BEYOND THE NUMBERS: ESTIMATING THE DISABILITY BURDEN OF ROAD TRAFFIC INJURIES

Findings from Six Low and Middle-Income Countries

THE WORLD BANK

GRSF Global Road Safety Facility

FUNDED BY UKaid from the British people

Attribution

Please cite the work as follows: Mitra. S., Saadat. S., Neki. K., Khalaf. M., Rosen. H., Paichadze. N., Hyder. A. 2023. *Beyond the Numbers: Estimating the Disability Burden of Road Traffic Injuries-Findings from Six Low and Middle-Income Countries.* Washington, DC: World Bank.

Contents

Tables

Figures

Boxes

Foreword

The enormous impact of road traffic crashes in low- and middle-income countries (LMICs) is a major global challenge requiring urgent action. It is well-documented that road crashes claim around 1.35 million lives each year and rank as the eighth leading cause of death globally, causing huge burdens for economies, health systems, and transport networks. However, beneath the sobering fatality statistics lies a largely unexplored landscape: the staggering toll of disabilities induced by road crashes.

Although the accuracy of road crash statistics varies widely across countries, we know that there are considerably more injuries than deaths as a result of crashes. Still, the focus of research and policy discourse has predominantly revolved around fatalities, which has limited our understanding of traffic-related injuries and disability burdens at the individual, community, and national level.

To address this critical knowledge gap, this pioneering study provides valuable insights into the prevalence, causes, and long-term impacts of crash-related disabilities. By broadening the discussion beyond fatalities to the often-overlooked issue of disability, the report paves the way for a more holistic perspective on road safety impacts, which can inform more effective road safety policies.

This report is a call to action for comprehensive and context-specific interventions that encompass both the transport and health sectors. Effective measures may include implementing safety regulations, enhancing emergency services, strengthening rehabilitative care, and expanding social safety nets to ease the financial burden on crash survivors. Collaborative efforts between governments, global and regional organizations, civil society, and other stakeholders will be indispensable.

Addressing the road crash-induced disability burden would improve health outcomes for individuals and lead to more sustainable transport systems, long-term economic gains, and fewer families falling into poverty. The findings and recommendations in this report are vital tools that can help us prevent crashes, minimize the severity of injuries when crashes occur, and improve the quality of life of crash survivors. Let's harness this knowledge to make our roads safer and more inclusive for everyone.

Nicolas Peltier-Thiberge
Global Director
Transport
World Bank

Juan Pablo Uribe
Global Director
Health, Nutrition and Population
World Bank

Acknowledgements

This report was prepared by a team led by Sudeshna Mitra, Transport Specialist, Global Road Safety Facility (GRSF), World Bank, with researchers from the George Washington University- Prof. Adnan Hyder, Nino Paichadze, Heather Rosen, and Mohammad Khalaf, under the overall guidance of Said Dahdah, Lead Transport Specialist, and Head, GRSF; Sameera Maziad Al Tuwaijri, Global Lead, Population and Development; and Binyam Reja, Practice Manager, Transport Global Unit. Other contributing members of the team include Seemeen Saadat, Consultant, Health, Nutrition & Population, Kazuyuki Neki, GRSF, World Bank, and Amy Achieng Aida, GRSF, World Bank.

The report was peer-reviewed at different stages by Sameh El-Saharty, Lead Health Specialist, HNP MNA; Charlotte Vuyiswa McClain-Nhlapo, Lead Social Development Specialist Economist, OPSIS; Suresh Kunhi Mohammed, Senior Health Specialist, HSAHN, and Nino Pkhikidze, Economist, ITRGK. The task team received guidance and decision from the Global Directors Nicolas Peltier-Thiberge, Global Director, Transport and Juan Pablo Uribe, Global Director, Health, Nutrition & Population.

This report was produced with funding support from UK Aid under the Multidonor Trust Fund Phase 3 funded by the Foreign, Commonwealth & Development Office (formerly the Department for International Development) and Department for Health and Social Care through the GRSF Comprehensive Road Safety Research Projects to Improve Global Road Safety.

Acronyms

GBD	Global Burden of Disease
GCS	Glasgow Coma Scale
LMIC	low- and middle-income country
RTC	road traffic crash
RTI	road traffic injury
WHO	World Health Organization

Executive Summary

Study Scope and Rationale

The World Health Organization (WHO) estimates that road crashes injure up to 50 million people globally (2018). These injuries, and the resulting disability burden, is disproportionately borne by vulnerable road users—such as pedestrians, cyclists, and motorcyclists—and those in low- and middle-income countries (LMICs). In addition, road traffic crashes (RTCs) claim 1.35 million lives each year and are the eighth leading cause of death for all age groups globally (WHO, 2018).

Despite the huge injury burden of RTCs, the road safety research and policy communities has traditionally focused attention on fatalities. This has resulted in large data and knowledge gaps regarding road traffic injuries (RTIs). Closing these gaps is key to understanding the depth and breadth of the issue, and to developing more effective road safety strategies within the transportation, health, and other sectors.

To address the RTI knowledge gap, this study collected and analyzed original data on RTI patients in six LMICs: Bangladesh, Cambodia, Ethiopia, Mexico, Ukraine, and Zambia. Specifically, this study (i) estimates the extent of RTI-related disability in LMICs, (ii) identifies the key factors behind RTIs, and (iii) develops recommendations for interventions that would help reduce the incidence of RTI-related disability and its long-term impact on households and communities. Data were collected through hospital-based surveillance of RTI patients and follow-up phone interviews at one-, three-, and six-month intervals following discharge.

Major Findings

The demographics of RTI victims were similar across the six countries studied:

- The majority of RTI victims were younger men, most of whom were riding motorcycles.
- 81 percent of the RTI patients in this study were male, and among those 55 percent were 18-34 years old.
- Across the six countries, 75 percent of RTI victims were inside a vehicle—either as a driver or passenger—with an average of 46 percent riding on motorcycles.
- Among pedestrians, 55 percent were hit while walking along the road and 39 percent while crossing the road.
- Women RTI victims were most often vehicle passengers or pedestrians.

The limited use of safety measures played a large role in the injury outcome of RTCs. For example, only 30 percent of injured motorcycle riders were wearing a helmet, and less than 20 percent of injured car drivers wore seatbelts.

The nature of injuries sustained in RTCs seem to be similar across countries. Most of the survey participants (71 percent) had mild symptoms of traumatic brain injury and roughly a quarter had lost consciousness. The most common and serious injuries in the sample were to the extremities (73 percent), followed by the head and neck (18 percent). Among the injured, pedestrians and motorcyclists not wearing helmets were significantly more likely to have severe injuries.

Emergency medical services were slow to respond. Just over half of RTC victims (56 percent) received immediate care at the crash scene, but mainly from bystanders; just 13 percent first received care from trained ambulatory staff. Data also revealed that while about half of RTC victims were transported to a hospital within the first hour of a crash, only 20 percent were transported within the first 30 minutes; for some, it took 6 to 24 hours. Victims who received care from emergency personnel had lesser disability scores at all three follow-up periods.

Nearly half the hospital patients required surgery, but few received rehabilitation services. On average, RTI patients spent 14 days in hospital care, and nearly half required surgery. Across countries, only 10 percent of patients were discharged to a rehabilitation facility, except for Mexico, where 78 percent of all RTI patients were discharged to a rehabilitation facility due in large part to the high availability of rehabilitation facilities in that country.

The cost of care for RTI survivors was high, averaging about 10 percent of the victim's annual household income. Most patients used their own funds to pay for care (84 percent), and over half (56 percent) reported borrowing money to pay for the cost of treatment. The only notable difference was in Ethiopia where insurance covered the cost of care in 81 percent of cases.

RTIs had a long-term impact on survivors' health and well-being. Six months after their hospital discharge, 74 percent of RTI patients still reported some level of difficulty and only 44 percent had returned to normal life. The study also found an unmet need for assistive devices and physical support to aid in daily tasks, which further diminished survivors' health and well-being.

Lack of access to healthcare and transport emerged as the two main barriers to follow-up care, with women reporting higher barriers than men. While there was considerable variation across countries, 33 percent of all patients reported limited access to healthcare and 34 percent reported limited access to transportation. At both three- and six- months after hospital discharge, women reported significantly higher barriers to accessing healthcare and recovery services than men.

Recommendations for Policies and Interventions

Vulnerable road users need targeted support with protective infrastructure. More than 80 percent of those injured in RTCs were pedestrians, motorcyclists, and three-wheeler riders (except in Ukraine). Segregation of vulnerable road users and the enforcement of speed limits are relevant policy instruments that could help protect these road users.

The use of protective gear—such as helmets and seatbelts—needs to be legislated, promoted, and enforced. The limited use of protective gear among RTC victims was common across countries. Only 30 percent of motorcycle users wore helmets, and less than 20 percent of riders wore seatbelts in cars, buses, minibuses, and vans. Countries serious about improving road safety should aim to increase the proportion of correct helmet and seat belt use to close to 100 percent by 2030 as per the UN global road safety performance targets.

Motorcycle safety requires targeted interventions. Due to the high proportion of RTIs suffered by motorcycle drivers and passengers, targeted motorcycle safety interventions such as helmet wearing campaigns directed at young men and dedicated motorcycle lanes would reduce the overall disability burden of RTCs.

Gender gaps can be addressed through the adoption of gender-based transportation design. Despite the fact that most RTI-victims are male, female road users experience specific dangers and are more likely to be injured as pedestrians or vehicle passengers. To evaluate and address gender gaps, transportation agencies could conduct assessments of women's safety needs, gender-based safety audits, and universal accessibility requirements to assess road safety concerns from a gender lens. Women's increased participation in policy- and decision-making would also likely help identify and address women's specific needs.

Emergency and ambulance services need strengthening. In the LMICs studied, emergency and ambulance services were generally found to be extremely limited and fragmented, resulting in a low proportion of RTI victims receiving professional medical care in the crucial minutes and hours after a crash. The average disability outcome for patients treated at the crash scene by qualified health personnel was significantly better than for those that received care from bystanders, underscoring the need to strengthen emergency and ambulance services and improve the training of first responders.

More rehabilitation services—and better access to these services—is needed. With the exception of Mexico, the low percentage of patients discharged to a rehabilitation facility (10 percent) indicates that countries either lack sufficient rehabilitation facilities, or these may not be easily accessible for everyday road users, especially for women. Bringing integrated rehabilitation services closer to communities would aid in faster recovery times and better health and well-being for RTI survivors in LMICs.

RTI patients' burden of cost needs to be reduced. RTI patients faced enormous out-of-pocket costs—on average equivalent to 10 percent of their annual household income. Interventions such as disability benefits or the provision of subsidized health insurance can help mitigate these costs, including for assistive devices and rehabilitation support.

Public health communication campaigns can help raise awareness of key risk factors. Governments can partner with civil society organizations to increase vulnerable road users' awareness of safety risks, their rights as road users, and information on emergency numbers. To strengthen messaging, awareness campaigns could incorporate voices of those afflicted by RTI-related disabilities.

Opportunities for Further Investigation

Though this study achieved its intended objectives of assessing post-crash moderate and severe RTI disabilities, several factors warrant further investigation. For example, the impact of vehicle speed and the state of drivers on the rate of RTI incidence could be further studied to better illuminate the reasons behind fatality-to-injury ratios. Furthermore, since data on RTI-disability remains minimal, it would be beneficial for the research community if there were more assessments and surveys that sought to analyze disability causes, characteristics, prevalence, associated health conditions, and the use of and need for services including rehabilitation. Such research would also help close the knowledge gap about the total economic impact of RTIs, including minor injuries and fatalities.

