance (MANOVA) was considered appropriate, as the dependent variable is continuous and the independent variables are categorical, under the assumption of normal distribution.

To assess this assumption, normality tests using Kolmogorov□Smirnov and Shapiro□Wilk were performed. In addition, data transformation was attempted to improve normality and to meet the assumptions required for parametric analysis such as MANOVA.

However, the results indicated that the data did not satisfy the assumption of normality even after transformation. Therefore, a Generalized Linear Model (GLM) with a Gamma distribution was selected as an alternative analytical approach. This model is suitable for handling positively skewed continuous dependent variables and allows the inclusion of both continuous and categorical independent variables. The final analysis was conducted using the original dataset without transformation to preserve data integrity and avoid unnecessary distortion of the observed values.

3.14.2 QoL Test of normality

Two statistical procedures, the Kolmogorov-Smirnov test and the Shapiro-Wilk test, were employed to ascertain if the data adheres to a normal distribution. In all three domains; emotional, functional and physical referred to the significance values (Sig.) which are below 0.001, signifying that the data do not conform to a normal distribution. The results were detaild explained in Chapter IV.

3.14.3 Binary Logistic Regression (BLR) - QoL

To examine the association between socio-demographic, socio-economic, injury-related, and pre-crash factors and each domain of quality of life□ namely, physical, emotional, and functional□ a series of BLR analyses was conducted. This method was selected due to the nature of the dependent variables, which were measured as binary ou□ □o□ es □i□ e□ □ □a□ egori□ e□ as ei□ □er □ □o□ □ or □ □ig□ □ □o□ □ □ □en□ for modeling the probability of a dichotomous and categorical outcome as a function of one or more IVs. It allows for the estimation of Odds Ratios (ORs) to assess the strength and direction of associations.

The IVs included categorical predictors from four major domains. Socio-demographic variables consisted of age group, gender, ethnicity, education level, marital status, and occupation. On the other hand, socio-economic factors included respondent income, household income, and household size. Injury-related factors comprised injury severity and type of injury, while pre-crash status variables included the role of the respondent (motorcyclist or pillion rider), possession of a motorcycle license (yes or no), purpose of travel at the time of crash, presence of insurance coverage (yes or no), and history of road traffic crashes in the past year (yes or no). Note that all categorical variables were appropriately coded, with dummy variables created where necessary and reference categories clearly defined (e.g., B40 as the reference group for income).

Separate logistic regression models were constructed for each domain of QoL (physical, emotional, and functional) to identify factors significantly associated with higher quality of life in each respective domain. The results are reported in terms of regression coefficients (B), Standard Errors (SE), OR, 95% Confidence Intervals (CI), and p-values, with statistical significance evaluated at the 0.05 level. The results were arranged in Table 4.18. Table 4.19 and Table 4.20, respectively.

3.14.4 Generalized Linear Model (GLM) - WTP

Generalized Linear Models (GLM) were employed when the data were continuous but exhibited a non-normal distribution ($p<0.01$) as indicated by the aforementioned normality test. The Gamma GLM is suitable when the dependent variable is continuous and positively skewed, characterized by data clustering at the lower end with an extended tail on the right. The use of Normal GLM is contrary, as the data is negatively skewed, with the majority of data points concentrated at the lower end and a lengthy tail extending to the left. Model 1 (*retroreflective marker-fatality risk reduction)*, 3 (*Helmet-injury risk reduction*), 5 (*national road safety program*), 7 (*1st medical treatment*) and 9 (*follow up medical treatment*) - (Open ended WTP) was analyzed using GLM with Gamma distribution while Model 2 (*retroreflective marker-fatality risk reduction)*, 4 (*Helmet-injury risk reduction*), 6 (*national road safety program)*,8 (*1st medical treatment*) and 10 (*follow up medical treatment*) - (Maximum payment card WTP) was using GLM with normal distribution. The arrangement of the models were guided by the framework of Preeda et al. (2011) whose study provided a methodological basis that is well-suited to the present research context.

The results were extracted and summarized from the goodness-of-fit statistics, which provide information to assess how well the model fits the data. Note that parameter estimates were used to display the regression coefficient standard errors and significance value for each predictor, and the Omnibus Test was used to show whether the predictors were significant based on the Chi-Square test. The following table illustrates the graphical representation of negatively and positively skewed data, highlighting the distinctions in the analysis of the related data.

3.15 RESEARCH ETHICS CONSIDERATION

The following elaborate the study's research ethics approval process, potential benefit of the study, study safety and efficacy, and the study disposable and privacy.

3.15.1 Research ethics approval

This study was approved by the Ethics Committee Universiti Kebangsaan Malaysia (UKM), with the approval number **FF-2020-418**. The study was also applied to the Ethics Committee of the National Medical Research Register (NMRR). The approval number is **NMRR 20-3246-53718**. The study will adhere to the principles of the Declaration of Helsinki and the Malaysian Good Clinical Practice Guidelines.

3.15.2 Research publication policy

The respondents' information obtained was kept and handled discreetly, per applicable laws and regulations. Additionally, when publishing or presenting the study results, respondents' identities or personal information were not revealed under any condition without their expressed consent. This research was published according to the rules and regulations exhibited by the UKM Ethics Committee and NMRR. Additionally, approval was obtained from the Director General (DG) of the Ministry of Health, Malaysia, prior to the publication of this research. Note that all information obtained from the research was kept confidential.

3.15.3 Research potential benefits/risk of being in the study

Participation in this study did not affect the respondent's treatment, and the [illegible] risk is minimal. The respondent is free to decline to answer any of the questions that they feel uncomfortable with. The researcher believes that the information obtained from this study will enhance policy decision-making in planning road safety and reduce risk, ultimately affecting road users. If needed by the respondents, they will have access to the study's outcome.

3.15.4 Research safety and efficacy

All data and responses provided by the respondents are private and confidential, and will be used solely for the purpose of the research. The survey given does not require the res□on□en□'s a□□ua□ na□e an□ □ersona Additionally, none of the res□on□en□s' assessments or physical examinations were performed during the study. The structured telephone-administered questionnaire and self-administered survey were the only data collection tools used in the study, as clearly stated in the information sheet and informed consent form.

3.15.5 Research disposable and privacy

All data related to the study is destroyed after a period of storage of five years. As the data consists of res□on□en□s' information pertaining to the study, the physical data in the form of hard copies will be shredded, while the soft copy data will be permanently deleted from devices. Additionally, all study links provided to the respondent for data collection purposes were deactivated once the submission period ended.

3.16 SUMMARY

□□is □□a□□er □as □es□ri□e□ several s□ra□egies □or □□e s□u□□'s □e□□ strategies have been carefully planned to reflect the method of the current study. Figure 3.5 summarized the entire research process. Each of these process is discussed in detail, as elaborated in Chapter III.

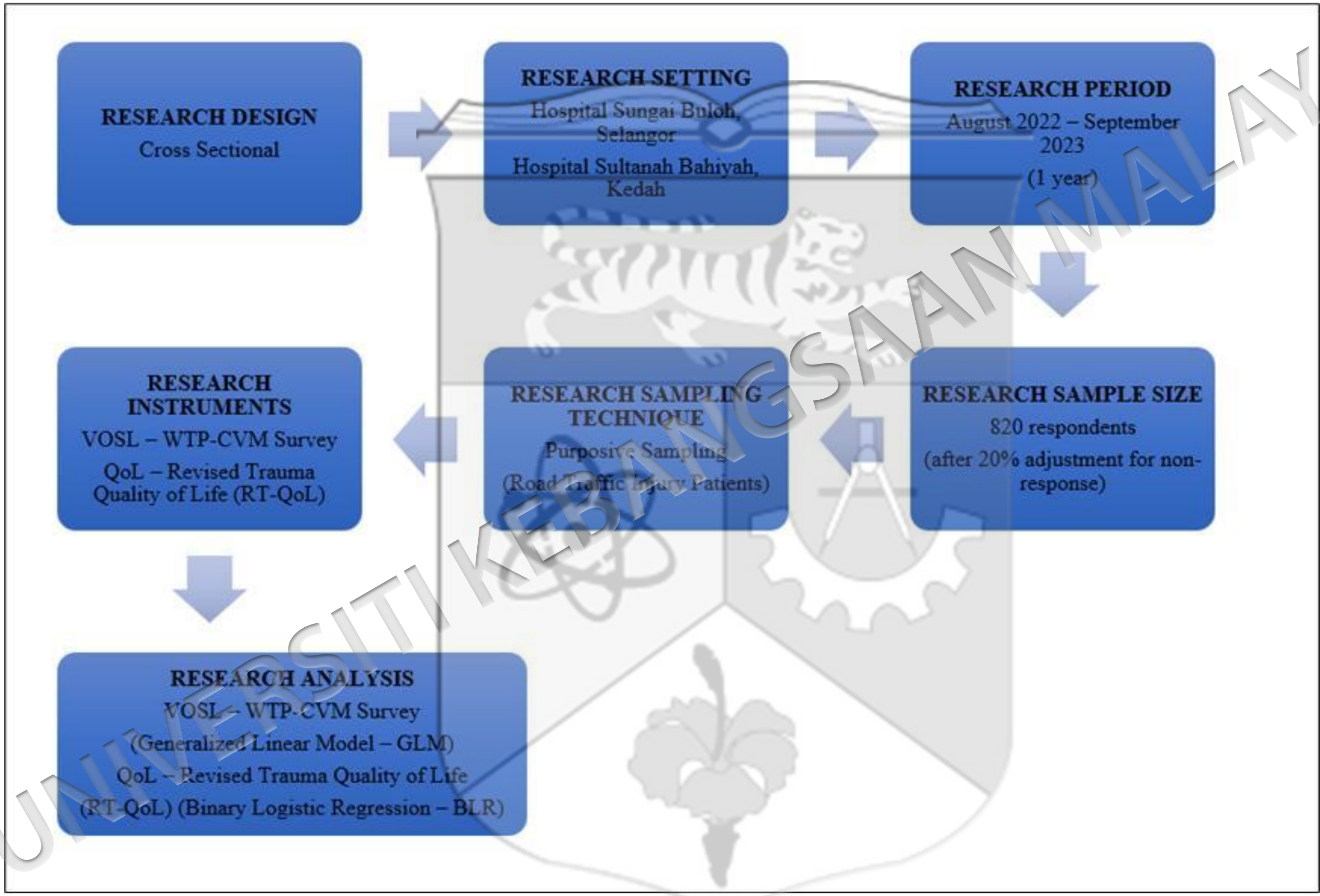


Figure 3.5 Research Process Summary

CHAPTER IV

RESULTS

4.1 INTRODUCTION

This chapter displays the results and analysis of the research findings. This chapter presents the results of the univariate and multivariate analyses, which are then overlaid. Descriptive statistics were used to profile the independent and dependent variables, while Gamma Generalized Linear Models (GLM) and Binary Logistic Regression (BLR) were employed to conduct the extended analysis. Gamma GLM was used to analyze the association of independent variables with VOSL, and BLR was used to examine the Quality of Life (QoL) and its Independent Variables (IVs). IVs are socio-demographic variables that consist of the res□on□en□'s age□ gen□er□ ra□e□ e□u□a□ic marriage status, and occupation. □o□ioe□ono□i□s □onsis□s o□ res□on□en□s' in□o□e□ household income, and household size. Injury status consists of the injury form and in□ur□ severi□□□ as □e□□ as □□e crash status, which includes those with a hospitalization history prior to the survey, the purpose of travel, insurance, license status, and whether the respondent was a motorcyclist or a pillion passenger.

Here, we lay out the univariate and multivariate extended analyses of the research data. The analysis began with a section-by-section approach, following the questionnaire. □irs□□ res□on□en□'s so□io □e□ogra□□i□ an□ e□ono□i□ ana res□on□en□'s a□□i□iona□ in□or□a□ion as a roa□ user an□ □os□i□a□ □is□or□ res□on□en□ Value of Statistical Life (VOSL), which consists section of WTP for injury risk reduction and fatality risk reduction (RM), WTP for national road safety program and injury medical treatment (RM), and finally, the calculation of cost of injury risk reduction and fatality risk reduction □□□□ an□ □as□□□ is □□e res□on□en□'s □ua□i□

respond. Tables, charts, and illustrations were used to assist the representation of findings and will be further discussed in Chapter V.

4.2 RESPONSE RATE

The study successfully disseminated 875 surveys to the respondents, and a total of 546 surveys were returned. The final calculations for the study samples were available for analysis after the data were cleaned. The total was 546 from 875 surveys, which were delivered to the respondents, resulting in a 62.4% response rate. This moderate response rate may be related to the nature of the study, which involves patients at the health center, a setting commonly associated with difficulties in engaging participants in research endeavors. We will elaborate further on the reason behind the response rate being presented in this manner in the discussion section, Chapter V onwards.

4.3 RESPONDENT'S SOCIO-DEMOGRAPHIC

This section specifies the socio-demographic characteristics of the respondents involved in the study. Articulating these traits is crucial, as they furnish vital background for evaluating the next studies and conclusions. The variables examined encompass age, gender, race, educational level, marital status, and occupation along with its sector in Table 4.1. By outlining the demographic profile of respondents, this section helps to ensure that the results are better understood within the context of the respondents' background.

4.3.1 General profile

Table 4.1 General Profile Socio-demographic

Variables		n	Percentage %
Age	18 - 29	269	49.3
	30 – 64	245	44.9
	65 ++	32	5.8
Gender	Male	415	76.0
	Female	131	24.0

To be continued

(Continuation)

Race	Malay	457	83.7
	Chinese	23	4.2
	Indian	62	11.4
	Others	4	0.7
Education	Primary Education	12	2.2
	Secondary Education	228	41.8
	Tertiary Education	306	56
Marital Status	Single	256	46.9
	Married	290	53.1
Occupation	Laborers	10	1.8
	Fisherman	5	0.9
	Industrial Workers	40	7.3
	Service Workers	99	18.1
	Students	70	12.8
	Admin clerk	42	7.7
	Self employed	114	20.9
	Pensioner	57	10.4
	Professionals	59	10.8
	Housewife	26	4.8
	Army	4	0.7
	Unemployed	20	3.7
Occupation sector	Government	286	52.4
	Private	260	47.6

4.3.2 Age

The initial analysis of age data exploration showed that the data were not normally distributed. Hence, a median was used to determine the age structure across the population under study. The median age is 30 years old with a standard deviation of 14.9, which falls under the adult categories of respondents, with 18 being the minimum age and 79 years old being the maximum age. The analysis of road crash data reveals that a significant majority of 269 respondents, accounting for 49.3%, were teenagers and young adults aged between 18 and 29 years old. This demographic appears to be the most affected by road crashes, highlighting a critical concern for this age group. In contrast, adults aged between 30 and 64 years constituted 44.9% of the respondents involved in road crashes, indicating that middle-aged individuals also face substantial risks on the road. Furthermore, elderly individuals aged 65 and above made up 32 respondents, or 5.8%, of those involved in crashes. This data underscores that while road crashes occur across all age groups, the incidence is notably higher among young, productive individuals, suggesting a need for targeted road safety interventions and awareness programs for younger populations. The trend of higher crash rates among young adults could be attributed to factors such as increased mobility, riskier driving behaviors, and higher exposure to road traffic, making it essential to address these issues through comprehensive safety measures and educational campaigns.

4.3.3 Gender

The gender distribution revealed a significant predominance of male participants. Specifically, out of a total of 546 respondents, 415 respondents (76.0%) were male, while 131 respondents (24.0%) were female. The markedly higher proportion of male respondents is consistent with national road traffic statistics, which frequently report a greater involvement of males□ particularly motorcyclists□ in road traffic crashes in Malaysia. This gender disparity may be attributed to several factors, including higher levels of risk exposure, travel frequency, and motorcycle ownership among males compared to females. Given that the present study focuses on motorcycle-related crash survivors, the observed gender imbalance is both expected and representative of the population under investigation.

4.3.4 Ethnicity

The demographic analysis of the respondents revealed that a substantial majority were of Malay descent, totaling 457 individuals, which constitutes 83.7% of the sample. This is followed by respondents of Indian ethnicity, amounting to 62 individuals or 11.4%. Chinese respondents accounted for 23 individuals, making up 4.2% of the total. Additionally, other races were represented by 7% of the respondents, indicating a diverse yet predominantly Malay population within the sample. This distribution highlights the significant representation of Malay individuals compared to other ethnic groups, suggesting that the study's findings may be particularly reflective of the Malay community's experiences. The inclusion of respondents from various ethnic backgrounds provides a comprehensive overview. However, the overwhelming majority of Malay respondents may also point towards specific cultural or regional factors that are unique to the study's location and the study itself.

4.3.5 Education

The majority of the respondents had attained higher education, with 306 individuals, or 56%, having completed their studies at either a university or a college. This indicates a well-educated sample population, with more than half possessing tertiary education qualifications. Following this, 228 respondents, accounting for 41.8%, had completed their education at the secondary school level. This substantial proportion underscores the importance of secondary education in the respondents' backgrounds. In contrast, a small minority of the respondents, specifically 12 individuals or 2.2%, were primary school leavers. This demographic detail highlights the varying educational backgrounds among the respondents, with a significant skew towards higher education, reflecting the age of the respondents under study.

4.3.6 Marital status

The marital status of the respondents reveals a notable distribution among the participants. A majority of 290 respondents, or 53.1%, were married, representing the largest segment of the sample. This indicates that more than half of the respondents were in marital relationships, which could potentially influence their perspectives within the study. In contrast, the remaining respondents, totaling 256 individuals or 46.9%, were single. This proportion reflects a significant number of individuals who are not currently in marital relationships. Despite this near-equal split, the difference in marital status between the married and single respondents is relatively small, suggesting that the study encompasses a balanced representation of both marital statuses.

4.3.7 Occupation

The occupational distribution among the respondents reveals a diverse range of employment statuses. A significant proportion, comprising 114 individuals or 20.9% of the sample, were self-employed. This group includes individuals engaged in various forms of entrepreneurship, such as owning their own businesses or operating online enterprises. Following this, 99 respondents, or 18.1%, worked in service-oriented roles, with a notable number being Grab riders, who contribute to the gig economy through ride-hailing services. Students represented 70 respondents, accounting for 12.8% of the sample, indicating a considerable presence of individuals who are currently pursuing their education. Among the professional sector, 59 respondents, or 10.8%, were employed as teachers or lecturers, highlighting the involvement of educators in the study. On the other end of the spectrum, the least represented occupations were those in the military and fishing industries, with only 4 respondents (0.7%) identifying as army personnel and 5 respondents (0.9%) as fishermen. This distribution underscores the broad spectrum of occupations represented among the respondents, from self-employment and service roles to specialized professional and minimal representation in traditional industries. It is also indicated that regional factors are involved in the selection of study locations.

4.3.8 Occupation sector

The occupational distribution of the respondents reveals a fairly balanced representation between the public and private sectors. A majority, comprising 286 respondents or 52.4%, were employed in the government sector. This significant proportion might reflect a robust presence of individuals working within various public institutions, which often include roles in administrative, educational, and public offices. Conversely, 260 respondents, amounting to 47.6%, were employed in the private sector. This group might encompass a range of industries such as finance, technology, and manufacturing. The relatively small difference between the two sectors, just 4.8 percentage points, suggests a notable parity in occupational distribution among the study participants. This balance indicates that both public and private sector employees are well-represented, providing a comprehensive view of employment across different organizational types.

4.4 RESPONDENT'S SOCIO-ECONOMIC

This section describes the socio-economic attributes of the respondents included in the study, as encapsulated in Table 4.2. Describing these attributes is important as they provide essential context for interpreting the subsequent analyses and findings. The variables considered include monthly income, household income, and household size.

These characteristics not only offer an overview of the respondents' background but also serve as potential explanatory factors that may influence outcomes examined in the study. By outlining the socio-economic profile of respondents, this section helps to ensure that the results are better understood within the context of the participants' financial and household circumstances.

4.4.1 General profile

Table 4.2 General Profile Socio-Economic

Variables		n	Percentage %
Monthly income	Category 1 (B40)	526	96
	Category 2 (M40)	20	4
	Category 3 (T20)	0	0
Household income	Category 1 (B40)	498	91.3
	Category 2 (M40)	45	8.24
	Category 3 (T20)	3	0.55
Household size	Small	474	87
	Medium	70	12.8
	Large	2	0.3

4.4.2 Income (RM)

The majority of the respondents, amounting to 526 individuals or 96%, reported monthly incomes that fell within the B40 category, which ranges from less than RM2,500 to RM4,849. This indicates that a significant portion of the participants belonged to the lower-income group. In contrast, the remaining 4% of respondents had monthly incomes ranging from RM4,850 to RM10,959, placing them within the M40 category. This distribution highlights the economic disparity among the respondents, with the majority earning considerably less than the minority who fall into the middle-income bracket. The categorization of incomes into B40 and M40 is crucial for understanding the socioeconomic dynamics. However, it is understandable that the categorization of income may be influenced by regional factors, such as the study location and the respondents' occupational backgrounds.

4.4.3 Household income (RM)

Most respondents in the study, totaling 498 individuals or 91.3%, were from households classified within the B40 income group. This group represents the bottom 40% of income earners in Malaysia, typically earning less than RM4,850 per month. A smaller portion of the respondents, amounting to 45 individuals or 8.24%, came from households in the M40 category, which includes the middle 40% of income earners with monthly incomes ranging from RM4,850 to RM10,959. Notably, only a very small fraction of the respondents, accounting for 0.55%, were from the T20 income category, which represents the top 20% of income earners. These allocations of income groups were more towards the B40 categories, which were closely related to the location under study, specifically the government hospitals that housed most of these patient categories.

4.4.4 Household size

A significant majority of the respondents, totaling 474 individuals or 87%, reported coming from small households, which typically consist of 1 to 3 members. This suggests that most respondents live in relatively compact family units. In contrast, a smaller portion of the respondents, 12.8%, come from medium-sized households that include 4 to 6 members. This reflects a moderate family size, which is less common among the respondents. Notably, only a very small fraction, 0.3%, comes from large families. These households, with more than 6 members, represent the minority among the respondents. This distribution highlights the prevalence of smaller household sizes within the surveyed population, suggesting a trend towards smaller family units.

4.5 INJURY STATUS

This section specifies the injury status of respondents, emphasizing the types and severity of injuries received, as described in Table 4.3. Documenting these features is crucial, since they provide the clinical background for interpreting the study outcomes.The type of injury provides insight into the nature of the trauma encountered, whereas the severity of the injury indicates the degree of physical impact and its possible consequences for recovery, treatment requirements, and quality of life.By outlining both the type and severity of injuries, this section establishes a clearer un□ ers□ an□ ing o□ □ □e res□ on□ en□ s' □ e□ i□ a□ □ on□ i□ ion an□ i□ s □ o□ en□ i subsequent findings in the study.

4.5.1 General profile

Table 4.3 General Profile Injury Status

Variables		n	Percentage %
Type of injury	Fractures	341	62.5
	Non fractures	205	37.5
Injury severity	Minor	198	36.3
	Moderate	197	36.1
	Serious	141	25.8
	Unknown	10	1.8

This section will include the types of injury, which were divided into fractures and others. It is very common for post-crash patients to suffer from fractures compared to other conditions, which are limited to abrasion, laceration, and trauma of the skin. This has been clearly seen in the hospital information system. Therefore, the study decided to divide the injury types into fractures and those other than fractures. Meanwhile, the determinants of the injury scale were referred to the Abbreviated Injury Scale 2015 Version (*The Abbreviated Injury Scale (2015 Revision)* 2016). The coding of each injury was assisted by two coders from the Malaysian Institute of Road Safety Research (MIROS) and one medical staff member.

4.5.2 Types of injury

A total of 546 injury cases were analyzed to determine the distribution of injury types among respondents. The most prevalent type of injury was fracture, reported by 342 individuals (62.6%), which constituted the majority of all injuries sustained. This finding highlights the significant burden of bone-related trauma among the injured population. The second most common injury was abrasion, accounting for 63 cases (11.5%), followed by soft tissue injuries with 57 cases (10.4%). Other reported injuries included laceration (n = 36, 6.6%), concussion (n = 13, 2.4%), and traumatic brain injury (n = 10, 1.8%). Less frequently reported injuries were hematoma and unknown injury types, each comprising 1.6% of the total cases (n = 9 each), abdominal injuries (n = 3, 0.5%), lung contusion (n = 2, 0.4%), and both contusion and dislocation, which were the least common at 0.2% (n = 1 each). The cumulative percentage indicates that by the time fractures are considered, over three-quarters of the cases (77.5%) have been accounted for. This suggests that a large proportion of injuries fall into a small number of categories, with fractures, abrasions, and soft tissue injuries alone constituting over 84% of all reported injuries. Overall, fractures contribute to the major types of injury, with 62.5% compared to non-fracture categories, 37.5%.

4.5.3 Injury severity (Abbreviated Injury Scales (AIS) and Multiple Abbreviated Injury Scales (MAIS)

In this study, most respondents were found to have suffered multiple injuries. Therefore, the Maximum Abbreviated Injury Scale (MAIS) was used instead of the Abbreviated Injury Scale (AIS). However, the MAIS score was derived based on the highest AIS score identified for each individual, and the calculation was referred to The Abbreviated Injury Scale© 2015 Revision May. The severity of injuries sustained by the 546 respondents was assessed using the MAIS classification. The findings revealed that the average severity score was 2.02 (SD = 1.23), with a median score of 2.00. The injury severity ranged from a minimum of 1 to a maximum of 9, indicating a wide variation in the level of trauma experienced. Based on the categorical classification, the majority of respondents sustained either minor or moderate injuries. Specifically, 198 individuals (36.3%) experienced minor injuries, while 197 individuals (36.1%) suffered moderate injuries. Meanwhile, 141 respondents (25.8%) sustained serious injuries, and 10 cases (1.8%) were categorized as unknown. Cumulatively, minor and moderate injuries accounted for 72.3% of all reported cases. This suggests that although the majority of injuries were not life-threatening, a significant proportion of individuals still experienced serious trauma. The high proportion of moderate and serious cases underscores the need for timely and appropriate post-crash interventions, rehabilitation, and follow-up care, particularly among vulnerable road users, including motorcyclists and their pillion passengers.

4.6 PRE-CRASH STATUS

This finding aimed to delve into respondents’ crashes experienced prior to the survey, their hospital admissions, and whether the respondents were either motorcyclists or pillion riders during the crash, or had any takaful for crash coverage describe in Table 4.4.

Table 4.4 Pre-Crash Status

Variables		n	Percentage %
Role in crash	Motorcyclist	100	18.3
	Pillion	446	81.7
Motorcycle license	Yes	512	93.8
	No	34	6.2
Purpose of travel	Non-work related	281	51.5
	Work related	265	48.5
Private insurance	Yes	267	48.9
	No	279	51.1
Crash in past 1 year	Yes	63	11.5
	No	483	88.5

The analysis of motorcycle crash data reveals several critical insights. A significant majority of the respondents involved in the crashes were pillion riders, totaling 446 individuals 81.7%, compared to 100 motorcyclists, who constituted 18.3% of the respondents. Additionally, it was found that 512 respondents, or 93.8%, had a valid license at the time of the crash. Interestingly, 51% of these crashes occurred while the individuals were traveling for work-related purposes. The study also highlighted that 279 respondents, or 51.1%, did not possess any form of private insurance, such as Takaful or life insurance, whereas 267 respondents, accounting for 48.9%, did have such coverage.

Further, the respondents were queried about their road crash experiences over the past year. It was observed that a substantial majority of 483 respondents, or 88.5%, had not been involved in any road crashes during that period. However, 63 respondents, equating to 11.5%, had been involved in road crashes within the past year. Of those who had crashes, 60 individuals, or 9.3%, required outpatient hospital visits, while three respondents needed hospital admission for periods ranging from one to three days. Regarding the severity of the injuries sustained in these crashes, 54 respondents, or 8.4%, reported having slight injuries, whereas nine respondents, making up 1.4%, reported moderate injuries. This additional data provides some overview of the res□ on□ en□'s crash, hospital, and situational information surrounding motorcycle crashes, highlighting the high involvement of pillion riders, the significant percentage of work-related travel crashes, and the varied insurance coverage among the respondents.

4.7 RESPONDENT'S ATTITUDE TOWARDS LOCAL ROAD SAFETY

In this section, respondents were questioned about their views on current road safety. Generally, the respondents were asked about their views on local road safety, including improvements to the current system, such as roads being maintained periodically, the addition of motorcycle lanes, and the use of technology systems to control vehicle speed on the road. The respondents were also asked whether the current local road safety needs improvement and whether the involvement of road users is important in reducing the statistics of road crash injuries and deaths. Respondents also asked if they might get involved in road crashes in five (5) years.

The respondents' attitudes towards the importance of local road safety were overwhelmingly positive, with an impressive 545 respondents, or 99.8%, agreeing on its significance. Only a very small portion, 0.2%, disagreed, indicating near-universal recognition of the issue's importance. Furthermore, 541 respondents, constituting 99.8%, agreed on the necessity of specific improvements to road safety. These improvements included maintaining road conditions, adding dedicated motorcycle pathways, and utilizing digital systems for speed control for motorcyclists. Such measures were deemed crucial for enhancing road safety.

Additionally, an overwhelming majority of 98.3% of respondents concurred that the current local road safety measures required substantial improvement. When asked about the importance of their empowerment in reducing road injury statistics, a significant majority of 83.5% agreed, though 20 respondents expressed a differing view.

This indicates a strong belief in the community's role in enhancing road safety, despite some dissent. Similarly, 95.9% of respondents agreed that their empowerment is crucial in reducing the fatality statistics of road crashes, reflecting widespread support for community involvement in safety initiatives. Lastly, 81.5% of respondents acknowledged that they might encounter or be exposed to a road crash at least once in the upcoming five years. This acknowledgement highlights the perceived risk of road crashes and underscores the urgent need for continuous improvements in road safety measures to mitigate these risks.

4.8 WILLINGNESS TO PAY (WTP)

VOSL was using WTP as an a□□roa□□ □o□erive□□e res□on□en□'s□a□a□i□□ ris□ injury risk reduction, WTP for the national safety program, and WTP for medical treatment with both initial treatment and follow-up treatment.

This section analyzes the association of independent variables and VOSL, which consists of WTP for fatality reduction, WTP for injury reduction, and WTP for medical treatment. Here, we aim to investigate the simultaneous effect of multiple IVs (socio-demographic, socio-economic, and injury status) on several continuous dependent variables (fatality risk reduction, injury risk reduction, and medical treatment). The IVs are treated as categorical variables, and the Dependent Variables (DVs) are treated as continuous (RM) data.

The survey has provided respondents with both open-ended and closed-ended questions. While open-ended questions were designed to determine res□on□en□s' maximum WTP, the closed-ended questions were designed to determine whether respondents are willing to pay more for fatality reduction, injury reduction, and medical treatment. Hence, here are five models assembled: WTP to reduce fatality Model 1 (open-ended) and Model 2 (closed-ended), WTP to reduce injury Model 3 (open-ended) and Model 4 (closed-ended), and medical treatment Model 4 (open-ended) and Model 5 (closed-ended).

4.8.1 Mean and median of WTP

Due to the non-distribution of data, the median was used to determine the average WTP by respondents in terms of fatality risk reduction, injury risk reduction, medical treatment, and attention to pay for the national safety program. Table 4.4 below simplifies the median of each scenario.

Table 4.5 Mean and Median of WTP

Scenarios	**n (546)**	**Mean (RM)**	**IQR**	**Median (RM)**
Retroreflective Marker Tape		28	10	30
Payment Card Retroreflective Marker Tape		26	10	30
Helmet		53	25	50
Payment card - Helmet		45	20	50
National safety program		36	30	35
Payment card □National safety program		34	25	40
First emergency treatment		64	70	50
Payment card □First emergency treatment		57	70	50
Follow-up treatment		59	20	40
Payment card □Follow-up treatment		45	20	40

Table 4.4 above presents the mean and median o□ res□on□ enWTsP on all safety-related scenarios, which shows both respondents' WTP and their maximum WTP using the Payment Card (PC) method. As most of the studies previously used the mean (Chaturabong et al., 2011; Mon et al., 2018, 2019; Puttawong & Chaturabong, 2020) to calculate the fatality and risk reduction cost, a similar action was used to allow comparison against other studies.

The average WTP for Retroreflective Marker Tape is RM 28, although the median is marginally more at RM 30 Utilising a PC in this context yields a slightly reduced mean of RM 26, while the median persists at RM 30. Both WTP interquartile range □□□□□ □as □□□□□□□□□ sugges□ing □□a□ □□e □i□□□e □□□ expenditures fell within a narrow spread of RM10.00 around the median.

The average willingness to pay for a helmet is RM 53, while the median is RM 50. In the helmet scenario, the mean utilising a PC decreases to RM 45, while the median remains the same at RM 50. The findings revealed that the median expenditure for the helmet was RM50.00, accompanied by an interquartile range (IQR) of RM25.00. In contrast, the median for paymnt card helmet was similarly RM50.00, but with a narrower IQR of RM20.00. This signifies that while the core spending amount remained constant, the expenditure dispersion exhibited greater variability for Topi Keledar B in comparison to Kad Pembayaran Topi Keledar B.

In a National Safety Program, the mean WTP is RM 36, with a median of RM 35. Conversely, the PC technique yields a mean of RM 34 and a marginally elevated median of RM 40. Despite the closeness of both medians, the increased median of RM40.00 for the payment card □ national safety program, coupled with its narrower IQR of RM25.00, indicates that expenditures via the payment card were marginally higher and more consistent than those of the national safety program, which exhibited a median of RM35.00 and a broader IQR of RM30.00.

The average WTP for First Emergency Treatment is RM 64, whereas the median is RM 50. Upon the application of the PC method, the mean diminishes to RM 57, while the median remains constant at RM 50. Additionally, the investigation indicated that the median spend for first emergency treatment was RM50.00, with an interquartile range (IQR) of RM70.00. Likewise, the payment card □ first emergency treatment exhibited a median of RM50.00 and an interquartile range of RM70.00, signifying that both categories possessed same central pattern and variation in expenditure.

The average WTP for Follow-Up Treatment is RM 59, whereas the median is RM 40. Utilising the PC technique, the mean declines to RM 45, but the median persists at RM 40. The results reveal discrepancies in mean willingness to pay between direct and PC methods. However, the medians for the majority of cases generally remain consistent which further indicated that the median expenditure for follow up treatment was RM40.00, with an interquartile range (IQR) of RM20.00. An identical trend was noted for the payment card follow up treatment, which similarly exhibited a median of RM40.00 and an interquartile range of RM20.00, signifying that both categories possessed same central tendency and variability in expenditure. The highest WTP (mean RM 64) is noted for First Emergency Treatment, underscoring its perceived significance among responders.

4.8.2 WTP for fatality and injury risk reduction

In the methodology section, it has been mentioned that to calculate the fatality risk reduction, a formula was used, which is fatality risk reduction = WTP/ □ ρ □ □ □ ange o□ risk). The calculation was performed using an Excel spreadsheet that has been formulated with formulas both suggested by Mofadal & Kanitpong (2010) and Chaturabong et al. (2011). The entire items involved in the calculation are explained in the Methodology Section, Chapter III, of this thesis.

Table 4.6 Respondents Probability and risk reduction for HSB and HOSB

Number	**HSB and HOSB**
*Number of motorcycle users (1)	14,322,201
*Number of fatalities (2)	3959
*Number of injuries (3)	6037
*Number of motorcycle crashes (4)	117,786
Probability	
Prob. of crash (5) = (4/1)	0.008224015 □ □ □ □ □ □
Prob. of injury/fatal (6) = (2+3)/4	0.084865774 □ □ □ □ □ □
Prob. of fatal (7) = (2/2+3)	0.396058423 □ □ □ □ □ □
Prob. of injury (8) = (3/2+3)	0.603941577 □ □ □ □ □ □
Risk	
Risk of fatality (9) = 5x6x7	0.000276424 (2.76 x □ □ ^{4}
Risk of injury (10) = 5x6x8	0.000421513 (4.22 x □ □ ^{4}

*number as of 2019 as per Laporan Perangkaan Jalan Raya Malaysia PDRM (PDRM 2019)
formula from (Chaturabong et al. 2011; Mofadal & Kanitpong 2010)
*HSB = Hospital Sungai Buloh *HOSB = Hospital Sultanah Bahiyah
*(1) until (10) = the steps of calculation

A total of 14,322,201 motorcycle users were recorded in the study population. From this, 111,786 motorcycle-related crashes were reported, resulting in 3,959 fatalities and 6,037 injuries. Based on the calculated figures in Table 4.5, when scaled to a population of 100,000, the estimated fatality risk among motorcyclists and pillion riders was 0.000276424 (2.76 x □ □) , ^{4} which translates to approximately 27.64 individuals per 100,000 population. This suggests that about 28 individuals out of every 100,000 are willing to pay for the proposed safety improvement. In this case, the use of retroreflective tape is employed to reduce the risk of fatality. Meanwhile, the risk of injury was calculated at 0.000421513 (42.1 x □ □), equivalent to approximately 42.15 individuals per 100,000 population. This implies that, statistically, about 42 people out of every 100,000 would benefit from the proposed injury prevention measure, namely the use of a helmet, based on the risk reduction scenario presented in the WTP study. Hence, expressing these risks in a standardized population format enhances interpretability and policy relevance by illustrating the broader societal impact of individual safety investments.

4.8.3 The cost of fatality and injury risk reduction

The costs of fatality and injury risk reduction were also calculated based on the WTP approach using a formulated Excel. Table 4.6 shows the cost of fatality and injury risk reduction for this population.

Table 4.7 The cost of fatality and injury risk reduction

	Value (RM)
Fatality	94,058.41 to 101,293.66
Injury	24,494.88 to 28,849.52

The estimated fatality risk reduction ranged from RM94,058.41 to RM101,293.66, and the value of injury risk reduction ranged at RM24,494.88 to RM28,849.52, representing the monetary values that individuals place on reducing the risks of motorcycle-related injuries, respectively. These values are derived from the respondents' stated WTP for small reductions in risk□ specifically, RM26 to reduce the risk of fatality by 0.000276424 □ □ □ □ □ × and □RM45 □ to □reduce the risk of injury by 0.000421513 (4.22 × □ □ . It is □important to note that these values do not represent the price of a single person's life or injury. Instead, they reflect the total amount that a population, on average, is willing to pay to reduce the risk of one statistical death or injury. In other words, the figures represent a collective value placed on improving safety, not the value of an individual. Additionally, using both open-ended WTP and maximum payment card WTP, if many individuals are each willing to pay RM28 and a maximum of RM26 to reduce their fatality risk, the collective value of saving one life would amount to RM94,058.41 to RM101,293.66.

Similarly, RM24,494.88 to RM28,849.52 reflects the total societal value of avoiding one injury when individuals are willing to pay of RM53 to maximum of RM45 for a small reduction in injury risk. These estimates are vital in economic evaluations and policy decisions, as they provide a benchmark for determining whether investments in road safety interventions are worthwhile. For example, helmet laws, devices such as retroreflective tape, safer road infrastructure, or awareness campaigns are all cost-effective measures. In essence, the values serve as evidence of how much motorcycle users value their safety and can guide the allocation of resources toward interventions that yield the greatest societal benefit.

In summary, by using the WTP □CVM, the cost of fatality risk reduction which represented by the VOSL was estimated to range between RM RM94,058.41 and RM101,293.66 while the cost of injury risk reduction was estimated at RM24,494.88 to RM28,849.52.

4.8.4 WTP for the national safety program

The findings from Table 4.4, which revealed the mean WTP, indicated that the average WTP for the national road safety program among the 546 respondents was RM36 per person per year. Additionally, based on the payment card method, the highest mean WTP by respondents was RM34. Both values reflect the monetary amount respondents are willing to contribute annually to support a program that could reduce road fatalities by 50%.

□ □e sa□ e □ □ □ □ □ □ formula was used to determine the WTP for the national safety program. Respondents are WTP for RM36, and the maximum WTP was for RM34 per year for the national safety program improvements, such as the development of additional, wider lanes specifically for motorcycle users, installation of road barriers, improved maintenance of road surface conditions, intensive road safety education for road users, and installation of street lights. According to the WTP-CVM survey, the respondents were asked, *"On average, there were 3000 deaths due to motorcycle crashes; therefore, how much (RM) are you willing to pay to public funds per year for the implementation of a safety program that can save 50% of the lives of* *road users?".* This design of questions is similar to that applied in Ainy et al. (2016) and Mofadal & Kanitpong (2010).

Calculating the VOSL for a road safety program starts by identifying the baseline individual risk, which refers to the original probability that a person will die in a road traffic crash before any safety intervention is introduced. In this road safety hypothetical scenario, with 3,000 road deaths per year and a national population of 32 million, the baseline individual risk is 3,000 divided by 32,000,000, which equals 0.00009375 or about 0.0094%. This means that, under current conditions, each Malaysian has a 0.0094% chance of dying in a road crash each year. If a safety program can reduce these deaths by 50%□ from 3,000 to 1,500□ the new individual risk becomes 0.000046875. The change in risk, or the amount of risk reduced by the program, is calculated by subtracting the new risk from the baseline risk, resulting in 0.000046875. In other words, this means that there are about 3,000 road deaths each year, and the national population is around 32 million. This equals roughly 9.4 deaths per 100,000 people each year. If a safety program could reduce road deaths by half □ from 3,000 to 1,500 □ the rate would drop to 4.7 deaths per 100,000 people. The difference between these two rates, 4.7 per 100,000, represents the reduction in fatality risk that the program would achieve. This is the scenario that was explained for the WTP for the national road safety program.

The baseline individual risk was used because it provides a meaningful starting point to estimate the amount of safety improvement offered by the program. Without this baseline, it would be impossible to quantify the risk reduction. Thus, it would not be possible to accurately estimate and measure how much people are willing to pay for increased safety. It is this difference in risk□ before and after the program□ that allows us to calculate the VOSL.

Based on a survey where respondents indicated a willingness to pay RM36 per □ear □o su□ □or□ □ □is □rogra□ □ □e a□ □ □ □ □ □e □ □ □ □ □or□ u□ a□ □ □ □ results in a VOSL of RM36/0.000046875 = RM768,000. Similarly, with maximum WTP, respondents indicate that it is RM34. Therefore, RM34/0.000046875 = RM725,333. This means that based on their WTP, individuals in the sample value the prevention of one statistical death at approximately RM725,333. In simple terms, this means that□ based on the survey responses□ people value the act of saving one life on the road at around RM725,333 to RM768,000. This shows that even small individual contributions reflect a strong value placed on protecting lives through safer roads.