1. Introduction and Background

Road traffic injuries (RTIs) are the eighth leading cause of death for all age groups—surpassing HIV/AIDS, tuberculosis, and diarrheal diseases—and vulnerable road users and those in low- and middle-income countries (LMICs) bear a disproportionately high burden. The World Health Organization estimates that road traffic crashes (RTCs) claim 1.35 million lives and cause up to 50 million injuries globally each year (WHO 2018). According to the Institute for Health Metrics and Evaluation's recent Global Burden of Disease (GBD) estimates, the incidence of RTIs doubled to 103.2 million in 2019 (IHME 2020).

RTIs have a high cost in terms of health and socioeconomic outcomes. The health impact from RTIs is a major burden globally and more so in LMICs (Peden et al. 2004). Per the Institute for Health Metrics and Evaluation's GBD estimates, RTIs were responsible for about 26 percent of total years lived with disability (YLDs) due to injuries (IHME 2020). A substantial proportion of people injured in RTCs experience disability that affects their health, quality of life, and human capital in both the short and long terms (Palmera-Suárez et al. 2015). The seminal *World Report on Disability* showed that disability (from all causes) is associated with lower educational attainment, lower employment rates, and limited access to health care (WHO and World Bank 2011). For example, children with disabilities are less likely to attend school, limiting their opportunities for human capital formation, reducing employment opportunities, and decreasing productivity in adulthood. In addition, persons with disability face social barriers caused by negative attitudes or perceptions about disability that hinder their opportunities further (Barbareschi et al. 2021; Bjørnshagen and Ugreninov 2021; Trani et al. 2020).

Evidence shows that RTIs have high disability outcomes and adverse long-term health consequences. In the Netherlands, for example, a study on persons living with disability after a crash found that 90 percent of the burden of injury was due to lifelong consequences experienced by 20 percent of all those seriously injured in a crash (Weijermars, Bos, and Stipdonk 2016). In France, a cohort study reported that only 45 percent of the victims of mild to moderate RTIs recovered fully from their injury (Hours et al. 2010). Follow-up studies of orthopedic and trauma patients who received compensation from the Transport Accident Commission in Victoria, Australia, had experienced worse short-term and long-term health and vocational and functional outcomes than before the RTI (Berecki-Gisolf, Collie, and McClure 2013).

A few studies in LMICs have also investigated the prevalence of disabilities from RTIs. A population-based survey in seven Nigerian states using two-stage stratified cluster sampling found that RTIs caused disability for about 30 percent of those affected (Juillard et al. 2010). Lin et al. (2013), using the results of the 2006 China National Disability Survey, identified 1.5 million Chinese with road crash–generated disabilities, estimating a population-weighted prevalence of 1.12 per 1,000 population (95 percent, confidence interval: 1.07–1.17). A study of disability at discharge from a district hospital in Malaysia found that 48 percent of all injured victims from motor vehicle crashes were disabled at discharge (Nik Hisamuddin et al. 2016). In Ethiopia, a study found that between 25 and 88 percent of participants who had experienced an RTI had a functional limitation because of the severity of injury, length of hospital stay, or discharge against medical advice (Denu et al. 2021b). Several hospital-based studies in India also point to long-term disability for 20 to 40 percent of people discharged after an RTI (Gururaj 2008, 2005).

Limited evidence also indicates that the economic cost of disabilities caused by RTIs can be significant. In Mexico, a study on direct treatment costs and indirect productivity losses in 2012 estimated the cost of RTC-generated permanent disabilities at US$4,941.77 per victim, equivalent to approximately 48 percent of the country's gross domestic product per capita in the same year.[1] However, the study did not consider

[1] Mexico gross domestic product per capita (current US$) in 2012 = US$10,241.73, data from GDP Per Capita (current US$) Mexico (database), World Bank, Washington, DC (accessed May, 15, 2023), https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=MX.

nonmedical costs such as travel and transportation or the cost of adaptations to housing and transportation, indicating that the actual costs may be higher than the estimate (Sánchez-Vallejo, Pérez-Núñez, and Heredia-Pi 2015). A similar study in Spain also revealed high long-term care costs associated with motor-vehicle crash-related disability. The cost ranged from €12,512.47 to €17,295.60 (US$18,393.33 to US$25,424.53),[2] or approximately 43 to 60 percent of Spain's gross domestic product per capita in 2008.[3] A higher cost was associated with greater dependence on third-party assistance with daily activities and was especially high for those under age 65 (Alemany, Ayuso, and Guillén 2013). These studies show that the costs are significant, but more comprehensive analyses are needed to show the full extent of the economic and welfare impacts of RTC–generated disabilities, especially in LMICs, where a lack of data often limits such analyses.

Disability is also a major cause and consequence of poverty (McEwan and Butler 2007). Those living in poverty are often at greater risk of being involved in an RTC that leads to injury and disability. Several factors contribute to this risk, such as poor quality of roads, missing sidewalks, reliance on the least safe modes of transportation, and limited investment in road safety measures (GRSP 2017). At the same time, onset of disability can create poverty at the individual and household levels because of the cost of care and potential loss of income after a road crash. For example, in India, 22.2 percent of households that experienced an RTI incurred catastrophic out-of-pocket health expenditures, and 12 percent of the households fell into poverty because of them (Prinja et al. 2019). In Nigeria, 16.7 percent of persons with disabilities caused by RTCs lost their jobs after the crash, and 88.6 percent experienced a reduction in earnings (Juillard et al. 2010). Similarly, in Ethiopia, 44 percent of people who were in RTCs never returned to work because of their disability (Denu et al. 2021b).

Creating successful policy to prevent RTIs and manage their impacts requires strong, evidence-based knowledge of their related factors. This includes data on factors contributing to RTIs and the nature of injuries sustained, and post-treatment factors influencing the duration and severity of disabilities. Yet data are often mixed and limited in scope, especially on disability from RTIs (Ameratunga et al. 2004; Chang et al. 2020). According to the GBD data, leg and ankle fractures are the most common types of injury sustained in an RTC, followed by brain injuries. However, these data have limitations because of their quality and prediction methods that assign only the most disabling injury to a crash that could have multiple injuries (James et al. 2020). Several hospital-based studies, such as in The Gambia and Saudi Arabia, report similar injury patterns (Ahmed et al. 2019; Sanyang et al. 2017), and others, such as in Ethiopia and Romania, highlight other types such as chest injuries and contusions as most common injuries after an RTC (Rus Ma et al. 2015; Woyessa et al. 2021).

Global knowledge regarding RTIs clearly has large gaps, including the extent of RTI-generated disability, follow-up information on those discharged with injuries or impairments, and the limited understanding of the context of long-term impairment issues. The nature and severity of injury depends on factors such as the mode of transportation (including walking), safety precautions or lack of them (such as seat belts and speed limits), and individual characteristics such as age, among others. Understanding the underlying causes and barriers to road safety and preventable disability from RTIs helps identify key areas for policy and programmatic interventions to address them. It also helps identify cross-cutting challenges (such as gaps in emergency response or the poverty impact of RTIs on households) that will need attention to make a mitigating impact on RTI outcomes.

[2] Estimated at the average closing price for the euro of US$1.47 in 2008, from Euro Dollar Exchange Rate (EUR USD): Historical Chart (database), Macrotrends, Seattle, WA (accessed May 15, 2023), https://www.macrotrends.net/2548/euro-dollar-exchange-rate-historical-chart.

[3] Spain gross domestic product per capita (current US$) in 2008 = US$35,366.25, data from GDP Per Capita (current US$) Spain (database), World Bank, Washington, DC (accessed May 15, 2023), https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=ES.

This study aimed to assess the level and impact of short-term disability from RTIs in six LMICs. The study's objectives were to (i) estimate the level of RTI-related disability in LMICs; (ii) identify key factors that influence its occurrence; and (iii) provide recommendations for advocacy, actions, and policies to help reduce the incidence of RTI-related disability and their long-term impact on households and communities. The study did not focus on RTI-related mortality but rather on the disability outcomes for RTC survivors over a six-month period after hospitalization and discharge. The study is part of the UK Aid-supported research initiatives under the Global Road Safety Facility.

2. Methods

This study collected original data on a cohort of road traffic injury (RTI) patients admitted to selected hospitals in six low- and middle-income countries (LMICs): Bangladesh, Cambodia, Ethiopia, Mexico, Ukraine, and Zambia. For this study, a road traffic crash (RTC) is defined as "a collision or incident that may or may not lead to injury, occurring on a public road and involving at least one moving vehicle" (Peden et al. 2004); RTIs are defined as "fatal or nonfatal injuries incurred as a result of a road traffic crash" (Peden et al. 2004); and an injury is defined as "physical damage that results when a human body is suddenly or briefly subjected to intolerable levels of energy" (Holder et al. 2001).

Data were collected in two stages: hospital-based surveillance of RTI patients; and phone interviews conducted at one month, three months, and six months to follow up with patients after discharge from the hospital.

Study Sites

Countries were selected based on the following criteria:

- Countries where road traffic crash data are available from both police and hospitals, at least on a sample basis, with any provision for insurance agency data
- Countries representing different World Bank Regions
- LMICs from major World Health Organization (WHO) regions (WHO 2018)
- Countries with an active World Bank project that can facilitate access to and cooperation with government agencies

The selection process also considered any known challenges with the quality of RTC data in these countries regarding inconsistencies in reporting with either WHO versus the Institute for Health Metrics and Evaluation's Global Burden of Disease or the Global Burden of Disease and WHO versus country-reported numbers. Table 2.1 lists the selected countries and cities where study sites are located. The sample included one hospital site each in Bangladesh, Ethiopia, and Zambia; two in Ukraine and Cambodia; and four in Mexico.

Table 2.1. Countries and Cities Selected

World Bank Region	WHO region	Countries selected	Cities
Europe and Central Asia	Europe	Ukraine	Kyiv
South Asia	Southeast Asia	Bangladesh	Dhaka
East Asia and Pacific	Western Pacific	Cambodia	Phnom Penh
Sub-Saharan Africa	Africa	Ethiopia, Zambia	Addis Ababa, Lusaka
Latin American and the Caribbean	Americas	Mexico	Cuernavaca, Axochiapan, Cuautla, Temixco

Source: Global Road Safety Facility.

Note: The study could not include a site from the Eastern Mediterranean WHO region (the World Bank's Middle East and North Africa Region). WHO = World Health Organization.

Hospital Surveillance

Eligibility Criteria

The study population covers males and females ages 18 years and older who were admitted to the hospital because of an RTI, and to qualify for this study, the RTI had to be severe enough to require hospitalization for at least one day. This includes patients admitted to the emergency department and other relevant hospital departments (for example, neurosurgical *or* orthopedic surgery units) because of an RTI. Individuals had to be able to give consent and complete interviews *or* have a suitable proxy who could give consent on their behalf during their unconscious time. Individuals who were "...transferred to another facility.." shortly after receiving first aid and who asked to be sent home were not included in the study. Table 2.2 summarizes the inclusion and exclusion criteria for recruiting patients for the study.

Table 2.2. Inclusion and Exclusion Criteria-Hospital Surveillance

Inclusion criteria	Exclusion criteria
1. Persons ages 18 and older admitted to hospital as a result of a road traffic injury	1. Repeated attendance at same hospital for the same injury
2. Persons who were able to give consent or have a suitable proxy who could give consent on their behalf	2. Previous attendance at other study site for the same injury
3. Consent was provided	3. Children and adolescents under age 18

Source: Global Road Safety Facility.

Sample Size

A sample size of 400 persons with qualifying RTIs in each country was estimated for the study's hospital surveillance portion, calculated based on the proportion of moderate to severe injury from the target RTI patient population. The required sample size for each country was calculated based on the following formula:

$$n = p \times (1 - p) \times (z/e)^2$$

where n is the sample size required for the large population, p is the proportion of population sustaining severe injuries from an RTC, z is the confidence level, and e is the margin of error.

The value for p is based on the evidence from several RTI studies in LMICs that estimate that 30 percent of the study population may sustain moderate to severe injuries from RTCs (Juillard et al. 2014; Nik Hisamuddin et al. 2016; Zafar et al. 2018). The z value is set at 1.96 (for a 95 percent confidence level [*a*]), and e is set at 5 percent.

Given these assumptions, a minimum sample size of 323 was calculated as adequate for estimating the proportion of moderate to severe injuries from the total RTI patient population in participating hospitals. Assuming a 20 percent combined refusal and attrition rate, the estimated minimum target sample size for each participating country is 400. Consecutive sampling was done such that every patient who met the inclusion criteria was selected until the required sample size was reached in each study country. Data collection ended when the desired sample size was reached or when the six months of continuous data collection ended.

Data Collection Procedures

Trained data collectors performed all data collection at the study sites using a standardized hospital surveillance tool and the World Bank's Survey Solutions software (release 21.05). Data collectors at each hospital monitored patient admissions to the emergency department to identify potential study participants. They also monitored daily hospital discharge lists for all RTI victims to identify survey candidates who may have bypassed the emergency department. These additional RTI patients were recruited on their discharge day.

Data Collection Instrument

The hospital surveillance tool is designed to gather information on the patient, the RTI, injury details, treatment received, and payments to the hospital. The surveillance tool has seven sections on the following topics: (i) general patient information (for example, age, gender, educational level); (ii) pre-hospital care (for example, whether care was provided at the scene of the crash, the type of care provided, the mode of arrival at hospital); (iii) RTI details (for example, date, location, type of road, type of vehicle, mobile use); (iv) initial clinical assessment and care provided (for example, vital signs, initial Glasgow Coma Scale, alcohol use, treatment, anatomical region of injury, surgery); (v) payment information (for example, different costs, method of payment); (vi) disability history; and (vii) final disposition of admitted patient (for example, death, discharge, transfer). A tracking sheet was also used to record detailed information for contacting RTI patients for the three follow-up interviews.

Box 1: Glasgow Coma Scale

The Glasgow Coma Scale (GCS) is a common scoring system for measuring a patient's consciousness, from fully awake (a score of 15) to deep coma (a score of 3). In the context of traumatic brain injury, the GCS rates the severity from mild to moderate to severe. For more information about the Glasgow Coma Scale, see Cleveland Clinic, "Glasgow Coma Scale (GCS)," https://my.clevelandclinic.org/health/diagnostics/24848-glasgow-coma-scale-gcs

Disability Follow-up Survey

Eligibility Criteria

The study population for the follow-up comprised those already included in the hospital-based surveillance and who met the eligibility criteria. Table 2.3 outlines the eligibility criteria.

Table 2.3. Inclusion and Exclusion Criteria-Follow-up Survey

Inclusion criteria	Exclusion criteria
1. Persons ages 18 and older who sustained a moderate to severe road traffic injury	1. Children and adolescents younger than 18 years old
2. Persons or their proxies who participated in the hospital-based interview or questionnaire	2. Persons who were discharged less than 24 hours after being admitted to the hospital for a road traffic injury
	3. Persons who are deceased (post-discharge from hospital)
	4. Persons who are unable to communicate verbally and do not have a proxy

Source: Global Road Safety Facility.

Sample Size

The sample for the follow-up study is by default a subset of the patients identified at the first follow-up. With a 95 percent confidence interval (a value of 0.05), a 20 percent attrition rate by the six-month follow-up yields a sample of 320 (Denu et al. 2021a; Jette et al. 2005). However, this sample size could be maintained only in three of the six countries.

Data Collection Procedures

Trained data collectors completed all data collection using a standardized disability follow-up tool and the World Bank's Survey Solutions software (release 21.05). Data collectors used participant contact information provided at the hospital to call each study participant at one, three, and six months after discharge.

Data Collection Instrument

The goal of the follow-up questionnaire was to assess the respondent's activity limitations, participation restrictions, and environmental barriers to participation. The Milken Institute School of Public Health at George Washington University developed this instrument, which consisted of questions taken directly from two validated instruments: the WHO Disability Assessment Survey 2.0 (Üstün 2010) and *Craig Hospital Inventory of Environmental Factors: Version 3.0*. Questions in this survey were taken from the two instruments and modified slightly to fit with the study's three data collection time points and the instrument's delivery mode.

The instrument consisted of three modules: module A: WHO Disability Assessment Survey 2.0; module B: Assistive Devices and Return to Usual Activities; and module C: Craig Hospital Inventory of Environmental Factors. Module A included questions aimed at measuring limitations in performance in six domains: understanding and communicating, getting around, self-care, getting along with people, life activities, and participation in society. Questions were scored on a five-point Likert scale. Module B included questions about returning to normal life and work and about assistive devices. Module C included questions aimed at quantifying the degree to which elements of the physical, social, and policy environment acted as barriers to participation in daily activities. Responses were scored on a scale of 0–4 indicating the frequency with which each barrier is encountered. If a barrier was present, participants were then asked to report the magnitude of the problem.

Two key measures were calculated for the study: the disability score and barrier impact score. The disability score was calculated using data from module A by adding the points from each response across the six domains. The score ranges from 0 to 48, with higher scores indicating higher levels of disability. The barrier impact score, which is derived from module C, calculates the extent to which environmental factors are a barrier to participation in daily life. The barrier impact score for each environmental factor is equal to the product of the frequency response multiplied by the magnitude response—that is, assessing how frequently a particular environmental aspect such as the availability of transportation has been a problem for the victim (daily, weekly, monthly, less than monthly, or never), and if it was a problem, how big a problem it was (the magnitude, concerning the victim's participation in the activities). The barrier impact score ranges from 0 to 8, with higher scores indicating higher barriers. The overall barrier impact score is an average of the impact scores for all barriers.

Data Management and Analysis

Training of Data Collectors and Data Handling

To ensure a uniform data collection approach, World Bank staff organized online workshops to train local data collectors. The George Washington School of Public Health study team facilitated the workshops. After the training and before commencing data collection, data collectors pretested the tools with at least five patients to address any problems with local translation, procedures, or digital functionality. The George Washington study team conducted regular reviews of the data collected and addressed any issues that arose in data quality with the World Bank Group team and local data collection teams, who made any necessary changes. Data collectors used Android-based devices and the Survey Solutions software to collect, store, and transfer all data.

Analysis

The data collected were used for descriptive statistics, cross-tabulations, and multivariate analysis. Analysis of the hospital surveillance data started with overall descriptive statistics, followed by cross-tabulations based on age, gender, and education. Predictors of in-hospital mortality were estimated using logistic regression and the Firth method (to account for small sample size bias). The study tested for multicollinearity using variance inflation factor and assessed model fit and significance of coefficients using Hosmer-Lemeshow and Wald tests, respectively. Follow-up disability data analysis began with descriptive statistics of the one-, three-, and six-month samples, followed by cross-tabulation of disability score and barrier impact score by gender. An attrition analysis was performed to test for correlation between demographic and clinical variables and loss to follow-up. Finally, longitudinal analysis was conducted using a mixed effects model with robust standard errors (to account for heteroskedasticity) to assess predictors of disability score. The study checked variance inflation factor, assessed model fit using F-test, and used Wald test to calculate significance of coefficients. All analyses were conducted using Stata 17 (Stata Statistical Software, release 17).

Ethical Approvals

The study received ethical approval in each country before conducting the surveys. Ethical approval was obtained from the ERES Converge Institutional Review Board in Zambia (Rf. No. 2021-Jan-003); National Ethics Committee for Health Research in Cambodia (Rf. No. 018 NECHR); Institutional Review Board of the Ethiopian Public Health Association (Rf. No. OG/039/21); Centre for Injury Prevention and Research in Bangladesh Ethical Review Committee (Rf. No. 2021/01); Instituto Nacional de Salud Pública in Mexico (Rf. No. 1729); and the George Washington University's Office of Human Research.

3. Results

Introduction

This chapter presents the results of the hospital surveillance and follow-up study, starting with descriptive analysis of key demographics (gender, age, and education) and data on crash characteristics, pre-hospital care, physiological assessment, patient care, payment, and prior disability. The study examines the relationship between age, gender, and education and key descriptive data, and then estimated the predictors of in-hospital mortality. The descriptive results from the follow-up surveys are next, including World Health Organization Disability Assessment Schedule disability scores, reported return to normal life, and Craig Hospital Inventory of Environmental Factors environmental barrier impact scores at one, three, and six months after discharge from the hospital. The study also examined the relationship between gender and the disability score and the barrier impact score. It also explores the predictors of disability score longitudinally.

Data Collection Summary

Table 3.1 presents the sample size by country at different stages of the study. The study enrolled more than 2,300 patients in the hospital surveillance and completed follow-up interviews with more than 1,800 patients at the first follow-up, 1,700 patients at the second, and 1,600 patients at the third. Overall, 31 percent of patients dropped out of the study by the time o the last interview. Hospital-based surveillance and follow-up surveys ended early in Ukraine because of the ongoing war. In Mexico, the pandemic affected study participant recruitment severely, and thus the study did not reach its target sample size.

Table 3.1. Summary of Data Collection Enrollment and Retention

Country	Hospital surveillance	First follow-up	Percent first follow-up	Second follow-up	Percent second follow-up	Third follow-up	Percent third follow-up
Bangladesh	836	696	83	647	77	583	70
Cambodia	443	415	94	389	88	397	90
Ethiopia	503	366	73	408	81	404	80
Mexico	137	102	74	96	70	85	62
Ukraine	33	23	70	21	64	2	6
Zambia	375	211	56	147	39	130	35
Total	2,327	1,813	78	1,708	73	1,601	69

Source: Global Road Safety Facility.