4.8.5 WTP for 1st medical treatment and follow-up medical treatment for the injury

□□e ana□□sis o□ res□on□en□s' □□□ □or □e□i□a□ □are □o□□o□ing a roa□ included two separate components: initial treatment and follow-up care. For the first s□enario□ res□on□en□s □ere as□□□ *How much (RM) are you willing to pay per year to get first initial aid treatment?"* The findings showed that the mean WTP was RM64 per person per year, with a maximum mean WTP of RM57 based on the payment card method. These values reflect the amount respondents were willing to contribute annually to access emergency or first-response treatment after an crash.

In a second scenario, respondents were asked: *"How much (RM) are you willing to pay per year to get this follow-up treatment to prevent your condition from getting worse?"* For this, the mean WTP was RM59, while the maximum mean WTP recorded using the payment card was RM45. These figures indicate the perceived value placed on continued care and rehabilitation to avoid further complications or worsening of injuries.

In both scenarios, the WTP values were reported directly, as the questions focused on accessing care after injury had occurred, not on reducing the probability of future harm. This approach is consistent with previous studies such as Abate et al. (2015) and Belete & Walle (2023), which also reported WTP for medical treatment without applying risk-based valuation formulas like the VOSL. The formula from Belete & Walle (2023) was used to calculate the average willingness to pay by adding up res□on□en□s' WTP and dividing by the total number of respondents. The results provide valuable insights into how road traffic injury patients value not only emergency care but also the importance of ongoing follow-up treatment. The WTP for first medical treatment was calculated at RM57to RM64 per year, while the WTP for follow-up medical treatment was at RM45 to RM59 per year.

4.8.6 VOSL Test of normality

For VOSL-dependent variables, normality tests were first conducted to determine the suitability of the analysis. One-Way Multivariate Analysis of Variance (MANOVA) was first suggested as the dependent variable was continuous, and the independent variables were categorical, assuming the data were normally distributed. However, when running a Kolmogorov-Smirnov and Shapiro-Wilk test, the dependent variables are at $p < 0.01$, which is smaller than 0.05, indicating that the data are not normally distributed. This suggests that the Way MANOVA is not suitable for the extended analysis, as shown in Table 4.7. Additionally, the data transformation has been performed to improve normality and facilitate a robust MANOVA. However, the transformation process has still resulted in $p < 0.01$, indicating a similar non-normal distribution of the data. Therefore, a Gamma Generalized Linear Model (GLM) was used to replace the One-Way MANOVA analysis, allowing for both continuous and categorical IVs, while the DV was continuous. The decision was made to retain the data as is to minimize unnecessary bias and enhance the validity of the results.

Table 4.8 Test of Normality

(RM)	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Overall	.058	546	<.001	.955	546	<.001
Retroreflective Marker Tape	.239	546	<.001	.671	546	<.001
Payment Card Retroreflective Marker Tape	.258	546	<.001	.902	546	<.001
Helmet	.331	546	<.001	.379	546	<.001
Payment card - Helmet	.289	546	<.001	.777	546	<.001
National safety program	.242	546	<.001	.763	546	<.001
Payment card □National safety program	.259	546	<.001	.832	546	<.001
First emergency treatment	.296	546	<.001	.413	546	<.001
Payment card □First emergency treatment	.206	546	<.001	.875	546	<.001
Follow-up treatment	.396	546	<.001	.098	546	<.001
Payment card □Follow-up treatment	.228	546	<.001	.884	546	<.001

P<0.01, indicating data not normally distributed for the entire set of WTP scenarios
payment card indicating a closed-ended (CE) choice of payment

4.8.7 Socio-demographic factors associated with WTP for fatality risk reduction

A Generalized Linear Model (GLM) with a Gamma and Normal distribution and log link function was used to mode the WTP for *retroreflective marker* based on socio demographic consists of age, gender, ethnicity, education, marriage status and occupation for both Models 1 and 2 which model 1 reflect WTP pay and model 2 reflect res□on□en□s' □a□i□u□ □□□□

For Model 1, the model fit the data reasonably well, as indicated by goodness-of-fit Deviance/df = 0.366, Pearson Chi Square/df = 0.401, AIC = 4499.431. The Omnibus Test was not significant, Wald χ² □□□□ □ □□□. Regarding the □□□□□ □re□i□□ors□ □or □ge □□a□□ χ² □□□□□□□□□□□. □□ □□□□□□□□ □ □ □□□□□□□□ □a□e □□a□□ χ² □□□□□□□□□□□ □ □ □□□□□□□□ □□□□□□□□□ an□ □□□u□a□ion □□a 180) χ² are all not significant, as their □ □□□ p-values are greater than 0.05. However, the highest level of education shows a significant effect with a Wald Chi-Square of 8.722 and a p-value of 0.013, indicating its importance in predicting the outcome.

For Model 2: The goodness-of-fit indicates the model fits the data well with Deviance/df=75513, Pearson Chi Square/df=75513, AIC=4268.962. The Omnibus Test □as signi□i□an□ □ □a□□ χ² □□□□ . This indicates that the model significantly improves predictions and suggests that the included predictors (age, gender, race, education level, marital status, and occupation) collectively contribute to explaining the DV.

□□e□n□er□e□□ □as an es□i□a□e o□ β-value of < 0.001, meaning it significantly contributes to the model. The young age varia□□e□as β □ □□□□- □□i□□ a value of 0.106, suggesting it is not statistically significant. For Race, the categories Malay and Chinese □ave signi□i□an□ nega□ive es□i□a□es o□ β□ -□ an□ -0.432, with p-values of 0.002 and 0.033, respectively, indicating that race significantly influences the dependent variable. The highest level of education, which is primary education, has β □-0.460 with a p-value of 0.024, indicating a significant effect. In contrast, the secondary and tertiary education categories, as well as occupation, have non-significant effects, with p-values above 0.05.

4.8.8 Socio-economic factors associated with WTP for fatality risk reduction

For Model 1: The goodness-of-fit indicates the model fits the data well with Deviance/df = 194.994, Pearson Chi Square/df = 222.261, AIC = 4485.147. The Omnibus Test was signi□i□an□ □ □5) = 17.137, χ^2 p < 0.05, indicating that the model significantly improves upon the intercepts, including the predictors (income, household income, and household size), which collectively explain the outcomes.

The model's parameter estimates show the relationships between the predictors and the outcome. The Intercept es□i□a□es β □ □□□□□□□ -value of 0.001, indicating statistical significance. For the variable income (specifically, income = B40), the es□i□a□e is β -0.084, with a p-value of 0.536, suggesting it does not significantly affect the outcome. The category income = M40 □as no es□i□a□e □β □ □□□□□□□ an□ no s□a□ significance.

The variable household income = B40 □as an es□i□a□e o□ β □ □□□□□□□ □i□ p-value of <0.001, indicating a strong and significant positive relationship with the dependent variable. Similarly, household income M40 □as β □ □□□□□□ -value of a□ <0.001, suggesting it also has a significant positive effect. However, household size (small) and household size (medium) s□o□ re□a□ive□□ □o□er es□i□a□es □β □ □□□ β □ □□□□□□□ res□e□ -values of 0.547 and 0.508, meaning they do not significantly influence the DV. Lastly, the scale variable has an estimated coefficient of β □ □□□□□□□ -value of 0.001, indicating a significant impact on the outcome, as confirmed by a 95% confidence interval ranging from 0.302 to 0.379.

For Model 2: The goodness-of-fit indicates the model fits the data well with Deviance/df = 76553, Pearson Chi Square/df = 76553, AIC = 4262.426. The Omnibus □es□ □as signi□i□an□ □ □a□ □ χ^2 □□, implying that the predictors (income, house income, and house size) significantly contribute to explaining the DV.

□□e □n□er□e□□ □as an es□i□a□e o□ β -value of 0.020, indicating it signi□i□an□□□ □on□ri□u□es □o □□e ou□□o□e□ □□e varia -1.550 with o□e □□□ a p-value of 0.093, which is not statistically significant. The household income (B40) varia□□e □as β □ □□□□ -value of 0.175, which is not significant. However, household income (M40) [illegible]as β [illegible] -value is < 0.001, indicating a significant positive effect on the outcome. The estimates for household size are β [illegible] an[illegible] β [illegible] [illegible]or [illegible]e [illegible]i[illegible] categories [illegible] of 0.547 and [illegible]o[illegible] 0.508, respectively, suggesting no significant effect on the outcome. The scale variable [illegible]as β [illegible] -value of < 0.001, indicating it has a significant impact on the DV.

4.8.9 Injury factors associated with WTP for fatality risk reduction

Model 1: The results of the Generalized Linear Model (GLM) analysis for the expenditure on *retroreflective markers* revealed that the intercept parameter was statistically significant. [illegible]e in[illegible]er[illegible]e[illegible] va[illegible]ue [illegible]as [illegible] [illegible]a[illegible] χ^2 [illegible] indicating the expected mean log expenditure for the reference categories[illegible] MAIS = 9.00 (unknown) and non-fracture type of injury. This value serves as the baseline against which other parameter estimates are compared.

In terms of injury severity measured by MAIS, none of the categories showed a statistically significant association with the expenditure on retroreflective tape. Compared to the reference category MAIS = 9.00, the coefficients for MAIS = 1.00 (B = -0.307, SE = 0.1912, 95% CI: -[illegible] [illegible]o [illegible] [illegible]a[illegible] χ^2 [illegible] MAIS = 2.00 (B = -0.325, SE = 0.2014, 95% CI: -[illegible] [illegible]o [illegible] [illegible]a[illegible] χ^2 p = .106), and MAIS = 3.00 (B = -0.296, SE = 0.2033, 95% CI: -0.695 to 0.102, Wald χ^2 [illegible]d not reach statistical significance. Although these coefficients were negative, suggesting lower expenditures with less severe injuries, none were statistically robust.

Similarly, the variable type of injury, representing another covariate in the model, did not show a significant relationship with the outcome. The parameter estimate for the fracture type of injury was B = -0.002 (SE = 0.0731, 95% CI: -0.145 to 0.141, [illegible]a[illegible] χ^2 [illegible] in[illegible]i[illegible]a[illegible]ing no [illegible]eaning[illegible]u[illegible] [illegible]i[illegible]eren[illegible] the reference and comparison categories.

Overall, the model indicates that neither injury severity (MAIS) nor type of injury was significantly associated with the cost incurred for retroreflective tape among respondents, despite a significant intercept that reflects a baseline expected expenditure.

Model 2: The Generalized Linear Model (GLM) analysis examined the relationship between the dependent variable and the predictors MAIS and types of injury. The model intercept was statistically significant (B = 3.367, SE = 0.1745, Wald χ^2 [illegible] in[illegible]i[illegible]a[illegible]ing a s[illegible]rong [illegible]ase[illegible]ine va[illegible]ue when all predictors are at their reference categories.

For the MAIS variable, none of the categories, either minor, moderate, or serious injury, showed statistically significant associations with the outcome. For instance, MAIS=1.00 had an estimated coefficient of B = -[illegible] and p = 0.545, indicating no significant difference from the reference category MAIS=9.00 (unknown). Similarly, the other categories, moderate and serious injury, also demonstrated non-significant effects with p-values of 0.539 and 0.301, respectively.

The types of injury variable also did not exhibit a statistically significant relationship with the DV. The coefficient for fractures was B = 0.060 (SE = 0.0687), [illegible] χ^2 [illegible] an[illegible] [illegible] i[illegible]ing [illegible] influence the amount respondents were willing to pay for the retrospective reflective strip PC.

Overall, the model suggests that while the intercept indicates a strong baseline payment level, the predictor variables MAIS and types of injury did not significantly affect the outcome within this model. This implies that the severity of injury (MAIS levels, which are minor, moderate, serious, and unknown) and type of injury, which is fractures and non-fractures, were not strong predictors of the amount respondents were willing to pay in this context.

4.8.10 Pre-crash factors associated with WTP for fatality risk reduction

Model 1: The in□ er□ e□ □ □ ara□ e□ er □ as s□ a□ is□ i□ a□ □ □ signi□ i□ an□ □ β □ □ □ a□ □ χ ² □ in□ i□ a□ ing a □ eaning□ u□ □ ase□ predictor variables are held at their reference categories. Among the predictors, only one variable□ crash status in the past year□ was found to be statistically significant. Note that respondents who had not experienced a road crash in the past year were significantly less likely to pay for the retroreflective tape compared to those who ha□ □ β = -0.286, SE = 0.0816, Wald χ ² □ □ □ □ □ □ □ □ □ □ □ -0.126 to -0.126). This □ □ □ suggests that prior involvement in an crash may increase awareness and perceived i□ □ or□ an□ e o□ sa□ e□ □ □ easures□ raising □ □ e in□ ivi□ ua□ 's □ □ □ □

□ □ □ er varia□ □ es□ in□ □ u□ ing □ o□ or□ □ □ □ e □ i□ ense -0.13d, ners□ i□ user ro□ e □ e□ g□ □ □ o□ or□ □ □ □ is□ or □ □ □ □ □ □ □ □ □ □ □ insuran -0.028, SE = 0.0510, p = 0.583), and purpose of travel □ β -0.073, SE = 0.0514, p = 0.156), did not show statistically significant associations with WTP.

Model 2: The □ o□ e□ 's in□ er□ e□ □ □ as s□ a□ is□ i□ a□ □ □ signi□ i□ an□ □ □ □ □ □ □ □ □ □ a□ □ χ ² □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ -mean of the dependent ing □ □ e □ variable when all predictors are at their reference levels. The goodness-of-fit statistics showed acceptable model fit, with a deviance/df ratio of 0.286, a scaled Pearson Chi-square/df ratio of 0.238, and a log-likelihood of -2142.473. The Omnibus Test of model □ oe□ □ i□ ien□ s □ as s□ a□ is□ i□ a□ □ □ signi□ i□ an□ □ χ ² □ □ □ □ □ □ □ □ □ □ □ □ □ the model with predictors significantly improved fit compared to the intercept-only model.

Among the predictors, purpose of travel, insurance status, and crash experience in the past year were found to be statistically significant factors. Specifically, respondents whose purpose of travel was categorized as non-work related had significantly lower compared to the reference group (B = -□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ = 15.746, p < .001, 95% CI: -0.272 to -0.092). Those without insurance also reported significantly lower expected payments (B = -□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ a□ □ χ p = .045, 95% CI: -0.181 to -0.002). Additionally, individuals who did not experience an crash in the past year showed significantly lower willingness to pay compared to those who had been in an crash (B = - a χ^2 95% CI: -0.622 to -0.335).

In contrast, motorcycle license status and respondent type, which are motorcyclists and pillion riders, were not statistically significant predictors of willingness to pay for the retrospective indicator card, with p-values of 0.777 and 0.160, respectively. These findings highlight that crash experience, purpose of travel, and insurance coverage play more prominent roles in shaping individuals' perceived value of retrospective payment schemes for emergency care.

4.8.11 Socio-demographic factors associated with WTP for injury risk reduction

Model 3: In the Generalized Linear Model (GLM) analysis using a Gamma distribution i a og in un ion e in er e as s a is i a sig a χ^2 . This indicates a meaningful baseline estimate of the WTP for the selected helmet when all predictors were at their reference levels.

Among the predictor variables, age, education level, and occupation showed statistically significant associations with WTP. Specifically, respondents in the adult category demonstrated a significantly higher WTP compared to the reference group older age i an es i a e o β a χ^2 CI: 0.009 to 0.605). This suggests that middle-aged individuals were more willing to pay for the helmet compared to older respondents. For education level, individuals in primary school had a significantly lower WTP compared to those in the highest e u a ion grou i a nega ive es i a e β -0.789, SE = 0.224, Wald χ^2 -1.221 to -0.357). Similarly, those in secondary school showed a marginally non-signi i an ren o o er β -0.128, p = 0.069), suggesting that educational attainment may influence perceptions of safety or affordability.

With regard to occupation, respondents in the high skills category were significantly less willing to pay for the helmet compared to those in the reference non-working group i an es i a e o β - a χ^2

95% CI: -0.482 to -0.021). Other occupational categories, including low- and medium-skilled workers, did not reach statistical significance, although they also indicated negative associations with WTP.

Other variables such as gender, race, and marital status did not show significant e□□e□□s□ □or e□a□□□e□ □□e e□□e□□ o□ gen□er □β □□□□□□□□□ significant. However, it suggested a trend toward higher WTP among males. Similarly, the race categories Malay, Chinese, and Indian had wide confidence intervals that included zero and p-values above 0.05, indicating no significant difference in WTP □ase□ on ra□ia□ grou□ings□ □ari□a□ s□a□us a□so s□o□e□ no □eaning□u□ e□□e p = 0.862).

Overall, the results suggest that age, education level, and occupational group are □e□ □e□er□inan□s o□ in□ivi□ua□s' □i□□ingness □o □a□ □or □e□□e□ sa□e□ gender, race, and marital status are not significant predictors in this model.

Model 4: In the Generalized Linear Model (GLM) using a Gamma distribution □i□□ a □og □in□□ □□e in□er□e□□ □as s□a□is□i□a□□□ signi□i□an□ □β □ χ² □□□□□□□. This demonstrates a significant baseline level of WTP for the helmet payment card when all covariates are held at their reference categories.

Among the predictors, age, education level, and occupation were significantly associated with WTP. Respondents in the young age group had significantly higher WTP compared to the reference group, the older group□ □i□□ an es□i□a□e o□ β □□□□ □□□ □ □□□□□□□□ □a□□ χ² □ □□□□□□□ □ □ □adult group□□□ □□□ a□so s□o□e□ a □osi□ive e□□e□□ □β □ □□□□□□□ □ □ □□□□□-□□□ □□ou significant at the 0.05 level.

Regarding education, those with a lower level of education, primary school, were significantly less willing to pay compared to the highest educated group, tertiary level□ □i□□ an es□i□a□-e o□ β□ □□□ □ □□□□□□□□ □a□□ χ² □□□□□ CI: -0.835 to -0.227). Respondents in secondary education also exhibited a negative □ren□ in □□□ -0.096, p = 0.057), approaching statistical significance.

Significant effects were found for two groups in terms of occupation. Respondents in low skills showed higher WTP compared to the reference group of non-working [illegible] β [illegible] χ² [illegible] 0.352). Similarly, medium skills a[illegible]so [illegible] a significan[illegible] [illegible] higher [illegible] β [illegible] $p = 0.005$), indicating that certain job categories may positively influence safety-related spending.

On the other hand, variables such as gender, race, and marital status did not show statistically significant associations with WTP. For example, the gender effect [illegible]as [illegible] β [illegible] an[illegible] Malay, Chinese [illegible] ra[illegible] ia[illegible] su[illegible] and Indian, reached significance, with p-values ranging from 0.706 to 0.925. Marital s[illegible]a[illegible]us a[illegible]so s[illegible]o[illegible]e[illegible] no signi[illegible]i[illegible]an[illegible] -0.029, $p = 0.696$) β [illegible]

In summary, the findings suggest that younger age, higher education, and specific occupational groups are significant predictors of WTP for the helmet safety PC, while gender, race, and marital status appear not to be influential factors in this model.

4.8.12 Socio-economic factors associated with WTP for injury risk reduction

Model 3: The Generalized Linear Model (GLM) analysis began with an intercept estimate of $B = 3.669$ ($SE = 0.6794$, $p < .001$), which was statistically significant. This value represents the baseline log cost of purchasing the helmet when all predictor variables are at their reference categories. The model incorporated income group, household income level, and house size as predictors. However, the Omnibus Test was no[illegible] s[illegible]a[illegible]is[illegible]i[illegible]a[illegible] signi[illegible]i[illegible]an[illegible] χ² [illegible] model did not significantly improve the fit compared to the intercept-only model.

For individual predictors, none showed a statistically significant effect on the dependent variable. The income variable B40 yielded a coefficient of $B = -0.012$ [illegible] a[illegible] χ² [illegible] 4), indicating no significant impact on helmet expenditure. Similarly, household income levels B40 and M40 showed no significant association with helmet costs, with p-values of .940 and .864, respectively. For house size, small and medium size, the coefficients were also non-significant, with p-values of .569 and .408.

Overall, while the intercept was significant, indicating a meaningful baseline expenditure, the predictors□ income, household income, and house size□ did not significantly influence the amount spent on "Topi Keledar B". These findings suggest that helmet expenditure was not strongly associated with the selected socio-economic variables in this model.

Model 4: The Generalized Linear Model (GLM) was applied to examine the relationship between socioeconomic variables and the WTP-payment card for helmets. The intercept of the model was statistically significant (B = 3.826, SE = 0.4944, Wald χ ² □ □□□□□□), indicating that when all independent variables are held in their reference categories,

However, the omnibus test for the model was not statistically significant □□i□e□i□oo□ □a□io χ ² □ □□□□□□ □□□ □□ □ □ □□□□□□□ sugges□ predictor variables□ monthly income, household income level, and house size□ did not result in a model that fits significantly better than the intercept-only model.

Analysis of individual predictors revealed that none of the variables showed statistically significant associations with helmet payment. Monthly income (B = -0.144, SE = 0.1203, p = .232), household income level (B = 0.007, SE = 0.3066, p = .982 for level 1; B = -0.151, SE = 0.3140, p = .629 for level 2), and house size (B = 0.158, SE = 0.3683, p = .668 for level 1; B = 0.043, SE = 0.3732, p = .907 for level 2) were all non-significant predictors.

Overall, while the model intercept was statistically significant, the lack of significant effects for income, household income level, and house size indicates that these socioeconomic characteristics were not strong predictors of the amount paid for Helmet in this sample.

4.8.13 Injury factors associated with WTP for injury risk reduction

Model 3: The parameter estimates from the Generalized Linear Model (GLM) analysis for the DV begin with t□e in□er□e□□ □□ □ □□□□□□□ □□ □ □□□□□□□□ □ p < .001), which was statistically significant. It indicates the baseline expected value of

WTP for respondents in the reference category (MAIS = 9 (unknown) and non-fractures. The 95% confidence interval for the intercept ranged from 3.458 to 4.346, suggesting a robust estimation.

However, none of the predictor variables□ MAIS categories or types of injury levels□ were discovered to have statistically significant effects on the outcome. For example, compared to the reference group (MAIS = 9), the coefficients for MAIS = minor injury (B = 0.117, p = .617), MAIS = moderate (B = 0.004, p = .986), and MAIS = serious injury (B = 0.046, p = .852) were all not statistically significant, as their respective p-values exceeded the standard alpha level of 0.05. Similarly, fractures showed no significant influence (B = 0.046, p = .621) compared to the reference group, which included non-fracture types of injury.

These results suggest that neither injury severity, as measured by MAIS, nor the type of injury had a meaningful association with WTP for the helmet component (Topi Keledar B). The model's fit statistics, including a non-signi□i□an□ □□ni□us □es□ □χ^2 □ 1.575, df = 4, p = .813), also support the conclusion that the predictors collectively did not significantly improve the model over the intercept-only model.

Model 4: In the Gamma Generalized Linear Model assessing WTP-payment card for motorcycle helmet, the intercept was statistically significant (B = 3.882, □□ □ □□□□□□□□ □a□□ χ^2 □. This indicates that the baseline log-mean payment card value (when all predictors are at their reference categories) was substantial.

None of the levels of MAIS injury severity were statistically significant predictors of WTP. Compared to the reference group (MAIS = 9.00 (unknown)), those with minor injury severity had a slightly lower WTP (B = -0.060, SE = 0.1699, p = 0.725), as did moderate injury severity (B = -0.082, SE = 0.1792, p = 0.649) and serious injury severity (B = -0.123, SE = 0.1802, p = 0.497), though all associations were statistically non-significant (p > 0.05). The 95% confidence intervals for these estimates also crossed zero, suggesting no clear directional effect of injury severity on helmet payment WTP.

Similarly, the variable type of injury, representing fractures and non-fractures, did not significantly predict WTP. Compared to the reference category, non-fractures, individuals in the fractures group had a non-significant increase in WTP (B = 0.043, [illegible] a[illegible] χ² [illegible] -0.084 to 0.170) [illegible] e [illegible] o again includes zero, indicating a lack of statistical evidence for an association.

The Omnibus Test of model coefficients indicated that the full model was not statistically significant compared to the intercept-on[illegible] o[illegible] e[illegible] χ² [illegible] p = 0.891), suggesting that the included predictors did not substantially improve model fit. Consistent with this, the Type III Wald tests also showed non-significant effects for [illegible] o[illegible] χ² [illegible] an[illegible] p = 0.511).

Overall, these results indicate that neither the severity of injury (MAIS) nor the type of injury had a statistically significant association with the amount respondents [illegible] ere [illegible] i[illegible] ing [illegible] o [illegible] a[illegible] or a [illegible] o[illegible] or[illegible] e [illegible] e[illegible] e[illegible] e [illegible] o[illegible] e[illegible] 's [illegible] i[illegible] s[illegible] an[illegible] earson χ² [illegible] fit, though the explanatory power of the predictors remains limited.

4.8.14 Pre-crash factors associated with WTP for injury risk reduction

Model 3: Based on the Gamma Generalized Linear Model (GLM) analysis for the dependent variable of helmet, the model begins with a statistically significant intercept [illegible] a[illegible] χ² [illegible]. It demonstrates the baseline [illegible] eve[illegible] o[illegible] e[illegible] e[illegible] os[illegible] en a[illegible] re[illegible] i[illegible] ors are se[illegible] o[illegible] eir re[illegible] eren[illegible] e [illegible] a goodness-of-fit statistics established an acceptable fit, with a Deviance/df ratio of 0.531 and a non-significant Pearson Chi-Square/df ratio (0.968), suggesting no serious overdispersion. Additionally, the Omnibus Test of Model Coefficients was significant [illegible] χ² [illegible] on[illegible] ir[illegible] ing [illegible] a[illegible] e i the model fit over the intercept-only model.

Among the predictors, insurance status showed a significant effect on the helmet purchase. Specifically, respondents without insurance were associated with a significantly lower helmet cost compared to insured individuals, with a coefficient of

B = -[illegible] a[illegible] χ^2 [illegible] ranging from -0.414 to -0.174. This suggests that uninsured respondents were willing to spend less on helmet purchases.

Other variables such as motorcycle license status (p = 0.112), purpose of travel (p = 0.288), and crash status in the past one year (p = 0.094) were not statistically significant at the 0.05 level, indicating that these factors did not have a meaningful impact on the amount respondents were willing to pay for the helmet in this model.

In summary, the analysis revealed that only insurance status significantly influenced the amount paid for helmet purchase, with uninsured individuals spending significantly less. Other variables included in the model did not significantly contribute to the variation in helmet cost.

Model 4: A Generalized Linear Model (GLM) with a Gamma distribution and log link was conducted to examine factors influencing WTP-payment card helmet. The model included the intercept, motorcycle license status, purpose of travel, insurance ownership, and crash involvement within the past year. The intercept parameter was s[illegible]a[illegible]is[illegible]i[illegible]a[illegible] signi[illegible]i[illegible]an[illegible] [illegible] a[illegible] suggesting a meaningful baseline log-transformed estimate of payment when all predictors are set at their reference levels.

The overall model fit was confirmed to be appropriate based on the deviance/df ratio (0.259) and Pearson chi-square/df ratio (0.154), indicating no substantial overdispersion. Additionally, the Omnibus Test was significant (Likelihood Ratio Chi-Square = 62.307, df = 5, p < 0.001), demonstrating that the full model explained significantly more variance in the DV compared to the intercept-only model.

Among the predictors, three variables were significantly associated with WTP. Respondents who traveled for work purposes reported a significantly lower willingness to pay compared to those traveling for other reasons (B = -0.164, SE = 0.0439, [illegible]a[illegible] χ^2 [illegible] -0.250 to -0.078). Those without insurance were also less willing to pay compared to insured respondents (B = -0.178, SE = 0.0435, [illegible] -0.264 to -0.093). Furthermore, individuals who had not experienced any crash in the past year were significantly less willing to pay than those who had (B = -[illegible] -0.446 [illegible] to -0.172). On the other hand, motorcycle license status did not show a statistically significant effect ($p = 0.766$).

In summary, the WTP payment card for helmets was significantly influenced by travel purpose, insurance ownership, and crash experience, suggesting that those with higher perceived risk or prior involvement in crashes were more inclined to invest in safety-related measures.

4.8.15 Socio-demographic factors associated with WTP for the road safety program

Model 5: In the Generalized Linear Model (GLM) using a Gamma distribution with a [illegible]. This indicates a strong baseline level of WTP for the national safety program via PC when all predictor variables are set to their reference categories.

Among the predictors, only one variable showed a statistically significant effect. Respondents with a lower level of education, primary school, exhibited significantly lower WTP compared to those with higher education, tertiary level, with an estimated [illegible] -0.789 to -0.029). This suggests that individuals with lower educational attainment may perceive less benefit or value in paying for national safety programs.

Other variables, including age, gender, race, marital status, and occupation, did not yield statistically significant effects, although some exhibited directional trends. For instance, respondents in the adult age group had a positive but non-significant [illegible] the young age group showed a slight negative association (β = -0.053, $p = 0.428$). Note that none of the race categories were significant (p-values > 0.70), indicating no observable racial differences in WTP within the model.

Regarding occupation, none of the occupational groups reached statistical significance, although the middle-skilled occupation had a marginal p-value of 0.055

□β □ □□□□□□□□ sugges□ing a □ossi□□e asso□ia□ion □□a□ □ig□□ □arran□ □ The other occupational groups, including lower-skills and high-skills occupations, had p-values of 0.149 and 0.254, respectively, with confidence intervals that crossed zero.

In summary, while most socio-demographic variables were not significantly associated with WTP for the national safety program, education level emerged as a key determinant, with lower education linked to reduced willingness to contribute financially. These findings may have implications for targeted communication or subsidy strategies in public safety campaigns.

Model 6: In the Generalized Linear Model (GLM) using a Gamma distribution □i□□ a □og □in□ □□□e in□er□e□□ □as s□a□is□i□a□□□ signi□i□an□ □β □ χ² □ □□□□□□□. It demonstrates a substantial baseline level of WTP for the maximum (payment card) WTP for the national safety program when all predictors are held at their reference categories.

Among the explanatory variables, age, education level, and occupation were statistically associated with WTP. Specifically, respondents in the young category were significantly more willing to pay compared to the reference group [older group], with an es□i□a□e o□ β □ □□□□□□ □□□ □ □□□□□□□□□ □a□□ χ² □ □□□□□□□ 0.551). Similarly, the adult-middle-aged group also demonstrated a higher WTP, although the association was marginally non-signi□i□an□ □β □ □□□□□□□□ □ □□□□□

In terms of education, respondents in primary school had significantly lower WTP compared to the highest education group, the tertiary level, with an estimate of β -□□□□□ □□□ □ □□□□□□□□□ □a□□ χ² □-0.749 to -0.091). The □□□□□□□ second education group, secondary school, also showed a negative association, a□□□oug□ no□ s□a□is□i□a□□-0.059, p = 0.279). signi□i□an□ □β □

Other than that, occupation also emerged as a significant predictor. Those in lower skills □a□ a □ig□er □□□ □β □ □□□□□□□ □□ □ □□□□□□□□□ □a□□ χ² 95% CI: 0.019 to 0.382), and those in middle skills occupation showed an even stronger □osi□ive e□□e□□ □β □ □□□□□□□ □□ □ □□□□□□□□□ □a□□ χ² □ □□□□

0.331) compared to the reference group of non-working. However, a high-skilled occupation was not significantly associated with WTP (p = 0.399).

Conversely, gender, race, and marital status did not exhibit significant re[illegible]a[illegible]ions[illegible] i[illegible] s [illegible] i[illegible] [illegible] or ins[illegible] an-0.041, p = 0.468) and all racial categories had p-values far above 0.05, suggesting no meaningful difference in WTP across these groups. Similarly, marital status showed no statistically significant effect (β = -0.115, p = 0.155).

In summary, age, educational attainment, and occupational category were the main factors influencing WTP for the national safety program PC, while gender, race, and marital status did not play significant roles.

4.8.16 Socio-economic factors associated with WTP for the road safety program

Model 5: The analysis using Generalized Linear Model (GLM) was performed to examine the factors associated with the amount paid for the national road safety program. The model included income level, household income category, and house size as predictors.

The intercept of the model was statistically significant (B = 2.406, SE = 0.7753, [illegible]a[illegible] χ^2 [illegible] in[illegible]i[illegible]a[illegible]ing [illegible]a[illegible] [illegible]en a[illegible] re[illegible] categories, that is, M40 income categories, T2O household income, and large household size, the estimated baseline mean contribution is significantly different from zero. However, income level B40 did not significantly predict contribution to the program (B = [illegible] a[illegible] χ^2 [illegible] as [illegible] s[illegible] not a significant factor in determining the amount contributed.

Among the categorical predictors, household income level showed a significant overa[illegible] e[illegible]e[illegible] [illegible]a[illegible] χ^2 [illegible] B40 an[illegible] s[illegible]e[illegible] household income contributed significantly more compared to the reference group T2O household income [illegible] a[illegible] χ^2 [illegible] to 2.609). Meanwhile, the household income M4O category did not reach statistical significance (B = 0.903, p = .151).

On the other hand, medium household size was not significantly associated with contributions (p = .939), as both medium and large household sizes were non-significant relative to the reference group, which was large household size.

In summary, while the overall model was significant based on the Omnibus Test □□i□e□i□oo□ □a□io χ ² □ □□□□□ only the B40 household income level □□ was a significant predictor of contribution amount to the national road safety program, whereas personal income level and house size were not significant contributors.

Model 6: The results from the Gamma Generalized Linear Model (GLM) analysis on the WTP for the national road safety program via payment card revealed several key findings. The model included predictors such as income group, household income group, and house size category. The intercept parameter was statistically signi□i□an□ □□ □ □□□□□□□□ □□ □□□□□□□□ □a□□ χ ² baseline □□□□□□□ expected log-transformed payment when all predictors are set to their reference categories.

□□□□oug□ □□e o□ni□us □es□ □as s□a□is□i□a□□□ signi□i□an□ □χ p < .001), suggesting that the model with predictors fitted the data significantly better than the intercept-only model, not all individual predictors were significant. Specifically, the income variable was not a statistically significant predictor of WTP (B = -□□□□□□ □□ □ □□□□□□□□□ □a□i□ χ ² □ing □□a□□res□□on□□en□s' □ersona income levels did not significantly influence the amount they were willing to pay.

However, household income was determined to be a significant factor. Respondents from households in the first category, B40, showed a higher and statistically significant WTP compared to the reference group (B = 1.409, SE = 0.3128, □a□□ χ ² □ □□□□□□□□ □ □ □□□□□□□ □i□□ □□e□□□ □□ ranging □ro those in the second household income group M40 also showed a significant effect (B = □□□□□□ □□ □ □□□□□□□□□ □a□□ χ ² □ □□□□□□□□ □ □□□□□□ □□ suggest that individuals from higher household income brackets were more likely to report a greater WTP for the safety program card.

Conversely, household size did not significantly influence the WTP. Both the first (B = -[illegible] a [illegible] χ^2 [illegible] (B = -[illegible] a[illegible]) of house size were not statistically different from the reference group, as their p-values were far above the significance threshold.

Overall, the model indicates that while individual income and house size did not significantly affect maximum WTP, household income level played a critical role in predicting willingness to pay for the safety program. This highlights the importance of household-level economic context in such public health financing measures.

4.8.17 Injury factors associated with the WTP for the road safety program

Model 5: In the Gamma Generalized Linear Model analyzing WTP for the national road safety program, the intercept was statistically significant (B = 3.611, SE = 0.1987, [illegible] a [illegible] χ^2 [illegible]), indicating a substantial baseline log-mean WTP when all covariates were at their reference categories.

Regarding injury severity (MAIS), none of the categories showed a statistically significant association with WTP when compared to the reference group (MAIS = 9.00 (unknown). Respondents with minor injury had a slightly higher WTP (B = 0.090, SE = 0.2045, p = 0.660), while those with moderate injury and serious injury severity had negligible and non-significant changes in WTP (B = -0.009, p = 0.966 and B = 0.012, p = 0.957, respectively). All associated confidence intervals included zero, indicating a lack of statistical evidence for a relationship between injury severity and WTP for the program.

Similarly, the type of injury was not a significant predictor of WTP. Compared to the reference group of non-fracture, those in the fracture group had a small, non-significant decrease in WTP (B = -[illegible] a [illegible] χ^2 [illegible] with the confidence interval ranging from -0.168 to 0.154.

The overall model fit, as assessed by the Omnibus Test, was not statistically signi[illegible]i[illegible]an[illegible] [illegible]i[illegible]e[illegible]i[illegible]oo[illegible] [illegible]a[illegible]io χ^2 [illegible] with predictors did not significantly improve over the intercept-only model. Likewise, the Type III Tests of Model Effects indicated non-significant contributions from both [illegible] χ² [illegible] an[illegible] ne[illegible] However, goodness-of-fit statistics, including the Deviance (value/df = 0.424) and Pearson Chi-Square (value/df = 0.383), indicated that the model adequately fit the data.

In summary, while the model demonstrated acceptable fit, none of the predictors [illegible] injury severity (MAIS) or type of injury [illegible] were significantly associated with the amount respondents were willing to pay for the national road safety program.

Model 6: In the Gamma Generalized Linear Model (GLM) analysis examining WTP for the national road safety program via payment card, the intercept was found to [illegible] e s[illegible] a[illegible] is[illegible] i[illegible] a[illegible] signi[illegible] i[illegible] an[illegible] [illegible]. It [illegible] a[illegible] indicates a substantial baseline log-transformed WTP value when all covariates were at their reference levels.

In terms of injury severity (MAIS), none of the categories demonstrated statistically significant associations with WTP. Compared to the reference group (MAIS = 9.00 (unknown), respondents classified as minor injury had a slightly lower WTP (B = -0.043, SE = 0.1785, p = 0.809), followed by moderate injury (B = -0.071, SE = 0.1887, p = 0.707), and serious injury (B = -0.099, SE = 0.1902, p = 0.604). All corresponding 95% confidence intervals included zero, suggesting no significant difference in WTP across these levels of injury severity.

Similarly, the type of injury was not a significant predictor of WTP. Respondents with fractures showed a slight, non-significant increase in WTP (B = [illegible] a9), [illegible] χ² compared to the reference group, non-[illegible] fracture, with a confidence interval ranging from -0.089 to 0.186.

The Omnibus Test indicated that the model containing both MAIS and types of injury did not significantly improve over the intercept-on[illegible] o[illegible] e[illegible] i[illegible] e[illegible] i[illegible] oo[illegible] a[illegible] io = 0.748, df = 4, p = 0.945). This was further supported by the Type III Tests of Model Effects, which showed non-signi[illegible] i[illegible] an[illegible] resu[illegible] s [illegible] or [illegible] o[illegible] [illegible] a[illegible] χ² [illegible] p = 0.894) and types of injury [illegible] χ^2 [illegible] goodness-of-fit indices (Deviance/df = 0.319 and Pearson Chi-Square/df = 0.188) suggest an acceptable fit of the model to the observed data.

Overall, while the model fit was adequate, the results indicated that neither injury severity (MAIS) nor types of injury had a statistically significant influence on respondents' willingness to pay for the national safety program.

4.8.18 Pre-crash factors associated with WTP for the road safety program

Model 5: The Generalized Linear Model (GLM) with a gamma distribution and log link was applied to assess the factors influencing the number of respondents who were WTP for the national road safety program. The model included five predictors: motorcycle license status, self-identification category, purpose of travel, insurance status, and crash history in the past year.

[illegible] e in[illegible]er[illegible]e[illegible] as s[illegible]a[illegible]is[illegible]i[illegible]a[illegible] signi[illegible]i[illegible]an[illegible] [illegible] 6645.086, $p < 0.001$, 95% CI [3.710, 3.892]), indicating the estimated baseline payment when all independent variables are at their reference levels. The overall model was a good [illegible] as in[illegible]i[illegible]a[illegible]e[illegible] [illegible]e o[illegible]ni[illegible]us [illegible]es[illegible] o[illegible] [illegible]o[illegible]e[illegible] [illegible]oe[illegible]i[illegible] [illegible] df = 5, $p < 0.001$), suggesting that the inclusion of predictors significantly improved the model over the intercept-only model.

Goodness-of-fit statistics also supported model adequacy, with deviance/df = 0.401 and Pearson Chi-Square/df = 0.498, both values being close to 1. Additionally, information criteria such as AIC (4633.597), AICC (4633.814), and BIC (4663.414) indicated a relatively parsimonious model.

Among the predictors, insurance status and crash experience in the past year were statistically significant. Respondents without insurance were associated with significantly lower willingness to pay for the program (B = -0.196, SE = 0.0549, Wald χ^2 [illegible] -0.303, -0.088]). Similarly, those who had not been involved in a road crash in the past year were willing to pay significantly less compared to those who had (B = -[illegible] χ² [illegible] 0.571, -0.209]).

In contrast, other variables such as motorcycle license status (p = 0.130), roles as motorcyclists or pillions (p = 0.141), and purpose of travel (p = 0.279) were not statistically significant, indicating no meaningful influence on the WTP for the program.

Model 6: The result of the Generalized Linear Model (Gamma with log link) for the WTP toward the national road safety program via PC reveals several statistically significant predictors. The intercept parameter was statistically significant with a [illegible] χ² [illegible] baseline log-mean expenditure when all predictors are at their reference levels.

Among the predictor variables, having a motorcycle license was not a [illegible] χ² [illegible] suggesting no meaningful difference in WTP between licensed and unlicensed respondents. The role as a [illegible] (B = -[illegible] χ² [illegible]

In contrast, the purpose of travel was a significant predictor. Respondents who reported non-work-related travel purposes had significantly lower WTP compared to those traveling for work (B = -[illegible] χ² [illegible] 95% confidence interval ranging from -0.205 to -0.026.

Insurance status also influenced WTP, where those without insurance coverage were significantly less willing to pay compared to insured individuals (B = -0.194, [illegible] χ² [illegible] -0.282 to -0.106).

Finally, respondents who had not been involved in any road crashes in the past year showed a significantly lower WTP than those who had experienced crashes (B = -[illegible] χ² [illegible] -0.752 to -0.458).

Overall, these findings highlight that the purpose of travel, insurance status, and recent crash experience are significant predictors of the amount respondents are willing to pay toward national road safety program contributions, while motorcycle license possession and user role (motorcyclist or pillion) were not significant contributors.

4.8.19 Socio-demographic factors associated with WTP for first medical treatment

Model 7: In the Generalized Linear Model (GLM) using a Gamma distribution with a log link, the intercept was statistically significant (β [illegible], Wald χ^2 [illegible]), indicating a [illegible] WTP for First Emergency [illegible] Treatment when all independent variables are held at their reference categories.

Among the predictor variables, education level and occupation showed statistically significant associations with WTP. Respondents in primary school, representing those with lower education, had significantly lower WTP than the highest education group, tertiary level, with an estimate of −0.591 (β, SE = 0.2552, Wald χ^2 [illegible], 95% CI: −1.091 to −0.091). Similarly, individuals in secondary education level also demonstrated significant [illegible] (β = −0.315, SE = 0.0833, Wald χ^2 [illegible], 95% CI: −0.478 to −0.151). It suggests that higher educational attainment is positively associated with greater willingness to contribute to emergency treatment.

For occupation, two categories were significantly associated with WTP. Respondents in middle skills occupations had a significantly higher WTP compared to the reference group, the non-working, with an estimate of β [illegible], Wald χ^2 [illegible] lower-skilled [illegible] occupations exhibited significantly lower WTP (β = −0.551, SE = 0.1435, Wald χ^2 [illegible], 95% CI: −0.832 to −0.269). This indicates occupational roles may influence the perceived importance or affordability of contributing to emergency healthcare programs.

Other variables such as age, gender, race, and marital status did not show statistically significant effects. While Chinese as a race had a relatively low p-value (p = 0.089), it did not reach the standard level of statistical significance. Gender and marital status also exhibited no significant association, with p-values of 0.112 and 0.990, respectively.

In summary, the findings indicate that education level and occupation are significant predictors of WTP for emergency medical treatment. Meanwhile, age, gender, race, and marital status were not significantly related in this model.

Model 8: In the Generalized Linear Model (GLM) with a Gamma distribution an[illegible] og [illegible] in[illegible] e in[illegible] er[illegible] e[illegible] as s[illegible] a[illegible] is[illegible] i[illegible] a[illegible] signi[illegible] i[illegible] an[illegible] β [illegible] χ² [illegible]. This determines a strong baseline estimate of WTP for first emergency treatment via PC when all independent variables are set at their reference categories.

Among the predictors, age, education level, and occupation were found to be statistically significant. Respondents in the young age category had a significantly higher WTP than those in the reference group, the oldest [illegible] i[illegible] a [illegible] oe[illegible] i[illegible] ien[illegible] o[illegible] β [illegible] a[illegible] χ² [illegible] (adult) age group did not differ significantly from the reference group (p = 0.454).

Regarding education, those with lower educational attainment at the primary level were significantly less willing to pay than the most highly educated group of tertiary level education, [illegible] i[illegible] an es[illegible] i[illegible] a[illegible] e o[illegible] β [illegible] a[illegible] χ [illegible] p = 0.002, 95% CI: -0.945 to -0.210). Similarly, respondents at the secondary level also s[illegible] o[illegible] e[illegible] signi[illegible] i[illegible] an[illegible] re[illegible] u[illegible] e[illegible] β [illegible] a[illegible] χ [illegible] p < .001, 95% CI: -0.403 to -0.161).

Occupation also played a significant role in influencing WTP. Individuals with low skills and medium skills had significantly higher WTP compared to the reference group of non-working individuals. [illegible] e [illegible] oe[illegible] i[illegible] ien[illegible] s [illegible] ere β [illegible] χ² [illegible] o [illegible] an[illegible] χ² [illegible] o [illegible] high-[illegible] res[illegible] skilled occupations re[illegible] or[illegible] e[illegible] signi[illegible] i[illegible] an[illegible] o[illegible] er [illegible] β -0.322, SE = 0.081, Wald χ² [illegible] -0.534 to -0.111).

Other variables, including gender, race, and marital status, were not significantly asso□ia□e□ □i□ □ □□□□ □or e□a□ □□e□ □□e e□ □e□ □ o□ gen□er □β □ □

race categories ($p > 0.30$) were statistically non-significant, as was marital status ($p = 0.281$).

In summary, this analysis highlights that age, educational level, and occupation are significant predictors of WTP for first emergency care via payment cards. Meanwhile, gender, race, and marital status do not significantly influence the outcome.

4.8.20 Socio-economic factors associated with WTP for first medical treatment

Model 7: A Generalized Linear Model (GLM) with a Gamma distribution and log link function was employed to examine the factors associated with the amount of first emergency treatment. The Omnibus Test of model coefficients was statistically signi□i□an□ □χ² □□□□□□□□ □□ □□□ □ □ □□□□□□□□ in□i□a□ing □

improved the fit over the intercept-only model. The model included three predictors: household income category, house size category, and income.

The results showed that the household income category was significantly asso□ia□e□ □i□ □ e□ergen□ □ □rea□ □en□ □os□ □□a□ □ χ² □ □□□□□□□

Compared to the highest household income category, respondents from lower household income categories B40 and M40 reported significantly higher WTTP, with estimated coefficients of 1.627 ($p = 0.001$) and 1.367 ($p = 0.008$), respectively. Income □as a□ so a signi□ i□ an□ □re□ i□ □or □ □a□ □ χ² □ □□□□□□□ □ □ □□□□□□

the WTP of emergency treatment. In contrast, household size was not a significant predictor ($p = 0.610$), suggesting no meaningful difference in emergency treatment WTP across house size categories.

These findings suggest that income-related (household income and personal income) factors significantly influence the emergency medical treatment WTP, highlighting the economic disparities in out-of-pocket health expenditure following injury or illness.

Model 8: The Gamma Generalized Linear Model (GLM) analysis was conducted to assess the relationship between selected predictors [illegible] monthly income level, household income category, and household size [illegible] and the WTP for first medical treatment via PC. The model began with a significant intercept parameter (B = 3.740, [illegible] χ^2 [illegible] in[illegible] ing [illegible] pay when all predictors are at their reference levels.

The Omnibus Test showed that the overall model was statistically significant [illegible] χ^2 [illegible] sugge[illegible] jointly contributed to explaining the variance in payment values. Furthermore, goodness-of-fit statistics, such as a scaled deviance (539.652) and a Pearson Chi-Square value (138.075 with df = 503, Value/df = 0.275), indicated an acceptable model fit.

Among the independent variables, income level was significantly associated with the dependent variable. Specifically, respondents with lower monthly income, who were in the B40, had significantly lower WTP compared to the higher-income reference group M40, with an estimate of B = -[illegible] χ^2 [illegible] and a 95% confidence interval ranging from -0.648 to -0.083. This suggests that lower-income respondents were less likely to contribute a higher payment for emergency treatment.

In contrast, the household income categories and household size variables were not statistically significant predictors in this model. Both the B40 household income (B = 0.315, p = 0.469) and M40 household income (B = -0.236, p = 0.595) did not show significant effects. Similarly, neither small household size (B = 0.479, p = 0.264) nor medium household size (B = 0.315, p = 0.469) showed statistical significance.

Overall, the analysis revealed that only individual monthly income significantly influenced the WTP for emergency medical treatment via payment card, while household income and house size did not emerge as significant predictors in the model.

4.8.21 Injury factors associated with WTP for first medical treatment

Model 7: In the Gamma Generalized Linear Model assessing WTP for First Emergency Treatment, the intercept was statistically significant (B = 4.472, SE = 0.2724, Wald χ^2 [illegible] in[illegible]-mean WTP when all covariates [illegible] og are set at their reference categories.

Regarding injury severity (MAIS), none of the levels were statistically significant at the 5% level. However, there were some marginal trends worth noting. Compared to the reference category (MAIS = 9.00 (unknown)), respondents with minor injury showed a non-significant reduction in WTP (B = -0.215, SE = 0.2801, p = 0.443), as did those with moderate injury (B = -0.525, SE = 0.2949, p = 0.075) and serious injury (B = -0.498, SE = 0.2975, p = 0.094). Although not statistically significant, the negative coefficients suggest a decreasing trend in WTP for emergency treatment among those with lower MAIS scores compared to the most severe injury category.

The variable type of injury was also not a statistically significant predictor of WTP. Respondents classified as having fractures reported a slightly higher WTP compared to the reference category, non-fractures. However, the difference was not signi[illegible]i[illegible]an[illegible] [illegible] a[illegible] χ^2 [illegible] confidence interval (-0.064 to 0.354) included zero.

The Omnibus Test of model coefficients was statistically significant (Likelihood [illegible]a[illegible]io χ^2 [illegible] = 4, p = 0.041), suggesting that the model with predictors (MAIS and type of injury) provided a significantly better fit than the intercept-only model. The Type III Tests of Model Effects further supported this finding for MAIS (Wald χ^2 [illegible] indicating that injury severity had a significant overall effect on WTP. However, types of injury did not contribute significantly to the model [illegible]a[illegible] χ^2 [illegible]).

Model 8: The Generalized Linear Model (GLM) analysis was conducted to examine the relationship between injury severity (MAIS) and type of injury with the amount paid for the first emergency treatment card via PC. The intercept of the model [illegible]as s[illegible]a[illegible]is[illegible]i[illegible]a[illegible] signi[illegible]i[illegible]an[illegible] [illegible] indicating a baseline estimated log value of the DV when all predictors are at their reference categories.

However, none of the explanatory variables showed a statistically significant association with the dependent variable. For injury severity (MAIS), compared to the reference group (MAIS = 9 (unknown)), the parameter estimates for minor injury (B = -0.047, p = 0.816), moderate injury (B = -0.084, p = 0.696), and serious injury (B = -0.086, p = 0.689) were not statistically significant. Similarly, for the type of injury, the comparison between fractures and the reference category non-fractures also yielded a non-signi□i□an□ resu□□ □□ □ □□□□□□ □□ □ □□□□□□□ □a□□ χ^2 □□ confidence intervals for all predictors crossed zero, further supporting the lack of significant effects.

The omnibus test of model coefficients was not statistically significant □□i□e□i□oo□ □a□io χ^2 □□□□□□□ □□ □ □□ □ □ □□□□□□□ sugges□ not provide a better fit than the intercept-only model. Additionally, the Type III tests of model effects showed non-signi□i□an□ resu□□s□or□o□□ □□□□ □□a□□ χ^2 □□ p = 0.961) and types of injury □□a□□ χ^2 □□□□□□□ □□ □ □□ □ □ □□□□□□□ variables did not significantly explain the variability in emergency treatment payments. The scale parameter was estimated to be 0.388 (SE = 0.0229) using the maximum likelihood method.

In summary, while the intercept was significant, indicating a meaningful baseline level of payment, neither injury severity nor type of injury was a significant predictor of the amount paid for the initial emergency treatment. These findings suggest that other factors not included in the model may better explain variations in emergency treatment costs.

4.8.22 Pre-crash factors associated with WTP for first medical treatment

Model 7: The Generalized Linear Model (GLM) analysis was performed to examine factors associated with the WTP for first emergency medical treatment. The model included several predictors: motorcycle license status, rider status (motorcyclist or pillion rider), purpose of travel, insurance status, and involvement in an crash in the past year.

The intercept parameter was statistically significant, with an estimate of B = 4.432 (SE = 0.0624, 95% CI [4.309, 4.554], $p < .001$), indicating the expected log-transformed mean WTP when all predictors are at the reference category level.

Among the independent variables, the status of being a motorcyclist or pillion showed a significant effect on WTP. Specifically, being a pillion was associated with a statistically significant reduction in WTP compared to being a motorcyclist, with an estimated coefficient of B = -0.405 (SE = 0.0981, 95% CI [-0.597, -0.212], Wald χ^2 [illegible] p < [illegible]001). This suggests that pillion riders were willing to pay less for emergency treatment than motorcyclists.

Insurance status also significantly influenced WTP. Respondents without insurance had a lower WTP compared to those with insurance, as indicated by B = -0.237 (SE = 0.0723, 95% CI [-0.378, -[illegible] a[illegible] p [illegible] χ^2 .001). [illegible]

In addition, those who had not been involved in an crash in the past year had significantly lower WTP compared to those who had, with an estimated B = -0.769 (SE = 0.1199, 95% CI [-1.004, -[illegible] a[illegible] p [illegible] χ^2 .001). On the other hand, the effect of motorcycle license status (B = 0.050, p = .754) and purpose of travel (B = -0.061, p = .409) were not statistically significant predictors of WTP in this model.

Overall, the model suggests that rider role, crash history, and insurance status are significant determinants of WTP for emergency treatment.

Model 8: Based on the Generalized Linear Model (GLM) analysis using a Gamma distribution with a log link function, the overall model predicting the first emergency medical treatment via payment card was statistically significant, as indicated [illegible] e [illegible] ni[illegible] us [illegible] es [illegible] χ^2 [illegible] -of-fit statistics [illegible] demonstrated acceptable model fit, with a deviance of 171.373 (df = 503, value/

df = 0.341) and a Pearson Chi-Square of 134.928 (df = 503, value/df = 0.268), suggesting no evidence of overdispersion or lack of fit.

The intercept parameter was highly significant (B = 4.403, SE = 0.0428, Wald χ^2 [illegible] retransforming 1st medical [illegible] treatment (PC) for the reference group in the model.

[illegible]ong [illegible]e [illegible]re[illegible]i[illegible]ors[illegible] [illegible]e res[illegible]on[illegible]en[illegible]'s ro[illegible]e as a [illegible]o[illegible]or[illegible]is[illegible] statistically significant (B = -[illegible] a[illegible] χ^2 [illegible] pillion riders showing a significantly lower predicted payment compared to motorcyclists. Insurance status was also significant, with uninsured individuals reporting a lower willingness to pay (B = -[illegible] a[illegible] χ [illegible] p < 0.001). Respondents who had not experienced an crash in the past year also reported a significantly lower predicted payment (B = -0.701, SE = 0.0856, Wald χ^2 [illegible] o[illegible] are[illegible] [illegible]o crash [illegible]o[illegible]a[illegible] [illegible]een in

Additionally, the purpose of travel was found to be a significant predictor (B = -[illegible] a[illegible]), χ^2 with those traveling for non-[illegible] work purposes demonstrating a reduced estimated payment. However, the possession of a motorcycle license did not have a statistically significant effect (p = 0.163), suggesting that licensing status did not meaningfully influence the first medical treatment.

In summary, the analysis indicated that the predicted amount respondents were WTP for first emergency medical treatment via PC was significantly influenced by role (motorcyclist vs pillion), insurance coverage, travel purpose, and crash history, while motorcycle license status was not a significant predictor.

4.8.23 Socio-demographic factors associated with WTP for follow-up medical treatment

Model 9: A Generalized Linear Model (GLM) with a Gamma distribution and log link function was conducted to examine the association between socio-demographic factors and the number of respondents who were WTP for follow-up treatment. The intercept [illegible]as s[illegible]a[illegible]is[illegible]i[illegible]a[illegible] signi[illegible]i[illegible]an[illegible] [illegible] indicating that the estimated baseline expenditure for follow-up treatment when all predictors are held at their reference categories is significantly different from zero.

The overall model demonstrated a statistically significant improvement over the intercept-only model, as indicated by the Omnibus Test (Likelihood Ratio Chi-Square = 72.562, df = 12, p < .001). However, model fit statistics such as the Pearson Chi-Square/df ratio (4.417) and the scaled Pearson Chi-Square (3152.693) suggest some potential overdispersion or deviation from model assumptions, which should be interpreted with caution.

At the individual predictor level, none of the socio-demographic variables showed statistically significant effects on the amount spent on follow-up treatment. This in u es age a χ^2 0 gen er a χ^2 0.462), race a χ^2 0 ig es eve o e u a ion 0.541), a χ^2 ari a s a us a χ^2 an 0.634). u a ion Although the overall effect of race appeared significant in the model effects table, parameter estimates for individual race categories were not statistically significant, with p-values ranging from 0.188 to 0.468, indicating no meaningful differences when compared to the reference group.

In summary, while the model as a whole was statistically significant, none of the individual socio-demographic factors emerged as significant predictors of WTP for follow-up medical treatment. These findings suggest a relatively homogeneous valuation of follow-up care across different demographic groups within the sample.

Model 10: The Generalized Linear Model (GLM) analysis identified several key predictors of WTP for medical follow-up via payment card. The model's intercept was s a is i a signi i an a χ^2 a substantial baseline value when all covariates are set at the reference category. The overall model was a good fit, supported by the goodness-of-fit indices, with a evian e ra io o an a signi i an ni us es χ^2 .002), confirming that the model with predictors performed significantly better than the intercept-only model.

Among all predictors, occupation was the only factor with a statistically signi[illegible]i[illegible]an[illegible] e[illegible]e[illegible] [illegible]a[illegible] χ^2 [illegible] low skills category showed a significantly lower WTP compared to the reference group (B = -0.228, SE = 0.0975, 95% CI = [-0.419, -[illegible] a[illegible] χ^2 [illegible] Similarly, those in medium skills (B = -0.132, SE = 0.0672, 95% CI = [-0.264, -0.001], [illegible]a[illegible] χ^2 [illegible] high skills (B = -0.444, SE = 0.0984, 95% CI = [-0.637, -0.25[illegible] a[illegible] χ^2 [illegible] a[illegible]so [illegible]e[illegible]ons[illegible]ra[illegible]e[illegible] willingness to pay. These findings suggest that occupation type plays a pivotal role in influencing post-treatment follow-up costs willingness among respondents.

In contrast, other variables[illegible] including age, gender, race, highest level of education, and marital status[illegible] did not demonstrate statistically significant associations with WTP for follow-up care (all $p > 0.05$). These non-significant findings suggest that socio-demographic variables aside from occupation may not have a meaningful influence on the payment amount respondents are willing to make for post-treatment medical services.

4.8.24 Socio-economic factors associated with WTP for follow-up medical treatment

Model 9: The Generalized Linear Model (GLM) analysis for WTP for follow-up medical treatment began with the assessment of the model intercept. The intercept was s[illegible]a[illegible]is[illegible]i[illegible]a[illegible] signi[illegible]i[illegible]an[illegible] [illegible] a[illegible] CI [2.072, 4.939]), indicating the expected log mean value of expenditure for the reference group (those in the highest income and largest household categories) when all predictors are at the reference level.

For the income variable, participants in the B40 income group showed a positive but statistically non-significant association with WTP for follow-up for medical treatment [illegible] a[illegible] χ -0.057, 0.639]) [illegible]. This suggests that although there may be a slight increase in expenditure among lower-income individuals, the result does not reach the conventional level of statistical significance ($p > 0.05$).

Regarding household income, respondents from the M40 income group were significantly more likely to incur higher expenditures compared to the reference group T20 [illegible] i[illegible] a[illegible] χ^2 [illegible] 2.198]. This suggests that individuals from the middle household income group were significantly associated with increased WTP for follow-up treatment compared to those from higher household income categories.

In contrast, none of the household size categories showed statistically significant effects. For example, respondents from the small household size group had a negative but non-significant relationship with expenditure (B = -0.107, SE = 0.5483, p = 0.846), while those in medium household size also had a non-significant positive estimate (B = 0.472, SE = 0.5565, p = 0.396). This suggests that household size was not a significant predictor of follow-up treatment expenditure in this model.

Overall, the model indicates that household income [illegible] particularly being in the middle-income group [illegible] has a significant influence on the WTP for follow-up treatment services. Meanwhile, individual income and household size do not significantly predict such payments.

Model 10: Based on the Generalized Linear Model (GLM) output for WTP for follow-up medical treatment via payment card, the intercept parameter was statistically significant. The intercept estimate was 4.321 with a standard error of 0.5372, and a Wald chi-square value of 64.680 (p < 0.001). This indicates that when all predictors are at their reference category, the expected value of the dependent variable is significantly different from zero.

In terms of the income variable, individuals categorized as B40 and as a reference to M40 had an estimated coefficient of 0.011, with a standard error of 0.1349. However, this relationship was not statistically significant, as indicated by a Wald chi-square value of 0.007 and a p-value of 0.934. This suggests that income level was not a significant predictor of payment amount for follow-up treatment.

For the variable representing household income categories, neither category B40 household income nor M40 household income showed significant associations. Specifically, the coefficient for B40 was -0.420 (SE = 0.3297, p = 0.203), while for M40 it was -0.031 (SE = 0.3401, p = 0.927). Both results imply that household income level has no meaningful effect on the amount paid for follow-up treatment services.

Similarly, for house size, the estimates for small household size and medium household size were -0.113 (SE = 0.4020, p = 0.778) and 0.032 (SE = 0.4070, p = 0.938), respectively. Neither was statistically significant, indicating that house size was not a significant determinant of the payment amount for follow-up medical care.

In summary, while the model intercept was highly significant, none of the explanatory variables (income, household income, or house size) via PC demonstrated a statistically significant effect on WTP of follow-up medical treatment in this model.

4.8.25 Injury factors associated with WTP for follow-up medical treatment

Model 9: A Generalized Linear Model (GLM) was performed to examine the association between injury severity (MAIS) and type of injury with the WTP for follow-up medical treatment. The intercept was statistically significant (B = 4.564, [illegible] χ^2 [illegible] -WTP in[illegible] when all predictors were held at their reference categories (MAIS = 9 (unknown)) and non-fracture types of injury. The overall model was statistically significant, as indicated by the Omnibus [illegible] χ^2 [illegible] model effects confirmed that types of injury were a significant predictor of WTP [illegible] -of-fit was [illegible] acceptable, with a log-likelihood value of -2708.297 and a scale parameter estimated at 0.760 (SE = 0.0418). Note that model selection criteria (AIC = 5428.594, BIC = 5454.310) further supported the model's reliability.

In terms of injury severity (MAIS), none of the categories showed a statistically significant association with WTP. Compared to the reference group (MAIS = 9 (unknown)), the coefficients for minor injury (B = -0.146, p = 0.606), moderate injury severity (B = -0.421, p = 0.170), and serious injury (B = -0.403, p = 0.193) were all non-significant. This indicates that varying levels of injury severity did not □eaning□u□ □ □ in□ □uen□ e res□ on□ en□ s' □ i□ □ ingness care.□ a□ □or □ o□ □ o□

However, the type of injury was significantly associated with WTP. Respondents with fracture-related injuries demonstrated a significantly lower WTP compared to those with non-fracture injuries, with a coefficient of B = -0.300 □ □ □ □ □ □ □ □ □ □ □ □ □a□ □ χ ² □is in□ i fractures were still willing to pay for follow-up medical treatment, the average amount they were willing to pay was significantly less than that of individuals with non-fracture injuries.

Overall, it was indicated that respondents who had injuries, specifically fractures, were WTP for follow-up medical treatment, whereas the other variables did not significantly influence the WTP for follow-up medical treatment.

Model 10: A Generalized Linear Model (GLM) was performed to examine the association between injury severity (MAIS) and type of injury, with the maximum WTP for follow-up medical treatment via PC. The intercept of the model was statistically significant (B = 4.025, SE = 0.1831, Wald χ ² □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ in□ i□ a all predictors were set to their reference categories (MAIS = 9.00 (unknown)) and types of injury, the baseline log-transformed WTP was significantly greater than zero. The overall model was not statistically significant, as shown by the Omnibus Test □ □ i□ e□ i□ oo□ □a□ io χ ² □ in□ i□ a and type of injury did not significantly improve the prediction of WTP over the intercept-only model. This was further supported by the non-significant results from the □ □ □e □ □ □ □a□ □ □es□ s □or □ o□ □ □ □ □ □ □ □χ ² □the type of injury □ □ □ □ □ □χ ² □

With regard to injury severity, respondents with MAIS = 1.00 had a lower WTP compared to those with MAIS = 9.00 (unknown) (B = -0.206, SE = 0.1885, Wald χ ² □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ a□ □ □oug□ □ □e resu□ □ □as no□ s□ a□ is□ significant reductions in WTP were observed for respondents with moderate injury (B = -0.197, SE = 0.2004, p = 0.325) and serious injury (B = -0.150, SE = 0.2020, p = 0.458). For the type of injury, respondents with fractures had a slightly higher WTP compared to the reference category, non-fractures. However, this effect was not statistically significant [illegible] These [illegible] findings suggest that neither injury severity nor type of injury had a significant influence on WTP for follow-up treatment.

4.8.26 Pre-crash factors associated with WTP for follow-up medical treatment

Model 9: The Generalized Linear Model (GLM) analysis for follow-up medical treatment began with the intercept parameter, which was statistically significant [illegible] Wald χ^2 [illegible] variables are held constant. Overall, the model significantly improved over the intercept-only model as indicated [illegible] Omnibus Test [illegible] Likelihood [illegible] df = 5, p < .001), and goodness-of-fit statistics such as the Deviance/df ratio (0.850) supported acceptable model fit.

Among the predictors, the variable of the role as motorcyclists and pillion showed a significant association with the outcome. Specifically, being a pillion rider (reference group = motorcyclist) was associated with a decrease in the expected WTP of follow-up treatment (B = -[illegible] Wald χ^2 [illegible] [-0.686, -0.278]). The purpose of travel also demonstrated a significant effect (B = -[illegible] Wald χ^2 [illegible] for non-work-related purposes had lower follow-up costs compared to those traveling for work-related reasons. In terms of insurance status, those without insurance incurred significantly higher follow-up treatment costs (B = 0.398, SE = 0.0762, Wald χ^2 [illegible]

However, variables such as motorcycle license status (B = 0.270, p = .106) and crash status within the past year (B = -0.101, p = .420) did not show statistically significant associations with the WTP of follow-up treatment. These findings suggest that the role of the crash (motorcyclist vs. pillion), insurance status, and travel purpose significantly influence the expected WTP of follow-up medical treatment.

Model 10: A Gamma-distributed Generalized Linear Model (GLM) with a log link was fitted to predict the amount respondents were willing to pay for follow-up medical treatment via PC. The intercept was highly significant (B = 3.851, SE = 0.042, [illegible] χ² [illegible] 3.934), establishing a baseline (log-scale) payment when all covariates are at their reference categories. Model adequacy was supported by the devian[illegible]e [illegible] ra[illegible]io [illegible] an[illegible] [illegible]earson χ² [illegible] ra[illegible]io [illegible] the Omnibus Test confirmed that the full model improved fit over the intercept-only model (Likelihood-[illegible]a[illegible]io χ² [illegible]

Four predictors emerged as significant determinants of payment in which respondents without a valid motorcycle licence were willing to pay more than licensed ri[illegible]ers [illegible] χ² [illegible] 0.494). [illegible] Rider role (motorcyclist vs pillion). Being a pillion rider was associated with a lower payment compared with motorcyclists (B = -[illegible] χ² [illegible] p < .001; 95 % CI = -0.434 [illegible] -0.171). The purpose of travel, for which participants were travelling for non-work purposes, showed a modest but significant increase in payment [illegible] χ² [illegible] 0.215). [illegible] Additionally, those with no crash in the past year were willing to pay less than those who had experienced an crash (B = -[illegible] χ² [illegible] % CI = (-0.444 [illegible] -0.120).

Insurance status did not significantly influence the payment (p =.658), indicating no discernible difference between insured and uninsured respondents in this context. In summary, WTP for the follow-up treatment card is shaped chiefly by license ownership, rider role, travel purpose, and recent crash involvement, whereas insurance coverage appears unrelated once these factors are taken into account.

Table 4.9 Fatality risk reduction GLM analysis (Gamma and Normal)

Variables	Fatality Risk Reduction									
	Model 1					Model 2				
	Estimate (β)	Standard Error (SE)	Wald Chi-Square	p-value	95% CI	Estimate (β)	Standard Error (SE)	Wald Chi-Square	p-value	95% CI
Intercept	3.759	0.3323	127.926	<0.001	3.107, 4.410	3.542	1.924	338.779	<0.001	3.165, 3.919
SD										
Age = 1	-0.002	1.4499	0.000	0.990	-0.296, 0.292	0.187	1.116	2.612	0.106	-0.040, 0.415
Age = 2	-0.013	1.266	0.010	0.919	-0.235, 0.261	0.134	1.021	1.731	0.188	-0.066, 0.335
Gender = 1	-0.023	0.0601	0.146	0.702	-0.141, 0.095	0.003	0.461	0.003	0.955	-0.088, 0.093
Education = 1	-0.515	0.1763	8.546	**0.003**	-0.861, -0.170	-0.460	0.2042	5.069	0.024	-0.860, -0.059
Education = 2	0.001	0.0566	0.000	0.990	-0.110, 0.112	-0.048	0.431	1.251	0.263	-0.133, 0.036
Education = 3	0.001	0.0566	0.000	0.990	-0.110, 0.112	-	-	-	-	-
Ethnicity = 1	-0.474	0.3005	2.493	0.114	-1.063, 0.114	-0.506	1.647	9.448	**0.002**	-0.829, -0.183
Ethnicity = 2	-0.631	0.3290	3.677	**0.055**	-1.276, 0.014	-0.402	1.887	4.547	**0.033**	-0.772, -0.033
Ethnicity = 3	-0.370	0.3115	1.408	0.235	-0.980, 0.241	-0.396	1.734	5.226	**0.022**	-0.736, -0.057
Marriage status = 1	0.012	0.0855	0.020	0.888	-0.156, 0.180	-0.010	0.0610	0.028	0.867	-0.130, 0.109
Occupation = 1	0.188	0.1019	3.407	0.065	-0.012, 0.388	0.118	0.0781	2.288	0.130	-0.035, 0.271
Occupation = 2	0.079	0.0672	1.383	0.240	-0.053, 0.211	0.130	0.0553	5.524	**0.019**	0.022, 0.239
Occupation = 3	-0.023	0.0984	0.055	0.815	0.216, 0.170	0.0555	0.0788	0.496	0.481	-0.099, 0.210
Occupation = 4	-0.000	0.0797	0.000	0.998	-0.157, 0.158	-	-	-	-	-

□ o □ e □ on□ inu

□ □ on□ inua□ ion

SE **Intercept**	1.806	0.5521	10.705	0.001	0.724, 2.888	2.138	0.9178	5.428	0.020	1.340, 3.937
Income = 1	-0.084	0.1356	0.383	0.536	-0.350, 0.182	-0.155	0.0939	2.742	0.098	-0.339, 0.029
Household income = 1	1.391	0.3404	16.698	**<0.001**	0.724, 2.058	1.131	0.8335	1.840	0.175	-0.503, 2.764
Household income = 2	1.153	0.3499	10.858	**<0.001**	0.467, 1.839	0.895	0.8373	1.1444	0.285	-0.746, 2.537
Household income = 3	0.000	0.0797	0.000	0.998	-0.157, 0.158	-	-	-	-	-
Household size = 1	0.248	0.4122	0.362	0.547	-0.560, 1.056	0.188	0.3727	0.255	0.614	-0.542, 0.919
Household size = 2	0.277	0.4175	0.439	0.508	-0.542, 1.095	0.085	0.3771	0.051	0.821	-0.654, 0.824
IS **Intercept**	3.651	0.186	385.085	<0.01	3.286, 4.105	3.367	0.1745	372.311	<0.001	3.025, 3.709
Types of injury = 1	-0.002	0.0731	0.001	0.980	-0.145, 0.141	0.06	0.0687	0.769	0.381	-0.074, 0.195
Injury severity = 1	-0.307	0.1912	2.573	0.109	-0.682, 0.068	-0.109	0.1794	0.367	0.545	-0.46, 0.243
Injury severity = 2	-0.325	0.2014	2.607	0.106	-0.702, 0.07	-0.116	0.1893	0.378	0.539	-0.488, 0.255
Injury severity = 3	-0.296	0.2033	2.122	0.145	-0.695, 0.102	-0.197	0.1903	1.072	0.301	-0.57, 0.176
PC										
Motorcycle license	-0.131	0.1101	1.421	0.233	-0.347, 0.085	-0.028	0.0984	0.08	0.777	-0.221, 0.165
Motorcyclist/pillion	0.06	0.0675	0.781	0.377	-0.073, 0.192	0.084	0.0599	1.97	0.16	-0.033, 0.201
Purpose of travel	-0.073	0.0514	2.016	0.156	-0.174, 0.028	-0.182	0.0458	15.746	**<0.001**	-0.272, 0.092
Insurance	-0.028	0.051	0.301	0.583	-0.128, 0.072	-0.091	0.0456	4.002	**0.045**	-0.181, -0.002
Crashes for the past year	-0.286	0.0816	12.264	<0.001	-0.126, -0.126	-0.478	0.0734	42.518	**<0.001**	-0.622, -0.335

SD=socio demographic; SE=socio economics; IS=injury status; PC=pre-crash status
Dependent variable: WTP for retroflective marker tape (RM)

Table 4.10 Injury risk reduction GLM analysis (Gamma and Normal)

Variables	Injury risk reduction									
	Model 3					Model 4				
	Estimate (β)	Standard Error (SE)	Wald Chi-Square	p-value	95% CI	Estimate (β)	Standard Error (SE)	Wald Chi-Square	p-value	95% CI
SD										
Age=1	0.176	0.1798	0.961	0.327	-0.176, 0.529	0.299	0.129	5.382	**0.020**	0.046, 0.552
Age =2	0.307	0.1521	4.072	**0.044**	0.009, 0.605	0.201	0.1078	3.463	0.063	-0.011, 0.412
Gender = 1	0.119	0.0717	2.74	0.098	-0.022, 0.259	0.036	0.0524	0.48	0.488	-0.066, 0.139
Ethnicity = 1	0.119	0.3592	0.109	0.741	-0.585, 0.823	-0.092	0.2597	0.125	0.724	-0.601, 0.417
Ethnicity = 2	0.277	0.3933	0.497	0.481	-0.494, 1.048	-0.107	0.2833	0.143	0.706	-0.662, 0.448
Ethnicity = 3	0.019	0.3723	0.003	0.958	-0.710, 0.749	-0.025	0.2689	0.009	0.925	-0.552, 0.502
Education = 1	-0.789	0.2204	12.806	**<0.001**	-1.221, -0357	-0.531	0.155	11.72	**<0.001**	-0.835, -0.227
Education = 2	-0.128	0.0705	3.314	0.069	-0.267, 0.010	-0.096	0.0501	3.631	**0.057**	-0.194, 0.003
Marital status = 1	0.018	0.1022	0.03	0.862	-0.183, 0.218	-0.029	0.0749	0.153	0.696	-0.176, 0.117
Occupation = 1	-1.06	0.1198	0.781	0.377	-0.341, 0.129	0.182	0.0868	4.415	**0.036**	0.012, 0.352
Occupation = 2	-0.112	0.0811	1.908	0.167	-0.271, 0.047	0.164	0.0589	7.738	**0.005**	0.048, 0.279
Occupation = 3	-0.252	0.1174	4.591	0.032	-0.482, -0.021	-0.039	0.0869	0.206	0.65	-0.210, 0.131
SE	3.669	0.6794	29.166	<0.001	2.337, 5.0	3.826	0.4944	59.864	<0.001	2.857, 4.795
Intercept										
Income	-0.012	1.655	0.005	0.944	-0.336, 0.313	-0.144	0.1203	1.426	0.232	-0.379, 0.092
Household = 1 income	0.032	0.4204	0.006	0.94	-0.792, 0.856	0.007	0.3066	0.001	0.982	-0.594, 0.608
Household = 2 income	-0.074	0.4319	0.029	0.864	-0.92, 0.773	-0.151	0.314	0.233	0.629	-0.767. 0.464

□ o □ e □ on□ inu

(continuation)

Household size = 1	0.289	0.5072	0.325	0.569	-0.705, 1.283	0.158	0.3683	0.184	0.668	-0.564, 0.88
Household size = 2	0.425	0.5138	0.686	0.408	-0.582, 1.433	0.043	0.3732	0.014	0.907	-0.688 0.755
IS										
Intercept	3.902	0.2266	296.529	<0.001	3.458, 4.346	3.882	0.1653	551.402	<0.001	3.558, 4.206
Types of injury = 1	0.046	0.093	0.244	0.621	-0.136, 0.228	0.043	0.0648	0.431	0.511	-0.084, 0.17
Injury severity = 1	0.117	0.2329	0.25	0.617	-0.34, 0.573	-0.06	0.1699	0.124	0.725	-0.393, 0.273
Injury severity = 2	0.004	0.2471	0.00	0.986	-0.48, 0.489	-0.082	0.1792	0.208	0.649	-0.433, 0.27
Injury severity = 3	0.046	0.2489	0.035	0.852	-0.441, 0.534	-0.123	0.1802	0.462	0.497	-0.476, 0.231
PC										
Intercept	4.153	.0527	6206.074	<0.001	4.049, 4.256	4.019	0.0371	11717.142	<0.001	3.947, 4.092
Motorcycle license	-0.215	0.1351	2.531	0.112	-0.48, 0.05	-0.028	0.0944	0.089	0.766	-0.213, 0.157
Motorcycle/pillion	-0.054	0.0834	0.417	0.519	-0.217, 0.11	0.001	0.0575	0.001	0.981	-0.111, 0.114
Purpose of travel	-0.066	0.0623	1.128	0.288	-0.188, 0.056	-0.164	0.0439	13.925	**<0.001**	-0.25, -0.078
Insurance	-0.294	0.0611	23.146	**<0.001**	-0.414, -0.174	-0.178	0.0435	16.82	**<0.001**	-0.264, -0.093
Crash for the past year	0.165	0.0986	2.809	0.094	-0.028, 0.358	-0.309	0.07	19.456	**<0.001**	-0.446, 0.172

SD=socio demographic; SE=socio economics; IS=injury status; PC=pre-crash status
Dependent variable: WTP for helmet (RM)

Table 4.11 Road Safety Program (Gamma and Normal)

Variables	Model 5					Model 6				
	Estimate (β)	Standard Error (SE)	Wald Chi-Square	p-value	95% CI	Estimate (β)	Standard Error (SE)	Wald Chi-Square	p-value	95% CI
SD										
Age =1	0.153	0.1634	0.877	0.349	-0.167, 0.473	0.277	0.1396	0.949	**0.047**	0.004, 0.551
Age = 2	0.141	0.1369	1.065	0.302	-0.127, 0.410	0.203	0.1162	3.04	0.081	-0.025, 0.430
Gender = 1	-0.053	0.0665	0.628	0.428	-0.183, 0.078	-0.041	0.0567	0.527	0.468	-0.152, 0.070
Education = 1	-0.409	0.1939	4.441	**0.035**	-0.789, 0.029	-0.42	0.1679	6.257	**0.012**	-0.749 -0.091
Education = 2	-0.026	0.0632	0.163	0.686	-0.149, 0.098	-0.059	0.0541	1.173	0.279	-0.165 0.047
Ethnicity =1	-0.027	0.3169	0.007	0.932	-0.648, 0.594	-0.11	0.2729	0.162	0.688	-0.645 0.425
Ethnicity = 2	-0.112	0.3509	0.103	0.749	-0.800, 0.575	-0.069	0.2986	0.054	0.816	-0.655, 0.516
Ethnicity = 3	-0.038	0.3277	0.013	0.909	-0.680, 0.605	-0.071	0.2821	0.064	0.8	-0.624, 0.482
Marriage status = 1	-0.125	0.0936	1.778	0.182	-0.308, 0.059	-0.115	0.0807	2.02	0.155	-0.273, 0.043
Occupation = 1	0.158	0.1093	2.084	0.149	-0.056, 0.372	0.2	0.0927	4.669	**0.031**	0.019, 0.382
Occupation = 2	0.14	0.0732	3.673	**0.055**	0.000, 0.284	0.209	0.0605	11.156	**<0.001**	0.086, 0.331
Occupation = 3	-0.121	0.087	1.3	0.254	-0.330, 0.087	-0.078	0.0919	0.712	0.399	-0.258, 0.103
SE	2.046	0.7753	9.633	0.002	0.887, 3.926	2.384	0.5065	22.161	<0.001	1.392, 3.377
Intercept										
Income = 1	-0.171	0.1432	1.423	0.233	-0.451, 0.11	-0.169	0.1233	1.869	0.172	-0.379, 0.073
Household income = 1	1.389	0.6228	4.972	**0.026**	0.168, 2.609	1.409	0.3128	20.285	**<0.001**	0.796 2.022

□ o □ e □ on□ inu

(Continuation)

Household income = 2	0.903	0.6279	2.066	0.151	-0.328, 2.133	1.034	0.3208	10.39	**0.001**	0.405, 1.663
Household size = 1	0.038	0.4377	0.008	0.93	-0.82, 0.896	-0.014	0.3777	0.001	0.97	-0.754, 0.726
Household size = 2	0.067	0.4441	0.023	0.88	-0.803, 0.937	-0.115	0.383	0.09	0.764	-0.865, 0.636
IS **Intercept**	3.611	0.1987	330.381	<0.001	3.222, 4000	3.611	0.1735	433.024	<0.001	3.271, 3.951
Types of injury = 1	-0.007	0.0821	0.007	0.931	-0.168, 0.154	0.048	0.0700	0.479	0.489	-0.089, 0.186
Injury severity = 1	0.090	0.2045	0.193	0.660	-0.311, 0.491	-0.043	0.1785	0.058	0.809	-0.393, 0.307
Injury severity = 2	-0.009	0.2168	0.002	0.966	-0.434, 0.416	-0.071	0.1887	0.141	0.707	-0.441, 0.299
Injury severity = 3	0.012	0.2188	0.003	0.957	-0.417, 0.441	-0.099	0.1902	0.270	0.604	-0.472, 0.274
PC										
Intercept	3.801	0.0466	6645.086	<0.01	3.71, 3.892	3.78	0.0384	9695.314	<0.001	3.704, 3.855
Motorcycle license	0.181	0.1197	2.289	0.130	-0.054, 0.416	0.098	0.0979	1.003	0.317	-0.094, 0.29
Motorcycle/pillion										
Purpose of travel	-0.107	0.0727	2.165	0.141	-0.249, 0.035	-0.095	0.0593	2.559	0.11	-0.211 0.021
Insurance	-0.061	0.0561	1.173	0.279	-0.171, 0.049	-0.116	0.0457	6.046	**0.011**	-0.205, -0.026
Crash for the past	-0.196	0.0549	12.708	**<0.001**	-0.303, -0.088	-0.194	0.045	18.613	**<0.001**	-0.282, -0.106
year	-0.39	0.0926	17.751	**<0.001**	-0.571, -0.209	-0.605	0.0752	64.729	**<0.001**	-0.752, -0.458

SD=socio demographic; SE=socio economics; IS=injury status; PC=pre-crash status

Dependent variable: WTP for road safety program (RM)

Table 4.12 Emergency Treatment (Gamma and Normal)