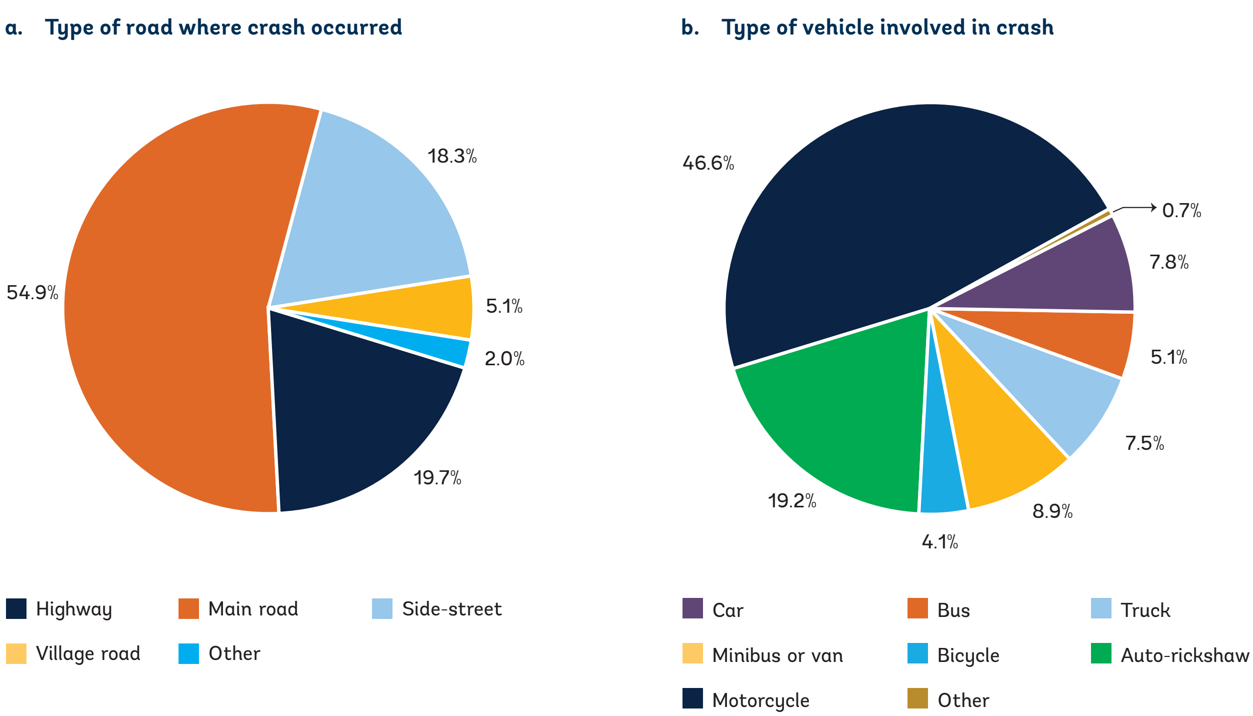
Hospital Surveillance Findings

Descriptive Analysis

Data indicate that the majority of road traffic injury (RTI) patients were male (81 percent) ages 18–34 (55 percent) except for Ukraine, where the sample was slightly older (appendix A, table A.1). The patients were mostly married (62 percent), with primary (24 percent) or secondary school education (45 percent), although in Ukraine, they were more likely to have a bachelor's degree or higher. Patients were mostly salaried workers (28 percent) or self-employed (28 percent).

The proportion of RTI patients that were pedestrians, drivers, and passengers varied by country (appendix A, table A.2). Most crashes took place on main roads (55 percent) and involved motorcycles (47 percent; figure 3.1, panels a and b). However, the data also highlight country-level variations. For example, 54 percent of the RTI victims in Cambodia used helmets, but only 6 percent did so in Zambia; in Cambodia and Ukraine, crashes were more likely to occur on a side street; and in Ukraine and Zambia, cars were more likely involved. In Ethiopia, 30 percent of injuries involved a minibus or van, and in Bangladesh, 40 percent involved an auto-rickshaw (appendix A, table A.2).

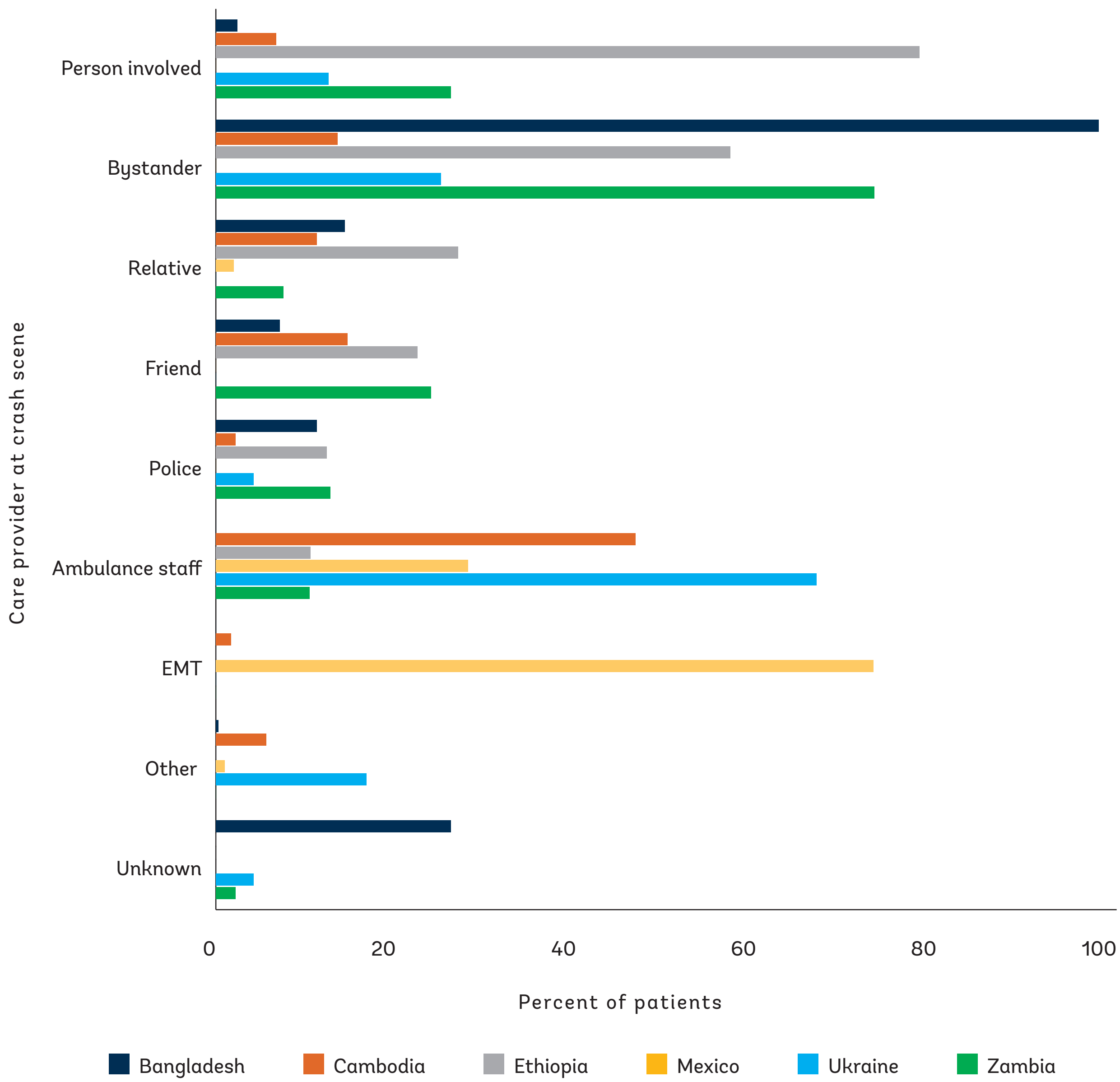
Figure 3.1. Percentage of Crashes by Road Type and Vehicle Type



Source: Global Road Safety Facility.

Care received at the scene of the crash and transport to a health care facility varied widely across countries. On average, 56 percent of the RTI victims received care at the scene of the crash (pre-hospital care), but this varied from 40.5 percent in Zambia to 77.4 percent in Ukraine. Care on the scene was provided primarily by someone involved in the crash or a bystander, followed by ambulance or other emergency medical staff (figure 3.2; appendix A, table A.3). Across countries, an ambulance transported most RTI victims (appendix A, table A.3) except for Ethiopia and Zambia, where personal cars transported them.

Figure 3.2. Persons Who Provided Emergency Care on the Scene (Pre-hospital Care)



Source: Global Road Safety Facility.

Note: EMT = emergency medical technician.

Transport times from the scene of the crash to the hospital also varied,[1] with the longest times experienced in Bangladesh. Overall, about 14 percent of RTI victims were transported to a hospital within the first 30 minutes of the crash. Another 27 percent were transported between 30 minutes to 1 hour, and about 5 percent took between 6 and 24 hours to reach a hospital (table 3.2). Most RTI victims were transported to a hospital within 2 hours of the crash, but in Bangladesh, nearly 50 percent of RTI victims (211 victims) took from 2 to 6 hours to reach a hospital, and another 30 percent (128 victims) took 1 to 2 hours. Factors such as road conditions, location, and distance from the facility and fragmented ambulance services may have contributed to these transport times (Hossain, Maggi, and Vezzulli 2022; Islam et al. 2023; Roy et al. 2021). In Mexico, which also experienced longer transport times, the largest proportion of RTI victims (42 percent, 50 victims) were transported between 1 to 2 hours. By comparison, in Cambodia, about 44 percent (55 victims) of RTI victims reached the hospital in 30 minutes to 1 hour, and in Zambia, about 52 percent (78 victims) arrived at a hospital within the same time frame (table 3.2).

Table 3.2. Transport Time to Hospital from Scene of Road Traffic Crash

Time to hospital	Bangladesh		Cambodia		Ethiopia		Mexico		Ukraine		Zambia		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
0–30 minutes	4	1.0	18	14.4	60	42.9	8	6.7	3	11.1	42	28.2	135	13.7
30 minutes–1 hour	50	11.9	55	44.0	42	30.0	25	20.8	12	44.4	78	52.3	262	26.7
1–2 hours	128	30.4	35	28.0	14	10.0	50	41.7	5	18.5	23	15.4	255	26.0
2–6 hours	211	50.1	16	12.8	15	10.7	19	15.8	3	11.1	4	2.7	268	27.3
6–24 hours	26	6.2	1	0.8	8	5.7	10	8.3	3	11.1	2	1.3	50	5.1
More than 24 hours	2	0.5	0	0.0	1	0.7	8	6.7	1	3.7	0	0.0	12	1.2

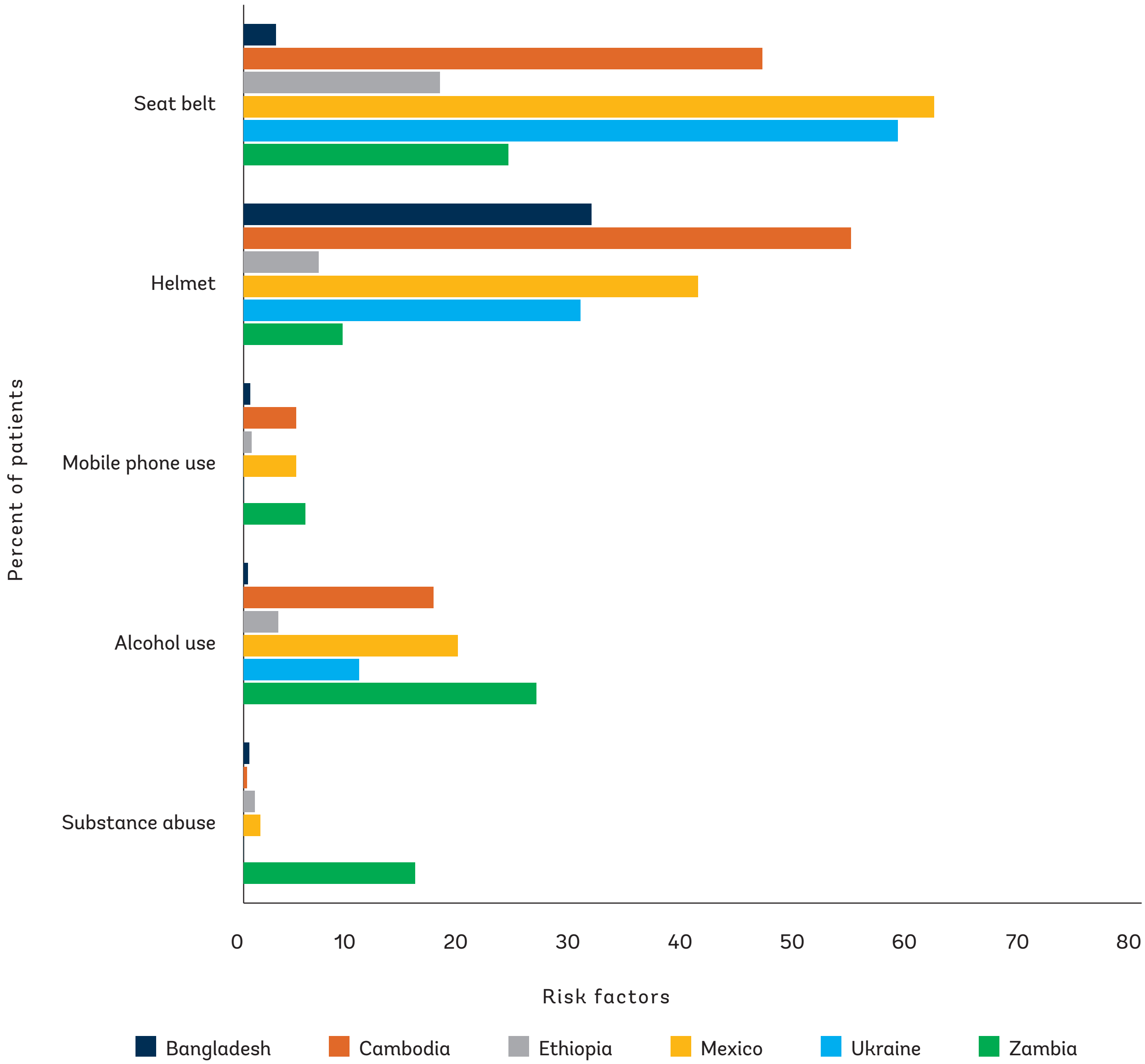
Source: Global Road Safety Facility.