Variables	Model 7 Estimate (β)	Model 7 Standard Error (SE)	Model 7 Wald Chi-Square	Model 7 p-value	Model 7 95% CI	Model 8 Estimate β)	Model 8 Standard Error (SE)	Model 8 Wald Chi-Square	Model 8 p-value	Model 8 95% CI
SD										
Age = 1	0.144	0.2188	0.431	0.511	-0.285, 0.573	0.349	0.1646	4.504	**0.034**	0.027, 0.672
Age = 2	0.088	1.833	0.232	0.63	-0.271, 0.447	0.105	0.1401	0.562	0.454	-0.170, 0.380
Gender = 1	0.138	0.0869	2.52	0.112	-0.032 0.308	0.042	0.063	0.443	0.505	-0.082, 0.166
Education = 1	0.591	0.2552	5.357	**0.021**	-1.091, -0.091	-0.578	0.1875	9.493	**0.002**	-0.945, -0.210
Education = 2	-0.315	0.0833	14.277	**<0.001**	-0.478, -0.151	0.282	0.0618	20.835	**<0.001**	-0.403, -0.161
Ethnicity = 1	-0.535	0.4902	1.193	0.275	-1.496, 0.425	-0.257	0.3496	0.539	0.463	-0.942, 0.429
Ethnicity = 2	-0.897	0.5278	2.891	0.089	-1.932, 0.137	-0.377	0.3754	1.006	0.316	-1.112, 0.359
Ethnicity = 3	-0.346	0.5027	0.474	0.491	-1.331, 0.639	-0.167	0.3591	0.215	0.643	-0.871, 0.537
Marriage status = 1	-0.002	1.29	0.00	0.99	-0.254, 0.251	-0.099	0.092	1.164	0.281	-0.280, 0.081
Occupation = 1	0.176	0.1465	1.449	0.229	-0.111, 0.464	0.312	0.107	8.504	**0.004**	0.102, 0.522
Occupation = 2	0.227	0.0973	5.453	**0.020**	0.037, 0.418	0.231	0.094	10.889	**<0.001**	0.094 0.368
Occupation = 3	-0.551	0.1435	14.718	**<0.001**	-0.832, -0.269	-0.322	0.1081	8.906	**0.003**	-0.534, -0.111
SE	1.835	0.7928	5.357	0.021	3.389	3.74	0.6276	35.509	<0.001	2.51, 4.97
Intercept										
Income = 1	0.107	0.0351	9.242	**0.002**	0.038, 0.175	-0.365	0.1441	6.431	**0.011**	-0.648, -0.083
Household income = 1	1.627	0.5039	10.428	**0.001**	0.640, 2.615	0.315	0.435	0.523	0.469	-0.538, 1.167
Household income = 2	1.367	0.5114	7.143	**0.008**	0.364, 2.369	-0.236	0.4436	0.282	0.595	-1.105, 0.634
Household size = 1	0.523	0.6073	0.741	0.389	-0.668, 1.713	0.479	0.4288	1.249	0.264	-0.361, 1.32

□ o □ e □ on□ inu

□ □ on□ inua□ ion

Household size = 2	0.581	0.6170	0.887	0.346	-0.628, 1.790	0.315	0.435	0.523	0.469	-0.538, 1.167
IS	4.472	0.2724	269.459	<0.001	3.938,	4.413	0.1969	442.748	<0.001	3.757,
Intercept										
Types of injury = 1	0.145	0.1067	1.846	0.174	5.006 -0.064, 0.354	0.088	0.0804	1.187	0.276	4.529 -0.070, 0.245
Injury severity=1	-0.215	0.2801	0.589	0.443	-0.764, 0.334	-0.047	0.2029	0.054	0.816	-0.445, 0.350
Injury severity = 2	-0.525	0.2949	3.165	0.075	-1.103, 0.053	-0.084	0.2146	0.153	0.696	-0.505, 0.337
Injury severity = 3	-0.498	0.2975	2.796	0.094	-1.081 0.086	-0.086	0.2164	0.160	0.689	-0.511, 0.338
PC										
Intercept										4.319, 4.487
Motorcycle license	4.432	0.0624	5040.606	<00.1	4.309, 4.554	4.403	0.0428	10583.133	<0.001	-0.063, 0.373
Motorcycle/pillion	0.05	0.1603	0.098	0.754	-0.264, 0.364	0.155	0.1113	1.945	0.163	-0.425, -0.158
Purpose of travel	-0.405	0.0981	17.03	**<0.001**	-0.597, 0.212	-0.291	0.0683	18.208	**<0.001**	-0.236, -0.031
Insurance	-0.061	0.0738	0.681	0.409	-0.205, 0.084	-0.133	0.0521	6.566	**0.01**	-0.372, 0.171
Crash for the past year	-0.237	0.0723	10.704	**0.001**	-0.378, -0.095	-0.271	0.0521	28.121	**<0.001**	-0.869, -0.533
	-0.769	0.1199	41.087	**<0.001**	-1.004, -0.534	-0.701	0.0856	67.153	**<0.001**	

SD=socio demographic; SE=socio economics; IS=injury status; PC=pre-crash status
Dependent variable: WTP for first medical treatment (RM)

Table 4.13 Follow-up Treatment (Gamma and Normal)

Variables	Follow-up treatment									
	Model 9					Model 10				
	Estimate (β)	Standard Error (SE)	Wald Chi-Square	p-value	95% CI	Estimate (β)	Standard Error (SE)	Wald Chi-Square	p-value	95% CI
Intercept SD	4.489	0.5012	80.212	<0.01	3507,5.472	4.532	0.3279	176.221	<0.001	3.71, 4.995
Age = 1	-0.21	0.2259	0.866	0.352	-0.635, 0.233	0.066	0.148	0.197	0.657	-0.224, 0.356
Age = 2	-0.194	1.8555	1.095	0.295	-0.558 0.169	0.074	0.1241	0.353	0.552	-0.169, 0.317
Gender = 1	-0.067	0.0907	0.54	0.462	-0.244, 0.111	-0.048	0.0591	0.659	0.417	-0.164, 0.068
Education = 1	-0.301	0.279	1.165	0.281	-0.848, 0.246	-0.197	1.832	1.154	0.283	-0.556, 0.162
Education = 2	-0.036	0.0848	0.178	0.673	-0.202, 0.13	0.03	0.0556	0.29	0.59	-0.079, 0.139
Ethnicity = 1	-0.388	0.4494	0.747	0.387	-.1269, 0.492	-0.385	0.2955	1.701	0.192	-0.964, 0.194
Ethnicity = 2	-0.644	0.4888	1.736	0.188	-1.602, 0.314	-0.502	0.322	2.428	0.119	-1.133, 0.129
Ethnicity = 3	0.337	0.4652	0.526	0.468	-0.574, 1.249	-0.408	0.306	1.774	0.183	-1.007, 0.192
Marriage status = 1	0.217	0.1381	2.471	0.116	-0.054, 0.488	0.001	0.0855	0.00	0.993	-0.167, 0.168
Occupation = 1	-0.062	0.1474	0.179	0.672	-0.351, 0.226	-0.228	0.0975	5.484	**0.019**	-0.419, -0.037
Occupation = 2	0.082	0.1014	0.652	0.419	-0.117, 0.281	-0.132	0.0672	3.879	**0.049**	-0.264, -0.001
Occupation = 3	-0.028	0.1488	0.035	0.851	-0.32, 0.264	-0.444	0.0984	20.335	**<0.001**	-0.637, -0.251
SE Intercept	3.505	0.7314	22.97	<0.001	2.072, 4.939	4.321	0.5372	64.68	<0.001	3.268, 5.374
Income = 1	0.291	0.1774	2.691	0.101	-0.057, 0.639	0.011	0.1349	0.007	0.934	-0.253, 0.276

□ o □ e □ on□ inu

□ □ on□ inua□ ion

Household income =1	0.116	0.451	0.066	0.798	-0.768, 1.0	-0.42	0.3297	1.622	0.203	-1.066, 0.226
Household income = 2	1.293	0.4617	7.847	**0.005**	0.388, 2.198	-0.031	0.3401	0.008	0.927	-0.698, 0.635
Household size = 1	-0.107	0.5483	0.038	0.846	-1.181, 0.968	-0.113	0.402	0.08	0.778	-0.901, 0.674
Household size = 2	0.472	0.5565	0.719	0.369	-0.619, 1.563	0.032	0.407	0.006	0.938	-0.766, 0.829
IS										
Intercept	4.564	0.2757	274.102	<0.001	4.024, 5.105	4.025	0.1831	483.078	<0.001	3.666, 4.384
Types of injury=1	-0.300	0.1298	5.362	**0.021**	-0.555, -0.046	0.031	0.0769	0.158	0.691	-0.120, 0.181
Injury severity =1	-0.146	0.2834	0.266	0.606	-0.701, 0.409	-0.206	0.1885	1.191	0.275	-0.575, 0.164
Injury severity = 2	-0.421	0.3074	1.880	0.170	-1.024, 0.181	-0.197	0.2004	0.970	0.325	-0.590 0.195
Injury severity = 3	-0.403	0.3097	1.691	0.193	-1.010, 0.204	-0.150	0.2020	0.550	0.458	-0.546, 0.246
PC										
Intercept	4.053	0.0677	3585.349	<0.01	3.921, 4.186	3.851	0.0422	8337.44	<0.001	3.768, 3.934
Motorcycle license	0.27	0.1675	2.606	0.106	-0.058, 0.599	0.282	0.1082	6.789	**0.009**	0.07, 0.494
Motorcycle/pillion	-0.482	0.104	21.46	**<0.001**	-0.686, 0.278	-0.302	0.0671	20.286	**<0.001**	-0.434, -0.171
Purpose of travel	-0.204	0.0775	6.954	**0.008**	-0.356, 0.052	0.115	0.051	5.08	**0.024**	0.015, 0.215
Insurance	0.398	0.0762	27.316	**<0.001**	0.249, 0.548	0.022	0.0504	0.197	0.658	-0.076, 0.121
Crash for the past year	-0.101	0.1258	0.65	0.42	-0.348, 0.145	-0.282	0.0826	11.676	**<0.001**	-0.444, -0.12

SD=socio demographic; SE=socio economics; IS=injury status; PC=pre-crash status
Dependent variable: WTP for follow-up medical treatment (RM)

4.9 DEBRIEFING

Debriefing questions were suggested to determine the respondent's WTP decision. This section was recommended in the CVM study guide. This section asking respondent four main questions, regarding; (a) how confident the respondents are in the stated payment mentioned in the previous scenario if the scenario is implemented in reality, (b) res□on□en□s' res□on□ on i□ □□eir vie□ on roa□ sa□e□□ □us□ □e □a□en in consideration, these two questions were asked in likert scales and (c) the methods of payment for the stated scenarios and (d) what respondents think should be entrusted to managing the public funds for road safety improvements. These questions elicit direct responses from what respondent think is appropriate to their best view of the questions.

4.9.1 The respondents were confident in their statements about the payment of WTP scenarios

The following Table 4.14 delineates the respondents' answers to the inquiries concerning their previously indicated WTP. The average response is 3.62, indicating that respondents tend to have a slight inclination towards confidence in their payment. The median value of the data is 3.00, indicating that the majority of respondents exhibit neutrality in their payment confidence. Note that the majority of respondents exhibited neutrality or slight confidence in their payment behavior, with responses being moderately (IQR=1) constant if the scenarios were realized in reality.

Table 4.14 Respondent Confidence on WTP Payments

Statistic	**Value**	**Standard Error (SE)**
Mean	3.62	0.04
95% confidence interval for the mean	3.54-3.69	-
5% trimmed mean	3.65	-
Median	3.00	-
Variance	0.89	-
Standard deviation (SD)	0.944	-
Interquartile range (IQR)	1	-
Skewness	-0.020	0.105
Kurtosis	-0.317	0.209

4.9.2 Respondents' views on including them in road safety improvement

The data indicate that a significant majority (98.5%) of respondents feel that the opinions of road users should be taken seriously when discussing ways to enhance road safety. A minimal number of respondents (0.4%) strongly disagree, suggesting a robust agreement with the statement. The distribution of responses is illustrated in Figure 4.1 below.

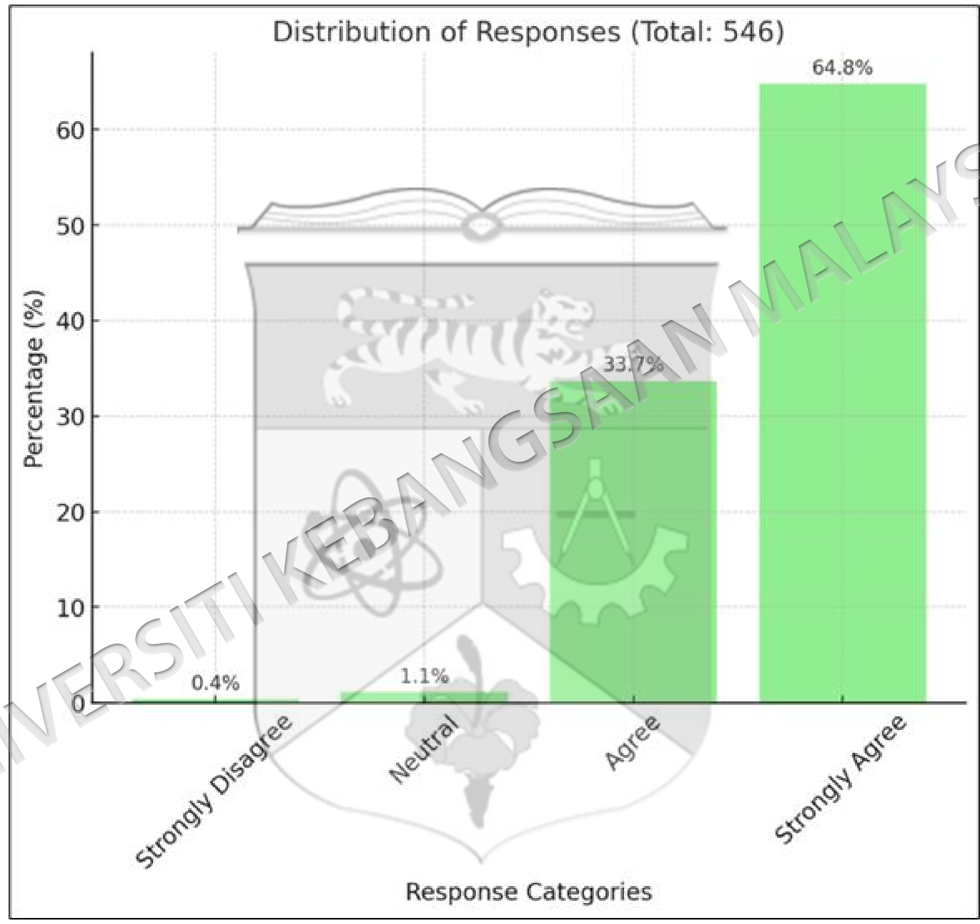


Figure 4.1 Respondents' views on their involvement in road safety improvement

4.9.3 The payment methods respondents think are appropriate to commit to the payment for the previous WTP scenarios

Out of the 546 respondents recruited, only 484 answered the questions related to payment commitment in the WTP scenarios. The remaining 62 respondents did not answer this question, and these instances were classified as missing data. However, the results show a distinct inclination towards direct payment methods among participants when engaging with the scenarios provided. A significant portion (45.5%) chose "Out of Pocket Payment," indicating a clear preference for immediate, direct transactions. Similarly, 45.2% of respondents stated they would prefer to make contributions through "Monthly Salary" deductions, demonstrating their readiness to make regular, systematic contributions. The combination of these two methods represents 90.7% of the total responses, highlighting a notable inclination towards straightforward and convenient payment systems. In contrast, merely 7.0% of respondents chose Lembaga Hasil Dalam Negeri (LHDN), implying a diminished preference for tax-based contribution methods. The "Others" category, accounting for just 1.3% of responses, suggests a limited interest in payment methods outside of those specifically mentioned. The data indicate that implementing a contribution system should focus on flexible direct payment methods, such as out-of-pocket (OOP) payments and salary deductions, as these options align with res□ on□ en□ s' □re□ eren□ es an□ are □i□ e□ □ □o□ os□ er grea□ er a□ □e□ □an□ this may indicate that respondents prefer to have direct control over their contributions, opting for direct payments rather than relying on third-party or government systems. Table 4.15 presents □ □e □is□ ri□ u□ ion o□ resresponses□ s'

Table 4.15 □ □es□ on□ enWTsP Method of Payment

Category	Frequency	%
Out of pocket	220	45.4
LHDN (tax)	38	8.0
Monthly salary	219	45.2
Others	7	1.4
Total	484	100

4.9.4 The respondents' views on those who should be entrusted to handle the public fund for road safety improvement

The data reveal the preferences of respondents concerning which entity ought to be responsible for managing public funds. A significant portion (55.1%) identified the Government as the most appropriate institution for this responsibility, reflecting a robust confidence in governmental systems and their perceived ability to manage public funds efficiently. This may indicate the public's inclination towards centralized and regulated financial management. The private sector emerged as the second most preferred option, chosen by 37.7% of respondents. This considerable percentage indicates that a substantial portion of respondents appreciates the efficiency and accountability of the private sector in fund management, likely stemming from their belief in its superior transparency or operational effectiveness relative to public institutions. A smaller percentage (6.0%) chose a Statutory Body, which denotes organizations created by law for particular functions. This suggests that although there is some level of trust in statutory bodies, they do not enjoy the same level of favor as the government or the private sector. The Non-Statutory Body garnered limited support (0.4%), indicating that respondents perceive these entities as less competent or trustworthy in handling public finances. Similarly, the category identified as □Others□ captured merely 0.7%, potentially encompassing a variety of alternative preferences that are not included in the primary options. The data indicate a clear inclination towards public or government-controlled fund management, while a notable minority supports private sector participation. This insight may assist policymakers in exploring collaborative strategies that merge public confidence in government with the efficiency of the private sector for fund management initiatives. Table 4.16 shows the dispersion of the findings.

Table 4.16 □es□ on□ en□s' WTP Method of Payment

Category	**Frequency**	**%**
Government	301	55.1
Private	206	37.7
Statutory body	33	6.0
Non-statutory body	2	0.4
Others	4	0.7
Total	546	100

4.10 QUALITY OF LIFE (QOL)

In this particular section of the study, respondents were asked to evaluate their QoL using a 5-point Likert scale that assessed their emotional state, functional state, and physical state. Note that this self-reported data was collected 30 days after the respondents had either visited the hospital for treatment or had been discharged from the hospital. The aim was to understand their overall well-being and recovery after a month, as well as their emotional health, ability to function in daily activities, and physical condition.

The study employed the Revised Trauma Quality of Life (RT-QoL) instrument, which consists of five Likert Scales, to evaluate the emotional, functional, and physical states of respondents one month after experiencing injuries from road crashes. The RT-QoL consists of 18 items, with six items each dedicated to assessing emotional state, functional state, and physical state. These domains were scored to reflect the respondents' conditions accurately. During the data cleaning process, all negative data points were converted into positive statements to maintain consistency. The total scores were then calculated and analyzed to determine the level of agreement or disagreement of respondents with the questions in each of the three domains.

This section of analysis is to determine the factors associated with □ a□ ienQoL after one month of discharge from the hospital. Since the QoL measures (physical, emotional and functional) is into binary categories (high QoL and Low QoL) binary logistic regression analysis are used to determine the association of each independent variables such as socio demographics (age, gender, ethnicity, education, marriage status and occupation), socio-economic (income, household income and household size), injury status (types of injury and injury severity score) and pre-crash status □ □ os□ i□ a□ i□ a□ ion □ is□ or□ oLon □ a□ ien□ 's □

4.10.1 QoL Test of normality

The tests of normality, including the Kolmogorov-Smirnov and Shapiro-Wilk tests, were used to determine the normality of the QoL data distribution. This is essential to determine the cut-off points of each QoL measure, which were recoded in binary categories. Based on the normality test in Table 4.17, the QoL was significant at $p<0.01$. Thus, the data significantly deviates from a normal distribution.

Table 4.17 Emotional, Physical, and Emotional measurement of QoL normality test.

Quality of Life	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Total_Emotional_Score	.162	546	<.001	.873	546	<.001
Total_Functional_Score	.182	546	<.001	.831	546	<.001
Total_Physical_Score	.183	546	<.001	.875	546	<.001

Table 4.17 displays the outcomes of normalcy assessments performed on the QoL scores across emotional, functional, and physical domains in patients 30 days post-hospital discharge. The emotional quality of life scores exhibit Kolmogorov-Smirnov and Shapiro-Wilk statistics of 0.162 and 0.873, respectively. Meanwhile, the functional QoL scores provide 0.182 and 0.831, and the physical QoL scores reveal 0.183 and 0.875. The results consistently indicate that the scores for all three QoL dimensions diverge from the anticipated normal distribution, which permits a non-parametric analysis.

4.10.2 Cut-off points

The median was chosen because, as mentioned earlier, the data are not normally distributed, and the median is more suitable for measuring the central tendency of non-normal data. Additionally, the nature of the survey itself is a Likert scale, which is the nature of ordinal data, and the median is more aligned with the ordinal nature of data (Boone & Boone, 2012). Therefore, in order to recode QoL measurements, the cut-off point of the median in Table 4.18 was calculated from the total score of each measurement.

Table 4.18 RT-QoL score Distribution Score and Cut Off Points

Measurements	Median	Range	Frequency	%	Indication
Emotion	10	> 10	287	52.6	Low quality of life (below or equal to the median)
		□ □□	259	47.4	High quality of life (above the median)
Functional	10	> 10	292	53.5	Low quality of life (below or equal to the median)
		□ □□	254	46.5	High quality of life (above the median)
Physical	15	> 15	273	50	Low quality of life (below or equal to the median)
		□ □□	273	50	High quality of life (above the median)

Table 4.18 summarizes the QoL metrics across three domains emotional, functional, and physical assessed in patients 30 days post-hospital discharge.

In the emotional category, the median score is 10, with 52.6% of patients (n=287) above the median, signifying a diminished emotional quality of life, whilst 47.4% (n=259) scored at or below the median, suggesting an elevated emotional QoL. In the functional dimension, the median score is 10, with 53.5% of patients (n=292) exhibiting low functional QoL, while 46.5% (n=254) report a higher QoL in this regard. The physical domain exhibits a balanced distribution, with an equal percentage of patients (50%, n=273) scoring above and below or equal to the median of 15, indicating an even division between low and good physical quality of life reported by respondents.

4.11 SOCIO-DEMOGRAPHIC AND EMOTIONAL QUALITY OF LIFE

A BLR analysis was conducted to examine the influence of socio-demographic characteristics on emotional QoL among individuals affected by road traffic injuries. The variables included in the model were age, gender, ethnicity, education level, marital status, and occupation.

Ethnicity was a significant predictor ($p = .009$). Respondents from certain ethnic backgrounds were less likely to report high emotional QoL (OR = 0.701, 95% CI [0.537, 0.915]), indicating potential disparities in emotional recovery across ethnic groups, possibly influenced by cultural coping mechanisms or access to support services. On the other hand, education level was strongly associated with emotional QoL ($p < .001$). Respondents with lower levels of education had significantly lower odds of reporting high emotional QoL (OR = 0.482, 95% CI [0.338, 0.689]). This suggests that education may play a protective role, potentially through better health literacy, access to information, and stronger coping strategies. Occupation was also a significant factor ($p < .001$). Employed individuals had significantly higher odds of experiencing high emotional QoL compared to those who were unemployed or not in the workforce (OR = 1.816, 95% CI [1.471, 2.241]). This may reflect the role of employment in providing financial stability, routine, and social engagement that can support emotional well-being. On the other hand, age (OR = 1.767, $p = .180$), gender (OR = 1.008, $p = .969$), and marital status (OR = 0.914, $p = .746$) were not statistically significant predictors of emotional QoL in this model, suggesting that these factors did not independently influence emotional outcomes in the studied population.

Overall, the analysis revealed that ethnicity, education, and occupation were statistically significant predictors of emotional QoL, while age, gender, and marital status were not.

4.12 SOCIO-ECONOMIC AND EMOTIONAL QUALITY OF LIFE

A BLR analysis was conducted to assess the association between socio-economic characteristics and emotional QoL among RTI respondents. The IVs included individual income, household income, and household size.

Individual income was not significantly associated with emotional QoL ($p = .22$). Although the odds ratio (OR = 0.537, 95% CI [0.195, 1.475]) suggested a negative relationship, the result was not statistically meaningful, indicating that a person's income alone may not independently affect their emotional well-being post-injury. In contrast, household income was a significant predictor ($p = .01$). Note that respondents from households with higher income had more than twice the odds of reporting good emotional QoL compared to those from lower-income households (OR = 2.361, 95% CI [1.214, 4.590]). This suggests that economic stability at the household level may provide a supportive environment that enhances emotional recovery following injury. On the other hand, household size showed the strongest association with emotional QoL ($p < .001$). Participants from larger households had significantly higher odds of experiencing good emotional QoL (OR = 7.021, 95% CI [3.598, 13.703]). This may reflect the positive role of family support, shared responsibilities, and emotional care within larger family units in promoting psychological well-being during recovery. These findings emphasize the importance of evaluating socio-economic context□ particularly at the household level□ when considering emotional outcomes among RTI survivors.

Overall, the analysis revealed that household income and household size were statistically significant predictors of emotional QoL, while individual income was not.

4.13 INJURY STATUS AND EMOTIONAL QUALITY OF LIFE

A BLR analysis was conducted to examine the association between injury-related factors—specifically, type of injury and injury severity—and *emotional* domain QoL. The overall model was statistically significant, as indicated by the Omnibus Test of Model Coefficients (χ^2 [illegible]) sugges[illegible] predictors provided a better fit than the null model. Additionally, the Hosmer and Lemeshow Test result was non-significant (χ^2 [illegible] model adequately fit the data. However, the amount of variance explained by the model was small, with Cox & Snell $R^2 = 0.018$ and Nagelkerke $R^2 = 0.024$.

In terms of predictors, the type of injury approached statistical significance ($p = 0.059$), with respondents categorized under having fractures having 38.3% lower odds of reporting a high quality of life compared to the reference group (OR = 0.617; 95% CI: 0.373–1.019). Although not statistically significant at the 0.05 level, this result suggests a potential inverse relationship between specific injury types and QoL. For injury severity, the overall MAIS variable was not statistically significant ($p = 0.068$), though the subcategory minor injury showed a marginally significant negative association with quality of life ($B = -0.498$, $p = 0.069$, OR = 0.608; 95% CI: 0.355–1.040). Other severity levels, namely moderate injury and serious injury, were not significant predictors. The constant term was also not significant ($B = 0.246$, $p = 0.327$), indicating no inherent baseline tendency for high QoL when all predictors were at their reference levels. These findings suggest that certain types and severities of injury may influence emotional domain quality of life outcomes, although the evidence is not conclusive within this model.

In summary, when looking at the factors that might affect a per[illegible] well-being after a crash, the type of injury they had—particularly fractures—seemed to play a role. People who had fractures were about 38% less likely to report good emotional QoL compared to those who had other types of injuries. Although this result was not strongly significant, it still suggests that having a fracture might make it harder for someone to feel emotionally well after the injury.

4.14 PRE CRASH AND EMOTIONAL QUALITY OF LIFE

A BLR was conducted to examine the association between selected socio-demographic and travel-related factors with emotional QoL post-crash. The model included four independent variables: possession of a motorcycle license, purpose of travel, and insurance coverage. The regression model was statistically significant ($p < .001$), indicating that the predictors reliably distinguished between individuals with high and low emotional QoL.

Specifically, motorcyclists without a valid license were significantly less likely to report high emotional QoL compared to those with a license (OR = 0.083, 95% CI [0.023, 0.300], $p < .001$). Importantly, the purpose of travel was also a significant predictor. Those who traveled for non-work-related purposes were less likely to report high emotional QoL compared to those who traveled for work-related reasons (OR = 0.271, 95% CI [0.185, 0.396], $p < .001$). Additionally, respondents without private insurance had significantly lower odds of reporting high emotional QoL than those with insurance coverage (OR = 0.449, 95% CI [0.308, 0.655], $p < .001$).

Additionally, examine the association between crash involvement in the past year and emotional QoL among RTI survivors. The results indicate that crash status within the past year was a statistically significant predictor of emotional QoL ($p < .001$). Respondents who had experienced an crash in the past year were significantly less likely to report good emotional QoL compared to those who had not. Specifically, individuals with a history of an crash in the past year had approximately 91% lower odds of reporting high emotional QoL (OR = 0.091, 95% CI [0.040, 0.203]). This strong negative association suggests that recent exposure to road trauma may exacerbate emotional distress, possibly due to ongoing psychological effects such as anxiety, fear of recurrence, or post-traumatic stress.

Overall, the analysis indicated that motorcyclists without a license, purpose of travel, traveler for non-work related, ownership of insurance, and past crash experience were significant predictors of emotional QoL.

4.15 SOCIO-DEMOGRAPHIC AND FUNCTIONAL QUALITY OF LIFE

A BLR analysis was conducted to examine the relationship between socio-demographic variables and functional QoL among RTI survivors. The predictors included age, gender, ethnicity, education level, marital status, and occupation.

Ethnicity showed a significant association with functional QoL ($p = .009$). Individuals from certain ethnic backgrounds had 30% lower odds of reporting high functional QoL compared to the reference group (OR = 0.701, 95% CI [0.537, 0.915]), suggesting potential disparities that may be related to cultural, healthcare access, or socioeconomic differences. Education level was a strong predictor of functional QoL ($p < .001$). Respondents with lower education levels were less likely to report good functional outcomes (OR = 0.482, 95% CI [0.338, 0.689]). This suggests that higher educational attainment may support better post-crash adaptation through enhanced health literacy, improved problem-solving ability, or increased access to resources. Occupation also demonstrated a significant influence on functional QoL ($p < .001$). Employed individuals were nearly twice as likely to experience good functional outcomes compared to unemployed or inactive individuals (OR = 1.816, 95% CI [1.471, 2.241]). This may reflect the physical activity, routine, or financial stability associated with employment, which could facilitate faster functional recovery. In contrast, age (OR = 1.767, $p = .18$), gender (OR = 1.008, $p = .969$), and marital status (OR = 0.914, $p = .746$) were not statistically significant, indicating that these factors did not independently contribute to functional QoL outcomes in this study.

The analysis revealed that ethnicity, education, and occupation were statistically significant predictors of functional QoL, while age, gender, and marital status were not.

4.16 SOCIO-ECONOMIC AND FUNCTIONAL QUALITY OF LIFE

A BLR was conducted to examine the association between socio-economic factors and functional QoL among individuals involved in road traffic injuries. The independent variables included individual income, household income, and household size.

Household size had a strong and significant positive association with functional QoL ($p < .001$). Respondents from larger households were approximately four times more likely to report good functional QoL outcomes (OR = 4.035, 95% CI [2.297, 7.088]), compared to those from smaller households. This suggests that larger family units may provide increased emotional, physical, and logistical support, which can facilitate functional recovery after injury. In contrast, individual income (OR = 0.718, 95% CI [0.277, 1.862], $p = .49$) and household income (OR = 1.060, 95% CI [0.589, 1.908], $p = .84$) were not statistically significant predictors of functional QoL. These results suggest that financial resources alone may not be sufficient to explain differences in functional recovery, especially when other forms of support□ such as caregiving from household members□ play a more significant role. These findings highlight the importance of considering family structure and social support, in addition to economic indicators, when assessing recovery trajectories in post-crash functional health.

Overall, only household size was found to be a statistically significant predictor of functional QoL.

4.17 INJURY STATUS AND FUNCTIONAL QUALITY OF LIFE

The BLR analysis revealed that the overall model was statistically significant, as in□ i□ a□ e□ □ □ □ □ e □ □ ni□ us □ es□ o□ □ o□ e□ □ oe df = 4, p = 0.014) χ^2 □ □ □ □ suggesting that the combination of predictors reliably distinguished between the outcome categories. The model explained approximately 3.0% of the variance in the DV, based on the Nagelkerke R Square value of 0.030. Additionally, the Hosmer and Lemeshow goodness-of-fit test was not significant □ χ^2 □ □ □ □ □ □ □ □ □ □ □ □ □ □ indicating that the model fit the data well.

In terms of individual predictors, injury severity coded under minor injuries was associated with a lower likelihood of the outcome (B = -0.459, OR = 0.632, 95% CI: 0.370□1.078), suggesting a 36.8% reduction in odds compared to the reference group. Although this result approached statistical significance ($p = 0.092$), it did not meet the conventional threshold of $p < 0.05$. For moderate injuries, the odds of the outcome were 1.37 times higher (OR = 1.365, 95% CI: 0.786□2.370), though the association was not statistically significant ($p = 0.269$). Similarly, serious injuries yielded an odds ratio of 1.197 (95% CI: 0.335–4.281, $p = 0.782$), indicating a non-significant association with a wide confidence interval. The type of injury, specifically those with fractures, was also not a significant predictor ($B = -0.192$, $OR = 0.825$, 95% CI: 0.501–1.359, $p = 0.451$), indicating a 17.5% reduction in odds compared to non-fracture injuries. The constant term was also non-significant ($B = 0.012$, $p = 0.960$).

In summary, while the overall model was significant and demonstrated a good fit, none of the variables independently predicted the outcome at a statistically significant level. However, the near-significance of minor injuries suggests a possible trend that warrants further investigation in future studies.

4.18 PRE CRASH AND FUNCTIONAL QUALITY OF LIFE

A BLR analysis was performed to assess the relationship between selected predictors—motorcycle license ownership, role as motorcyclist or pillion rider, purpose of travel, and insurance coverage—and functional QoL among road traffic injury respondents. The overall model was statistically significant ($p < .001$), indicating that the predictors reliably distinguished between respondents with high and low functional QoL outcomes one month post-discharge.

Respondents who did not possess a valid motorcycle license had significantly lower odds of reporting high functional QoL compared to those who were licensed ($OR = 0.231$, 95% CI [0.088, 0.606], $p = .003$). This suggests that unlicensed riders experienced a substantial disadvantage in terms of functional recovery. Additionally, pillion riders had significantly better functional QoL outcomes compared to motorcyclists. Specifically, pillion riders were more than twice as likely to report high functional QoL ($OR = 2.104$, 95% CI [1.273, 3.476], $p = .004$), indicating that injury severity and recovery may differ between these two user types. The purpose of travel was also a significant predictor. Individuals who traveled for non-work-related purposes (such as personal visits, errands, or leisure) were significantly less likely to report high functional QoL compared to those who traveled for work-related purposes ($OR = 0.319$, 95% CI [0.221, 0.461], $p < .001$). This suggests that work-related travel may be associated with more structured environments, support systems, or access to resources that facilitate better functional outcomes. Furthermore, respondents who did not have private insurance coverage (e.g., life insurance or Takaful) were significantly less likely to achieve high functional QoL compared to insured respondents (OR = 0.512, 95% CI [0.355, 0.737], $p < .001$). The absence of insurance may contribute to delays in accessing rehabilitation services or added financial stress, both of which can hinder recovery.

Additionally, the result indicated a statistically significant association between recent crash history and functional QoL ($p < .001$). Respondents who had experienced an crash in the last year were significantly less likely to report good functional QoL compared to those who had not. Specifically, those with a recent crash history had approximately 85% lower odds of experiencing good functional QoL (OR = 0.152, 95% CI [0.077, 0.299], $p < .001$). This suggests that repeated or recent trauma may negatively affect physical function recovery, possibly due to compounded injuries, delayed healing, or psychological stress that hinders participation in daily activities. These findings underscore the importance of identifying individuals with repeated crash exposure as a high-risk group for poor functional outcomes and highlight the need for more intensive post-crash rehabilitation and support for these individuals.

Overall, motorcycle license, pillion, traveler of non-work related, ownership of insurance, and past experience of crash were significantly influenced the predictor for functional QoL.

4.19 SOCIO-DEMOGRAPHIC AND PHYSICAL QUALITY OF LIFE

A BLR analysis was conducted to identify socio-demographic factors associated with physical QoL one month post-injury among RTI survivors. The IVs included age, gender, ethnicity, education, marital status, and occupation.

Ethnicity was significantly associated with physical QoL ($p = .009$). Respondents from certain ethnic groups had 30% lower odds of experiencing good physical QoL compared to others (OR = 0.701, 95% CI [0.537, 0.915]). This finding may reflect disparities in healthcare access, cultural health practices, or post-discharge support among different ethnic communities. Education level showed a strong and significant relationship with physical QoL ($p < .001$). Individuals with lower education levels were significantly less likely to report high physical functioning (OR = 0.482, 95% CI [0.338, 0.689]).

This may indicate that higher education contributes to better health literacy, awareness of recovery practices, and engagement with healthcare services, which support better physical outcomes. Occupation was also a significant predictor ($p < .001$). Employed individuals were nearly 1.8 times more likely to report high physical QoL compared to unemployed individuals (OR = 1.816, 95% CI [1.471, 2.241]). Employment may promote physical recovery through better access to medical benefits, physical activity, and structured daily routines. In contrast, age (OR = 1.767, $p = .18$), gender (OR = 1.008, $p = .969$), and marital status (OR = 0.914, $p = .746$) were not statistically significant, indicating that these variables did not independently influence physical QoL within this sample.

Overall, the analysis revealed that ethnicity, education, and occupation were statistically significant predictors of physical QoL, while age, gender, and marital status were not.

4.20 SOCIO-ECONOMIC AND PHYSICAL QUALITY OF LIFE

A binary logistic regression analysis was conducted to assess the influence of socio-economic factors including individual income, household income, and household size on physical QoL among individuals who sustained RTIs. The results showed that all three socio-economic variables were statistically significant predictors of physical QoL. Individual income was negatively associated with physical QoL ($p = .006$). Respondents with lower income had significantly lower odds of reporting good physical QoL (OR = 0.214, 95% CI [0.071, 0.647]).

This suggests that lower personal income may limit access to post-injury care and rehabilitation services, thereby hindering physical recovery. Household income demonstrated a strong positive association with physical QoL ($p = .002$). Respondents from higher-income households were three times more likely to report good physical QoL compared to those from lower-income households (OR = 3.013, 95% CI [1.521, 5.967]).

This implies that economic stability at the household level may facilitate better healthcare access, home care support, and nutrition, contributing to improved physical functioning. Household size also emerged as a significant predictor ($p = .028$). Individuals from larger households were about 1.8 times more likely to report good physical QoL (OR = 1.774, 95% CI [1.065, 2.955]). This could reflect the advantages of having more family members available to provide physical assistance and encouragement during the recovery period. These findings highlight that both economic resources and family structure play critical roles in influencing post-crash physical health outcomes.

Overall, the analysis indicated that personal income, household income and household size are the predictors of physical QoL.

4.21 INJURY STATUS AND PHYSICAL QUALITY OF LIFE

A BLR analysis was performed to investigate the relationship between injury-related factors — specifically, type of injury and injury severity — and the physical domain of QoL. The overall model was not statistically significant, as indicated by the Omnibus Test of Model Coefficients, χ^2 [illegible] predictors did not significantly improve the model compared to the null model. Additionally, the Hosmer and Lemeshow goodness-of-fit test was non-significant, χ^2 [illegible] 0.790, indicating that the model adequately fits the data. However, the explanatory power of the model was very limited, with Cox & Snell $R^2 = 0.005$ and Nagelkerke $R^2 = 0.007$. This indicates that the model accounts for less than 1% of the variance in physical QoL.

In terms of individual predictors, neither the type of injury nor the overall injury severity (MAIS) was statistically significant ($p = 0.327$ and $p = 0.794$, respectively). Respondents with fractures were 1.28 times more likely to report a higher physical QoL compared to those without fractures (OR = 1.280; 95% CI: 0.781–2.098). However, this result was not statistically meaningful. Similarly, all individual levels of injury severity (minor, moderate and serious) showed no significant association with physical QoL ($p > 0.05$). The constant term was also non-significant ($p = 0.694$), indicating no baseline tendency toward a higher physical QoL when all predictors were at their reference levels. Overall, this analysis suggests that neither the type of injury nor its severity had a significant effect on the physical dimension of QoL in this sample.

This analysis looked at whether the type and severity of injuries from a crash affected how well people felt physically afterwards. The results showed that neither the type of injury (like having a fracture) nor how serious the injury was had a clear link to how people rated their physical well-being. In short, these injury-related factors did not seem to make a big difference in how good or bad people felt physically after the crash. This result may be due to the timing of the measurement, as respondents with fractures had already healed and felt better, while others with non-fractures might still be experiencing physical discomfort, which could require a longer time to heal.

4.22 PRE CRASH AND PHYSICAL QUALITY OF LIFE

A BLR analysis was performed to assess the relationship between selected predictors□ motorcycle license ownership, role as motorcyclist or pillion rider, purpose of travel, and insurance coverage□ and physical QoL among road traffic injury respondents. The overall model was statistically significant ($p < .001$), indicating that the set of predictors reliably explained variations in physical QoL one month post-discharge.

While motorcycle license ownership was not statistically significant at the 5% level ($p = .072$), the odds ratio (OR = 0.420, 95% CI [0.164, 1.080]) suggested a trend whereby unlicensed riders had lower odds of reporting high physical QoL compared to those with a valid license. Although not conclusive, this may indicate that licensing status still holds practical relevance in predicting physical recovery. Regarding road user type, pillion riders had significantly higher odds of reporting good physical QoL compared to motorcyclists (OR = 0.523, 95% CI [0.322, 0.850], $p = .009$). This suggests that motorcyclists may sustain more severe injuries affecting their physical function. The purpose of travel was also a significant predictor. Those who traveled for non-work-related purposes were less likely to experience high physical QoL than those who traveled for work-related reasons (OR = 0.547, 95% CI [0.380, 0.788], $p = .001$). This may reflect differences in the structure, urgency, or context of travel, which could influence the severity of incidents and subsequent physical recovery. Importantly, lack of insurance coverage was strongly associated with lower physical QoL. Respondents without private insurance were 68% less likely to report good physical functioning (OR = 0.320, 95% CI [0.223, 0.459], $p < .001$) compared to those who had coverage. This highlights the protective role of insurance in facilitating access to treatment and rehabilitation services following injury.

Additionally, the analysis revealed a statistically significant association between recent crash history and physical QoL ($p < .001$). Individuals who reported being involved in a road traffic crash within the past year were significantly less likely to report good physical QoL compared to those who had not experienced a recent crash. Specifically, the odds of reporting good physical QoL were 93.1% lower among those with recent crash experience (OR = 0.069, 95% CI [0.027, 0.175], $p < .001$). This finding suggests that the physical effects of repeated or recent trauma may hinder recovery and limit the ability to return to pre-crash levels of physical function.

Overall, the analysis indicated that age, purpose of travel, ownership of insurance, and having experienced an crash previously were significantly influenced by physical QoL, while license ownership was not.