Note: $p = 0.000$

Crash characteristics highlight the importance of protective safety gear such as wearing helmets and seat belts. Major risk factors for injuries as reported in the surveys were lack of helmet use for motorcycle riders (70 percent) and lack of seat belt use in cars (81 percent) across the six countries (appendix A, table A.2). Alcohol use, substance or drug abuse, and mobile phone use were low by comparison. However, at the country level, alcohol use was the main risk factor for Zambia (26.1 percent), followed by seat belt use (23.6 percent) and substance abuse (15.3 percent). Alcohol use was also relatively high as a risk factor in Mexico (19.1 percent) and Cambodia (16.9 percent), even though lack of seat belts and helmets remained the highest risk factors (figure 3.3). Although speeding is also a major risk factor for road crashes and injuries, it is difficult to know if the respondent was speeding, and thus speeding data was not included in the survey.

[1] This refers to patients who were transported directly from the crash scene to the hospital, not those transferred from another facility.

Figure 3.3. Risk Factors Associated with Road Traffic Injuries



Source: Global Road Safety Facility.

As expected, motorcycle riders without helmets experienced more severe injuries to the head and neck region (22 percent) than those who wore helmets (8 percent; table 3.3). Patients experiencing head and neck injury were more likely to suffer moderate to severe brain injury (48 percent) compared with other injury types.

Table 3.3. Helmet Use and Main Injury Type among Motorcycle Road Traffic Injury Patients

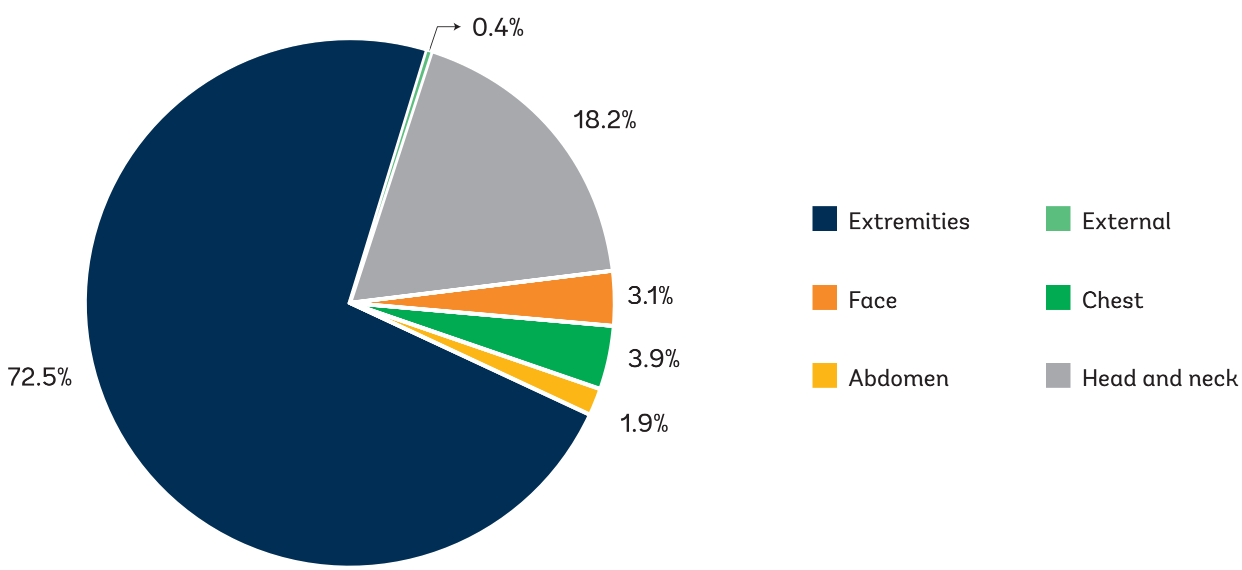
Main injury	Helmet use: no		Helmet use: yes		Total	
	No.	Percent	No.	Percent	No.	Percent
Head and neck	208	21.5	33	8.1	241	18
Face	29	3.0	9	2.2	38	3
Chest	27	2.8	21	5.1	48	3
Abdomen	22	2.3	2	0.0	24	2
Extremities	676	70.0	344	83.9	1,020	74
External	4	0.4	1	0.2	5	0

Source: Global Road Safety Facility.

Note: p value = 0.000

The most common and serious injuries were to the extremities (73 percent), followed by the head and neck (18 percent; figure 3.4; table 3.4), but with variation across countries and road users. For example, pedestrians sustained more head and neck injuries (24 percent) than other road users (table 3.4). In Ukraine, pedestrians frequently had chest injuries (appendix A, table A.4). A little more than half the cases (56 percent) involved only one major injury, though in Ukraine, it was common for patients to have three injuries (appendix A, table A.4). On average, only 6 percent of patients had a prior disability except for in Ukraine and Zambia (15–20 percent).

Figure 3.4. Types of Patient Injuries Attributable to Road Traffic Crashes



Source: Global Road Safety Facility.

Table 3.4. Type of Injury by Road User (total)

Injury region	Driver (includes cyclists)		Passenger		Pedestrian		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Abdomen	19	2.0	14	2.0	10	1.7	43	1.9
Chest	37	4.0	26	3.6	24	4.1	87	3.9
External	2	0.2	3	0.4	4	0.7	9	0.4
Extremities	710	76.5	507	71.1	395	67.8	1,612	72.5
Face	38	4.1	22	3.1	8	1.4	68	3.1
Head and neck	122	13.1	141	19.8	142	24.4	405	18.2

Source: Global Road Safety Facility.

Note: p-value = 0.000.

The majority of survey participants had mild symptoms of brain injury, and about one-quarter had lost consciousness. More than 70 percent of the participants scored low on the Glasgow Coma Scale (GCS) except for in Cambodia, where a greater number of patients exhibited moderate to severe levels of brain injury (table 3.5). Among head and neck injuries, about 16 percent of all RTI patients surveyed experienced severe injuries, and another 33 percent had moderate injuries.

Table 3.5. Glasgow Coma Scale for Main Injury (all countries total)

Glasgow Coma Scale	Head and neck		Face		Chest		Abdomen		Extremities		External		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Mild	205	51.8	40	60.6	52	60.5	31	72.1	1,211	75.5	7	77.8	1,546	70.2
Moderate	128	32.3	19	28.8	22	25.6	10	23.3	247	15.4	2	22.2	428	19.4
Severe	63	15.9	7	10.6	12	14.0	2	4.7	146	9.1	0	0.0	230	10.4

Source: Global Road Safety Facility.

Note: p-value = 0.000.

For type of road users, drivers tended to have the most severe GCS, approximately three times that of other RTI patients (table 3.6). These drivers were primarily motorcycle drivers from Cambodia.

Table 3.6. Glasgow Coma Scale by Type of Road Users (all countries total)

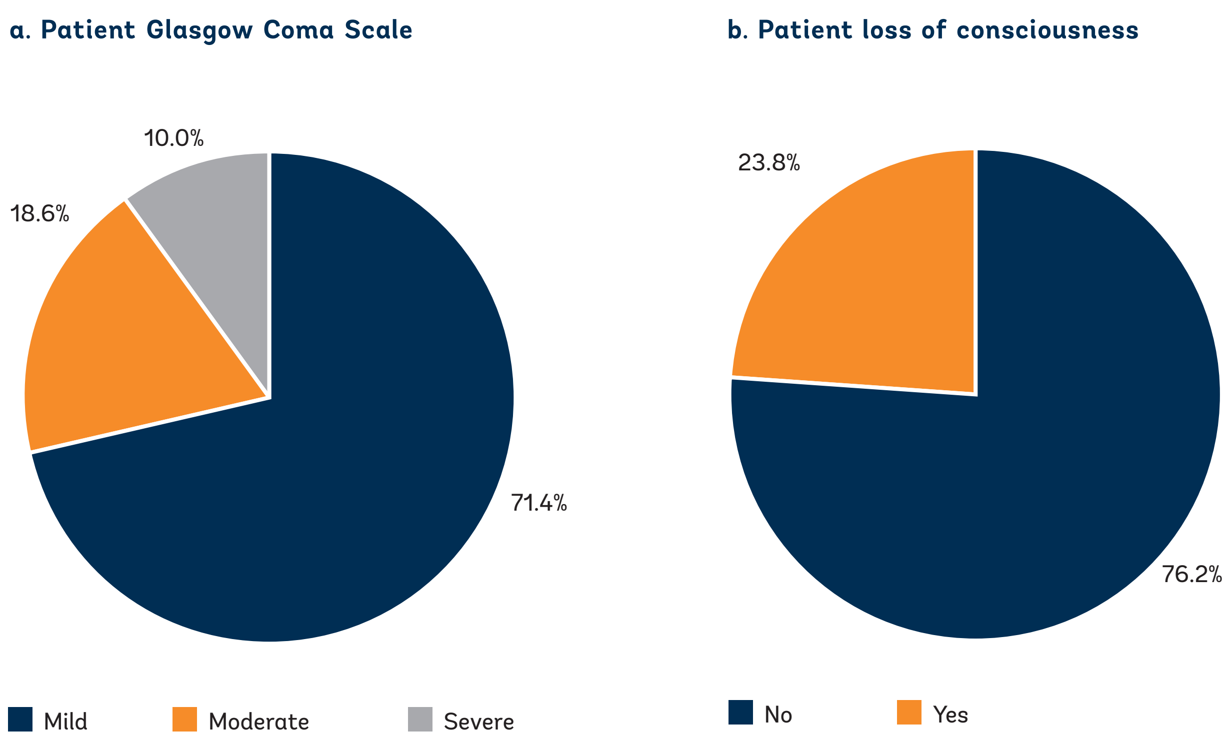
Glasgow Coma Scale	Type of road user							
	Pedestrian		Driver		Passenger		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Mild	463	77.82	560	59.83	621	80.44	1,644	71.39
Moderate	102	17.14	214	22.86	113	14.64	429	18.63
Severe	30	5.04	162	17.31	38	4.92	230	9.99
Total	595	100	936	100	772	100	2,303	100

Source: Global Road Safety Facility.

Note: p-value = 0.000.

Relatedly, most participants stayed awake after their crash, with about 24 percent losing consciousness (figure 3.5, panel b). Bangladesh had the highest level of participants who stayed conscious after a road traffic crash (RTC), with only about 7 percent losing consciousness.

Figure 3.5. Percentage of Patient Glasgow Coma Distribution and Patient Loss of Consicousness



Source: Global Road Safety Facility.

The average stay at a hospital was 14 days, and nearly half of RTI patients required surgery. The hospital stay ranged from 9 days in Mexico to up to 22 days in Ukraine. Forty-four percent of patients had an operation, and 2 percent died in the hospital. Across countries, data were collected at tertiary care hospitals, and only 9 percent of patients were discharged to a rehabilitation facility. The length of hospital stay depended on factors such as treatment protocols for different injuries and the severity of injuries. Generally, shortened hospital stays may be combined with recovery at rehabilitation facilities (if they exist), but longer hospital stays may be necessary in other situations to ensure that patients are stable enough to go home. For instance, 78 percent of all RTI patients in Mexico were sent to a rehabilitation facility (which are more easily accessible and available in Mexico compared with other countries in this study). However, in Bangladesh, rehabilitation facilities are limited, and nearly all RTC patients were discharged to their homes with instructions for follow-up at the hospital (mainly because of few fully dedicated rehabilitation centers for patients with orthopedic complications). Hospitals in Mexico recognized referral to a rehabilitation facility as necessary to reduce hospital follow-up.

The out-of-pocket cost of hospital care varied across countries, but on average was about 10 percent of the annual household income. Sixty-five percent of patients paid a fee on arrival at the hospital, averaging about US$51. The total cost of hospital care across all countries averaged US$229, with the highest cost in Cambodia at US$567. About 35 percent of all RTI patients surveyed did not include payment information in their responses, and this ranged considerably by country (95 percent in Mexico, 81 percent in Zambia, 30 percent in Cambodia, 25 percent in Bangladesh, and less than 1 percent in Ethiopia). The correlation between the total amount paid and days in hospital or injury region was very weak, suggesting that other factors were driving the cost. Most patients used their own funds to pay for care (84 percent), but 56 percent also borrowed to pay the fee. Notably, insurance covered the cost of care in 81 percent of cases in Ethiopia.

Cross-tabulation by Gender at Hospital Surveillance

Key findings from cross-tabulations show that female RTI patients were more likely to be pedestrians or passengers in cars and buses and less likely to be wearing a seat belt or using a helmet. Thus, female RTI patients had a higher share of moderate to severe GCS and sustained a higher share of head and neck injuries. The majority of male patients were drivers (appendix A, table A.5), often younger (under age 35), and riding a motorcycle.

Regression Analysis

The results of the multivariate logistic regression indicate that severe brain trauma and older age were significant predictors of death among RTC victims. The adjusted odds ratio for GCS was 11.92 (confidence interval: 3.94–36.07), indicating that the odds of death for patients with a severe GCS was almost 12 times higher than for patients with a mild GCS, and the adjusted odds ratio for older age was 1.03 (confidence interval: 1.00–1.06)—both were significant for death during the hospital stay (appendix A, table A.6). Relatedly, patients having the most severe injury to the extremities versus the head and neck (adjusted odds ratio 0.06 [0.02–0.24]) was protective against death during the hospital stay.[2] This shows that even though injuries to the extremities were prevalent, the incidence of death was less likely. The large magnitude of the adjusted odds ratio for severe GCS indicates that this was a very important predictor of in-hospital mortality.

[2] These calculations excluded Bangladesh because there were no deaths during the hospital stay. Ukraine was excluded because of its small sample size.

Follow-Up Findings

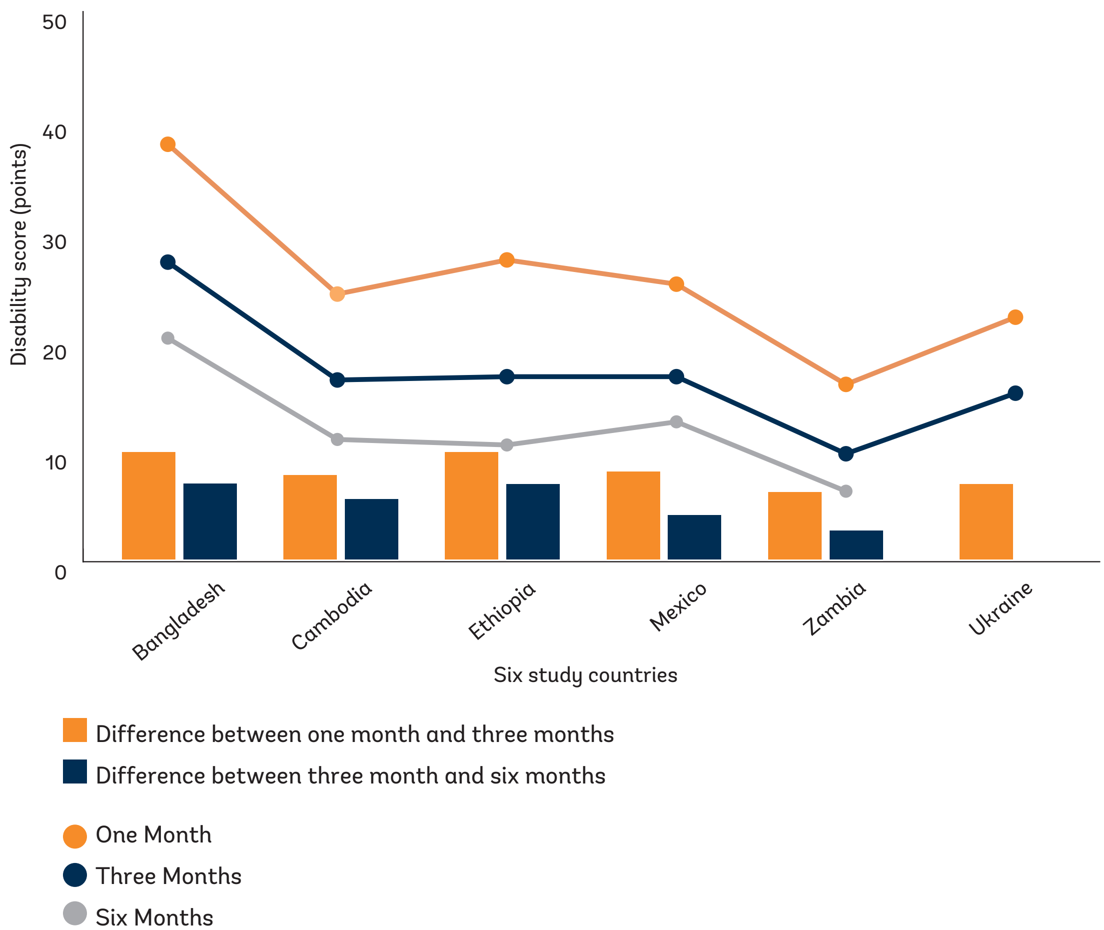
The follow-up results show some variations across countries but highlight key factors associated with long-term disability for RTI patients in all settings, including age, severity, type of injury, and barriers to health care.

Descriptive Analysis

One Month Follow-Up

Most patients were still in recovery and experiencing difficulties one month after discharge. At one month, the mean disability score was 29 (indicating moderate to extreme disability), ranging from a low of 16 in Zambia to 38 in Bangladesh (figure 3.6; appendix A, table A.8). Only 8 percent of patients stated that they had returned to normal life, with considerable variation across countries, from a low of 4 percent in Bangladesh to a high of 23 percent in Ukraine (figure 3.7, panel a; appendix A, table A.7). Three-quarters of RTI patients who were working before their crash (76 percent) reported returning to work at three months, but the rate in Bangladesh was very low at 22 percent. Almost all patients reported experiencing some difficulties 27 days out of the month on average. Forty-eight percent of the patients surveyed reported using assistive devices for support, with Ukraine reporting the lowest usage at 32 percent (figure 3.7, panel b). However, about 11 percent of the patients who reported not using assistive devices needed them, mostly mobility aids (figure 3.7, panel c).

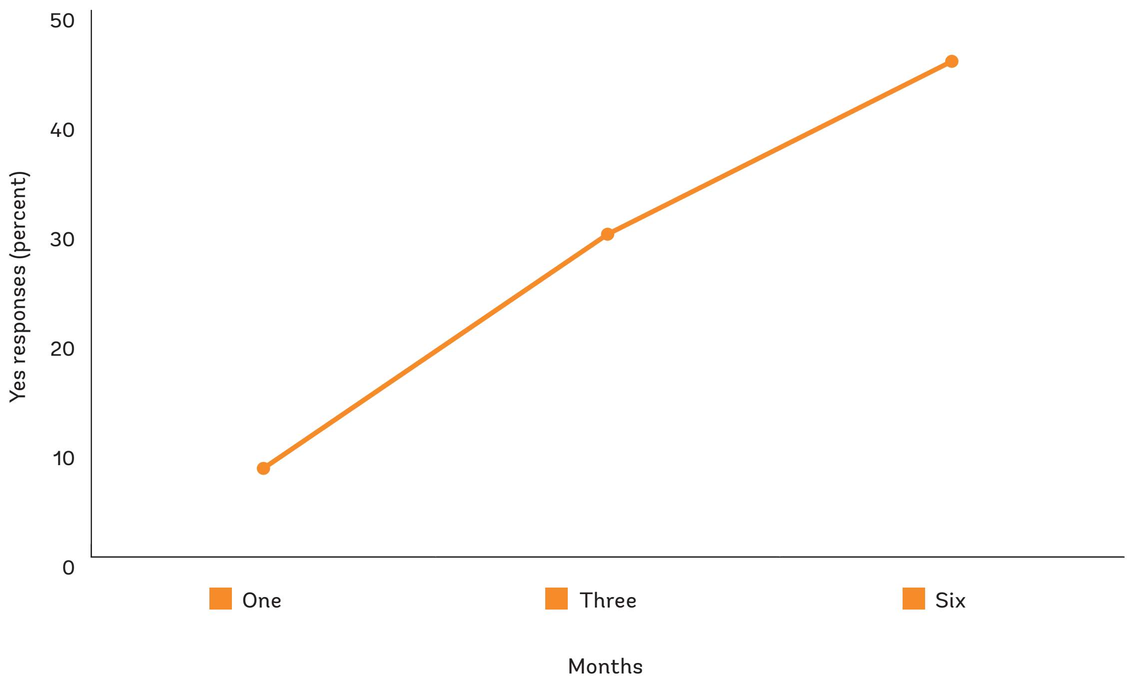
Figure 3.6. Disability Scores



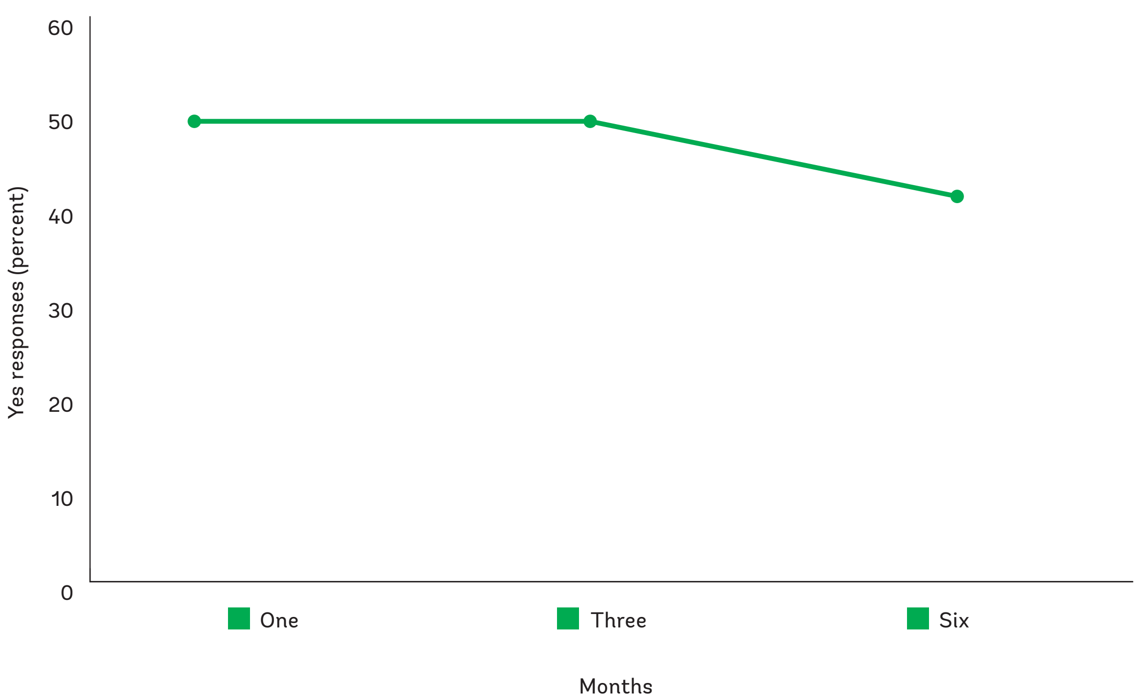
Source: Global Road Safety Facility.