Table 4.19 Results of Binary Logistic Regression Analysis for Factors Associated with Emotional Measurement

Variables	B (Log – Odds)	SE	Wald	OR (Exp (B)	95% CI for OR	p-value
Socio-demographic						
Age	0.569	0.242	5.548	1.767	1.100-2.837	0.18
Gender	0.008	0.217	0.001	1.008	0.658-1.544	0.969
Ethnicity	-355	0.136	6.819	0.701	0.537-0.915	**0.009**
Education	-729	0.182	16.112	0.482	0.338-0.689	**<0.001**
Marriage Status	-0.090	0.279	0.105	0.914	0.529-1.579	0.746
Occupation	0.596	0.107	30.869	1.816	1.471-2.241	**<0.001**
Socio-economic						
Income	-6.22	0.516	1.455	0.537	0.195-1.475	0.22
Household income	0.859	0.339	6.414	2.361	1.214-4.590	**0.01**
Household size	1.949	0.341	32.633	7.021	3.598-13.703	**<0.001**
Injury status						
Type of injury	-0.483	0.256	3.552	0.617	0.373-1.019	**0.059**
Injury severity	-0.498	0.222	3.003	0.068	0.355-1.040	0.069
Pre-Crash status						
Have a motorcycle license	-2.491	0.656	14.399	0.083	0.023-0.300	**<0.001**
Respondents are either motorcyclists or pillion riders	1.231	0.281	19.248	3.425	1.976-5.938	**<0.001**
Purpose of travel during the crash	-1.307	0.194	45.482	0.271	0.185-0.396	**<0.001**
Have insurance	-0.800	0.192	17.340	0.449	0.308-0.655	**<0.001**
Crash experiences over the last 1 year	-2.401	0.411	34.069	0.091	0.040-0.203	**<0.001**

Table 4.20 Results of Binary Logistic Regression Analysis for Factors Associated with Functional Measurement

Variables	B (Log – Odds)	SE	Wald	OR (Exp (B)	95% CI for OR	p-value
Socio-demographic						
Age	0.569	0.242	5.548	1.767	1.100-2.837	0.18
Gender	0.008	0.217	0.001	1.008	0.658-1.544	0.969
Ethnicity	-355	0.136	6.819	0.701	0.537-0.915	0.009
Education	-729	0.182	16.112	0.482	0.338-0.689	<0.001
Marriage Status	-0.090	0.279	0.105	0.914	0.529-1.579	0.746
Occupation	0.596	0.107	30.869	1.816	1.471-2.241	<0.001
Socio-economic						
Income	-0.331	0.486	0.465	0.718	0.277-1.862	0.49
Household income	0.059	0.300	0.038	1.060	0.589-1.908	0.84
Household size	1.395	0.287	23.543	4.035	2.297-7.088	<0.001
Injury status						
Type of injury	-0.192	0.254	0.570	0.825	0.501-1.359	0.451
Injury severity	-0.459	0.273	2.836	0.632	0.370-1.078	0.092
Pre-Crash status						
Have a motorcycle license	-1.467	0.493	8.844	0.231	0.88-0.606	<0.003
Respondents are either motorcyclists or pillion riders	0.744	0.256	8.421	2.104	1.273-3.476	<0.004
Purpose of travel during the crash	-1.142	0.188	39.962	0.319	0.221-0.461	<0.001
Crash experiences over the last 1 year	-1.883	0.344	29.888	0.152	0.077-0.299	<0.001

Table 4.21 Results of Binary Logistic Regression Analysis for Factors Associated with Physical Measurement

Variables	B (Log – Odds)	SE	Wald	OR (Exp (B)	95% CI for OR	p-value
Socio-demographic						
Age	0.569	0.242	5.548	1.767	1.100-2.837	0.18
Gender	0.008	0.217	0.001	1.008	0.658-1.544	0.969
Ethnicity	-355	0.136	6.819	0.701	0.537-0.915	0.009
Education	-729	0.182	16.112	0.482	0.338-0.689	<0.001
Marriage Status	-0.090	0.279	0.105	0.914	0.529-1.579	0.746
Occupation	0.596	0.107	30.869	1.816	1.471-2.241	<0.001
Socio-economic						
Income	-1.542	0.564	7.467	0.214	0.071-0.647	0.006
Household income	1.103	0.349	10.009	3.013	1.521-5.967	0.002
Household size	0.573	0.260	4.846	1.774	1.065-2.955	0.028
Injury status						
Type of injury	0.247	0.252	0.962	1.280	0.781-2.098	0.327
Injury severity	-0.079	0.269	0.087	0.924	0.545-1.565	0.768
Pre-Crash status						
Have a motorcycle license	0.866	0.481	3.239	0.420	0.164-1.080	0.072
Respondents are either motorcyclists or pillion riders	-0.648	0.248	6.841	0.523	0.322-0.850	**0.009**
Purpose of travel during the crash	-0.603	0.186	10.470	0.547	0.322-0.850	**0.009**
Have insurance	-1.140	0.185	38.047	0.320	0.223-0.459	**<0.001**
Crash experiences over the last 1 year	-2.671	0.475	31.628	0.069	0.027-0.175	**<0.001**

CHAPTER V

DISCUSSIONS

5.1 INTRODUCTION

Chapter V focuses on the results that are described in Chapter IV and represents a good analysis and examination of the results, and is further accompanied by other related similar works. An excellent method of arranging the discussion is to discuss each research aim one by one, and each aim should be discussed comprehensively with sufficient literature and articles. Not only does this chapter review the principal findings, but it also places those findings in the context of the available body of research writing about them and, in the process, sheds insights and makes links to previous literature. Moreover, implications of the findings are discussed to indicate potential implementations and further studies. In this elaborate explanation, Chapter V strives to present a coherent narrative, which interrelates the research goals to the actual findings with reference to academic sources and empirical data.

5.2 RESPONSE RATE

This research dispatched out 875 questionnaires exceeding the calculated required sample size of 820. In survey research, it is widely acknowledged that response rates are unpredictable and that researchers often distribute more questionnaires than the minimum required sample size to achieve sufficient valid responses for analysis (Sahlqvist et al., 2011; Smith et al., 2019). This approach is particularly relevant in field-based and health-related studies where non-response is common and cannot be fully controlled during data collection (Pickery & Carton, 2008). From those 875 questionnares have yielded a total of 546 responses, equating to a response rate of 62.4% which adheres to recognized survey criteria (Fincham 2008) and aligns favorably with road-safety contingent-valuation literature, where participation rates are sometimes restricted or unreported (Andersson Järnberg et al. 2024). The rate similar to study by Kenardy et al. (2015) in the study related to The Effect of Mental Health on long term health related quality of life following a road traffic crash. The identified moderate response rate is also in line with typical reporting in similar research in public health studies, and particularly when working with a patient population. The use of health centers to recruit research respondents is problematic, mainly because of time constraints, changing health conditions, variability of interest or confidence in research processes. It is plausible that the COVID-19 pandemic also played a significant role in the identified response rate. The fear of an infection and fear of being involved in something non-essential influenced the engagement critically during the studied period.

The guided interviews mechanism used in data collection must have discouraged the participation of many who did not want to be involved physically or believed that the method was too time-consuming or intrusive during the pandemic backed by the reasons of fear of infection and following the principles of social isolation that have been promoted during the pandemic.

Despite these challenges, a response rate of approximately 60% is deemed acceptable, with similar figures noted in public health studies, including National Health Survey (NHS) - inpatient surveys that reported response rates of 63% in 2004 and 59% in 2005 (Europe 2004;Garratt 2009). The challenges in patient-centered research are considerable. However, the response rate achieved indicates a satisfactory level of engagement within the context, establishing a strong basis for data analysis and subsequent findings.

5.3 PROFILING RESPONDENTS' SOCIO-DEMOGRAPHIC

The predominant age group of respondents is 18–29 years (49.3%), followed by 30–64 years at 44.9%, and merely 5.9% are aged 65 and beyond. This youthful predominance signifies a demographic in its most vigorous and economically fruitful phase. The pronounced male predominance (76%) in the sample is especially remarkable across all age demographics, suggesting that males exhibit greater involvement in the activity or domain pertinent to this research. This distribution corresponds with general trends in motorcycling demography, as the study concentrates on riders. Young males frequently dominate high-risk pursuits like motorcycling, which is common as both a means of transport and a lifestyle in Malaysia. According to research findings, young males in Malaysia are particularly accepting of the privileges of riding because of the low cost, feasibility, as well as cultural affiliation (Rohana et al., 2020). This trend is in line with the results of other developing countries, showing that a large number of road traffic crashs can be linked to male motorcyclists, backed by research made in Thailand and Sudan. Research conducted by Chaturabong et al. (2011) indicated that in Thailand, male riders, especially among younger age groups, exhibit a lower propensity to invest in risk reduction measures. This may suggest an underlying overconfidence or a cultural perspective on risk-taking. In a similar vein, Adam et al. (2015) observed that vulnerable road users, including motorcyclists, represent a considerable share of fatalities in Sudan. Female participation in motorcycling is comparatively lower, likely attributable to cultural, sociological, and safety-related issues that dissuade their engagement (Manan & Varhelyi, 2012).

Additionally, the predominant age group of respondents is 18–29 years (49.3%), followed by 30–64 years at 44.9%, and merely 5.9% are aged 65 and beyond. This youthful predominance signifies a demographic in its most vigorous and economically productive phase. The significant male predominance (76%) in the sample is especially remarkable across all age groups, suggesting that males exhibit more involvement in the activity or area pertinent to this study. Younger males frequently dominate high-risk or economically active industries. However, females are underrepresented, potentially due to cultural, sociological, or contextual hurdles to participation. Research in Malaysia indicates that younger individuals, especially males, are more likely to participate in public surveys and initiatives, particularly those concerning income production or career advancement (Rahman et al., 2020). This is a trend that runs across several sectors, such as education and employment.

This trend is aligned with the findings made by Nor Ghani et al. (2003), which emphasized that such male motorists and particularly individuals of less than 30 years old form a significant pool of respondents when the topic of road safety meets questions related to economic productivity. Moreover, Dissanayake (2010) noted a similar age and gender distribution in road safety research in Thailand and noted that young males participate too much in risk-related activities, including motorcycling, due to their demographics that are more prone to risk-taking.

Residing in the self-employed or service worker category, younger men indicate trends of entrepreneurship and favorable choices of entry-level jobs in Malaysia (Yusof et al., 2020). The percentage of students in the 18 29 age range is 12.8, implying that a large concentration is on education among the age brackets. Out of the total number of people, 10.4% from the demographic of pensioners, the age bracket is mainly seen as 65 years and above, and this identifies the need to find specific policies that can be helpful in this regard in meeting the demands of this age bracket. The middle-aged, educated people (10.8%) relate to professional workers, which portrays their input in economic development and employment stabilization (Cheong et al., 2021).

This research has found that there was a significant gender bias in the population of the respondents, where 415 (76.0%) were male and 131 (24.0%) were female. A similar finding is consistent with national and regional road traffic data, which unanimously prove that males are overrepresented among motorcycle users and the victims of road crashes in Malaysia (Harith & Mahmud, 2018; Rahman et al., 2015). Men tend to ride motorbikes as a chief mode of transportation and are more likely than women to work in high-risk road settings because they travel more often, faster, and farther (Harith & Mahmud, 2018; Rahman et al., 2015). Additionally, out of male respondents (n = 415), a large percentage (87.7%, n = 364) were pillion riders, whereas only 51 (12.3%) of them were motorcyclists. Comparatively, 62.6% (n =82) of the female respondents (n=131) were pillion riders, whereas 37.4% (n =49) were motorcyclists.

This observed gender difference has important implications for interpreting the study results, particularly in relation to the Value of Statistical Life (VOSL) and post-injury Quality of Life (QoL). Previous research has shown that gender can influence risk perception, willingness to pay (WTP) for safety improvements, and coping mechanisms following injury (Rizzi & Ortúzar, 2006). Furthermore, the overrepresentation of male participants in this study is likely to reflect structural patterns of road use rather than sampling bias. Nevertheless, it highlights the need for gender-sensitive policy development, particularly in road safety campaigns, insurance schemes, and rehabilitation programs. Such targeted approaches may better address the behavioural patterns and safety needs of male motorcyclists and pillion riders, who remain the most vulnerable group in road traffic crash.

Next is the distribution of marital status among the respondents shows a nearly equal division, with 53.1% identifying as married and 46.9% as single. The observed gender imbalance may indicate differences in life stages, with males potentially remaining single for a longer duration than females, especially among younger age cohorts. This is consistent with the cultural norms observed in Malaysia, where men frequently place a higher emphasis on achieving career stability prior to entering into marriage (Idris et al., 2019). Married respondents may indicate increased participation among individuals who feel a heightened sense of responsibility or connection to the study topic, potentially associated with concerns regarding family safety, which are closely related to the area under study.

The distribution of occupations, characterized by the predominant categories of self-employed individuals (20.9%) and service workers (18.1%), illustrates the economic framework of Malaysia. The significant presence of self-employed individuals corresponds □ i□ □ □ a□ a□ sia's e□ □ an□ ing en□ re□ reneuria□ □ u□ □ ure□ as r Yusof et al. (2020). Government support for Small and Medium Enterprises (SMEs) has contributed to a rise in self-employment, especially among the youth demographic. The younger age group, comprising 12.8% of students, demonstrates significant engagement in education. This is consistent with the trend in the country of paying high attention to educational attainment as being of ultimate importance to economic development. This is because pensioners make up 10.4% of the population, and professional workers assume 10.8% of the older and more experienced members of the national workforce contribute to the economy of the nation (Abdullah et al., 2018).

Collectively, these findings suggest that RTI prevention strategies should be specifically tailored toward young, educated working males to effectively reduce the incidence rate within this high-risk demographic which similar to studies executed by (Champahom et al. 2023; Chaturabong et al. 2011; Mon et al. 2018).

5.4 PROFILING SOCIO-ECONOMIC

Considering the socioeconomic characteristics of motorcyclists, a clear trend can be observed in which respondents from the lower-income group constituted a substantial proportion of the study population, highlighting the affordability of motorcycles as a mode of transportation. A total of 81.7% of motorcyclists were from the B40 category, indicating a monthly income below RM4,850. In contrast, only 3.1% of respondents were from the M40 category, while none were from the T20 category. This low representation of higher-income groups suggests that motorcycles may not be the preferred primary mode of transport among individuals with greater financial capacity, who are more likely to use private cars or other alternative transportation options (Rahman et al., 2023).

This finding is consistent with previous studies in Malaysia. A report by the Malaysian Institute of Road Safety Research (MIROS) found that the majority of motorcyclists in Malaysia are from lower-income groups, as motorcycles are considered a more economical form of transportation (Nuura et al., 2010). Similarly, Nor Ghani et al. (2003) and Rosli et al. (2024) stated that motorcycles are disproportionately used by lower-income households, which consequently increases their exposure to road crashes and related injuries.

Distribution of household income shows that 77.3% of respondents are members of B40 households, 7.0% of M40 households and only 0.5% of T20 households. The coincidence in the income levels of the individuals and the households represents the economic challenges experienced by motorcyclists. In low-income houses, the use of motorcycles is often necessitated by the feasibility of using them, as they are the least expensive in terms of buying, maintenance, and fuel consumption. The statistics highlight the fact that economic restrictions can shape people, and at the same time reflect broader financial conditions of households, which lead to collective transport choices. The data indicates that the majority of respondents originate from small-sized households, which make up 86.5% of the sample. In contrast, medium-sized households comprise 12.8%, and large households account for only 0.7%. The occurrence of small households indicates that motorcyclists within this demographic are probably single individuals, couples without children, or small family units. This demographic characteristic may impact their economic behavior and dependence on motorcycles as a cost-effective mode of transportation (Ahmad et al., 2022). The correlation between smaller-sized households and motorcyclists is consistent with national survey findings, indicating that individuals or smaller households tend to rely more on affordable transportation options like motorcycles (Faudzi et al., 2011). This demographic profile highlights economic difficulties and restricts access to safer, more costly transportation options such as cars, underscoring the necessity for cost-effective safety measures aimed at B40 groups.

Overall, The findings of this study highlight a profound socioeconomic disparity, with an overwhelming 96% of RTI respondents belonging to the B40 income group. This concentration aligns with broader literature suggesting that road traffic injuries (RTIs) disproportionately affect individuals in low-to-middle-income brackets (LMICs) who often rely on higher-risk modes of transport, such as motorcycles (Teh et al., 2023). In Malaysia, the B40 group is officially defined as households earning a total monthly income of RM4,360 or below, a threshold that characterizes nearly the entire respondent pool in this study (Zakaria et al., 2022).

The data further reveals that 91% of respondents' household incomes fall within the B40 category, and 86.8% reside in small households. This socioeconomic profile creates a vulnerability trap, research indicates that for low-income families, even minor injuries can lead to significant financial instability due to medical costs and loss of productivity (Alkhatni et al., 2023; Mohd Misban et al., 2023). In a small household where the primary earner is often a young male□ as seen in the sociodemographic data□ an RTI can result in a total loss of income, forcing the family to live frugally and without luxury to survive the crisis (Zakaria et al., 2022).

Furthermore, the high prevalence of RTI within the B40 group may be linked to active transportation and commuting patterns. Lower-income individuals often reside in areas or work in roles that require frequent travel, yet they may lack the financial resources for safer vehicle options or advanced safety measures like Child Restraint Systems (CRS), which are often underutilized in lower-income demographics (Ramli & Mohd Yunus, 2020). Consequently, the socioeconomic findings of this study emphasize that RTIs are not merely a health issue but a significant driver of economic □ ar□ s□ i□ □ or □ a□ a□ sia's □ os□ vu□ nera□ □ e □ o□ u□ a□ ions□

5.5 PROFILING INJURY STATUS

The present study explored the patterns and severity of injuries sustained by motorcycle crash victims, focusing on age, gender, crash history, and the role as either motorcyclist or pillion rider. The most common type of injury recorded across all demographic and crash-related variables was fracture, accounting for 342 out of 546 total cases. This high prevalence of fractures is consistent with findings by Francis et al. (2021), who noted that orthopedic trauma remains the most frequent morbidity in motorcycle-related crashes due to the lack of external vehicle protection. Among the age groups, young individuals (n = 185) experienced the highest number of fractures, followed by adults (n = 140) and the elderly (n = 17). This suggests that younger individuals are more susceptible to fractures, potentially due to higher levels of activity, speed, or risky behavior while riding a trend supported by Fui et al. (2022), who identified young riders as a high-risk group for severe skeletal trauma.

Additionally, injury severity was assessed using the Maximum Abbreviated Injury Scale (MAIS). Across the cohort, the most common injury classifications were minor injuries (n = 198, 36.3%) and moderate injuries (n = 197, 36.1%). Among younger individuals, moderate injuries (n = 110) were more frequently reported compared to minor (n = 83) and serious injuries (n = 71). In contrast, elderly victims showed a relatively higher proportion of serious injuries, accounting for 28.1% (n = 9 out of 32) of cases. This finding is consistent with previous research suggesting that older individuals are more vulnerable to trauma due to reduced physical resilience and the presence of pre-existing conditions (Teh et al. 2023). These findings highlight the need for targeted interventions for older road users.

Gender differences were also notable. Males comprised the majority of the sample (76.0%) and consistently reported higher frequencies of all injury types compared to females. Fractures were predominantly observed among males (n = 250) versus females (n = 92), followed by soft tissue injuries (n = 44 vs. n = 13), abrasions (n = 52 vs. n = 11), and lacerations (n = 30 vs. n = 6). Similarly, when classified by severity, males experienced more serious injuries (n = 108) than females (n = 33). These trends may reflect gender-related behavioral differences in road usage, with men generally engaging in higher-speed or riskier riding practices (Musa et al, 2020).

Further analysis based on the rider's role in the crash revealed that pillion riders accounted for a greater proportion of total injuries (n = 446) compared to motorcyclists (n = 100). Interestingly, pillions recorded substantially more fracture cases (n = 283) than motorcyclists (n = 59), indicating increased vulnerability despite their passive role with abrasions and soft tissue injuries were more common among pillions. According to Ramli and Mohd Yunus (2020), pillion riders often face higher risks because they may not anticipate the impact or lack the same level of protective gear as the rider. Although motorcyclists had fewer total injuries, they exhibited a relatively higher proportion of serious injuries (n = 26%), suggesting that the nature of impact experienced by active riders may be more severe in certain cases. This underscores the importance of protective equipment and road safety education not only for motorcyclists but also for pillion riders.

With regard to crash history, only 63 respondents reported involvement in a crash within the past year. Among these, fractures were the most frequent injury (n = 42), followed by abrasions (n = 8) and soft tissue injuries (n = 5). MAIS severity levels among those with recent crashes showed nearly equal proportions of minor (n = 21), moderate (n = 21), and serious injuries (n = 20). According to these findings, although the crash cases in the latest records were fewer, they show diversity and also clinically important injuries. This may indicate the differences in the severity of crashes and the use of protective equipment (Zamzuri & Qi 2022).

Taken together, the results show that fractures continue to be the predominant injury within all the stratified categories, regardless of age, gender, reporting history, or the role of a rider. Such a high proportion of moderate-to-severe injuries and the high incidence of fractures indicate the need to implement certain types of prevention measures. These can comprise increased use of protective equipment on motorcyclists and pillion riders, age-related awareness campaigns and gender-sensitive road safety measures. Hence, intensifying such work can be particularly important in minimizing the health and economic costs of motorcycle-impaired injuries particularly the B40 group who bear the highest financial burden (Yasin et al. 2024).

5.6 PROFILING PRE CRASH STATUS

The pre-crash status of the study participants provides important insights into the situational characteristics associated with motorcycle crashes. A large proportion of the individuals involved in the crashes were pillion riders (69.3%), which is consistent with previous studies highlighting the vulnerability of pillion riders due to their limited control over the motorcycle and the lack of adequate protective gear in many cases (Rahman et al., 2015). This trend underscores the importance of strengthening safety campaigns and policy interventions related to pillion rider safety and awareness, particularly in countries where motorcycles are commonly used as a mode of transportation, such as Malaysia.

In addition to rider position, licensing status was also examined. A high proportion of respondents (79.5%) reported having a valid motorcycle license; however, the occurrence of crashes suggests that possessing a license alone does not necessarily translate into safer riding behaviour. This finding is consistent with previous studies indicating that while licensing is essential, it should be complemented with continuous rider education and behaviour modification strategies (Goodwin et al., 2022).

Further examining the situational context of crashes, 48.5% of respondents reported being on a work-related journey at the time of the crash, indicating that occupational travel constitutes a significant context for motorcycle crashes. This reflects broader socio-economic patterns in which motorcycles are commonly used as a primary mode of transport among the working population, largely due to affordability and convenience. Therefore, occupational safety policies should also address transport-related risk factors and consider supportive measures to promote safer commuting practices.

Patterns of insurance coverage were also indicative, with 34.5% of the people covered not having any form of private insurance. This gap in protection raises concerns about financial vulnerability in the aftermath of road traffic injuries, especially among lower-income groups. The promotion of affordable Takaful or micro-insurance products could be an important policy step to mitigate the economic consequences of injury.

Although most respondents (80%) had not experienced road crashes in the past year, the minority who did report incidents often required outpatient care, with a small number needing hospital admission. The injuries were largely classified as slight (8.4%) or moderate (1.4%), suggesting that while the frequency of repeat incidents was relatively low, the health burden from even a single crash can be significant.

Overall, the data emphasise the importance of tailoring motorcycle safety interventions to riders and pillion passengers, and addressing the vulnerabilities particularly in the context of work-related travel and access to insurance. These findings can inform the development of policies, road safety education programs, and insurance frameworks aimed at reducing injury severity and enhancing post-crash support systems.

5.7 RESPONDENTS' ATTITUDES TOWARDS THE LOCAL ROAD SAFETY IMPROVEMENT

The results of this research indicate that there was a remarkable awareness and concern among the respondents about the road safety conditions in the locality. The finding that almost all the participants acknowledged the significance of road safety in their societies (99.8%) closely resembles other studies that have highlighted the level of concern that people have in regard to traffic risks, particularly within those societies where the rate of motorcycle use is high (Abdul Manan & Várhelyi, 2012). This globally ascribed consensus indicates that road safety is a technical concern and a socially agreed-upon factor that requires a common concern and solution.

The vast majority of the respondents have taken into consideration the necessity of particular enhancements of the existing road safety standards. Note that 99% of them admitted the necessity to make improvements in terms of road preservation and maintenance, use of motorcycle-dedicated lanes, and speed control technologies. This is in line with notes in the data that support the improvement of infrastructure and electronic interventions in addressing the traffic-related injuries and deaths (Peden et al., 2004). The awareness of these targeted improvements highlights the knowledge of ordinary people about feasible and successful safety measures.

Critically, 98.3% of the participants had the perception that the existing road safety approaches need to be improved significantly. This opinion can either signify the disappointment with the ongoing actions or a realization that the risks associated with using a road are continuous and that people commonly exposed to them are motorcyclists and pillion riders, who are overrepresented in low- and middle-income countries (WHO, 2018). In addition, the perception that road users can also contribute immensely to enhancing road safety was strongly supported by 83.5% of the respondents in injury reduction and 95.9% with regard to the reduction of fatalities. This observation confirms the concept of shared responsibility in road safety, where citizens and individuals must be engaged, educated, and not only governments that implement regulations and planning of infrastructures that contribute to road safety.

It is noteworthy to mention that 81.5% of respondents expected that they were going to get engaged in a road crash in the next five years. This perceived vulnerability implies internalization of risk, something that can be utilised when developing specific and potent awareness campaigns/interventions. Nevertheless, it also magnifies the perceived shortcomings of existing safety regimes, which supports the necessity to maintain constant observation, adjustment of the policy, and user-oriented safety initiatives.

In general, the findings indicate an informed citizen who understands the importance of road safety concerns and adheres to the importance of infrastructure development, technological implementation, and the power within individuals. Policies on road safety in the future should take lessons from these insights, merging top-down (governmental) and bottom-up (community-based) policies so that the results could be effective and sustainable.

5.8 THE COST OF FATALITY AND INJURY

This paper has estimated the VOSL for Malaysian motorcyclists through the individual WTP Contingent Valuation Method (CVM) to reduce risk. The findings denote that the WTP risk reduction of fatality was between RM94,058.41 and RM101,293.66, and the WTP risk of injury was between RM24,494.88 and RM28,849.52. These valuations are the summation of economic value and individual places on marginal improvements in fatal and non-fatal crash risks and thus can be used as a crucial input in cost-benefit analysis of road safety policies.

When compared with previous studies, the estimated VOSL in this research is considerably lower. For instance, Nor Ghani et al. (2003), in a comprehensive nationwide survey involving Malaysian motorists, reported a much higher VOSL value ranging from RM1.28 million to RM3.13 million, depending on the level of risk reduction scenarios presented. Their estimated conservative benchmark for policymaking was RM1.2 million. In contrast, the present study's VOSL is so much lower. This stark difference can be explained by several contextual and methodological factors. Firstly, the earlier study surveyed a large population sample under normal socioeconomic conditions. Meanwhile, the current study was conducted during the COVID-19 pandemic. This period significantly influenced the economic priorities and risk perceptions of respondents. In times of economic uncertainty, individuals are likely to exhibit more conservative WTP responses, leading to lower derived VOSL values. This is consistent with the economic theory that WTP is income-sensitive (Bateman et al. 2002), and risk valuation tends to be depressed during financial strain. Additionally, the observed decline in WTP in this study might reflects a broader trend of economic recalculation among individuals during the COVID-19 era. This finding is supported by recent research in Semarang, which demonstrated that the pandemic significantly lowered WTP across all membership tiers of the National Health Insurance (JKN) system. Dianingati et al. (2024) found that this shift was primarily driven by the instability of the informal sector and a subsequent change in household consumption patterns. Their data revealed that as potential fees increased, rejection rates climbed as high as 94%, suggesting that during periods of macroeconomic shock, individuals prioritize immediate liquidity over long-term service premiums. By aligning with these two findings, it supports that WTP is not a static value but is deeply sensitive to the external economic pressures introduced by the pandemic.

Furthermore, the former studies were done nationwide. They covered the public populations of Malaysia, whereas the current studies were particularly focused on the population that is directly exposed to health hazards in two public hospitals. Therefore, the differences were predictable.

Similarly, comparison with Chaturabong et al. (2011), who conducted a WTP study on motorcycle crashs in Thailand, further highlights the influence of local economic contexts and risk perception. Chaturabong reported VOSL estimates for motorcyclists ranging from USD 94,710 to USD 143,390 (equivalent to approximately RM380,000 to RM575,000 at the time), which are still significantly higher than the VOSL in this study. The difference may again be attributed to the economic environment in which the current survey was conducted, along with potentially greater fatalism or risk normalization among Malaysian motorcyclists, especially during and post-pandemic.

Despite the lower valuation, the findings remain highly relevant for policymaking. In fact, the modest WTP for fatality and injury risk reduction estimates suggest that even low-cost road safety interventions□ such as targeted awareness campaigns, improved helmet compliance, or stricter enforcement□ may be economically justifiable. These values also reflect the specific priorities and realities of motorcyclists, a vulnerable group in Malaysia's traffic ecosystem. Moreover, the estimation derived in this study provides a meaningful representation of the value road users place on safety, even when faced with uncertain circumstances. The acts that establish a state of uncertainty (be it economic fluctuations, pandemics, unforeseen risks) have the potential to formulate the priorities and choices of individuals in relation to finance. The recent valuation trends are significant to take into consideration because they might provide a new angle on how the resources can be distributed in periods like these. This implies that road users can perceive the value of safety investments regardless of periods of stability or turbulence, and this should drive the acceptance of the VOSL results in terms of policy and budget calculations.

Conclusively, although WTPs of fatality/injury risk reduction calculated in this research are significantly lower compared to those that were obtained in earlier years of conducting a similar study, the outcome actually reflects the current value humans in the population place on their safety during such a period of socioeconomic unstable times. These results highlight the necessity of context-specific economic analysis when planning road safety and set a realistic benchmark to assess the cost-effectiveness of interventions against motorcycle-related injury and death.

5.9 WILLINGNESS TO PAY

The following discusses factors associated with WTP for fatality, injury, road safety programs and medical treatment for injury and some comparison of current findings with other similar studies.

5.9.1 Factors associated with WTP for fatality risk reduction

The findings from the Generalized Linear Model (GLM) analyses offer a comprehensive view of the socio-demographic, socio-economic, injury-related, and pre-crash factors influencing fatality risk reduction through WTP for retroreflective tape among motorcyclists and pillion riders. Socio-demographically, Model 1 (actual WTP) revealed that most variables□ including age, gender, race, marital status, and occupation□ were not statistically significant, except for the highest education level ($p = 0.013$), suggesting that education influences individuals' safety-related spending behavior. In contrast, Model 2 (maximum WTP) showed that race (Malay and Chinese) and primary education were significant predictors, indicating that socio-cultural background and basic education levels can shape the perceived value of preventive safety measures. These findings of education are similar to Thailand VOSL studies, which were done by Puttawong & Chaturabong (2020)

For socio-economic variables, Model 1 showed a good model fit with a significant omnibus test, emphasizing the collective role of income-related variables. Interestingly, household income (B40 and M40) had a strong positive influence on WTP ($p < 0.001$), while individual income level and household size did not show significance. In Model 2, only household income (M40) remained significant ($p < 0.001$), further underlining that perceived household economic stability, rather than individual income, may better predict willingness to invest in preventive safety tools. These findings were similar to studies done by Puttawong & Chaturabong (2020) and Mofadal et al. (2015)

Regarding injury-related predictors, both Model 1 and Model 2 indicated that injury severity (measured by MAIS) and injury type (fractures vs. non-fractures) had no statistically significant effect on WTP, which was similar to the study by Chaturabong et al. (2011). However, studies by Faudzi (2011) in Malaysia have mentioned injury severity as an important predictor. Nevertheless, none of the injury categories emerged as strong predictors in this study, suggesting that the WTP for fatality risk reduction is not directly influenced by the nature or severity of injuries sustained.

In terms of pre-crash behaviors, Model 1 showed that only past-year crash experience significantly influenced WTP, where those with prior crashs were more willing to pay ($p < 0.001$), pointing toward increased risk awareness. On the other hand, Model 2 extended these findings by identifying insurance status and travel purpose as significant factors. Notably, individuals without insurance and those traveling for non-work reasons reported lower WTP, suggesting that perceived vulnerability and the perceived utility of safety measures vary depending on context and personal experience.

In summary, the findings of fatality risk reduction reveal that while socio-economic and pre-crash factors, such as household income, crash experience, insurance status, and travel purpose, significantly shape WTP for retroreflective safety measures, injury-related characteristics do not. Education and race also play a role, highlighting the importance of targeted awareness and policy interventions aimed at improving safety perceptions, especially among less educated or uninsured road users.

5.9.2 Factors associated with WTP for injury risk reduction

Based on the findings from the Gamma Generalized Linear Model (GLM) analyses, various factors demonstrated differing levels of influence on injury risk reduction, particularly in terms of willingness to pay (WTP) for motorcycle helmets. Socio-demographic characteristics such as age, education, and occupation were consistently significant across both models. Specifically, adult and younger respondents displayed higher WTP values compared to older individuals, indicating that middle-aged and younger groups perceived greater value or necessity in investing in the safety agenda. This finding was similar to that of Chaturabong et al. (2011), who reported that the younger population was more WTP for safety than studies by Nor & Yusoff (2003). Lower educational attainment (primary and secondary education) was associated with reduced WTP, suggesting that safety awareness or affordability concerns may hinder investment in safety features among less-educated groups. Occupational category also played a role, with high-skilled workers surprisingly showing lower WTP in one model, while low- and medium-skilled workers demonstrated higher WTP in another, possibly reflecting differing safety priorities or exposure risks.

In contrast, socio-economic variables such as income group, household income, and house size did not significantly affect WTP in any of the models. This suggests that, despite varying economic backgrounds, respondents may prioritize safety uniformly when deciding on helmet expenditure, or that other factors, such as perceived risk and previous experiences, are more influential. Similarly, injury-related variables, including the severity of injuries (measured by the MAIS) and types of injuries (fractures vs. non-fractures), did not show a significant influence on WTP. These findings imply that actual injury experience may not strongly alter individuals' valuation of safety equipment unless accompanied by other awareness or behavioral triggers.

Importantly, pre-crash behavioral and contextual factors provided meaningful insights. Insurance status consistently emerged as a significant predictor□ respondents without insurance were significantly less willing to pay for helmets, possibly due to financial constraints or lower perceived vulnerability. Additionally, work-related travel purpose and prior crash experience within the past year were associated with significantly lower WTP. This suggests that routine exposure and real-life crash experiences ma□ s□ a□ e in□ ivi□ ua□ s' ris□ □ er□ e□ □ ions an□ □ i□ □ ingness □ o inves□ measures.

In the summary, the findings of injury risk reduction highlight that while demographic factors like age, education, and occupation significantly influence WTP for injury risk reduction tools like motorcycle helmets, socio-economic status and injury experience alone do not drive significant changes in WTP. Rather, pre-crash contextual factors, particularly insurance coverage and crash history, are more significant in influencing investment in safety equipment. These results underscore the importance of tailored interventions that increase perception of safety and affordability, especially of uninsured and often commuting populations. Such results were comparable to the research of Mon et al. (2019).

5.9.3 Factors associated with WTP for the road safety program

After comparing RM36, average WTP and the maximum mean WTP of RM34 with the use of the payment card method, the difference is low but significant. Such estimates can be explained by corresponding notes in the literature, since in this case, the results of the WTP can vary slightly in different elicitation formats. An open-ended, direct questioning approach that elicited the average WTP of RM36 could be an indication of how respondents ideally or unrestrictedly value the road safety program. By contrast, the payment card method, where the corresponding mean WTP (RM34) was slightly lower, might elicit more conservative or restrained answers because of the existence of predetermined value segments, or anchoring effects, or even only of the psychological levels.

Yielding the VOSL estimates across the two WTP values, the outcome indicates that at RM36, VOSL would be around RM768,000 and at RM34, VOSL would be around RM725,333, based on a 50% reduction in the total annual road fatalities in the nation, to 3,000 to 1,500, together with the national population of 32 million. Although there is a slight difference between the two WTP, both VOSL estimates can be assumed to be within a reasonable balance and consistent range (between RM725,333 and RM768,000), which implies that the respondents of the surveys place utility on road deaths prevention at above RM700,000 per life saved. These findings are significant as they highlight the monetary value the public places on improved road safety and support the feasibility of introducing or enhancing national safety programs which are aligned with study by Rizati et al. (2015).

The findings from the analysis of socio-demographic, socio-economic, injury-related, and pre-crash factors offer important insights into the determinants of in□ivi□ua□s’ □ □ □ □ or a na□iona□ roa□ sa□e□ □□-demographically, education level consistently emerged as a significant predictor, with individuals possessing only primary education exhibiting significantly lower WTP compared to those with tertiary education as more educated individuals tend to have a clearer perception of long-term safety benefits. These findings were similar to Mofadal et al. (2015). In contrast, age and occupation showed partial significance. Younger and middle-aged individuals demonstrated higher WTP, and those in lower and middle-skill occupations had significantly greater WTP compared to the non-working group. However, variables such as gender, race, and marital status were not statistically significant across models.

From the socio-economic perspective, individual income level and house size were not associated with WTP. Instead, household income played a more crucial role, as respondents from B40 and M40 household groups indicated significantly higher WTP. However, in reverse, in Mofadal et al. (2015) study, respondents from higher-income families and those with higher education levels tend to be more willing to pay for safety improvements. Overall, these findings suggest that collective household economic context may be more influential than personal income.

In terms of injury-related variables, neither injury severity (as measured by MAIS) nor type of injury (fracture vs. non-fracture) significantly influenced WTP, and the overall model fit was weak, although technically adequate. This indicates that post-crash physical outcomes may not be a strong driver of financial support for safety initiatives.

However, pre-crash factors revealed stronger associations: lack of insurance and absence of crash experience in the past year significantly reduced WTP, suggesting that personal exposure and perceived risk are motivators of willingness to invest in safety programs. This association between past experience and safety valuation is documented by Ibrahim et al. (2019), where prior involvement in crashes was found to influence the psychological driver behind WTP. The purpose of travel also mattered, with non-work-related travelers less willing to contribute than those traveling for work. Interestingly, license possession and role (motorcyclist or pillion) were not significant in determining WTP which aligned with Chaturabong et al. (2011).

The WTP for a national road safety program was most significantly influenced by education level, household income, insurance coverage, crash experience, and purpose of travel. In contrast, gender, race, marital status, personal income, injury severity, and injury type were not significant contributors. These insights suggest that future interventions should emphasize targeted education, risk awareness, and insurance coverage to enhance program support.

5.9.4 Factors associated with WTP for emergency medical treatment

In the first scenario, respondents were asked about their WTP for initial emergency treatment immediately following a road traffic injury. The findings revealed that the average WTP was RM64 per year, with the maximum mean WTP recorded as RM57 using the payment card method. These values suggest that participants place a significant value on receiving prompt and adequate first aid or emergency services. Since the WTP question did not involve any reduction in risk or prevention of death, it is not appropriate to apply a risk-based valuation such as the VOSL. WTP will instead be identified through direct reporting and capture the perceived value and the economic value of gaining access to urgent medical care following a crash. Such a procedure is not in variance with the approach of Abate et al. (2015), who have indicated the values of WTP in the context of medical care according to the situation with treatment without reporting the results in units of risk reduction.

In order to compare the financial burden of medical treatment relative to the financial capacity of the various income groups, the mean WTP (RM57/person/year) based on the payment card method was examined as a proportion of the expected annual income. The following proportions were taken: WTP/Income% = (WTP/Estimated Annual Income) x 100. Doing this enables comparison of affordability across groups to make more sense, because we would not merely compare the absolute amount a respondent says he/she is willing to pay, but rather how it compares to the economic capacity of the respondents. The fact that the income variable in this study was categorical implies that when estimating the annual income per group, the midpoints were used.

The middle of the B40 group, RM2,500-RM4,849 (per month), was calculated to be RM3,675 per month or RM44,100 per year. As regards the M40 group, where the income range was RM4,850 to RM10,959, the median was RM7,905 a month, or RM94,860 a year. Using these amounts, the RM57 WTP would represent a negligible share of annual income, i.e., about 0.13% in the case of B40 respondents of the annual income and 0.06% among M40 respondents. This means that, for B40 respondents, the RM57 they were willing to pay is only about 0.13% of their yearly income □ roughly 13 cents for every RM100 they earn. For M40 respondents, it is about 0.06%, or 6 cents for every RM100. In other words, the amount is very small compared to what they earn in a year, suggesting that the contribution would be financially manageable for most people in both income groups. One possible reason for this modest WTP is that data collection was conducted in the post-COVID-19 period, when many households were still recovering from income losses and economic uncertainty. During this time, individuals were likely more cautious about spending, prioritizing essential needs over discretionary contributions, which may have influenced their stated amounts despite the overall affordability of the payment. However, these findings also suggest that even modest healthcare costs can represent a disproportionately greater impact for lower-income individuals. This reinforces the need for equity-based health financing strategies that account for income disparities when designing policies related to cost-sharing or access to care.

The mean WTP for medical treatment among motorcycle crash survivors was RM64 using the open-ended format and RM58 using the payment card method. When compared to the median cost-of-care for motorcycle road traffic injuries in Low- and Middle-Income Countries □ □ □ □ □ s□ □ es□ i□ a□ e□ a□ □ □ □ □ Oladeji et al. □ □ □ □ □ □ □ (2024) study, both values represent a small fraction of the actual treatment cost. Specifically, the open-ended estimate covers only 5.9% of the benchmark cost, while the payment card estimate covers 5.3%. This substantial shortfall suggests that although respondents value access to post-crash medical care, affordability constraints are a major barrier to covering the full economic cost. The gap between WTP and actual treatment costs is consistent with findings from other LMIC studies, where WTP frequently falls below the market value of medical services, especially when healthcare is heavily subsidized or perceived as a public good.

Next, the discussion below synthesizes the key findings related to the WTP for first emergency medical treatment, based on socio-demographic, socio-economic, injury, and pre-crash factors using two Generalized Linear Models (Model 7 and Model 8). The results from the Gamma GLM models underscore the multifaceted determinants influencing individuals' WTP for first emergency medical treatment. Education consistently emerged as a significant predictor across both models, with respondents possessing only primary and secondary education showing significantly lower WTP compared to those with tertiary education. This suggests that higher education levels may enhance awareness or perceived value of emergency medical care. Occupation also played a crucial role, where those in middle-skilled roles displayed higher WTP, while those in low-skilled or high-skilled jobs exhibited lower WTP, highlighting the nuanced influence of job type and possibly financial priorities. Age was a significant factor in Model 8, with younger individuals more willing to pay than their older counterparts.

Regarding socio-economic variables, individual monthly income was significantly associated with WTP in both models, particularly indicating that respondents in the B40 income group were less willing to pay compared to those in the M40. This confirms the burden of financial constraints among lower-income individuals. Interestingly, household income and household size did not significantly predict WTP in Model 8, which might reflect individual-level financial decision-making in urgent medical scenarios. However, in Belete & Walle's (2023) studies, WTP for medical care and its determinants reported that higher-income households showed greater WTP than lower-income households, which the authors linked to increased ability to pay and prioritization of health needs.

Injury-related variables such as injury severity (MAIS) and type of injury (fracture vs non-fracture) did not significantly influence WTP, although some non-significant negative trends were observed among respondents with minor or moderate injuries.

However, pre-crash factors showed stronger associations: being a pillion rider, lacking insurance coverage, and having no prior crash experience in the past year were significantly associated with lower WTP. These results imply that personal risk perception and insurance availability influence emergency treatment valuation. Travel purpose also significantly influenced WTP, with non-work-related travel associated with lower payments. Taken together, the results highlight the necessity of specific measures that would take into consideration educational outreach, finances, as well as medical insurance to provide equal access to emergency care and medical treatment and, in particular, to disadvantaged road users who can be described as less skilled and socio-economically deprived.

In summary, WTP for first emergency medical treatment was significantly influenced by individual factors such as age, education level, occupation, and monthly income. Younger individuals, those with higher educational attainment, and those in middle-skilled occupations demonstrated greater WTP. Socio-economic indicators, particularly lower income groups (e.g., B40), were associated with reduced WTP, emphasizing financial disparities in healthcare affordability. Pre-crash factors □ including being a pillion rider, lacking insurance, non-work-related travel, and absence of recent crash experience □ also significantly reduced WTP. In contrast, injury severity, type of injury, household income, and household size were not significant predictors. These results underscore the importance of addressing age-related and socio-economic gaps to promote equitable access to emergency medical treatment.

5.9.5 Factors associated with WTP for follow-up medical treatment

In the second scenario, the study examined WTP for follow-up treatment, specifically ai□e□ a□ □reven□ing a □orsening o□ □□e □a□ien□’s injury. Respondents indicated an average WTP of RM59 per year, with the maximum mean WTP of RM45. Although slightly lower than the WTP for initial treatment, this still reflects a meaningful valuation of continued care and rehabilitation. Like the first scenario, this question does not involve a probabilistic change in health outcome. Thus, the WTP is presented directly as a measure of how much respondents value maintaining their health and preventing long-term complications. These findings reinforce the idea that RTI patients value emergency care and sustained access to follow-up treatment, which is critical for full recovery. The results can be used to support healthcare planning and budgeting, particularly in efforts to improve the continuity of care after road traffic injuries (Champahom et al. 2023; Chaturabong et al. 2011; Guria 2020; Mon et al. 2018).

The maximum mean WTP of RM45 per year (obtained using the payment card method) was assessed against the level of income to assess the economic ability to pay for the medical treatment. The formula utilized in this process, *WTP as % of income = (WTP/Estimated Annual Income) X 100*. Such a method will enable a straightforward comparison of how much of the income earned by a respondent goes to medical care, and hence the differences in affordability between the income groups. Estimates such as Abate et al. (2015) and Belete & Walle (2023) have employed the same method to calculate WTP as a percentage of monthly income to assess affordability.

Midpoint values were taken to calculate the average household income of each group since data on income were collected categorically (i.e., B40 and M40). This is typical in the economic and health research in which precise income amounts are unknown (Johnston et al., 2017). In the case of the B40 category (income level of RM2,500 to RM4,899), the median was estimated at RM3,675/month, or RM44,100/year. In the case of the M40 cohort (RM4,850-RM10,959), the median was RM7,905 a month, or RM94,860 annually. These estimated annual incomes were further employed to estimate WTP as a proportion of income. The approach offers a logically applied and feasible approach to distinctions in economic burden between various socioeconomic classes, and the rationale is provided by the nature of income data.

Using the formula, the WTP of RM45 represented 0.102% of annual income for B40 and 0.047% for M40 respondents. For B40 respondents, the RM45 they were willing to pay is only about 0.10% of their yearly income — roughly 10 cents for every RM100 they earn. For M40 respondents, it is about 0.05%, or 5 cents for every RM100. This means the amount is very small compared to their annual earnings, suggesting that, in general, it would be financially manageable for people in both income groups to contribute this amount without placing a significant burden on their household budget. Similar to WTP for first medical treatment, this shows that the amount is very small compared to annual earnings, indicating that such contributions would generally be affordable for both income groups. However, because data collection took place in the post-COVID-19 period, many households were still in economic recovery, managing reduced savings or unstable incomes. This climate likely made respondents more cautious in stating their WTP, prioritizing essential expenses while still acknowledging that the requested amount was manageable relative to their income.

However, this finding indicates that the contribution of the B40 group is more than twice that of the M40 respondents, measured as a percentage of annual income. This can be explained by the fact that, although both groups stated relatively small amounts, the same amount represents a larger proportion of the B40 group because their earnings are substantially lower. That is to say, a relatively small payment consumes a larger percentage of a smaller pay. There is also a possibility that due to the COVID-19 impact, this gap may have increased over and above what it was. As households in both categories were impacted but the M40 group, on average, had more savings or a more stable source of their income. Hence, their WTP remained a smaller percentage of income when surveyed than the B40 group.

Thus, it is critical to say that when it comes to the analysis of WTP, it is necessary to take into account the differences related to income in the context of consideration of policy alternatives with respect to cost-sharing or subsidized healthcare. It also justifies the necessity of equity-oriented health financing methods, which will not overwhelm low-income populations when utilizing the required medical care.

Generalized Linear Models (GLMs) were then used to discuss WTP of follow-up medical treatment by road crash victims, taking into consideration socio-economic, socio-demographic, injury-related, as well as pre-crash factors. The socio-demographic perspective showed that even though the overall model ran was statistically significant, the variables gender, age, education, as well as status of marriage had no significant contribution towards the determination of WTP. Notably, in Model 10, occupation emerged as a critical factor which aligned with Abate et al. (2015) and Belete & Walle (2023). Respondents in low, medium, and high-skilled occupations showed significantly lower WTP compared to the reference group, highlighting occupation as a key socio-demographic determinant. These findings are similar to Ibrahim (2019) study which found that being employed or having specific occupation influence the probability of WTP.

Regarding socio-economic factors, household income proved to be a more reliable predictor than individual income or household size. Specifically, respondents from the M40 group demonstrated significantly higher WTP than those in the T20 group, suggesting that middle-income households might value follow-up care more or perceive a higher burden of treatment costs. These findings however is a reversal from the previous similar studies by Mohd Faudzi Mohd Yusoff in 2011 VOSL study.

In terms of injury characteristics, although injury severity (as measured by MAIS) did not significantly impact WTP in either model, type of injury did□ particularly in Model 9□ where respondents with fractures were significantly less willing to pay than those with non-fracture injuries. However, this pattern was not upheld in Model 10, indicating a possible shift in valuation when presented with a capped or guided payment option like a payment card. This contradicts the general assumption that victims of more severe trauma would be more willing to invest in prevention in which has been described in many other studies like Hokkam et al. (2015) Tan Chor Lip et al. (2019).

Lastly, pre-crash behaviors and statuses also played a vital role. Both models showed that pillion riders had lower WTP than motorcyclists, and travel purpose significantly influenced WTP, with non-work travel associated with reduced expenditure in Model 9 but increased expenditure in Model 10. Insurance status was significant in Model 9 (higher WTP among the uninsured) but not in Model 10. Interestingly, respondents without a valid motorcycle license or with recent crash history were more willing to pay, as shown in Model 10. These findings suggest that contextual, behavioral, and role-related factors may weigh more heavily in influencing post-crash financial responses than static socio-demographic characteristics.

In summary, WTP for follow-up medical treatment is not significantly influenced by basic socio-demographic characteristics, except for occupation. Middle-income households and certain behavioral factors (e.g., being a motorcyclist, having had a recent crash) are associated with higher WTP. Fracture-related injuries tend to reduce WTP.

5.10 DEBRIEFING DISCUSSION

The debriefing component of this study provided valuable insights into respondents' perceptions and attitudes toward their stated WTP and engagement in road safety improvements. Therefore, understanding these post-elicitation perspectives is crucial for interpreting the credibility and contextual relevance of the WTP values gathered.

Respondents' confidence in their stated WTP was moderate, with an average score of 3.62 and a median of 3.00. These values suggest that most respondents exhibited neutrality or slight confidence regarding their payment declarations. The Interquartile Range (IQR) of 1 further supports that responses were moderately consistent, indicating that participants were generally thoughtful and realistic when considering the hypothetical WTP scenarios. These findings might be due to COVID-19, as the survey was done right after COVID-19. However, such findings align with Bateman et al. (2002), who emphasized the importance of post-WTP debriefing to gauge the internal validity of responses in contingent valuation studies.

Furthermore, a significant majority (98.5%) of respondents believed that road users' views should be incorporated into road safety improvement strategies. This reflects strong public engagement and concern regarding road safety policies, particularly among those directly affected, such as motorcyclists and pillion riders. The high level of agreement also suggests that stakeholders, especially policymakers, must prioritize participatory approaches in road safety planning to ensure interventions are grounded in public expectations and realities.

In terms of preferred payment mechanisms, the findings reveal a clear preference for direct and flexible payment systems. Out-of-Pocket (OOP) payments (45.4%) and monthly salary deductions (45.2%) emerged as the most favored methods, together accounting for 90.7% of responses. This strong preference for user-controlled contributions suggests that future implementation of road safety financing mechanisms should prioritize autonomy and simplicity. Conversely, tax-based systems such as deductions via Lembaga Hasil Dalam Negeri (LHDN) received minimal support (8.0%), reflecting public skepticism or lack of trust in indirect funding mechanisms.

□ n □ □ e issue o□ res□ on□ en□ s’ □ re□ eren□ e on □ un□ □ anage□ en□ □ over □ □ respondents in which (55.1%) were confident with government institutions, signalling confidence in the centralized government oversight. Nonetheless, a significant share (37.7%) preferred the domestic, meaning non-government openness to cross-sectoral action and perhaps enhanced effectiveness or visibility of non-governmental forces. The outcomes reveal that hybrid governance systems combining the strengths of public trustworthiness and the flexibility of the business sector might become useful in administering funds toward road safety initiatives in the future.

On the whole, the debriefing results confirm the agreement of the WTP and have practical implications in the context of designing public financing schemes. Another point that they mention is the need to have the user's point of view, not just involved in the valuation process but also in the implementation strategy, as it aligns with prudent standards in public health as well as behavioral economics.

5.11 QUALITY OF LIFE

□ □ is s□ u□ □ assesse□ □ a□ ien of life (QoL) i 30 days following hospital discharge across three primary domains: emotional, functional, and physical. The findings reveal that a significant proportion of respondents continued to experience challenges mostly in their emotional and functional well-being during the early recovery phase.

Regarding the *emotional domain*, more than half of the patients (52.6%) had scores that exceeded the median, which was 10, hence demonstrating a lower emotional QoL. This leads to the belief that a patient may experience emotional distress such as mood disturbances, fear and anxiety despite physical discharge out of the hospital. These emotional sequelae are usually documented to be common in the post-discharge population, particularly in patients who are recovering after a traumatic experience or severe illness. The previous research has pointed to the same existing tendencies with regard to the fact that ensuring psychological support and monitoring mental health as a component of post-discharge care plans is necessary (Kenardy et al. 2015).

Equally, under the *functional domain*, 53.5% of the patients reported poorer functional QoL with a value above the median of 10. This is indicative of the problems of regaining pre-hospitalization levels of activity including mobility and self-care.

The *physical domain* also had an equal division in which half (50%) of the respondents fell above the median score of 15, and the other half fell at and below. This implies a disparate post-discharge physical recovery profile. Note that some patients appear to regain their physical capacity relatively well, while others may continue to experience limitations.

The overall findings indicate that the emotional and functional categories show a slightly greater percentage of patients reporting low QoL compared to those reporting high QoL, while the physical domain is evenly distributed. These findings highlight the necessity for focused therapies aimed at emotional and functional rehabilitation to improve patients' overall QoL following hospitalization, as the duration of this reporting condition was only one month. Considering the reporting is still at an early stage, it is □ossi□□e □o □ini□i□e an□ □ur□□er □a□age □o one's e□o□iona□ an□ □un□□ion Mitigating these discrepancies may enhance results and facilitate a more holistic healing process for patients transferring from hospital care to their regular lives.

5.11.1 Socio-demographic factors associated with quality of life

This study examined the association between socio-□e□ogra□□i□ varia□□es an□ □a□ien□s' QoL across emotional, functional, and physical domains 30 days post-hospital discharge using binary logistic regression analysis. The findings provide meaningful insights into which domain are more likely to report diminished QoL during early recovery and highlight priority areas for post-discharge support.

Emotional QoL analysis revealed that education, occupation, and ethnicity were significantly associated with emotional QoL. These findings were similar to study by

Sharwood et al. (2021) which compare psychological health outcomes for motorcyclists and other road users after crashes. For current study, patients with higher educational attainment had significantly lower odds of experiencing poor emotional QoL (OR = 0.482, 95% CI: 0.338□0.689, $p < 0.001$). This finding supports existing literature that suggests education improves health literacy, coping mechanisms, and access to psychosocial resources, which are protective against emotional distress post-discharge (Sharwood et al. 2021). Occupation also emerged as a significant factor (OR = 1.816, 95% CI: 1.471□2.241, $p < 0.001$), where employed individuals were more likely to report better emotional outcomes. Employment often offers financial security and social support and a sense of purpose, which may buffer psychological stress after hospitalization. Ethnicity showed a significant relationship with emotional QoL (OR = 0.701, 95% CI: 0.537□0.915, $p = 0.009$), suggesting possible cultural or structural disparities that influence post-discharge emotional well-being. This warrants further exploration, as cultural stigmas around mental health or access to culturally competent care could influence emotional recovery. Other variables□ age, gender were significant predictor in similar study by Alharbi et al. (2019), and marital status□ did not show significant associations with emotional QoL in this model. However, age approached significance ($p = 0.18$), indicating a potential trend worth investigating in larger samples.

The *functional domain* displayed an identical pattern of significance as the emotional domain, with education, occupation, and ethnicity again emerging as significant predictors. Educational attainment was associated with significantly reduced odds of low functional QoL (OR = 0.482, $p < 0.001$), reinforcing the role of knowledge and skills in facilitating recovery and independent functioning after discharge. Note that employed individuals were also more likely to maintain better functional status (OR = 1.816, $p < 0.001$), perhaps due to healthier pre-morbid conditions or access to work-related rehabilitation services. The finding that ethnicity remains a consistent predictor across both emotional and functional domains suggests deeper socio-cultural or systemic inequities that influence recovery trajectories which also mentioned in study by Alharbi et al. (2019). Variables such as gender, marital status, and age were again not statistically significant, suggesting that functional outcomes in this context may be less influenced by these factors when compared to educational and occupational status.

Similarly, in the *physical domain*, education, occupation, and ethnicity maintained their statistical significance. Respondents with higher education levels had lower odds of experiencing poor physical QoL (OR = 0.482, $p < 0.001$), consistent with previous findings that link education to better self-care and adherence to medical instructions. The role of employment was again significant (OR = 1.816, $p < 0.001$), indicating that those actively working may experience a faster or more complete physical recovery□ potentially due to better baseline health or stronger social and economic support systems. Ethnicity remained a significant predictor (OR = 0.701, $p = 0.009$), highlighting persistent disparities in post-discharge physical health among different ethnic groups. These may stem from differences in healthcare access, rehabilitation services, or health-seeking behavior influenced by cultural norms. No significant effects were observed for age, gender, or marital status in this domain either. This suggests that these variables may have a minor influence on physical QoL outcomes within 30 days after discharge, but their significance could increase in longer observation periods of quality of life following crashes, as demonstrated by Alharbi et al. (2019), which found that older age and being female were linked to poorer physical function.

Across all three QoL domains□ emotional, functional, and physical□ education, occupation, and ethnicity were consistently associated with post-discharge outcomes. These findings emphasize the importance of addressing social determinants of health in post-acute care planning. Tailored interventions focusing on disadvantaged groups□ such as those with lower education, unemployed individuals, and specific ethnic minorities□ could improve equity in recovery outcomes. In contrast, some conventional socio-demographic factors, including gender, age, as well as marital status, failed to report significant results as implied with most of the studies conducted on QoL-RTI, like in (Chellamuthu et al. 2024) and □ovačević e□ a□. □□□□□□

5.11.2 Socio-economic factors associated with quality of life

The effects of socio-economic factors on not attaining the purpose of life or QoL of patients 30 days after discharge were researched in this study, namely the household income, role of income, as well as household size. The results indicated different degrees of significance in the emotional, functional, as well as physical aspects of QoL.

Within the *emotional QoL domain,* household income and household size were reported as significant predictors. Emotional QoL was better among patients with a higher household income, who had an increased likelihood of experiencing (OR = 2.361, 95% CI: 1.214–4.590, p = 0.01). This result is consistent with the findings of Guest et al. (2017) and Ritva Rissanen et al. (2017), which suggests that financial stability may reduce emotional distress by improving access to support services, reducing financial anxiety, and facilitating a conducive home environment for emotional recovery. Household size was even more strongly associated with emotional QoL (OR = 7.021, 95% CI: 3.598–13.703, p < 0.001), indicating that patients from larger households were more likely to report better emotional well-being. This may reflect the protective effect of family and social support in emotional recovery, where larger households offer greater care, companionship, and emotional reinforcement. In contrast, individual income was not significantly associated with emotional QoL (p = 0.22), implying that while personal income may contribute to material well-being, it is the broader household environment that more meaningfully supports emotional recovery in the early post-discharge phase. These findings are supported by Wilson et al. (2020).

For *functional QoL*, only household size showed a significant relationship. Larger household size was associated with four times greater odds of better functional QoL (OR = 4.035, 95% CI: 2.297–7.088, p < 0.001). This may suggest that physical and functional recovery benefits from assistance provided by other household members, particularly in tasks such as mobility, self-care, and household activities. Neither individual income (p = 0.49) nor household income (p = 0.84) demonstrated significant associations with functional QoL. This implies that functional recovery may rely more on social or physical assistance than financial means, especially in the early stages of recovery, when physical help may be more immediately valuable than monetary support (Sharwood et al. 2021).

In the *physical domain*, all three socio-economics; income, household income and household size were statistically significant. Notably, individual income was negatively associated with physical QoL (OR = 0.214, 95% CI: 0.071–0.647, p = 0.006), indicating that lower-income individuals were more likely to report poor physical QoL. The current finding supported previous findings, which consistently reported lower-income individuals were more likely to experience poor physical QoL (Ozegovic et al. 2010; Berecki-Gisolf et al. 2013; Guest et al. 2017; Prang et al. 2015). This finding also suggests that financial constraints may limit access to medical follow-up, rehabilitation, or medications that facilitate physical recovery. On the other hand, higher household income showed a strong positive association with better physical QoL (OR = 3.013, 95% CI: 1.521–5.967, p = 0.002), resonant the trend seen in emotional outcomes. A financially stable household may support the patient with necessary health resources, including transportation, caregiving services, and nutritious food, all of which are critical for physical healing. Likewise, household size significantly predicted better physical QoL (OR = 1.774, 95% CI: 1.065–2.955, p = 0.028), reinforcing the idea that patients surrounded by more family members or cohabitants are better supported in their physical recovery process.

The socio-economic analysis highlights the importance of household-level factors—particularly household income and household size—in shaping recovery experiences after discharge. While individual income plays a role, especially in physical QoL, the broader household context appears to be more influential in both emotional and functional recovery. These findings emphasize the need for family-centered and socially inclusive discharge planning, especially for respondents from smaller households or lower-income backgrounds. Correspondingly, policies and interventions that promote home-based care, community support, and financial assistance could improve overall quality of life outcomes post-discharge.

5.11.3 Injury status factors associated with quality of life

This study explored the associations between injury-related factors—specifically, type of injury and injury severity—and QoL outcomes across three domains: physical, emotional, and functional. Overall, the findings suggest that injury severity may have a modest influence on emotional and functional QoL, while neither injury type nor severity showed a meaningful impact on the physical domain.

In the *emotional* domain, the regression model was statistically significant, indicating that the type and severity of injuries collectively contributed to explaining emotional QoL outcomes. Notably, respondents with fractures had 38.3% lower odds of reporting high emotional QoL compared to those without fractures (OR = 0.617), with a p-value of significance (p = 0.059). Similarly, minor injuries classified under minor injury showed a marginal negative association (p = 0.069), with an odds ratio of 0.608, suggesting that even less severe injuries may still impact emotional well-being. This means that even people with minor injuries were 39.2% less likely to report good emotional well-being compared to others. Although the injury was not serious, it still seemed to affect how they felt emotionally □ possibly causing stress, worry, or discomfort. However, the result was not strongly significant (p = 0.069). Nevertheless, a possible link remains for future research, particularly with a larger sample size and cohort or longitudinal studies. These findings underscore the psychological and emotional burden that can persist following a road traffic injury, even in the absence of high physical trauma. The direction of these results aligns with previous literature suggesting that emotional distress post-injury can be influenced by anxiety, fear, or trauma-related stress, regardless of injury severity (Kovacevic et al., □□□□□ □ovač ević et al., 2020).

For the *functional* domain, the study sought to explore the extent to which different dimensions of injury status□ including severity and type□ predict functional QoL among motorcycle crash survivors. The BLR analysis indicates that the collective set of predictors, namely, the type and severity of injury, provides a meaningful distinction between respondents with low and high functional QoL outcomes. Although the model's explanatory power was relatively modest (Nagelkerke $R^2 = 0.030$), this finding is still relevant in a real-world context, particularly when interpreting health outcomes within a multidimensional recovery framework. With regard to individual predictors, the results revealed nuanced but mostly non-significant associations.

Minor injuries were linked with a 36.8% reduction in the odds of reporting high functional QoL (OR = 0.632), although this association did not achieve statistical significance (p = 0.092). The observed trend, however, is clinically suggestive. It may reflect the possibility that even minor injuries can impair daily functioning (Gopinath et al., 2017; Langley et al., 2011), especially when compounded by psychological stress, financial (Melissa Legg et al. 2021), or limited access to rehabilitation services— a concern highlighted in other injury-recovery literature. Although not statistically conclusive, this finding may support the need for inclusive post-injury support, even for those initially classified as having minor trauma (Aitken et al., 2012; Kendrick et al., 2011).

Moderate injuries, in contrast, were associated with a 36.5% increase in the odds of reporting high functional QoL (OR = 1.365, p = 0.269). This means respondents with moderate injury were 1.37 times more likely to report high functional quality of life compared to those without moderate injuries. While this finding was not statistically significant, it raises a counterintuitive yet important consideration. Survivors of moderate injury severity may have benefited from targeted rehabilitation or follow-up care that inadvertently improved their functional recovery outcomes more effectively than those with minor injuries, who may have been overlooked for such interventions. This phenomenon warrants further investigation, particularly into post-discharge care trajectories and their influence on QoL domains. This finding was similar to that of Huang et al. (2025), in which patients with a lower severity score showed improvement after discharge. Therefore, this study, it indicates that both minor and moderate injuries might truly influence functional quality of life, and medical professionals or policymakers should not disregard the finding solely due to its failure to meet the stringent p-value threshold. It indicates a potential real-world impact that may be significant for patients' well-being efforts.

Similarly, serious injuries were not significantly associated with functional QoL (OR = 1.197, p = 0.782), and the wide confidence interval (95% CI: 0.335–4.281) underscores substantial variability in the experiences of those with severe trauma. This variability could stem from heterogeneous injury profiles, differing lengths of hospital stays, or access to rehabilitation resources. Previous studies have shown that while severe injuries often impair function, the long-term impact is moderated by factors such as social support (Juan P. Herrera-Escobar et al., 2019), access to physiotherapy, and personal resilience (Haider et al., 2020).

The analysis also explored the type of injury□ specifically, the presence of fractures□ as a predictor of functional QoL. The result was again statistically non-significant (OR = 0.825, p = 0.451), suggesting that having a fracture did not meaningfully alter the odds of reporting high functional QoL. However, the direction of the effect indicates a 17.5% lower likelihood of good functional outcomes among those with fractures, aligning with prior research that links orthopedic injuries with prolonged physical limitations and functional impairments (Carla Roberta Monteiro, 2010). Nonetheless, the lack of significance may reflect differences in the severity or location of fractures, variability in healing durations, or disparities in follow-up rehabilitation access.

Although the regression analysis did not find statistically significant associations between injury status (type and severity) and functional QoL, the trends observed offer meaningful clinical implications. Minor injuries showed a potential negative impact on functional QoL, while moderate and serious injuries demonstrated inconsistent and non-significant effects. Fractures also suggested a reduced functional outcome but did not reach statistical significance. These findings highlight the complex interplay of injury characteristics and recovery processes and underscore the need for comprehensive, individualized rehabilitation and support strategies for all crash survivors, regardless of the initial classification of injury severity. These findings were in contrast to many of the previous similar studies, such as those in (Gelaw et al., 2025; Haider et al., 2020; Huang et al., 2025; Langley et al., 2011).

In contrast, the regression model for the *physical* domain was not statistically significant (p = 0.593), and neither injury type nor severity showed meaningful associations with physical QoL. Surprisingly, respondents with fractures were 1.28 times more likely to report high physical quality of life (OR = 1.280), although this association was not significant (p = 0.327). This counterintuitive finding could be attributed to several factors. First, it is possible that individuals with fractures receive more comprehensive medical attention and rehabilitation, improving their recovery outcomes. Second, certain non-fracture injuries (such as internal injuries or soft tissue damage) may have longer-lasting effects on physical comfort and mobility than fractures, which can often heal completely.

In summary, together these findings suggest that emotional and functional domains of QoL are more sensitive to injury severity, while physical QoL may not be easily predicted by injury type or severity alone. These results highlight the complex and multidimensional nature of recovery following road traffic injuries. Intervention should therefore address physical healing and consider psychological support and functional rehabilitation, particularly for individuals reporting minor but impactful injuries.

5.11.4 Pre-crash factors associated with quality of life

This study investigated the association between pre-crash characteristics and post-discharge QoL among motorcyclists and pillion riders across three domains: emotional, functional, and physical. Results point to the fact that multiple pre-crash predictors, such as license status, purpose of travel, the role of a road user, vehicle insurance, as well as previous crash experience, had a significant impact on the QoL post-discharge one month following the discharge.

Emotional QoL, it was noted that a lack of a valid motorcycle license was positively related with reduced emotional QoL (OR=0.083, 95% CI=0.023-0.300, p<0.001). This implies that the emotional distress might be more in the unlicensed individuals because of low riding skills, sensing illegitimacy on the road, and more self-blame following the crash. Interestingly, pillion riders were much more likely to give better emotional well-being results than motorcyclists (OR=3.425, p<0.001), which may show decreased physical rates of injury as well as psychological burden. Those who were traveling for work at the time of the crash were also more likely to experience emotional distress post-injury (OR=0.271, p<0.001), possibly due to work disruption and economic insecurity. In addition, lacking insurance coverage negatively impacted emotional QoL (OR=0.449, p<0.001), reinforcing the psychological burden associated with out-of-pocket medical expenses. Prior crash involvement within the past year was another strong predictor of poor emotional QoL (OR=0.091, $p<0.001$), suggesting that repeated trauma exacerbates emotional vulnerability.

The *Functional QoL* was similarly influenced by pre-crash characteristics. Respondents without a valid motorcycle license had significantly lower functional QoL scores (OR=0.231, $p<0.003$), likely reflecting reduced road competency or increased injury severity due to lack of training. Pillion riders again demonstrated better outcomes compared to motorcyclists (OR=2.104, $p<0.004$), which may be attributed to their passive role during the crash. Functional limitations were also evident among respondents who traveled for work purposes (OR=0.319, $p<0.001$), highlighting the occupational impact of road traffic injuries. Repeated crash involvement within the past year further compounded functional limitations (OR=0.152, $p<0.001$), potentially due to cumulative physical impairments or ongoing psychological effects that hinder daily activity.

In the *physical domain*, lack of insurance coverage remained a significant predictor of poorer QoL (OR=0.320, $p<0.001$). This aligns with literature suggesting that financial strain and limited access to rehabilitation may hinder physical recovery. Respondents with recent crash history (past one year) also reported poorer physical functioning (OR=0.069, $p<0.001$), possibly due to unresolved injuries or chronic pain. Unlike emotional and functional domains, possession of a motorcycle license did not show a statistically significant effect on physical QoL ($p=0.072$), suggesting that physical outcomes may be more influenced by crash dynamics than licensing status. Pillion riders and those traveling for non-work purposes had better physical QoL scores (OR=0.523 and OR=0.547, respectively; $p=0.009$), reinforcing the notion that both role in the crash and travel context influence injury severity and recovery trajectory.

These findings underscore the importance of pre-crash factors in shaping post-discharge QoL among road users. Insurance coverage, travel purpose, as well as prior crash experience (Pons-Villanueva et al., 2011; Tin Tin et al., 2014) emerged as key variables regularly being correlated with all three QoL domains, rendering past strategies to prevent road injuries and crash-related crashes as proactive. Post-injury outcomes could be improved by enhancing access to insurance, safer means of traveling, in particular work-related traveling, as well as psychological support offered to those with a history of crashes. Moreover, the reversed QoL outcomes experienced by pillion riders further underscore that motorcyclists are the highest-risk population group on whom interventions based on specialized training, permit controls, as well as personal protection should be imposed. In general, the study helps to think a bit deeper about the impact of the pre-injury factors on short-term healing, thus guiding the work of the post-crash rehabilitation planning, road safety laws, as well as public health initiatives that can be applied to Malaysia in general.

5.12 THE IMPACT OF THE STUDY

This study offers valuable insights into both the VOSL and QoL outcomes, with particular emphasis on motorcyclists and pillion riders. The findings have meaningful implications for multiple stakeholders, including policymakers, healthcare providers, and the wider community. Other than that, the study can inform more effective road safety strategies with better guide of the allocation of road safety improvement budgets and health resources. It also supports evidence-based interventions aimed at improving post-crash recovery, especially short-term observation post-injury, to assist in reducing the burden of road traffic injuries. The following are some beneficial impacts on the community, specifically motorcyclists and pillion riders, policymakers, and healthcare providers.

5.12.1 Impact of the findings on the community

For road users, the findings serve as a critical awareness tool that underscores the profound personal and societal costs of road crashes. Often, public understanding of road safety focuses on fatality rates. However, this study demonstrates that even non-fatal injuries can result in substantial life changes, including physical disabilities, psychological distress, and reduced quality of life. Creating an economic valuation of risk reduction by implementing VOSL, the study indicates the value that society as a whole can place on preventing crashes. It may assist in changing the attitude of the general population to highlight the significance of personal responsibility in order to make the traffic environment safer. Greater compliance with traffic laws, regular wearing of protective gear like helmets and other seatbelts, and avoiding risk posing habits like over-speeds or distraction when driving can be encouraged when the users of the roads realise that this is not an individual or a personal matter but rather a type of communal good and influences the economic and health related tabs of our communities.

5.12.2 Impact of the finding on the policy

From the perspective of policymakers, the results of the present study offer crucial evidence to use for more strategic and economically viable road safety planning. The estimated VOSL provides a quantitative measure of the willingness of the population to pay to reduce fatal crash risks. This allows them to move beyond intuitive or reactive policymaking to policymaking based on economic valuation and cost-benefit analysis. As road traffic injuries place a huge burden on national health budgets, inhibit productivity and cause human suffering, VOSL offers the potential to assess the value of safety interventions, including speed control zones, the expansion of motorcycle lanes, enforcement of helmet legislation, as well as support of education. Simultaneously, the inclusion of QoL input of crash survivors into this policy-making lens is further supported by showing that road crashes do not simply affect mortality. Survivors often experience short- and long-term impairments that affect their physical, emotional, and social functioning, all of which translate into indirect economic burdens for families and society. These results support the development of comprehensive and survivor-oriented national road safety strategies that are preventive and rehabilitative.

5.12.3 Impact of the findings on the healthcare practitioner

The findings of this study carry important implications for healthcare practitioners involved in the treatment and rehabilitation of road traffic injury survivors. While physical injuries such as fractures are often prioritized during acute care, the results underscore the need for a more holistic and multidimensional approach to post-injury care□ particularly for addressing emotional and functional domains of quality of life.

First, the significant influence of injury severity on emotional and functional well-being, even among those with minor injuries, suggests that healthcare providers s□ ou□ □ no□ un□ eres□ i□ a□ e □ □ e □ s□ □ □ o□ ogi□ a□ an□ □ ai□ □ □ i□ e i□ □

injuries. This highlights the importance of early psychological screening, routine mental health assessments, and referrals for emotional support services, even for patients who do not exhibit visible or severe physical trauma.

Second, the modest yet meaningful association between injury severity and functional limitations points to the need for integrated rehabilitation planning that goes beyond physical healing. Healthcare teams, including physiotherapists, occupational therapists, and rehabilitation physicians, should assess and monitor patients' functional capabilities and ensure that recovery plans are tailored to facilitate return to daily activities, mobility, and independence.

Interestingly, the insignificance of the findings in the physical domain regarding the possibility of discrepancies between the physical recovery of patients and their subjective assessment of their QoL is. That means that practitioners must also assess patient-reported outcomes in conjunction with clinical reports on assessing recovery. Knowledge of the lived experience will lead to more person-centered care and, possibly, better satisfaction and longer-term results.

In short, a holistic and personalized healthcare approach is needed by healthcare practitioners encompassing physical, emotional, as well as functional rehabilitation. This way, it is possible to achieve full recovery, better QoL, and minimize the chance of long-term disability/emotional distress post road traffic injuries.

5.13 RECOMMENDATIONS

The VOSL is a significant economic angle that this study uses, and it shows the extent to which society is in unison and willing to pay to minimize the risk of fatality and injury. Such insights are important to guide public policy and enhance road safety measures and practices, as well as the culture of responsible behaviors of road users. Another result of this research is the highlight individual and social consequences of road traffic injuries, especially for motorcycle users. While public discourse often emphasizes fatalities, this research reveals that non-fatal injuries also result in profound physical, emotional, and functional burdens. The following recommendations are proposed to guide future interventions, policies, and community initiatives, which can be further researched by other researchers in the future.

5.13.1 Key findings recommendations

Targeted RTI Intervention. The findings from this study highlight a specific vulnerability profile: young, lower-income (B40) males, many of whom possess valid licenses but lack the financial protection of insurance. To address these systemic gaps, it is recommended that the Ministry of Transport and relevant stakeholders shift from generic safety messaging toward socioeconomically tailored interventions.

First, given that 96% of respondents are from the B40 group and 51% are uninsured, there is a clear need for inclusive micro-insurance schemes. Policymakers should introduce low-cost with flexible premium that accommodate the fluctuating cash flow of low-income and self-employed individuals, ensuring that financial hardship does not prevent access to post-crash recovery. Furthermore, it is recommended that the government pilot a centralized national health insurance scheme specifically designed for the low-income (B40) demographic. By subsidizing or automating coverage for this vulnerable group, the state can significantly alleviate the catastrophic financial burden and out-of-pocket medical expenses often incurred following a road traffic injury.

Second, the high prevalence of young males (49.3% aged 18–29) and pillion involvement (81.7%) suggests that current road user education is insufficient. The curriculum should be modernized to include simulation-based hazard perception training and specific safety modules for pillion passengers. These programs should be delivered through culturally resonant, digital-first campaigns to effectively reach the young Malay demographic that constitutes the majority of this cohort (83.7%).

Finally, because a significant portion of the sample is self-employed, traditional workplace safety nets are often inaccessible. It is recommended that community-based safety cooperatives be established to provide subsidized safety gear and defensive driving workshops for informal sector workers. By aligning safety policies with the specific socioeconomic realities of road users, authorities can move beyond mere enforcement and toward a more equitable and effective injury prevention framework.

Targeted Psychosocial Intervention. Given that "Crash Experience" and "Type of Injury" are core predictors of Emotional QoL, early psychological counseling or peer support groups should be mandated for trauma patients. Addressing the mental burden of the crash early can prevent long-term functional decline and improve the patient's perceived recovery. To promote holistic recovery, discharge protocols must integrate mental health evaluations at the community level. Scheduling follow-up assessments at the patient's nearest *Klinik Kesihatan* will facilitate the early detection of trauma-induced psychological distress, ensuring emotional wellbeing is monitored as closely as physical healing.

Multi-Dimensional Discharge Protocols. Clinical discharge should transition from a purely medical event to a holistic transition plan. Given that race, household income, and insurance status are significant determinants of QoL, hospitals should implement a social-risk screening tool at the point of discharge. Patients identified as "high-risk" (e.g., B40 group or those without insurance) should be automatically referred to medical social workers to secure financial aid or SOCSO/PERKESO benefits, ensuring that socioeconomic barriers do not impede physical recovery. Additionally, to help these group, it is suggested that the Malaysian Ministry of Health (MOH) integrate a simplified version of the RT-QoL tool into the *MySejahtera* application in which patients can self-report their functional and emotional status from home. If a score drops below a certain threshold, it triggers an automated alert for a tele-consultation, addressing the "Crash Experience" and "Income" barriers by removing the need for physical travel but still allow the continuous health delivery.

5.13.2 Future studies recommendations

In advancing future research on the VOSL and QoL, several methodological and conceptual improvements are recommended. Firstly, while this study utilized the CVM to estimate WTP among motorcycle users, future studies are encouraged to explore alternative or mixed-method valuation approaches. For instance, combining CVM with

Conjoint Analysis may enhance the robustness of findings and allow for a more nuanced understanding of individual preferences and trade-offs in road safety investments.

Secondly, although this study primarily focused on injury type and severity, future research should incorporate the specific body regions affected by the injuries and examine the influence of pre-crash variables, such as a history of previous crashes, on QoL outcomes. This is particularly important given the scarcity of studies addressing both pre-crash factors and QoL, at least in Asian countries, as encountered during this research. The involvement of this additional dimension may give better answers to the questions of how various injury patterns affect the VOSL estimates, as well as the outcomes in post-injury QoL.

Finally, it is recommended that to utilize qualitative methods in future studies to supplement the quantitative findings, especially the exploratory nature of the road users' lived experiences and perceptions. Expanding the study population to cover other vulnerable road users, like car drivers and vehicles occupants who are usually underrepresented in Malaysian VOSL studies surveys, can also give a broader picture of the road safety risk. Also, if we throw light on QoL studies, in future studies, one of the possible data sources to incorporate non-fatal injuries is primary health care facilities (health clinics). This approach, which remains limited in the Malaysian setting, has the potential to add beneficial information on the role of early intervention in managing injuries and rehabilitation and healthcare expenditure. This will eventually lead to more responsive healthcare services and the redistribution of scarce resources.

5.14 STRENGTH OF THE STUDY

This research has a number of important strengths in terms of improving its scholarly and practical relevance in the study of Road Traffic Injury (RTI) in Malaysia. The study first selected a population that was especially relevant to the research purpose, respondents who had suffered from road traffic injuries. The identification of potential crash hazards with a specific focus on respondents who have had firsthand experience puts the results grounded in personal experiences, thus increasing the accuracy and situational meaning of the findings.

Secondly, the study employed the CVM, a famous method of economic valuation that addressed the issue of the respondents' WTP to reduce the probability of future crashes explicitly. This method aided the quantification of the Value of Statistical Life (VOSL) based on the primary data and not just relying on the secondary or implied models.

Thirdly, the study involved the Road Traffic Quality of Life (RT-QoL) questionnaire, which was specifically designed to determine the quality of life of the traumatic victims of road crashes. This tool fits perfectly well with the study concept, and it was carefully modified and transposed into the Malay language; hence, it is both culturally and linguistically acceptable to local respondents of the study. Additionally, information on hospital data was used to classify the injuries based on clinical records to improve the accuracy of the severity of the injuries.

A significant advantage of the study is its one-month follow-up period after injury, which fills a crucial research gap. Most quality of life studies tend to emphasise long-term outcomes, frequently neglecting the vital early-phase recovery experiences of road traffic injury survivors.

5.15 LIMITATION OF THE STUDY

While this study has several notable strengths, it also presents certain limitations. One of such limitation is that the data were collected from only two public hospitals, which may restrict the generalizability of the findings to the broader Malaysian population. Specifically, individuals who receive care in private healthcare facilities, as well as those in rural areas, particularly those seeking treatment at public or private primary healthcare clinics, may have different healthcare experiences and outcomes that are not represented in this study.

The present study also has several limitations related to sample selection. Respondents involved in motorcycle crashes due to collision with fixed objects such as gates, electrical poles, or trees, as well as drug-related crashes, were excluded to maintain homogeneity of the study population. While this approach improves internal consistency by focusing on typical on-road motorcycle-vehicle crash mechanisms, it may also limit the generalisability of the findings. Specifically, exclusion of these crash types means that certain high-risk or non-standard crash mechanisms were not represented in the analysis. These crash categories may involve different injury severities and causal pathways compared to typical traffic interaction crashes. As a result, the estimated VOSL and QoL outcomes may not fully capture the broader spectrum of motorcycle crash experiences in Malaysia. In addition, excluding drug-related crashes removes a subgroup associated with impairment-specific risk behaviour, which may have different WTP responses and health outcomes. Therefore, the findings of this study should be interpreted as applicable primarily to standard road traffic motorcycle crashes, and caution should be exercised when generalising the results to all types of motorcycle crash scenarios.

In addition, the post-COVID-19 pandemic context presented multiple issues in gathering the data. Though the data selection process took place with the removal of the Movement Control Order (MCO), face-to-face interviews were not a desirable option since the health concerns and limits remained. Another notable difficulty was the shrinking of response rates on phone interviews, which could be explained by improved awareness among the populace and the fear of phone fraud, a common thing in Malaysia. Such unwillingness to participate in telephone surveys must have resulted in non-response bias in the study. These limitations could have been minimized using face-to-face interviews, if this were possible, as it would enhance the rate of response and the completeness of the information.

Lastly, the study focused exclusively on motorcycle users as the target population, which may limit the generalizability of the findings. Other categories of road users, such as car drivers, pedestrians, or cyclists, were not included and may offer additional perspectives that could contribute valuable insights into the estimation of the Value of Statistical Life (VOSL) and quality of life (QoL) outcomes.

5.16 SUMMARY

This section has laid out the outcomes of the studies, which discussion were done based on the objectives of the studies. Impact, recommendations, strengths and limitations of studies have also been addressed in this section. Overall, the outcomes of the studies have answered the research hypotheses in Table 5.1 below.

Table 5.1 Study hypotheses

Hypotheses	**Reject (x) / Accept (/)**
H1 B40 income only significantly influenced WTP for fatality risk reduction and WTP for first medical treatment	/
H1 B40 income significantly influenced WTP for injury risk reduction, road safety program and follow-up medical treatment	x
H2 Young male respondents only influenced the WTP for the road safety program	/
H3 The cost of injury risk reduction is higher than the cost of fatality risk reduction	x
H4 Respondent with severe injury reported having a poor (low) QoL	x
H5 An older, male respondent has a poor (low) QoL	x

CHAPTER VI

CONCLUSIONS

6.1 INTRODUCTION

The chapter gives the final summary of the research through the emphasis on the relationship between road traffic injuries, the Value of Statistical Life (VOSL) and quality of life (QoL) of the crash survivor. It summarizes the main points of the studies made and underlines the necessity of combining crash statistics, economic evaluation, as well as quality of life results in the context of supporting more efficient, evidence-based, and road safety-friendly policies in Malaysia.