Figure 3.7. Percentage of Returned to Normal Life, Using Personal Equipment and Need for Personal Equipment at One month, Three Months and Six Months

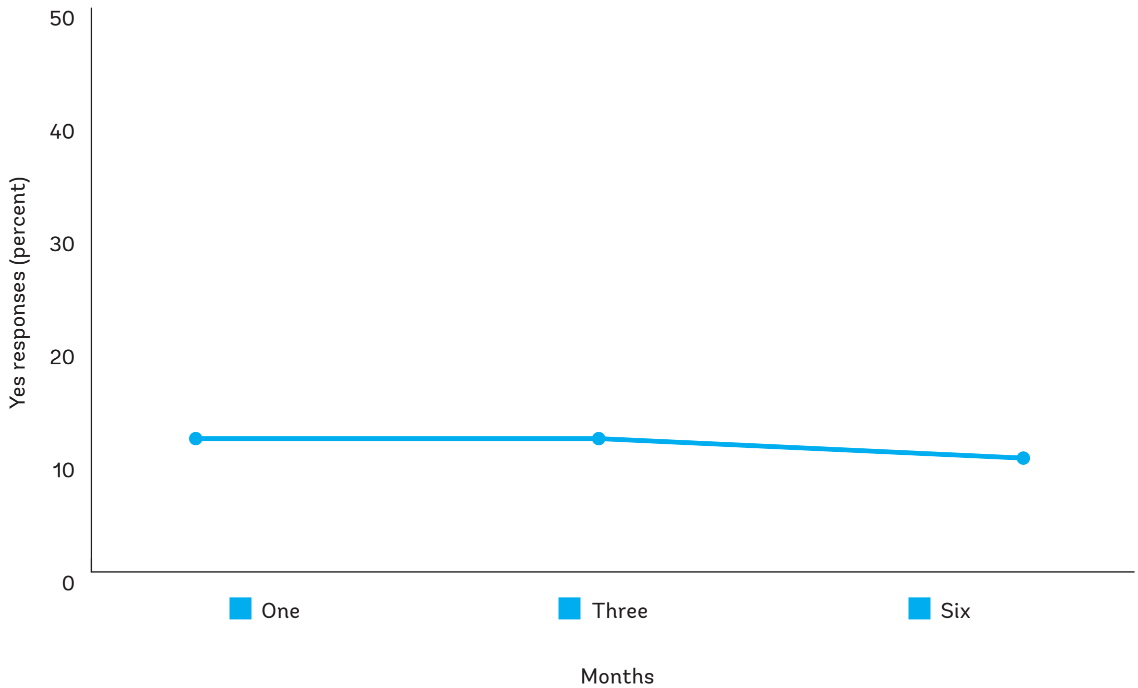
a. Returned to normal life



b. Using personal equipment



c. Need for personal equipment



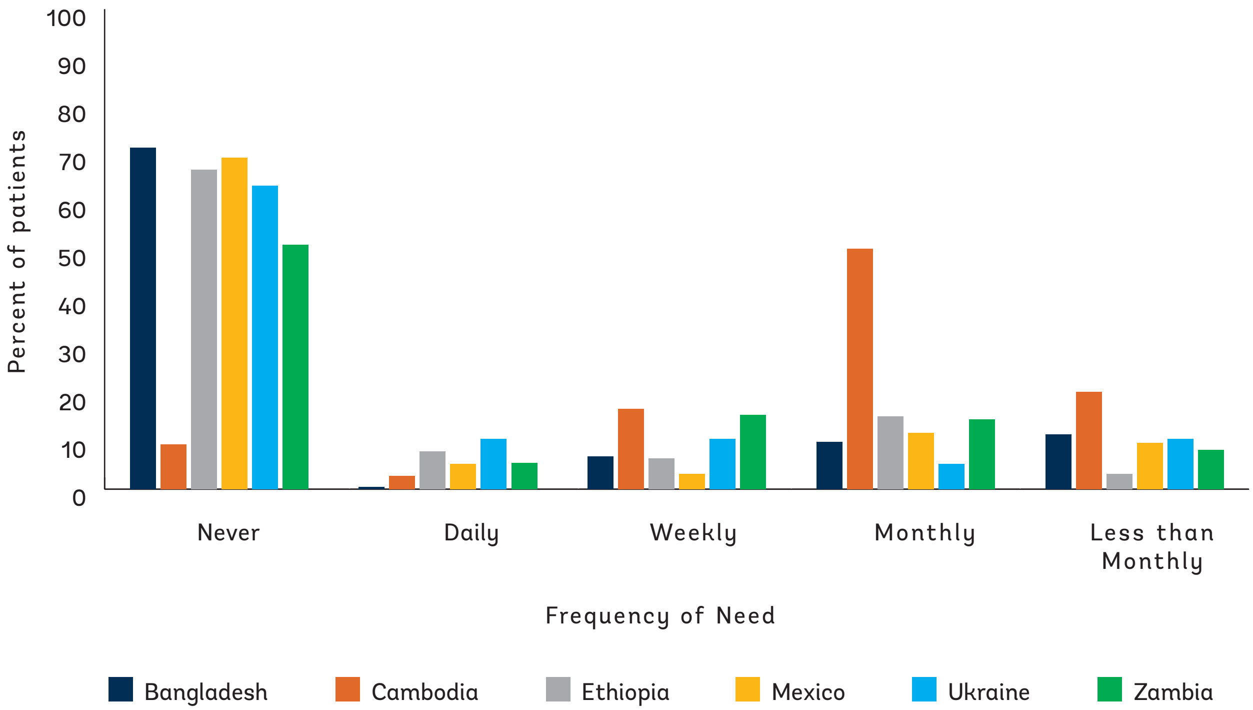
Source: Global Road Safety Facility.

Three Months Follow-Up

Although there was some improvement after three months, most RTI patients still experienced difficulties, and the need for assistive devices did not change. The mean disability score at three months after discharge was 20 across all countries except for Bangladesh, which still reported the highest levels at 27 (figure 3.6; appendix A, table A.8). Eighty-eight percent of patients reported experiencing some difficulties in the last 30 days, and difficulties were present an average of 20 days per month. About 30 percent of patients (differ by country, range 25–55 percent) had returned to normal life at three months after the injury (figure 3.7, panel a; appendix A, table A.7). Three-quarters of RTI patients who were working before their crash (76 percent) reported returning to work at three months, and the percentage of patients using assistive devices and expressing a need remained the same as at the one-month follow-up (figure 3.7, panels b and c).

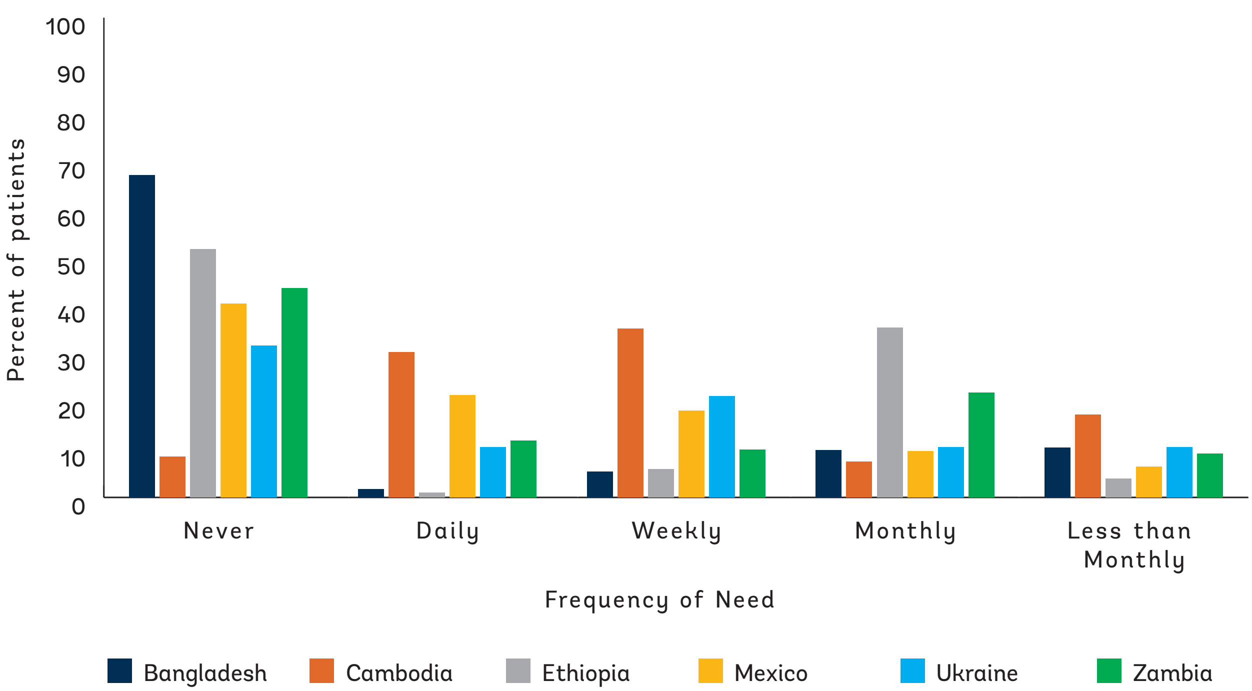
Patients also reported availability of health care and transportation as key barriers to seeking needed care. Forty-five percent of RTI patients reported that availability of health care was a barrier at the three-month follow-up except for in Cambodia, where nearly 90 percent reported it as a barrier (figure 3.8). Availability of transportation was a barrier for 50 percent of patients on average, and Cambodia once again lagged other countries, with 90 percent reporting a transportation barrier (figure 3.9). Evidence from a recent study in Phnom Penh suggests that persons with disability face challenges in access to transportation, such as being denied boarding or paying extra (Asia Foundation 2023), which may be a factor in the country's higher figure. At three months, the average barrier impact score was 1.4, and it ranged from a low of 0.7 in Bangladesh to a high of 2.0 in Cambodia (figure 3.10; appendix A, table A.9). The highest scores for barriers were in transportation and home help.