6.2 ROAD TRAFFIC INJURIES, VALUE STATISTICS, LIFE AND QUALITY OF LIFE

The prevalence of road traffic injuries and deaths remains a major social and economic health problem in Malaysia, leading to the development of disabilities over the long-term, loss of income, emotional distress and increased out-of-pocket health care expenditures. Although the statistics of crashes provided on a national basis provide important data concerning the scale and nature of road crashes, they often do not reflect the broader consequences involved regarding subsequent survivors and their families. Besides physical injuries that afflict the survivor upon first impact, many adopt a negative overall quality of life (QoL), which entails problems with mobility, mental health as well as function in society.

In order to promote Malaysia's road safety and health projects, creating an improvement through an evidence based research findings are necessary. Any kind of approach has to be holistic, and it has to include human experience as well as the economic consequences of road traffic injuries. Contextually, the Value of Statistical

Life (VOSL) has an important role. VOSL helps policymakers measure the economic benefits of helping reduce the risk of mortality and injury, therefore providing a strong evidence based argument as to why it would be a worthwhile investment to implement safety measures. Combined with injury severity and quality of life outcomes among survivors, the value of a statistical life (VOSL) measure not only quantifies the number of lives saved but also the social benefits of improved recovery, not just over the short term, but also long-term well-being.

The application of VOSL in a country like Malaysia, where motorcycles are a major mode of road travel and also account for a large number of road crashes that result in death and injuries, is particularly relevant. The addition of VOSL with local collision and quality of life data makes it possible to direct investments in high-impact projects such as better road design, behavioural education, as well as crash care systems after the crash. It highlights the importance of policies focused on the survivors that are no longer concerned with basic survival to a charity state but rather to rebuild lives by achieving health, independence, as well as self-worth after the injury.

Understanding the effects of road crashes on the quality of life of the survivors offers a human perspective, which is an added dimension to economic assessment. Such a twofold focus ensures such programs are cost-effective as well as sensitive to societal needs. In the case of healthcare professionals, this implies incorporating rehabilitation and psychological support in the management of trauma. Policymakers cannot afford to ignore the idea that injury prevention is not only a preventive measure that should be undertaken but an investment in national welfare.

Finally, by consolidating crash data and quality of life results, there is a more inclusive platform to design road safety action plans and healthcare delivery service enhancements in Malaysia. It enables the development of effective interventions, which can curtail mortality as well as have a meaningful impact on the lives of survivors. With the improved transport infrastructure and public health services in Malaysia in the coming years, it is important to use such resources to make road safety programs economically beneficial and as a source of better living standards for all citizens.

REFERENCES

Abate, K., Worku, A., Hussien, S. & Aklilu, A. 2015. Association Between Socioeconomic Status and Willingness to Pay for Medical Care Among Government School Teachers in Addis Ababa. Science Journal of Public Health 3(5): 677.

Abd Rahman, R., Meor Hussein, M.M.H., Nordin, N.A., Mohd, R.M.Z., Ibrahim, A.H. & Yusoff, R. 2023. Analysis of road traffic crashes data of Perak State in Malaysia. International Journal of Sustainable Construction Engineering and Technology, 14(2):266□276.

Abdalla, S., Apramian, S. S., Cantley, L. F. & Cullen, M. R. 2017. Occupation and Risk for Injuries. Disease Control Priorities, Third Edition (Volume 7): Injury Prevention and Environmental Health 97□132.

Abdelfatah, A. 2016. Traffic fatality causes and trends in Malaysia.

Abdul Manan, M.M. & Várhelyi, A. 2012. Motorcycle fatalities in Malaysia. *IATSS Research* 36(1): 30□39.

Adhikari, S. P., Dev, R. & Shrestha, J. N. 2020. Cross-cultural adaptation, validity, and reliability of the Nepali version of the Exercise Adherence Rating Scale: A methodological study. Health and Quality of Life Outcomes, 18(1), 1□8.

Ahadi, M. R. & Razi-ardakani, H. 2015. Estimating the cost of road traffic crashes in Iran using human capital method. International Journal of Transportation Engineereing 2(3): 163□178.

Ahmad, N., Salleh, M., & Ibrahim, R. (2022). Socioeconomic factors influencing transportation choices in urban Malaysia. *Journal of Urban Studies, 34*(3), 145-160.

Ainy, E., Soori, H., Ganjali, M., Basirat, B. & Haddadi, M. 2016. Cost Estimation of Road Traffic Injuries Among Iranian Motorcyclists Using the Willingness to Pay Method. Archives of Trauma Research In Press(In Press). doi:10.5812/atr.23198

Ainy, E., Soori, H., Ganjali, M., Le, H. & Baghfalaki, T. 2014. Estimating cost of road traffic injuries in iran using willingness to pay (WTP) method. PLoS ONE 9(12): 1□16.

Aitken, L. M., Chaboyer, W., Kendall, E. & Burmeister, E. 2012. Health status after traumatic injury. Journal of Trauma and Acute Care Surgery 72(6): 1702□1708.

Aitken, L. M., Chaboyer, W., Kendall, E. & Burmeister, E. 2012. Health status after traumatic injury. *Journal of Trauma and Acute Care Surgery* 72(6): 1702□1708.

Aizuddin, A. N. B. 2017. Malaysian Ability and Willingness To Pay for Healthcare and Their Healthcare and Their Influencing Factors. Retrieved from http://apacph2015.fkm.ui.ac.id/ppt/22 October 2015/23. FP Health Policy B-Pangrango/2. Azimatun Noor A.pdf

Ajzen, I. 1991. The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2): 179–211.

Ajzen, I. 2006. Behavior Interventions Based on Theory of Planned Behaviour. Available at: https://people.umass.edu./aizen/

Akmal Abdelfatah. 2016. Traffic Fatality Causes. Malaysia Sustainable Cities Program, Working Paper Series.

Akmal Abdelfatah. 2016. *Traffic Fatality Causes*. Malaysia Sustainable Cities Program, Working Paper Series.

□ □ □erini□ □ □ □ Ščasný □ □ □ □ □ □ □ □ □n □ □e va□ i□ i□ □ o□ □ □e es□ contingent valuation: Evidence from the Czech Republic. Journal of Risk and Uncertainty 62(1): 55–87.

Alharbi, R., Mosley, I., Miller, C., Hillel, S. & Lewis, V. 2019. Factors associated with physical, psychological and functional outcomes in adult trauma patients following Road Traffic Crash: A scoping literature review. Transportation Research Interdisciplinary Perspectives 3: 100061.

Alkhatni, F., Ishak, S. Z., Hashim, W. B., Borhan, M. N., & Zahran, E. M. M. 2023. Spatial analysis of the contribution of parking service facilities to traffic crashes along limited-access roadways. *The Open Transportation Journal*, *17*(1).

Andersson Järnberg, L., Andrén, D., Hultkrantz, L., Rutström, E.E. & Vimefall, E. 2024. Willingness to pay for private and public traffic safety improvements: the importance of the underlying good. Applied Economics (ePub ahead of print): 1–14.

Andersson, J. 2007. Age differences in the valuation of road safety: A contingent valuation study. *Transport Policy* 14(1): 1–8.

Antoniou, C. 2014. A stated-preference study of the willingness-to-pay to reduce traffic risk in urban vs. rural roads. *European Transport Research Review* 6(1): 31–42.

Armitage, C.J. & Conner, M. 2001. Efficacy of the theory of planned behaviour: A meta-analytic review. *British Journal of Social Psychology*, 40(4): 471–499.

Arrow, K., Solow, R., Portney, P. R., Leamer, E. E., Radner, R. & Schuman, H. 1993. Report of the NOAA Panel on Contingent Valuation. Federal Register 58(10): 4601–4614. Retrieved from

Arrow, K., Solow, R., Portney, P. R., Leamer, E. E., Radner, R. & Schuman, H. 1993. Report of the NOAA Panel on Contingent Valuation. Federal Register, 58(10), 4601–4614.

Association for the Advancement of Automotive Medicine. 2015. *Abbreviated Injury Scale (AIS): 2015 Revision*. Chicago: AAAM

Azami, M.F.A.M., Misro, M., Ismail, H., Mohd, H., Rahmat, R.F. & Nordin, N.H. 2024. Road crash dynamics in Malaysia: Analysis of trends and determinants. Heliyon, 10(e37457).

Azmaniza Azizam. 2019. Cost-effectiveness analysis of psoriasis treatment modalities in Malaysia. PhD Thesis, Universiti Kebangsaan Malaysia.

Bahamonde-Birke, F. J., Kunert, U. & Link, H. 2015. The Value of a Statistical Life in a Road Safety Context – A Review of the Current Literature. *Transport Reviews* 35(4): 488–511.

Baharuddin, K. & Mohamad, S.M. 2015. Burden of motorcycle-related injury in Malaysia (emergency department perspective).

Banzhaf, H. S. 2014. Retrospectives: The cold-war origins of the value of statistical life. Journal of Economic Perspectives 28(4): 213–226.

Banzhaf, H. S. 2021. The Value Of Statistical Life: A Meta-Analysis Of Meta-Analyses. Advances in Transport Policy and Planning.

Banzhaf, H. S. 2021. The Value Of Statistical Life: A Meta-Analysis Of Meta-Analyses. Advances in Transport Policy and Planning.

Basaza RK, Kiconco JH, Kyasiimire EP, Otieno ED. Determinants of Willingness to Pay for Community Health Insurance Among Commercial Motorcyclists in Kampala City, Uganda: A Contingent Valuation Study. J Res Health. 2022;12(2):75–84.

Bateman, I. J., T., R., Day, C. B., Hanemann, M., Mourato, N. H. T. H. M. J.-L. G. S., Ozdemiroglu, E., OBE, D. W. P., et al. 2002. Economic Evaluation with Stated Preference Techniques: A Manual. United Kingdom: Edward Edgar Publishig Limited.

Beaton, D. E., Bombardier, C., Guillemin, F. & Ferraz, M. B. 2000. Guidelines for the Process of Cross-Cultural Adaptation of Self-Report Measures. SPINE 25(24): 3186–3191.

Belete, G. T. & Walle, Y. 2023. Willingness to pay for medical care and its determinants in private health care facilities among Gondar city residents, Northwest Ethiopia: Cross sectional study. Heliyon 9(11): e21143.

Bhattacharya, S., Alberini, A. & Cropper, M. L. 2007. The value of mortality risk reductions in Delhi, India. Journal of Risk and Uncertainty 34(1): 21–47.

Bhattacharya, S., Alberini, A. & Cropper, M. L. 2007. The value of mortality risk reductions in Delhi, India. Journal of Risk and Uncertainty, 34(1), 21–47.

Boone, H. N., Jr., & Boone, D. A. (2012). Analyzing Likert data. *Journal of Extension, 50*(2), Article 48. Retrieved from https://open.clemson.edu/joe/vol50/iss2/48/

Borhan, M.N., Ibrahim, A.N.H., Aziz, A. & Yazid, M.R.M. 2018. The influence of demographic and risk-□a□ing □e□aviour on □o□or□□□□is□s' □ras□ invo□ve *Crash Analysis & Prevention* 121: 94–100.

Bosworth, R., Hunter, A. & Kibria, A. 2017. The Value of a Statistical Life: Economics and Politics 1–27.

Bosworth, R., Hunter, A. & Kibria, A. 2017. The Value of a Statistical Life: Economics and Politics 1–27.

Braathen, N. A., Lindhjem, H. & Navrud, S. 2010. Valuing lives saved through environmental, transport and health policies: A Meta-analysis of stated preference studies 33(2008): 1–60. Retrieved from http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?doclanguage=en&cote=env/epoc/wpnep(2008)10/final

Carla Roberta Monteiro, A. C. M. e F. 2010. Fractures At Hospitalization and At Home. Rev Esc Enferm USP 3(44): 711–715.

Carla Roberta Monteiro, A. C. M. e F. 2010. Fractures At Hospitalization and At Home. *Rev Esc Enferm USP* 3(44): 711–715.

□arson□ □□ □□ □□□□□ □on□ingen□ □a□ua□ion □□□ser's □nviron□ □□
1413-1418 34(8): 1413–1418.

Champahom, T., Banyong, C., Hantanong, N., Se, C., Jomnonkwao, S. & Ratanavaraha, V. 2023. Factors influencing the willingness to pay for motorcycle safety improvement: A structural equation modeling approach. *Transportation Research Interdisciplinary Perspectives* 22(April): 100950.

Charalampos, K. 2016. Examining the issue of Value of Statistical Life (February), 1–26.

Chaturabong, P., Kanitpong, K. & Jiwattanakulpaisarn, P. 2011. Analysis of costs of motorcycle crashs in thailand by willingness-to-pay method. Transportation Research Record (2239): 56–63.

Cheong, K. C., Hill, C. E., & Ismail, R. (2021). Education and socio-economic mobility in Malaysia. *Asian Education and Development Studies, 10*(2), 157-173.

Chhotu, A. K. & Kumar, C. S. 2014. Willingness to Pay for Better Safety on State Highways. International Journal of Civil Engineering Research 5(4): 407–410.

Chua V, et al. The willingness to pay for telemedicine among patients with chronic diseases: A systematic review. J Med Internet Res. 2022;24(4):e33372.

Clinical Research Malaysia. 2020. Hospital Sultanah Bahiyah (HSB) □Hospital profile (41 wards; total 1,108 beds: 910 HSB + 198 HAS). Diakses pada 25 Ogos 2025, daripada https://clinicalresearch.my/portfolio/hospital-sultanah-bahiyah/

Dahdah, S. & McMahon, K. 2008. The true cost of road crashes: Valuing life and the cost of a serious injury. International Road Assessment Programme (iRAP), London.

De Blaeij, A., Florax, R. J. G. M., Rietveld, P. & Verhoef, E. 2003. The value of statistical life in road safety: A meta-analysis. Crash Analysis and Prevention 35(6): 973□986.

de Sá-Caputo, D. C., et al. 2020. Development, validation and reliability of a questionnaire using the Google® Forms digital platform as it is a free and reliable platform. Annals of Medicine, etc. Diakses pada 25 Ogos 2025, daripada https://pmc.ncbi.nlm.nih.gov/articles/PMC7717004/

Department of Statistics Malaysia (DOSM). 2024. Statistical yearbook Malaysia 2024. Putrajaya: DOSM.

Department of Statistics Malaysia (DOSM). Latest available publication. Household Income and Basic Amenities Survey Report. Putrajaya: DOSM

Department of Statistics Malaysia. 2018. Statistics on causes of death, Malaysia 2017. Putrajaya: Department of Statistics Malaysia.

Department of Statistics Malaysia. 2019. Statistics on causes of death, Malaysia 2018. Putrajaya: Department of Statistics Malaysia.

Department of Statistics Malaysia. 2020. Statistics on causes of death, Malaysia 2019. Putrajaya: Department of Statistics Malaysia.

Department of Statistics Malaysia. 2021. Statistics on causes of death, Malaysia 2020. Putrajaya: Department of Statistics Malaysia

Dianingati, R. S. & Utami, W. 2024. (WTP) For National Health Insurance Monthly □ ee as □ n□ e□ en□ en□ □ ar□ i□ i□ an□ s □ □ □ urve□□66n □ e□ arang □ □ □ □ □

Ditsuwan, V., Veerman, L. J., Barendregt, J. J., Bertram, M. & Vos, T. 2011. The national burden of road traffic injuries in Thailand. Population Health Metrics 9(1): 2.

Europe, N. H. S. survey advice centre at P. I. 2004. Patient survey report 2004 - adult inpatients. Retrieved from http://www.healthcarecommission.org.uk

Faudzi, M. & Yusof, M. 2004. Malaysian Value of Statistical Life for Fatal Injury in Road Crash : a Conjoint Analysis Approach. Journal of Society for Transportation and Traffic Studies, 2(2), 30□40.

Faudzi, M. M., & Nor, N. G. M. 2011. Malaysian Value of Fatal and Non-Fatal Injury due to Road Crashs: Willingness to Pay Using Conjoint Analysis. *Eastern Asia Society for Transportation Studies, 8*.

Faudzi, S.A.M. & Zulkipli, Z. 2020. Non-fatal motorcycle crash configuration and injury severity. Journal of the Society of Automotive Engineers Malaysia, 4(1):21□28.

Ferrans CE, Zerwic JJ, Wilbur JE, Larson JL. Conceptual model of health-related quality of life. J Nurs Scholarsh. 2005;37(4):336□342.

Fincham, J.E. 2008. Response rates and responsiveness for surveys, standards, and the Journal. American Journal of Pharmaceutical Education 72(2): Article 43.

Fitzharris, M., Bowman, D. & Ludlow, K. 2010. Factors associated with return-to-work and health outcomes among survivors of road crashes in Victoria. Australian and New Zealand Journal of Public Health, 34(2), 153□159.

Francis, F., Moshiro, C., Hans Yngve, B. & Hasselberg, M. 2021. Investigation of road infrastructure and traffic density attributes at high-risk locations for motorcycle-related injuries using multiple correspondence and cluster analysis in urban Tanzania. *International Journal of Injury Control and Safety Promotion* 28(4): 428-438.

Fui, W. M., Majid, H. A., Ismail, R., Su, T. T., Pin, T. M. & Said, M. A. 2022. Psychosocial factors associated with mental health and quality of life during the COVID-19 pandemic among low-income urban dwellers in Peninsular Malaysia. *Cold Spring Harbor Laboratory*.

Galea, S., Merchant, R. M., & Lurie, N. 2020. The mental health consequences of COVID-19 and physical distancing: The need for prevention and early intervention. *JAMA Internal Medicine, 180*(6), 817-818.

Garratt, E. 2009. the Key Findings Report for the 2008 Inpatient Survey Acute Co-Ordination Centre for the (June).

Gayet-Ageron, A., Agoritsas, T., Schiesari, L., Kolly, V., & Perneger, T. V. 2011. Barriers to participation in a patient satisfaction survey: Who are we missing? *PLoS One, 6*(10), e26852.

Gelaw, A. Y., Gabbe, B. J., Arnup, S. J., Reeder, S., Fitzgerald, M., Lyons, R. A., Ponsford, J. L., et al. 2025. The association between post-injury chronic physical health conditions, health status, and survival time in people with serious orthopaedic injuries. Trauma (United Kingdom) 27(1): 39□50.

George, D. & Mallery, P. 2003. SPSS for Windows step by step: A simple guide and reference, 11.0 update. 4th ed. Boston: Allyn & Bacon.

Ghosh, S. & Mondal, S. 2011. *Willingness to pay for health insurance amongst the urban poor: evidence from a slum in Mumbai, India*. Artha Vijnana 53(2): 117□124.

□ □ ie□ □ □□ □□ □ □□ie□ □ □□ □□ □□□□□ □a□ □u□ a□ing□ in□ er□ re□ in alpha reliability coefficient for Likert-type scales. Midwest Research-to-Practice Conference in Adult, Continuing, and Community Education, 82□88.

Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2021 (GBD 2021) results. Malaysia: age-standardized DALY rate for road injuries per 100,000. Accessed via GBD visualization tool; 2023

Gopinath, B., Jagnoor, J., Elbers, N. & Cameron, I. D. 2017. Overview of findings from a 2-year study of claimants who had sustained a mild or moderate injury in a road traffic crash: prospective study. BMC Research Notes 10(1): 1□7.

Guest, R., Tran, Y., Gopinath, B., Cameron, I. D. & Craig, A. 2017. Psychological distress following a motor vehicle crash: Evidence from a statewide retrospective study examining settlement times and costs of compensation claims. BMJ Open 7(9): 1□9.

Guillemin, F., Bombardier, C. & Beaton, D. 1993. Cross-cultural adaptation of health-related quality of life measures: Literature review and proposed guidelines. *Journal of Clinical Epidemiology* 46(12): 1417□1432.

Haider, A. H., Herrera-Escobar, J. P., Al Rafai, S. S., Harlow, A. F., Apoj, M., Nehra, D., Kasotakis, G., et al. 2020. Factors associated with long-term outcomes after injury: Results of the functional outcomes and recovery after trauma emergencies (FORTE) multicenter cohort study. Annals of Surgery 271(6): 1165□1173.

Hasan-Basri, B., Rawi, S. B. & Bakar, N. 2015. Willingness To Pay and Willingness To Accept. American Economic Review, 10(September), 323 □329.

Hassim, M.H., et al. 2013. Commuter motorcycle crash risk factors in Malaysia. Journal of Safety Research / PMC indexed article. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3861834/

Hendratmoko, A. and Susilo, Y.O. 2014. Influence of perceived behavioral control on motorcycle safety behaviors. *Accident Analysis & Prevention* 68: 224□231.

Herrera-Escobar, J. P., Deroon-Cassini, T., Brasel, K., Nehra, D., Al Rafai, S. S., Toppo, A., Kasotakis, G. et al. 2020. Development and validation of a revised trauma-specific quality of life instrument. Journal of Trauma and Acute Care Surgery, 88(4), 501□507.

Herrera-Escobar, J. P., Rivero, R., Apoj, M., Geada, A., Villanyi, M., Blake, D., Nehra, D., et al. 2019. Long-term social dysfunction after trauma: What is the prevalence, risk factors, and associated outcomes? Surgery (United States) 166(3): 392□397.

Hirschman, C. (1986). The Making of Race in Colonial Malaya: Political Economy and Racial Ideology. *Sociological Forum, 1*(2), 330□361.

Hokkam, E., Gonna, A., Zakaria, O. & El-shemally, A. 2015. Trauma patterns in patients attending the Emergency Department of Jazan General Hospital, Saudi Arabia. *World Journal of Emergency Medicine* 6(1): 48.

Hosseini, H., Golestani, M., Sadeghi Bazargani, H. & Saadati, M. 2024. A Estimating willingness to pay for motorcycle helmet and its determinants through contingent valuation method Willingness to pay (WTP) Motorcyclist Safety helmet Crashs. *J Inj Violence Res* 16(2): 101–108.

Huang, C. Y., Peng, S. H., Lin, H. P., Hsu, S. Y. & Hsieh, C. H. 2025. Quality of life and spiritual health in motorcycle crash survivors: An analysis using the SF-36 Questionnaire and Spiritual Scale. Formosan Journal of Surgery 58(1): 6–13.

Huertas-Leyva, P., Baldanzini, N., Savino, G. & Pierini, M. 2021. Human error in motorcycle crashes: A methodology based on in-depth data to identify the skills needed and support training interventions for safe riding. Traffic Injury Prevention 22(4): 294–300.

Hultkrantz, L. & Svensson, M. 2012. The value of a statistical life in Sweden: A review of the empirical literature. Health Policy 108(2–3): 302–310.

Hung, K.K.C., Law, L.S.K., Chan, K.K., Wong, J.Y.H., Cheung, Y.T.D., Choi, E.P.H., Lam, H.S.L. & Yau, T.K. 2022. Psychological distress, pain and insurance claims negatively affect long-term health-related quality of life after road traffic injuries. Journal of Rehabilitation Medicine. Available at: https://pubmed.ncbi.nlm.nih.gov/35735901/

Ibrahim, N. I., Borhan, M. N., Yazid, M. R. M. & Ismail, A. 2019. Factors affecting the willingness to pay for road safety improvements: A case study in Malaysia. *International Journal of Civil Engineering and Technology* 10(3): 1205–1214.

Idris, A., Hamid, H. & Law, T.H. 2019. Factors contributing to motorcycle crashs in Malaysia. IOP Conference Series: Earth and Environmental Science, 357(1):012039.

Idris, N., Zainuddin, F. Z., & Hashim, R. (2019). Marital Patterns in Malaysia: An Analysis of Changing Trends. *Journal of Asian Studies, 76*(3), 456–475.

Institute for Health Metrics and Evaluation (IHME). 2021. *Global Burden of Disease Study 2021 (GBD 2021) Results*. Seattle, WA: IHME, University of Washington.

Institute, S. N. R. A. T. 2001. Road Safety on Three Continents (September): 19–21.

International Transport Forum (OECD). 2023. Road safety annual report 2023. Paris: OECD Publishing.

Isa, M., Ariffin, A.H., Jawi, Z.M. & Ting, C.H. 2013. Factors contributing to crash involvement of underage motorcycle riders in Malaysia. Jurnal Teknologi (Sciences & Engineering), 65(2):61–66.

Jabatan Perangkaan Malaysia. 2025. *Statistics on causes of death, Malaysia 2025*. Putrajaya: Jabatan Perangkaan Malaysia.

Jazdzik-Osmolska, A. 2021. Willingness to Pay for Road Safety Improvements in Poland. European Research Studies Journal XXIV(Issue 3B): 96–117.

Kamarudin, M.K.A., Wahab, N., Umar, R., Saudi, A.S.M., Saad, M.H.M., Rosdi, N.R.N., Razak, S.A., Merzuki, M.M., Abdullah, A.S., Amirah, S. & Ridzuan, A.M. 2018. Road traffic crash in Malaysia: Trends, selected underlying determinants and status intervention. International Journal of Engineering and Technology, 7(4.34):112–117.

Kenardy, J., Heron-Delaney, M., Warren, J. & Brown, E. 2015. The effect of mental health on long-term health-related quality of life following a road traffic crash: Results from the UQ SuPPORT study. Archives of Physical Medicine and Rehabilitation 96(3): 410–417.

Kenardy, J., Heron-Delaney, M., Warren, J. & Brown, E. 2015. The effect of mental health on long-term health-related quality of life following a road traffic crash: Results from the UQ SuPPORT study. Archives of Physical Medicine and Rehabilitation 96(3): 410–417.

[illegible] et al. 2011. The impact of injuries study. Multicentre study assessing physical, psychological, social and occupational functioning post injury - A protocol. BMC Public Health 11.

Kniesner, T. J. & Viscusi, W. K. 2019. The Value of a Statistical Life Summary and [illegible]

Kniesner, T. J. & Viscusi, W. K. 2019. The Value of a Statistical Life Summary and [illegible]

Kovacevic, J., Fotez, I., Miskulin, I., Lesic, D., Miskulin, M., Berlancic, T., Vukoja, I., et al. 2021. Different patterns of mental health outcomes among road traffic crash survivors: A prospective cohort study. International Journal of Environmental Research and Public Health 18(4): 1–19. doi:10.3390/ijerph18041564

[illegible] S., et al. 2020. Quality of life in road traffic crash survivors. Zdravstveno Varstvo 59(4): 202–210.

Krishnamurthy, A. and Hendratmoko, A. 2016. Attitudes and WTP for road safety: A behavioral perspective. *Transportation Research Part F: Traffic Psychology and Behaviour* 43: 167–177.

Kriswardhana, W., Hayati, N. N. & Puspita, K. D. 2020. Willingness to Pay Model for [illegible] n *Jurnal Teknik Sipil* 27(3): 231.

Langley, J., Derrett, S., Davie, G., Ameratunga, S. & Wyeth, E. 2011. A cohort study of short-term functional outcomes following injury: The role of pre-injury socio-demographic and health characteristics, injury and injury-related healthcare. Health and Quality of Life Outcomes 9: 1–12.

Lindberg, K. and Andersson, J. 2009. Risk perception and WTP for road safety: Evidence from Sweden. *Accident Analysis & Prevention* 41(3): 568–574.

Litman, T. 2008. Valuing Transit Service Quality Improvements. Journal of Public Transportation 11(2): 43–63.

Litman, T. A. 2013. Towards More Comprehensive and Multi-modal Transport Evaluation. LTA Academy (September 2013): 50–58.

Liu, F. 2019. Does Identity Theft Insurance Undermine Risk Perceptions and Increase Risky Behavioral Intentions? *Asian Economic and Financial Review* 9(8): 926-935.

Lugo, L. H., García, H. I., Cano, B. C., Arango Lasprilla, J. C. & Alcaraz, O. L. 2013. Multicentric study of epidemiological and clinical characteristics of persons injured in motor vehicle crashs in Medellín, Colombia, 2009-2010. Colombia Medica, (April), 100–107.

Mahidin, M. U. 2018. Department Of Statistics Malaysia Press Release Statistics on Causes of Death Malaysia 2018. Department of Statistics Malaysia, (October).

Malaysia Road Safety Department. 2014. Road Safety Plan Of Malaysia 2014-2020.

Malaysia, M. of E. 2025. The Malaysian Economy in Figures 2024. Retrieved from www.ekonomi.gov.my

Malaysian Institute of Road Safety Research (MIROS). 2023. Road safety statistics and reports. Kajang: MIROS.

Manan, M. M., & Varhelyi, A. (2012). Motorcycle fatalities in Malaysia. *Crash Analysis & Prevention, 49*, 17–29.

Manggaberani, A. A. & Darlis, A. M. 2024. The effectiveness of Google Forms in assessing and evaluating online learning outcomes: Meta-analysis study. Indonesian Journal of Social Technology, 5(10). Retrieved by 25 Ogos 2025, https://www.researchgate.net/publication/385404415_The_effectiveness_of_Google_Forms_in_assessing_and_evaluating_online_learning_outcomes_Meta-analysis_study

Maslina Musa, Normala Malik, Nor Fadilah Mohd Soid, Low Suet Fin, Law Teik Hua & Azhar Hamzah. 2023. *Value of Statistical Life (VOSL) and Its Association with the Use of Road Safety Devices*. In: MIROS Book of Abstracts 2023. Kuala Lumpur: Malaysian Institute of Road Safety Research (MIROS), pp. 7.

Mathers, C. D. & Loncar, D. 2006. Projections of global mortality and burden of disease from 2002 to 2030. PLoS Medicine 3(11): 2011–2030.

Mathers, C. D. & Loncar, D. 2006. Projections of global mortality and burden of disease from 2002 to 2030. PLoS Medicine, 3(11), 2011–2030.

Melissa Legg, Michele Foster, Rachel Jones, Melissa Kendall, Jennifer Fleming, Mandy Nielsen, Elizabeth Kendall, D. B. 2021. The impact of obstacles to health and rehabilitation services on functioning and disability: a prospective survey on the 12-months after discharge from specialist rehabilitation for acquired brain injury. Disability and Rehabilitation 44(20): 5919–5929.

MESA (Malaria Eradication Scientific Alliance). 2024. Hospital Sultanah Bahiyah. Diakses pada 25 Ogos 2025, daripada https://mesamalaria.org/institution/hospital-sultanah-bahiyah/

Milligan, C., Kopp, A., Dahdah, S. & Montufar, J. 2014. Value of a statistical life in road safety: A benefit-transfer function with risk-analysis guidance based on developing country data. Crash Analysis and Prevention 71: 236–247.

Min, K.B. et al. 2015. Occupational and socioeconomic classification in health outcomes research. *Annals of Occupational and Environmental Medicine* 27: 11.

Ministry of Transport Malaysia. 2022. *Malaysia Road Safety Plan 2022-2030*. Putrajaya: Ministry of Transport.

Ministry of Transport Malaysia. 2026. *Road safety performance report 2025: Ministerial briefing*. Putrajaya: Ministry of Transport.

Ministry of Transport Malaysia: 2025 Road Safety Performance Briefing

Mitchell, R. C. & Carson, R. T. 1989. Using Surveys to Value Public Goods. Using Surveys to Value Public Goods. Resources for the Future.

Mofadal, A. I. A. & Kanitpong, K. 2010. Analysis of Road Traffic Crash Costs in Sudan Using the Human Capital Method Keywords Road Traffic Crash, Crash Costs, Human Capital, Loss in Quality of Life, Sudan, Crash Severity Level. *Open Journal of Civil Engineering* 6(6): 203–216.

Mofadal, A. I. A., Kanitpong, K. & Jiwattanakulpaisarn, P. 2015. Analysis of pedestrian crash costs in Sudan using the willingness-to-pay method. Crash Analysis and Prevention, 78, 201–211.

Mohamed, H. A. 2015. Estimation of Socio-Economic Cost of Road Crashs in Saudi Arabia: Willingness-To-Pay Approach (WTP). Advances in Management & Applied Economics, 5(3), 19. Retrieved from http://www.scienpress.com/Upload/AMAE/Vol 5_3_5.pdf

Mohd Faudzi Mohd Yusoff, Nor Ghani Md Nor, N. A. M. 2011. Malaysian Value of Fatal and Non Fatal Injury due to Road Crash : The Willingness to Pay Using Conjoint Analysis Study. Proceedings of EASTS Vol. 9, 8(2004), 1–13.

Mohd Fauzi, M. Y., Nor Ghani, M. N., Radin Umar, R. S. & Hariza, H. A. 2004. The value of life and crash costing: A willingness-to-pay study amongst motorcyclists in Malaysia. *Applied Health Economics and Health Policy* 3(1): 5–8.

Mohd Misban, N. H., Kadir@Shaha, H., Mohd Zulkefli, N. A., & Mohd Nazan, A. I. N. 2023. Determinants of unintentional home injury prevention practice among B40 parents of under-five children in Selangor: A study protocol. *Malaysian Journal of Medicine and Health Sciences*, *19*(6), 334–339.

Mohd Saman, S.A., Jothee, S., Mohd Nor, F.N. & Shafie, M.S. 2020. The pattern of injuries among motorcyclists in fatal road traffic crashs: An autopsy-based study. American Journal of Forensic Medicine and Pathology, 42(2):141–146.

Mon, E. E., Jomnonkwao, S., Khampirat, B., Satiennam, T. & Ratanavaraha, V. 2019. Estimating the willingness to pay and the value of fatality risk reduction for car drivers in Myanmar. Case Studies on Transport Policy 7(2): 301–309.

Mon, E. E., Jomnonkwao, S., Khampirat, B., Satiennam, T. & Ratanavaraha, V. 2019. Estimating the willingness to pay and the value of fatality risk reduction for car drivers in Myanmar. *Case Studies on Transport Policy* 7(2): 301–309.

Mon, E. E., Jomnonkwao, S., Khampirat, B., Satiennam, W. & Ratanavaraha, V. 2018. Willingness to pay for mortality risk reduction for traffic crashs in Myanmar. Crash Analysis and Prevention 118(April 2017): 18–28.

Mon, E. E., Jomnonkwao, S., Khampirat, B., Satiennam, W. & Ratanavaraha, V. 2018. Willingness to pay for mortality risk reduction for traffic crashs in Myanmar. *Crash Analysis and Prevention* 118(April 2017): 18–28.

Mowafi H, Rice B, Nambaziira R, Nirere G, Wongoda R, James M, et al. Household economic impact of road traffic injury versus routine emergencies in a low-income country. Injury. 2021;52(9):2657–2664.

Musa, M. F., Hassan, S. A. & Mashros, N. 2020. The impact of roadway conditions towards crash severity on federal roads in Malaysia. *PLOS ONE* 15(7): e0235564.

Nankunda, C. & Evdorides, H. 2023. A Systematic Review of the Application of Road Safety Valuation Methods in Assessing the Economic Impact of Road Traffic Injuries 1253–1271.

Nasaruddin, N., Wah, Y.B., Voon, W.S., Ismail, A.R. & Talib, N.A. 2012. Fatality prediction model for motorcycle crashs. International Conference on Statistics in Science, Business and Engineering (ICSSBE).

Nawi, N. S. M., Deros, B. M., Rahman, M. N. A., Sukadarin, E. H. & Nordin, N. 2016. Malaysian oil palm workers are in pain: Hazards identification and ergonomics related problems. Malaysian Journal of Public Health Medicine 16(January): 50–57.

Nemmang, M. S., Sim, H. J., Arif, S. T. M. S. T., Khaidir, N. M., Ahmad, J., Hoong, A. P. W., Manan, M. M. A., et al. 2020. The Investigation on Pavement Surface along Bicycle Lane in Malaysia The Investigation on Pavement Surface along Bicycle Lane in Malaysia.

Nguyen H, Ivers RQ, Jan S, Martiniuk AL, Pham C. The economic burden of road traffic injuries: evidence from a provincial general hospital in Vietnam. Injury Prev. 2013;19(2):79□84.

NHS Surveys. (2005). Increasing response rates in NHS patient surveys: A literature review. Retrieved from nhssurveys.org

Nor Ghani, M. N., & Mohd Faudzi, Y. (2003). Value of Life of Malaysian Motorists: Estimates from a Nationwide Survey. *Journal of the Eastern Asia Society for Transportation Studies, 5*.

Nor, N. G. M. & Yusoff, M. F. mohd. 2003. Value of life of Malaysia motorists: Estimates from a nationwide survey. Journal of the Eastern Asia Society for Transportation Studies, 5(October), 160.

NorAzmaniza Azizam. 2019. *Kos Rawatan Psirosis di Hospital Awam*. Universiti Kebangsaan Malaysia.

Nuura Addina, M., & MIROS. 2010. Malaysian Value of Statistical Life for Fatal Injuries in Road Crash: A Conjoint Analysis Approach.

Obermeyer, A. & Hirte, G. 2021. Estimating the value of a statistical life in a road safety context: the impact of a driving simulation (July).

Oladeji, E. O., Ezeme, C., Baiyewu, L. A., Okunola, M. O. & Ogunlade, S. O. 2024. The catastrophic cost of motorcycle road traffic injuries: Experience from a major reference centre in a lower-middle income country. *Injury* 55(5): 111314.

Organisation for Economic Co-operation and Development (OECD). 2012. Mortality risk valuation in environment, health and transport policies. Paris: OECD Publishing.

Organisation for Economic Co-operation and Development (OECD). Mortality Risk Valuation in Environment, Health and Transport Policies. Paris: OECD Publishing, 2012.

Oxley, J., Ravi, M.D., Yuen, J., Hoareau, E. & Hashim, H. 2013. Identifying contributing factors to fatal and serious injury motorcycle collisions involving children in Malaysia. Annals of Advances in Automotive Medicine, 57:329□336.

Oxley, J., Yuen, J., Ravi, M.D., Hoareau, E., Mohammed, M.A.A., Bakar, H., Venkataraman, S. & Nair, P.K. 2013. Commuter motorcycle crashes in Malaysia: An understanding of risks. Annals of Advances in Automotive Medicine, 57:45□54.

Paiva, L., Pompeo, D. A., Ciol, M. A., Arduini, G. O., Dantas, R. A. S., Senne, E. C. V. de & Rossi, L. A. 2016. Health status and the return to work after traffic crashs. Revista brasileira de enfermagem 69(3): 443□450.

Pangestika, S. H., Kusumawati, A. & Sjafruddin, A. 2021. Study on Motorcycle Crash Cost in Bandung City. Jurnal Teknik Sipil 28(1): 17□22.

Patenaude, B. N., Semali, I., Killewo, J. & Bärnighausen, T. 2019. The Value of a Statistical Life-Year in Sub-Saharan Africa: Evidence From a Large Population-Based Survey in Tanzania. Value in Health Regional Issues, 19, 151□156.

Peden, M., Scurfield, R. & Sleet, D. 2004. World report on road traffic injury prevention. World Report on Road Traffic Injury Prevention,. doi:Export Date 19 June 2013

□□a□ □□ □□□ □e□□i□ □□ □□□ □e□rie□ □□ □□□ □□a□s□ □□□□ Willingness to Pay for a Motorcycle Helmet in Hanoi, Vietnam. Appl Health Econ Health Policy 6(2□3): 137□144.

Pickery, J. & Carton, A. 2008. Oversampling in relation to differential regional response rates. Survey Research Methods 2(2): 83□92.

Polis Diraja Malaysia (PDRM) Jabatan Siasatan dan Penguatkuasaan Trafik Malaysia. 2020. Traffic offences and crash contributing factors report. Putrajaya: JPJ Malaysia.

Polis Diraja Malaysia (PDRM). 2018. Jabatan Siasatan dan Penguatkuasaan Trafik. Laporan perangkaan kemalangan jalan raya Malaysia 2018.

Polis Diraja Malaysia (PDRM). 2024. *Statistik kemalangan jalan raya Malaysia 2023*. Kuala Lumpur: Jabatan Siasatan dan Penguatkuasaan Trafik (JSPT).

Polis Diraja Malaysia (PDRM). 2026. *Daily statistics of crashs nationwide 2025*. Kuala Lumpur: Jabatan Siasatan dan Penguatkuasaan Trafik (JSPT).

□u□e□ □□□□ □□□a□ □□□□ □i□u□□in □□□ □aina□ □□ □s□ai□ □□□ pay for their drugs in primary care clinics in an urbanized setting in Malaysia: a guide on drug charges implementation. Asia Pac Fam Med. 2017;16(1):5.

Puttawong, C. & Chaturabong, P. 2020. Willingness-to-pay for estimation the risk pedestrian group crash cost. *Civil Engineering Journal (Iran)* 6(6): 1064□1073.

Quigley, K. 2018. Grief and the value of a statistical life. The Globe and Mail, pp. 51□79. Journal of Risk and Uncertainty.

Rahman, A., Ali, M. S., & Lee, C. K. (2023). Transportation patterns among low-income groups in Malaysia. *Malaysian Journal of Mobility and Transport, 19*(1), 23-35.

Rahman, N. H. N., Baharuddin, K. A. & Mohamad, S. M. S. 2015. Burden of motorcycle-related injury in Malaysia. *International Journal of Emergency Medicine* 8(1): 4□9.

Rahman, S., Awang, H., & Haron, M. S. (2020). Youth Participation in Economic Development Initiatives in Malaysia. *International Journal of Social Science Research, 8*(1), 23□34.

Ramli, R., & Mohd Yunus, S. S. 2020. Malaysian child restraint issues: A brief narrative review. *International Journal of Environmental Research and Public Health*, *17*(6), 1922.

Reis, P. A. M., Carvalho, Z. M. de F., Darder, J. J. T., Oriá, M. O. B., Studart, R. M. B. & Maniva, S. J. C. de F. 2015. Cross-cultural adaptation of the quality of life index spinal cord injury - version III. *Revista da Escola de Enfermagem* 49(3): 401□408.

Reis, P. A. M., Carvalho, Z. M. de F., Darder, J. J. T., Oriá, M. O. B., Studart, R. M. B. & Maniva, S. J. C. de F. 2015. Cross-cultural adaptation of the quality of life index spinal cord injury - version III. *Revista da Escola de Enfermagem* 49(3): 401□408.

Rissanen, R., Ifver, J., Hasselberg, M. & Berg, H. Y. 2020. Quality of life following road traffic injury: the impact of age and gender. Quality of Life Research (0123456789).

Rissanen, Ritva, Berg, H. & Hasselberg, M. 2017. Quality of life following road traffic in□ur□ □ □ s□s□e□a□i□ □i□era□ure revie□ □ □ras□ ana□ □sis 108(September): 308□320.

Rizati, H. N., Ishak, S. Z. & Aklowash, A. K. 2015. The estimation of value of statistical life for road crashs in Malaysia. *Jurnal Teknologi* 76(14): 113□117.

Rizzi, L. I. & Ortúzar, J. de D. 2006. Estimating the willingness-to-pay for road safety improvements. Transport Reviews, 26(4), 471□485.

Road Transport Department Malaysia (JPJ). 2020. Road traffic crash statistics report. Putrajaya: JPJ Malaysia.

Road Transport Department Malaysia (JPJ). 2025□2026. Vehicle registration statistics (administrative database updates). Putrajaya: JPJ Malaysia.

Rohaida Mohamad. 2019. Department of Statistics Malaysia Press Release: Statistics on Causes of Death, Malaysia, 2019. Department of Statistics Malaysia, 2015(October).

Rohana, J., Awang, H., & Hassan, S. (2020). Risk factors and behavior of Malaysian motorcyclists: A review. *Journal of Transport and Health, 18*, 100872.

Rosli, H., Samat, N. & Abu Bakar, M.A. 2024. Assessing job accessibility and sustainable mobility among low-income groups in Penang, Malaysia. *Periodica Polytechnica Transportation Engineering* 52(2): 181□189.

Sahlqvist, S., Song, Y., Bull, F., Adams, E., Preston, J. & Ogilvie, D. 2011. Effect of questionnaire length, personalisation and reminder type on response rate to a complex postal survey: randomised controlled trial. *BMC* Medical Research Methodology 11: 62.

Sánchez-Martínez, F. I., Martínez-Pérez, J. E., Abellán-Perpiñán, J. M. & Pinto-Prades, J. L. 2021. The value of statistical life in the context of road safety: new evidence on the contingent valuation/standard gamble chained approach. Journal of Risk and Uncertainty 63(2): 203□228.

Saperi, B. S., Ramli, R., Ahmed, Z., Nur, A. M., Ibrahim, M. I., Rashdi, M. F., Nordin, R. et al. 2017. Cost analysis of facial injury treatment in two university hospitals in Malaysia: A prospective study. ClinicoEconomics and Outcomes Research, 9, 107□113.

Saurav, A.K., Bandyopadhyaya, R., Chakravarty, H. & Bandyopadhyaya, V. 2025. □ na□ □ □ ing □ e□ aviora□ □ a□ □ ors a□ □ e□ □ ing □ n□ ian □ o□ or□ □ □ □ is□ s' for safety. *Case Studies on Transport Policy* 21: 101542.

Se C. A correlated random parameters ordered probit approach to analyze the differential impact of crash attributes on injury severity between urban and rural areas. Accid Anal Prev. 2021;154:106072.

Shahar, S. et al. 2019. Socioeconomic determinants of health among Malaysian older adults. *BMC Public Health* 19: 549.

Shahid, S., Minhans, A., Puan, O.C., Abdullah, S. & Ismail, A. 2015. Spatial and temporal pattern of road crashs in Peninsular Malaysia. Jurnal Teknologi, 76(14):21□28.

Sharwood, L. N., Kifley, A., Craig, A., Gopinath, B., Jagnoor, J. & Cameron, I. D. 2021. Comparison of physical and psychological health outcomes for motorcyclists and other road users after land transport crashes: an inception cohort study. BMC Public Health 21(1): 1□16.

Sherin, A. 2021. Road safety: A major public health issue. Khyber Medical University Journal 13(1): 1□3.

Smith, M.G., Witte, M., Rocha, S., & Basner, M. (2019). Effectiveness of incentives and follow-up on increasing survey response rates and participation in field studies. BMC Medical Research Methodology, 19:230.

Subhan F, Khattak A, Ali M, Ilyas M, Jan A. Public intention to pay for road safety improvement: A case study of Pakistan. Sustainability. 2021;13(15):8274.

Subhan, F., Zhao, S., Diop, E. B., Ali, Y. & Zhou, H. 2021. Public intention to pay for road safety improvement: A case study of Pakistan. Crash Analysis and Prevention 160(August): 106315.

Subhan, F., Zhao, S., Diop, E. B., Ali, Y. & Zhou, H. 2021. Public intention to pay for road safety improvement: A case study of Pakistan. *Crash Analysis and Prevention* 160(August): 106315.

Subhan, F., Zhao, S., Diop, E. B., Ali, Y. & Zhou, H. 2021. Public intention to pay for road safety improvement: A case study of Pakistan. Crash Analysis and Prevention, 160(August), 106315.

Sultan, Z., Ngadiman, N.I., Kadir, F.D.A., Roslan, N.F. & Moeinaddini, M. 2016. Factor analysis of motorcycle crashes in Malaysia. Planning Malaysia, 14(Special Issue 4):135–146.

Suresh, N. 2022. Global Plan for the Decade of Action for Road Safety 2021-2030. Varnam Malaysia. https://varnam.my/55731/dr-kulanthayan-the-first-malaysian-to-helm-global-road-safety-organisation/ [15 April 2022].

Svensson, M. & Vredin, M. 2010. Willingness to pay for private and public road safety in s□a□e□ □re□eren□e s□u□ies □□□□ □□e□i□□eren□e □□ras□□na□ 42(4): 1205–1212.

Takasaki, H. & Gabel, C. P. 2017. Cross-cultural adaptation of the 12-item Örebro musculoskeletal screening questionnaire to japanese (ÖMSQ-12-J), reliability and □□ini□ians’ i□□ressions □or □ra□□i□a□ □□i□□. *Journal of Physical Therapy Science* 29(8): 1409–1415.

Tan Chor Lip, H., Tan, J. H., Mohamad, Y., Ariffin, A. C., Imran, R. & Azmah Tuan Mat, T. N. 2019. Clinical characteristics of 1653 injured motorcyclists and factors that predict mortality from motorcycle crashes in Malaysia. *Chinese Journal of Traumatology - English Edition* 22(2): 69–74. doi:10.1016/j.cjtee.2018.11.001

Tan, H.T.C., Tan, J., Mohamad, Y., Chan, A.C. & Kuan, W.S. 2018. Clinical characteristics of 1653 injured motorcyclists and predictors of mortality. Chinese Journal of Traumatology, 21(1):50–55.

Teh, J., Mazlan, M., Danaee, M., Waran, R. J., & Waran, V. 2023. Outcome of 1939 traumatic brain injury patients from road traffic crashs: Findings from specialist medical reports in a low to middle income country (LMIC). *PLOS ONE*, *18*(9), e0284484.

Thanh, N. X., Hang, H. M., Chuc, N. T. K. & Lindholm, L. 2003. The economic burden of unintentional injuries: a community-based cost analysis in Bavi, Vietnam. Scandinavian journal of public health. Supplement 62: 45–51.

Tournier, C., Charnay, P., Tardy, H., Chossegros, L., Carnis, L. & Hours, M. 2014. A few seconds to have an crash, a long time to recover: Consequences for road crash victims from the ESPARR cohort 2 years after the crash. Crash Analysis and Prevention 72: 422–432.

Tournier, C., Charnay, P., Tardy, H., Chossegros, L., Carnis, L. & Hours, M. 2014. A few seconds to have an crash, a long time to recover: Consequences for road crash victims from the ESPARR cohort 2 years after the crash. Crash Analysis and Prevention, 72, 422–432.

Tournier, C., Hours, M., Charnay, P., Chossegros, L. & Tardy, H. 2016. Five years after the crash, whiplash casualties still have poorer quality of life in the physical domain than other mildly injured casualties: analysis of the ESPARR cohort. BMC Public Health 16(1): 1–13.

UNCTAD. 2017. TRANSPORT AND Series No 10 Road Safety - Considerations in Support of the 2030 Agenda for Sustainable Development Considerations in Support of the 2030 Agenda for Sustainable Development (Series No. 10): 11. Retrieved from https://unctad.org/system/files/official-document/dtltlb2017d4_en.pdf

Ursachi, G., Horodnic, I. A. & Zait, A. 2015. How Reliable are Measurement Scales? External Factors with Indirect Influence on Reliability Estimators. Procedia Economics and Finance 20(15): 679–686.

Viscusi, W.K. & Aldy, J.E. 2003. The value of a statistical life: A critical review of market estimates throughout the world. *Journal of Risk and Uncertainty*, 27(1): 5–76.

Vu, H. M., Dang, A. K., Tran, T. T., Vu, G. T., Truong, N. T., Nguyen, C. T., Van Doan, A. et al. 2019. Health-related quality of life profiles among patients with different road traffic injuries in an urban setting of vietnam. International Journal of Environmental Research and Public Health, 16(8).

Widyastuti, H. & Utanaka, A. 2020. Valuing subjective cost of motorcyclists used willingness-to-pay in Surabaya. *IOP Conference Series: Materials Science and Engineering* 930(1).

Wijnen, W., Weijermars, W., Vanden Berghe, W., Schoeters, A., Bauer, R., Carnis, L., Elvik, R., Theofilatos, A., et al. 2017. Crash cost estimates for European countries. Project Safety Cube.

Wijnen, Wim, Wesemann, P. & de Blaeij, A. 2009. Valuation of road safety effects in cost-benefit analysis. Evaluation and Program Planning, 32(4), 326–331.

Wilson IB, Cleary PD. Linking clinical variables with health-related quality of life: A conceptual model of patient outcomes. JAMA. 1995;273(1):59–65.

World Bank. 2023. *World development indicators: Malaysia health expenditure data*. Washington, DC: World Bank.

World Health Organization (WHO). Global status report on road safety 2023: tracking SDG targets 3.6 and 11.2 [Internet]. Geneva: World Health Organization; 2023b [cited 2025 Aug 24]. Available from: https://www.who.int/publications/i/item/9789240085767

World Health Organization (WHO). Quality of life: The WHOQOL instruments [Internet]. Geneva: World Health Organization; 2020 [cited 2025 Aug 24]. Available from: https://www.who.int/tools/whoqol

World Health Organization (WHO). Road traffic injuries [Internet]. Geneva: World Health Organization; 2023a [cited 2025 Aug 24]. Available from: https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries

World Health Organization (WHO). WHOQOL: Measuring quality of life [Internet]. Geneva: World Health Organization; 1995 [cited 2025 Aug 24]. Available from: https://www.who.int/tools/whoqol

World Health Organization. 2013. Global Status Report on Road Safety 2013. World Health Organization 1–318. Retrieved from http://www.who.int/about/licensing/copyright_form/en/index.html

World Health Organization. 2023. Global status report on road safety 2023. Geneva: World Health Organization. https://www.who.int/publications/i/item/9789240086517

World Health Organization. 2023. *Road traffic injuries*. Geneva: World Health Organization. Available at: https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries

Yang, Z., Liu, P. & Xu, X. 2016. Estimation of social value of statistical life using willingness-to-pay method in Nanjing, China. Crash Analysis and Prevention, 95, 308–316.

Yasin, R. M., Tan, M. P., Said, M. A., Rasul, M. S., Thangiah, N., Rizal, H., Magli, A. S., et al. 2024. TVET programme and health-related quality of life among low-income populations during the COVID-19 pandemic in Malaysia. *Frontiers in Public Health* 12: 1164056.

Yuan, M., Chen, W., Chu, C.I. & Fang, Y. 2015. Joint effect of education and occupation on late life health. *PLoS ONE* 10(6): e0131331.

Zaal, C., Simone, M. and Giaglis, G. 2015. Risk perception, insurance, and pre-crash behaviors– Impacts on WTP within the TPB framework. *Transportation Research Record* 2519(1): 13–21.

Zainudin, N., Nordin, N. & Begum, H. 2016. Survey designing for contingent valuation studies. Proceeding of 2nd International Conference on Economics & Banking 2016 2016(November): 1–6. Retrieved from https://www.researchgate.net/profile/Norzalina_Zainudin/publication/303750748_Survey_Designing_For_Contingent_Valuation_Studies/links/5acf02f4a6fdcc87840f4223/SURVEY-DESIGNING-FOR-CONTINGENT-VALUATION-STUDIES.pdf%0 Ahttp://conference.kuis.edu.my/iceb2016/e

Zakaria, S. M., Abdullah, N., Md. Akhir, N., Amin, A. S., Mohd Shukry, A. N. A., Abdul Rashid, M. R., & Wan Yusof, W. N. 2022. Perceptions of quality of life during the pandemic: A case study on B40 single mothers. *International Journal of Environmental Research and Public Health*, *19*(19), 12219.

Zamzuri, Z. H. & Qi, K. Z. 2022. Classifying the Severity Levels of Traffic Crashs Using Decision Trees. *Proceedings of the International Conference on Mathematical Sciences and Statistics 2022 (ICMSS 2022)*: 173-181.

Bil:

Dengan Kerjasama

Hospital Sultanah Bahiyah, Alor Setar, Kedah

Hospital Sungai Buloh, Selangor

***NO PRN RESPONDEN:**	
***RESPONDEN**	

**wajib diisi*

**Bahagian ini diisi oleh penemubual*

NILAI KEHIDUPAN STATISTIK DAN KUALITI HIDUP AKIBAT KEMALANGAN JALAN RAYA DI HOSPITAL AWAM.

Pengguna Jalan Raya: Penunggang/Penumpang Motosikal

PENGENALAN:

Tuan/Puan yang dihormati,

Penyelidikan ini bertajuk "Nilai Kehidupan Statistik dan Kualiti Hidup Akibat Kemalangan Jalan Raya di Hospital Awam, Kedah, Malaysia. Kajian ini melibatkan dua (2) survei utama:

(a) **BAHAGIAN A** - Survei Kesanggupan Membayar bagi pengurangan risiko kematian dan kecederaan akibat kemalangan jalan raya dan juga kesanggupan membayar untuk mendapatkan rawatan di hospital.

Bahagian ini bertujuan untuk merekod jumlah (RM) yang sanggup Tuan/Puan bayar bagi mengurangkan risiko kematian dan kecederaan dan mendapatkan rawatan akibat kemalangan jalan raya. Survei ini berbentuk temubual separa berstruktur dan akan mengambil masa dari 20 - 30 minit untuk dilengkapkan. Tuan/Puan akan dibantu oleh pembantu penyelidik sepanjang temubual ini dijalankan. Survei ini mengandungi lima (5) bahagian utama:

Bahagian A1 - Pandangan responden

Bahagian A2 - Kesanggupan membayar

Bahagian A3 - Soalan Susulan

(b) **BAHAGIAN B** - Survei Kualiti Hidup yang bertujuan merekodkan keadaan kesihatan dan kesejahteraan Tuan/Puan selepas 30 hari kemalangan.

(c) **BAHAGIAN C** – Demografi dan Socio Ekonomi responden

(d) **BAHAGIAN D** – Maklumat Responden sebagai pengguna jalan raya dan sejarah kemasukan ke hospital.

SEMUA maklumat Tuan/Puan yang diperolehi melalui kajian ini adalah **SULIT** dan **HANYA** akan digunapakai untuk kajian ini sahaja. Sekiranya Tuan/Puan mempunyai sebarang soalan tentang kajian ini atau memerlukan maklumat tambahan, boleh menghubungi Cik Shamsinar Ibrahim (0197163525) atau Profesor Dr Sharifa Ezat Wan Puteh (0193217468).

Tuan/Puan akan dianggap **BERSETUJU** menyertai survei ini dengan menjawab soalan – soalan yang diberikan dibawah.

BAHAGIAN (A)

A1 - SIKAP/PANDANGAN RESPONDEN

Bahagian ini anda akan disoal berkaitan dengan pandangan anda berkaitan keselamatan jalan raya semasa. Sila nyatakan jawapan anda untuk soalan-soalan berikut.

Nyatakan pandangan anda sebagai pengguna jalan raya bagi setiap penyataan dibawah:

a. Keselamatan jalan raya di Malaysia adalah sangat penting**.**

[ ] Sangat setuju
[ ] Setuju
[ ] Neutral
[ ] Tidak setuju
[ ] Sangat tidak setuju

b. Penambahbaikan keselamatan jalan raya (contohnya jalan diselengara secara berkala, penambahan laluan motosikal, penggunaan sistem teknologi untuk mengawal kelajuan kenderaan di atas jalan) adalah penting?

[ ] Sangat setuju
[ ] Setuju
[ ] Neutral
[ ] Tidak setuju
[ ] Sangat tidak setuju

c. Keselamatan jalan raya pada ketika ini memerlukan penambahbaikan?

[ ] Sangat setuju
[ ] Setuju
[ ] Neutral
[ ] Tidak setuju
[ ] Sangat tidak setuju

d. Penglibatan pengguna jalan raya dalam mengurangkan **statistik (jumlah) kecederaan** akibat kemalangan jalan raya adalah penting?

[ ] Sangat setuju
[ ] Setuju
[ ] Neutral
[ ] Tidak setuju
[ ] Sangat tidak setuju

e. Penglibatan pengguna jalan raya dalam mengurangkan **statistik (jumlah) kematian** akibat kemalangan jalan raya adalah penting?

[ ] Sangat setuju
[ ] Setuju
[ ] Neutral
[ ] Tidak setuju
[ ] Sangat tidak setuju

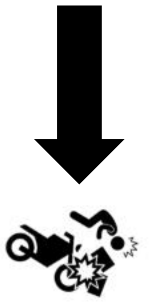
f. Berdasarkan laporan PDRM (2019), kira-kira 117,786 orang **pengguna motosikal** terlibat dalam kemalangan jalan raya. Berdasarkan data tersebut, anda merasakan anda boleh terdedah kepada kemalangan jalan raya sekurang-kurangnya **SEKALI** dalam masa 5 tahun akan datang.

[ ] Sangat setuju
[ ] Setuju
[ ] Neutral
[ ] Tidak setuju
[ ] Sangat tidak setuju

A2 - KESANGGUPAN MEMBAYAR (WTP)

Bahagian ini anda akan di soal berkenaan kesanggupan membayar anda sebagai pengguna motosikal.

Sebelum menjawab soalan-soalan berikut, dimaklumkan bahawa:

	(a) Jumlah yang anda nyatakan menggambarkan kesanggupan anda untuk **mengurangkan risiko kematian dan kecederaan di jalan raya dan mendapatkan rawatan.**
	(b) **Pendapatan anda adalah terhad**. Kesanggupan anda untuk membayar mengurangkan risiko kemalangan, bermakna anda perlu mengurangkan perbelanjaan anda berkaitan makanan, pakaian, utiliti, dan perbelanjaan/komitmen lain.
	(c) **Senario-senario yang diberikan adalah bersifat hipotesis (andaian)** dan ia tidak semestinya akan dilaksanakan secara serta merta. Walau bagaimanapun, jika dilaksanakan, ia boleh memberi manfaat kepada pengguna jalan raya dan penggubal dasar dalam meningkatkan keselamatan jalan raya agar bilangan kematian dan kecederaan dapat dikurangkan di masa akan datang.

PENGENALAN

Jabatan Perangkaan Malaysia melaporkan bahawa antara tahun 2018 hingga 2020, kemalangan jalan raya merupakan punca kematian keempat tertinggi di Malaysia dan motosikal adalah pengguna jalan raya kedua yang penyumbang punca kematian selepas kereta.
Rujuk Jadual 1 dan 2.

2010 – 2019 (dalam tempoh 10 tahun)	>45,000 Maut **Bersamaan 11 – 12 orang maut /sehari**
2019	21% kemalangan melibatkan
	Penyumbang 35% kematian selepas

Jadual 1

Laporan Statistik Kemalangan Jalan Raya di Malaysia 2019 oleh Polis Diraja Malaysia

(a) 567,516 jumlah kemalangan jalan raya. **(b) 832,673 kenderaan yang terlibat dalam kemalangan jalan raya.** **(c) 6,167 kes yang mengakibatkan kematian.** **(d) 8,877 kes yang mengakibatkan kecederaan parah dan ringan.**	
Daripada jumlah kemalangan jalan raya:	117,786 kenderaan yang terlibat adalah motosikal
Daripada semua kematian di jalan raya:	**(a) 3,617 penunggang motosikal** **(b) 342 pembonceng motosikal**
Daripada semua kecederaan di jalan raya:	**(a) 5,119 penunggang motosikal** **(b) 918 pembonceng motosikal**

Jadual 2

Setelah memahami penjelasan di atas, diminta responden menjawab soalan – soalan hipotesis yang berikutnya:

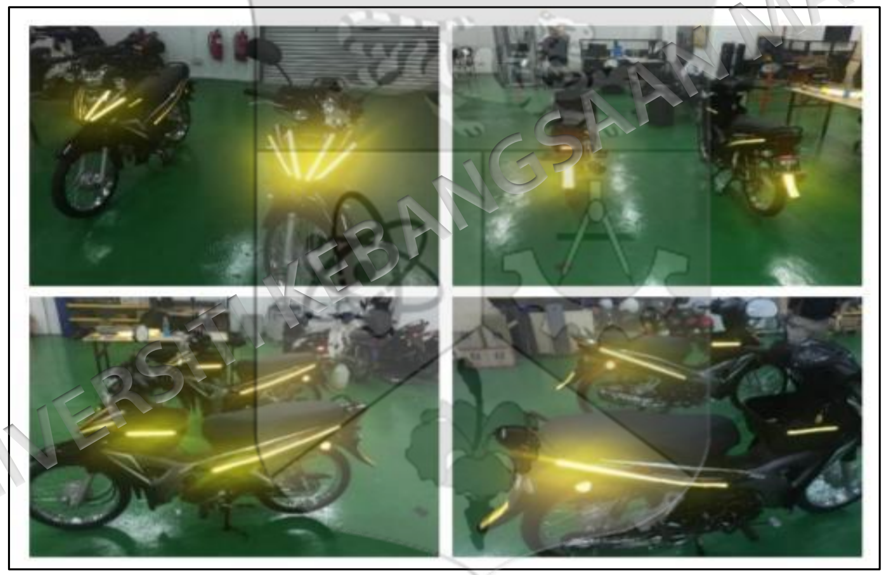
C1. Senario 1 – Pengurangan Risiko Kematian

Berdasarkan statistik nahas jalan raya oleh PDRM pada tahun 2019, sebanyak 3,959 kematian yang melibatkan penunggang dan pembonceng motosikal telah direkodkan.

Sila bayangkan bahawa Pita Keterlihatan Retroeflektif (*Retroreflective Conspicuity Tape*) dipasang pada sisi motosikal (rujuk Rajah 1). Pita ini boleh meningkatkan pengesanan jarak dan penglihatan pada waktu malam. Di samping itu, ia boleh mengurangkan risiko kematian sebanyak 50% (rujuk Jadual 1).

Kematian
Daripada 3,959 $\xrightarrow{\text{Pengurangan 50\% - PITA}}$ Kepada 1,979

Jadual 1: Pengguna motosikal



Rajah 1: Contoh pita penanda retroreflektif
Sumber: Abdul Khalid et al. (2020)

Adakah anda memahami kenyataan di atas

[ ] Ya
[ ] Tidak

(a) Berdasarkan penjelasan di atas, berapa banyakkah (RM) yang sanggup anda bayar setahun untuk memasang pita penanda retroreflektif yang dijangka dapat **mengurangkan risiko kematian** kemalangan jalan raya sebanyak 50%?

RM ______________________

(b) Sila **PILIH** pada jumlah (RM) paling tinggi di kotak yang yang sanggup anda bayar, setahun, untuk pita penanda retrospektif. Sila pilih di Kad Pembayaran di bawah.

RM/tahun					
0	5	10	15	20	25
30	35	40	45	50	Lebih daripada 50

Kad Pembayaran

C2. Senario 2 – Pengurangan Risiko Kecederaan

Berdasarkan statistik nahas jalan raya oleh PDRM pada tahun 2019, sebanyak 6,037 orang penunggang dan pembonceng motosikal telah mengalami kecederaan akibat kemalangan jalan raya. Seperti yang telah ditetapkan oleh undang – undang dan peraturan jalan raya di Malaysia, penunggang dan penumpang motosikal haruslah memakai topi keledar bagi setiap tujuan perjalanan untuk mengurangkan risiko kecederaan.

Kebiasaannya, topi keledar boleh digunakan selama lima tahun. Harga sebuah topi keledar adalah antara RM20 hingga RM500. Namun, terdapat juga topi keledar yang berharga antara RM1,000 hingga RM5,000 atau lebih. Walaupun topi keledar kelihatan sama, namun kualitinya adalah berbeza mengikut harga yang ditetapkan.

Andaikan bahawa semakin tinggi kualiti topi keledar, semakin tinggi kadar penyerapan bagi menggelakkan kecederaan kepala semasa kemalangan. Sekali gus dijangka dapat mengurangkan risiko kecederaan akibat kemalangan jalan raya.

Bayangkan anda perlu membeli topi keledar baharu untuk digunakan sewaktu menunggang motosikal. Anda diberi dua pilihan topi keledar iaitu **Topi Keledar A** dan **Topi Keledar B**.
Setiap topi keledar mempunyai jaminan satu tahun dan kelihatan sama. Namun, kualitinya adalah berbeza mengikut harga yang ditetapkan.

	Topi Keledar A	Topi Keledar B	
Harga	RM50	Lebih daripada RM50	
Kualiti topi keledar	Biasa	Mempunyai penyerapan hentakan yang lebih tinggi	↓ 50% risiko kecederaan kepala
Risiko kecederaan kepala	6,037	→ kepada	3,018

Jadual 1

Rajah di atas menunjukkan bahawa **Topi Keledar B** dapat mengurangkan risiko kecederaan kepala sebanyak 50% berbanding **Topi Keledar A**. (Sila rujuk Jadual 2)

Kecederaan
Daripada 6,037 $\xrightarrow{\text{Pengurangan 50\%}}$ Kepada 3,018

Jadual 2: Pengguna Motosikal

Adakah anda memahami kenyataan di atas

[ ] Ya
[ ] Tidak

(a) Berdasarkan Senario 2, berapa banyakkah (RM) yang sanggup anda bayar untuk **Topi Keledar B** setahun bagi **mengurangkan risiko kecederaan kepala** akibat kemalangan jalan raya sebanyak 50%?

RM ____________________

(b) Sila **PILIH** pada jumlah (RM) paling tinggi yang sanggup anda bayar setahun, untuk **Topi Kaledar B**. Sila pilih di Kad Pembayaran di bawah.

RM/tahun					
0	5	10	15	20	25
30	35	40	45	50	55
60	Lebih daripada 60				

Kad Pembayaran

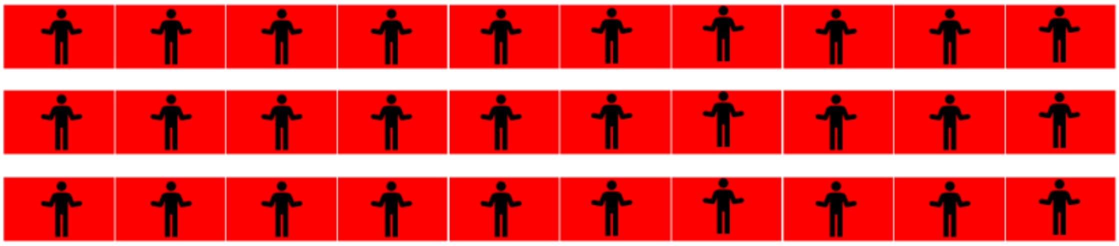
C3. Senario 3 – Program Keselamatan I

Sepanjang tempoh lima tahun lalu (2015 – 2019), secara purata kira-kira 3,000 kes kematian akibat kemalangan motosikal telah direkodkan setiap tahun. Kini, sila bayangkan bahawa terdapat program untuk meningkatkan keselamatan jalan raya di seluruh negara yang dikenali sebagai Program Keselamatan Nasional [Rujuk Jadual 3].

Nama Program	Program Keselamatan Nasional
Tujuan Program	Menambah baik program keselamatan semasa
Penambahbaikan	Program ini melibatkan: a. Pembangunan lorong tambahan yang lebih luas khas untuk pengguna motosikal b. Pemasangan penghadang jalan c. Peningkatan penyelenggaraan keadaan permukaan jalan d. Pemasangan lampu jalan e. Papan tanda jalan raya yang jelas **f.** Pendidikan keselamatan jalan raya yang intensif untuk pengguna jalan raya
Jika dilaksanakan	1,500 nyawa daripada 3,000 kematian dapat diselamatkan
Pengurangan risiko 	50%

Jadual 3 Program Keselamatan Nasional

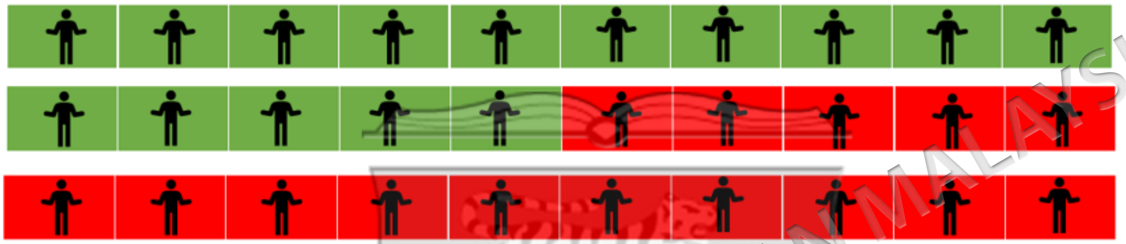
Sila rujuk kotak grid yang mengandungi ikon individu dalam rajah di bawah bagi memahami situasi yang dinyatakan di atas.



[Rajah 1: Kotak grid berwarna **MERAH** menggambarkan 3,000 kematian akibat kemalangan jalan raya]

Jika Program Keselamatan Nasional dilaksanakan, pengurangan risiko kemalangan sebanyak 50% = 1,500 nyawa

→ mewakili 100 nyawa



[Rajah 2: Rajah 2: Kotak grid berwarna **HIJAU** menggambarkan 1,500 nyawa yang dapat diselamatkan melalui penambahbaikan program keselamatan]

Adakah anda memahami kenyataan di atas

[ ] Ya
[ ] Tidak

(a) Berdasarkan penjelasan di atas, berapa banyakkah (RM) yang sanggup anda bayar kepada dana awam melalui setahun bagi pelaksanaan program keselamatan yang dapat menyelamatkan 50% nyawa pengguna jalan raya?

RM ____________________

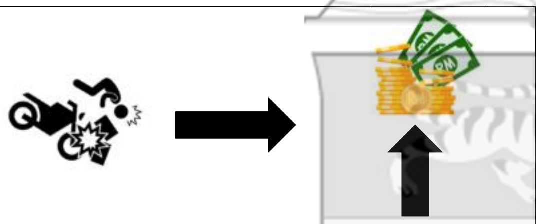
(b) Sila **PILIH** pada jumlah (RM) paling tinggi yang sanggup anda bayar setahun, untuk Program Keselamatan Nasional diatas. Sila pilih di Kad Pembayaran di bawah.

RM/tahun					
0	5	10	15	20	25
30	35	40	45	50	Lebih daripada 50

Kad Pembayaran

C4. Senario 4 – Kesanggupan Membayar Untuk Rawatan Kecederaan Kemalangan Jalan Raya

Caj rawatan adalah pelbagai perkhidmatan perubatan yang diberikan kepada pesakit termasuk pendaftaran, perundingan, keselesaan perubatan, diagnosa dan ubatan. Pada masa sekarang, rawatan kemalangan dan kecemasan pertama dicaj RM1 dan bagi kes rawatan susulan keluar wad caj rawatan adalah RM5 setiap lawatan. Caj rawatan tambahan (contohnya pembedahan di kaki akibat patah) adalah berdasarkan diagnosa yang diberikan oleh doktor yang merawat mengikut kes.

<table>
<tr><td></td><td>Kemalangan jalan raya telah mengakibatkan kerugian ekonomi Malaysia sebanyak RM9.28 bilion untuk kecederaan dan kehilangan nyawa.</td></tr>
<tr><td colspan="2">
Peningkatan Kenderaan / Peningkatan Pesakit / Peningkatan Kos rawatan</td></tr>
<tr><td colspan="2">Peningkatan bilangan kenderaan setiap tahun akan menyumbang kepada peningkatan kadar kemalangan dan peningkatan bilangan pesakit yang dimasukkan ke hospital. Kos rawatan hospital juga akan bertambah. Kos rawatan yang bertambah akan penyumbang kepada peningkatan caj rawatan untuk pesakit.</td></tr>
</table>

Adakah anda memahami kenyataan di atas

[ ] Ya
[ ] Tidak

Caj rawatan di hospital kerajaan adalah lebih rendah disebabkan subsidi kerajaan. Sila bayangkan jika kerajaan tidak dapat membiayai sepenuhnya caj rawatan pada masa akan datang dan memerlukan dana awam untuk terus memberikan perkhidmatan rawatan.

(a) Berapakah jumlah (RM) yang sanggup anda bayar setahun untuk mendapatkan rawatan kecemasan pertama?

RM ________________________

(b) Sila **PILIH** pada jumlah (RM) paling tinggi yang sanggup anda bayar setahun, untuk mendapatkan **RAWATAN KECEMASAN PERTAMA**. Sila pilih di kad pembayaran di bawah.

RM/tahun					
0	5	10	15	20	25
30	35	40	45	50	55
60	65	70	75	80	85
90	95	100	Lebih daripada 100		

Kad Pembayaran

(a) Bayangkan anda perlu mendapatkan rawatan susulan kerana cedera parah (contohnya patah kaki). Berapakah jumlah (RM) yang sanggup anda bayar setahun untuk mendapatkan rawatan susulan ini bagi menggelakkan keadaan anda menjadi lebih parah.

RM _________________

(b) Sila **PILIH** pada jumlah (RM) paling tinggi yang sanggup anda bayar setahun, untuk mendapatkan **RAWATAN SUSULAN**. Sila pilih di kad pembayaran di bawah.

RM/tahun					
0	5	10	15	20	25
30	35	40	45	50	55
60	65	70	75	80	85
90	95	100	Lebih daripada 100		

Kad Pembayaran

A3 - SOALAN SUSULAN

Sila PILIH pada **SATU sahaja PILIHAN di bawah.**

D1. Berdasarkan **SEMUA** Senario 1, 2, 3 & 4 yang diberikan di atas, sejauh manakah **KEYAKINAN** anda terhadap pembayaran yang dinyatakan jika ia dilaksanakan? Sila tandakan √ di dalam kotak.

1	2	3	4	5
←				→
Sangat tidak yakin	Kurang pasti	Neutral	Pasti	Sangat yakin

D2. Pandangan pengguna jalan raya perlu di ambil kira secara serius dalam rundingan mengenai cadangan penambahbaikkan keselamatan jalan raya.

[ ] Sangat setuju
[ ] Setuju
[ ] Tidak pasti
[ ] Tidak setuju
[ ] Sangat tidak setuju

D3. Apakah kaedah yang sesuai bagi anda untuk menyumbang bagi semua Senario 1, 2, 3, dan 4 di atas?

[ ] Potongan gaji bulanan
[ ] Potongan cukai melalui Lembaga Hasil Dalam Negeri (LHDN)
[ ] Bayar sendiri melalui saku
[ ] Tol
[ ] Derma
[ ] Lain – lain (Nyatakan) : _______________

D4. Pada pendapat anda, siapakah yang patut diamanahkan mengendalikan dana awam ini?

[ ] Kerajaan
[ ] Swasta
[ ] Badan berkanun
[ ] Badan tidak berkanun
[ ] Lain – lain (Nyatakan) : ____________________

BAHAGIAN (B) – SURVEI KUALITI HIDUP

Tinjauan ini adalah untuk mengetahui sejauh mana kesejahteraan/kesihatan Tuan/Puan telah berubah sejak cedera kerana kemalangan jalan raya 30 hari yang lalu. Sila klik pilihan yang paling **TEPAT** yang menggambarkan sejauh mana Tuan/Puan bersetuju dengan setiap pernyataan dibawah.

Bahagian Kualiti Hidup ini mempunyai **TIGA (3)** bahagian untuk dijawab oleh Tuan/Puan:
(a) Kesejahteraan **EMOSI**
(b) Penglibatan **FUNGSI**
(c) Pemulihan dan Kesejahteraan **FIZIKAL**

	Sangat Tidak Setuju	**Tidak Setuju**	**Neutral**	**Setuju**	**Sangat Setuju**
Kesejahteraan EMOSI					
Q1: Sejak kebelakangan ini, saya berasa lebih gelisah dan tidak tenteram					
Q2: Selera makan saya telah berubah sejak kecederaan itu.					
Q3: Mood saya semakin merosot sejak kecederaan itu.					
Q4: Saya berasa marah kerana saya mengalami kecederaan.					
Q5: Saya terpaksa bergantung kepada orang lain seperti keluarga, rakan, jaringan keselamatan sosial (contoh SOCSO) , atau program sokongan komuniti disebabkan oleh masalah kewangan saya.					
Q6: Kecederaan saya telah mempengaruhi hubungan saya dengan keluarga, rakan atau pasangan secara negatif.					
Penglibatan FUNGSI					
Q7: Saya memerlukan bantuan untuk menaiki tangga.					
Q8: Saya memerlukan bantuan untuk berjalan di permukaan yang rata.					
Q9: Saya memerlukan bantuan ketika mandi.					
Q10: Saya memerlukan bantuan ketika makan.					
Q11: Saya memerlukan bantuan untuk pergi ke bilik air.					
Q12: Saya memerlukan bantuan untuk memasak atau menyediakan makanan.					

Pemulihan dan Kesejahteraan FIZIKAL					
Q13: Walaupun saya mengalami kecederaan, kehidupan saya kini adalah lebih baik berbanding sebelumnya.					
Q14: Tempoh pemulihan saya adalah lebih singkat daripada yang saya dijangkakan.					
Q15: Keadaan fizikal saya terbatas pada ketika ini.					
Q16: Saya boleh melakukan senaman seperti dahulu.					
Q17: Saya boleh meneruskan aktiviti riadah saya seperti biasa.					
Q18: Saya mengalami kesakitan pada setiap hari.					

BAHAGIAN (C) - SOCIO-DEMOGRAFI DAN SOCIO-EKONOMI

Sila tandakan (√) pada ruangan yang bersesuaian dan isikan tempat kosong jika perlu.

Tuliskan nombor jejak yang dilekatkan di SLIP SALINAN PESAKIT (kuning) yang Tuan/Puan terima di hospital semasa mendapatkan rawatan.

ATAU jika tiada

Tuliskan 4 digit terakhir nombor IC

(nombor ini akan digunakan untuk menjejaki jenis kecederaan Tuan/Puan yang direkodkan di hospital).

ATAU

Nombor telefon yang diberikan semasa pendaftaran di jabatan kecemasan hospital.

ATAU

Nombor pendaftaran pesakit (ASxxxx)

____

E1. Umur: ______________________

E2. Jantina

[ ] Lelaki
[ ] Perempuan

E3. Bangsa

[ ] Melayu
[ ] Cina
[ ] India
[ ] Lain-lain: ____________________

E4. Tahap pendidikan tertinggi

[ ] Sekolah rendah
[ ] Sekolah menengah/teknik/vokasional
[ ] Maktab/Kolej/Pengajian pos-menengah
[ ] Universiti/Diploma/Sarjana muda/Sarjana/PhD
[ ] Tidak bersekolah
[ ] Lain-lain: _____________________

E5. Status perkahwinan

[ ] Bujang
[ ] Berkahwin
[ ] Berpisah/bercerai

E6. Pekerjaan semasa

[ ] Perniagaan sendiri/Bekerja sendiri
[ ] Pelajar
[ ] Suri rumah
[ ] Perkeranian/jualan
[ ] Tentera
[ ] Pekerja industri (conthnya: perkilangan)
[ ] Nelayan
[ ] Pesara
[ ] Buruh
[ ] Pekerja Perkhidmatan (contohnya: pekerja jualan, pekerja restoren, RELA dll)
[ ] Profesional (contohnya; Guru, pensyarah, dll)
[ ] Tidak bekerja

E7. Sektor pekerja anda:

[ ] Awam
[ ] Swasta

E8. Berapakah pendapatan bulanan anda (RM)?

Jika anda pelajar/surirumah (tidak bekerja) sila nyatakan pendapatan/perbelanjaan yang diterima daripada ibu/bapa/penjaga/suami. Bagi pesara, sila nyatakan jumlah pencen bulanan.

[ ] kurang daripada 2,500
[ ] 2,500 – 3,169
[ ] 3,170 – 3,969
[ ] 3,970 – 4,849
[ ] 4,850 – 5,879
[ ] 5,880 – 7,099
[ ] 7,110 – 8,699
[ ] 8,700 – 10,959
[ ] 10,960 – 15,039
[ ] lebih daripada 15,039

E9. Berapakah pendapatan isi rumah anda (RM)?

[ ] kurang daripada 2,500
[ ] 2,500 – 3,169
[ ] 3,170 – 3,969
[ ] 3,970 – 4,849
[ ] 4,850 – 5,879
[ ] 5,880 – 7,099
[ ] 7,110 – 8,699
[ ] 8,700 – 10,959
[ ] 10,960 – 15,039
[ ] lebih daripada 15,039

E10. Nyatakan bilangan isi rumah anda [termasuk anda]

[ ] 1
[ ] 2
[ ] 3
[ ] 4
[ ] 5
[ ] 6
[ ] 7
[ ] 8
[ ] 9
[ ] 10
[ ] lebih daripada10

BAHAGIAN (D) - MAKLUMAT PENGGUNA JALAN RAYA DAN SEJARAH KEMASUKAN KE HOSPITAL

F1. Adakah anda mempunyai lesen memandu/motosikal?

[ ] Ya
[ ] Tidak

F2. Anda seorang ___________________

[ ] Penunggang motosikal
[ ] Pembonceng motosikal

F3. Semasa kemalangan ini berlaku, apakah tujuan perjalanan anda?

[ ] Urusan kerja
[ ] Pendidikan/pengajian
[ ] Masa lapang/rekreasi
[ ] Pulang ke rumah
[ ] Kecemasan
[ ] Kunjungan peribadi/keluarga
[ ] Lain-lain: ________________

F4. Adakah anda mempunyai Takaful/insurans hayat? [semasa survei ini dijalankan]

[ ] Ya
[ ] Tidak

F5. Adakah anda pernah **MENDAPATKAN RAWATAN** di hospital/klinik sekurang – kurangnya **SEKALI** akibat kemalangan jalan raya dalam tempoh satu (1) tahun yang lalu?

[ ] Ya
[ ] Tidak

F6. Jika anda menjawab **YA** kepada soalan F5, sila nyatakan berapa hari anda dimasukkan ke hospital akibat kemalangan jalan raya?

[ ] 1 – 3 hari
[ ] 4 – 6 hari
[ ] 1 minggu
[ ] 2 minggu
[ ] lebih daripada 2 minggu
[ ] Pesakit luar
[ ] Tiada sejarah kemasukan ke hospital dalam tempoh satu (1) tahun yang lalu

F7. Jika anda pernah mendapatkan rawatan di hospital pada **TAHUN LEPAS** kerana kemalangan jalan raya, bagaimanakah anda mengelaskan kecederaan anda pada masa itu?

[ ] Tidak cedera
[ ] Kecederaan ringan
[ ] Kecederaan sederhana
[ ] Kecederaan teruk
[ ] Tidak berkaitan [tiada pengalaman kemalangan jalan raya]
[ ] Lain-lain: __________________

SOAL SELIDIK TAMAT

PENAFIAN:
a. Semua soalan yang diajukan adalah untuk kegunaan kajian sahaja dan tidak ada berkaitan dengan perkara –perkara yang lain.

Tuan/Puan, mohon pastikan semua soalan telah dijawab.
Terima kasih Tuan/Puan kerana telah memberikan kerjasama yang baik semasa survei ini dijalankan.