Figure 3.8. Barrier at Three Months: Availability of Health Care



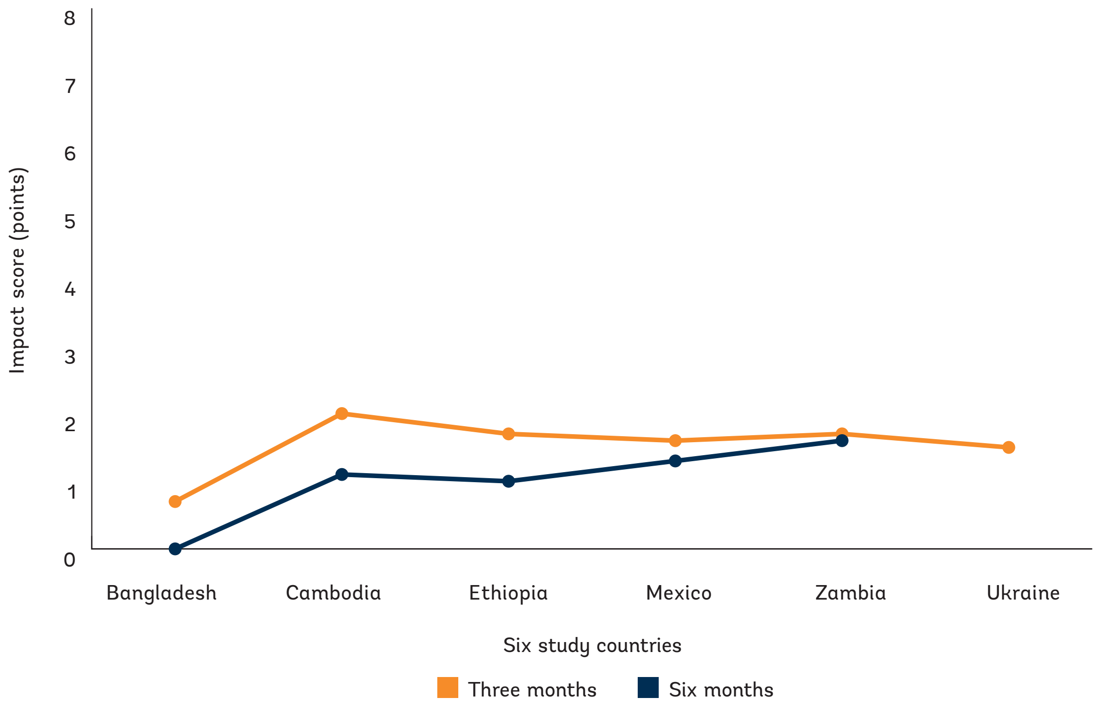
Source: Global Road Safety Facility.

Figure 3.9. Barrier at Three Months: Availability of Transportation



Source: Global Road Safety Facility.

Figure 3.10. Impact Score at Three Months and Six Months



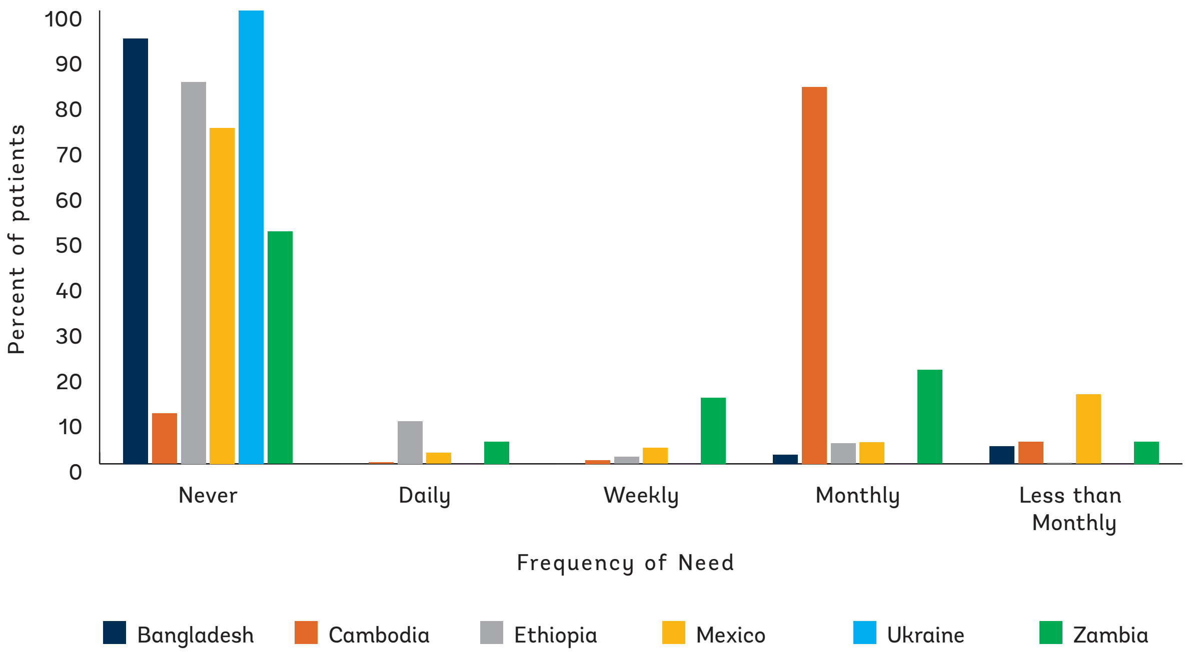
Source: Global Road Safety Facility.

Six Months Follow-Up

At six months, 74 percent of all RTI patients reported some level of difficulties. The disability score dropped for all countries, averaging 14, but it was still relatively high for Bangladesh at 20 (figure 3.6; appendix A, table A.8). Patients reported difficulties for 18 days per month. Forty-five percent of patients reported returning to normal life at six months (figure 3.7, panel a, appendix A, table A.7), and the same 75 percent that reported returning to work at three months were still working at six months. The percentage of patients using assistive devices (42 percent) declined slightly compared to earlier follow up time points, while the unmet need for assistive devices (11 percent) remained roughly the same.

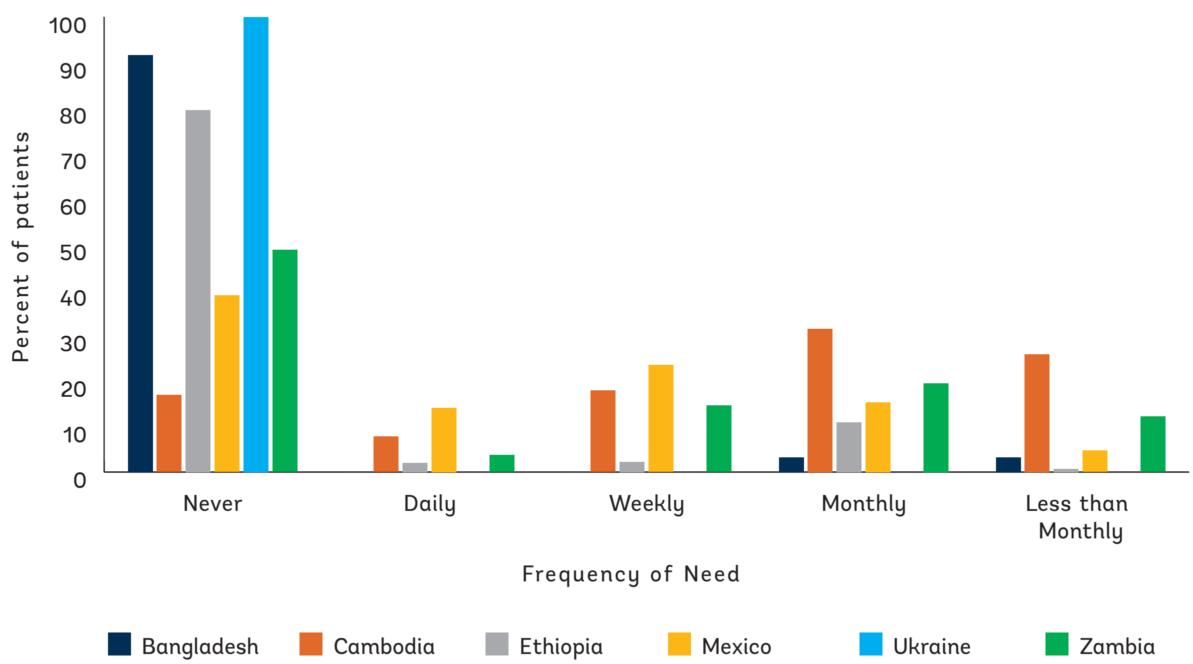
Patients continued to experience barriers to health care at the six-month mark. About 33 percent reported limited availability of health care as a barrier, and a similar proportion (34 percent) reported availability of transportation. RTI patients in Cambodia faced the largest barriers, with more than 80 percent experiencing barriers in access to health care monthly (figure 3.11), and about 31.5 percent continued to experience transportation barriers (figure 3.12). But in other countries, those experiencing these barriers was considerably smaller. In Zambia, for example, which has the next highest reported barriers, about 20 percent experienced barriers to health care and transportation, while patients in Ukraine did not report either as a barrier. The average barrier impact score was 0.7, and it ranged from a low of 0 in Bangladesh to a high of 1.6 in Zambia (figure 3.10; appendix A, table A.9). The scores remained unchanged for Mexico and Zambia. The highest barrier scores were for home help and natural environment.

Figure 3.11. Barrier at Six Months: Availability of Health Care



Source: Global Road Safety Facility.

Figure 3.12. Barrier at Six Months: Availability of Transportation



Source: Global Road Safety Facility.

Cross-tabulation by Gender at Follow-Up

As the descriptive statistics highlight, men had greater disability than women at the time of RTC, but for women with disabilities, long-term barriers were more significant. The disability score for men was significantly higher than for women, even at the one-month follow-up, but at three months and six months, there was no significant difference in disability (appendix A, table A.5). However, regarding barrier impact scores (which were calculated for the month three and month six follow-ups), male RTI patients scored significantly lower in both follow-ups than female RTI patients (table 3.7). The results show the challenges for long-term disability on women, who may face a greater barrier in accessing the rehabilitation and treatment they need for recovery because of social and gender norms.

Table 3.7. Gender Gaps in Disability Score and Barrier Impact Score

Score type	One month			Three months			Six months		
	Female	Male	*p*-value	Female	Male	*p*-value	Female	Male	*p*-value
Disability score mean (SD)	27.3 (11.2)	29.7 (12.3)	$p = 0.0015$	19.9 (13.6)	20.1 (15.3)	$p = 0.8092$	13.2 (12.6)	14.2 (14.2)	$p = 0.2824$
Barrier impact score mean (SD)	n.a.	n.a.	n.a.	1.8 (1.6)	1.3 (1.5)	$p = 0.0000$	1.0 (1.3)	0.7 (1.1)	$p = 0.0000$

Source: Global Road Safety Facility.

Note: n.a. = not applicable; SD = standard deviation.

Men also reported more use of assistive devices at the three- and six-month follow-ups than women: 51 percent versus 43 percent at three months, and 42 percent versus 38 percent at six months (table 3.8). It is likely that due to a higher number of men with severe injuries, they were more likely to receive these devices and had the financial and physical means to access them compared to women. However, the barrier impact scores at both three and six months showed that women faced significantly greater barriers than men in access to health care and support.

Table 3.8. Use of Assistive Devices at Three- and Six-Month Follow-Up by Gender

Using assistive devices	Female		Male		Total		*p*-value
	No.	Percent	No.	Percent	No.	Percent	
Three months							
No	194	58.1	677	49.3	871	51.1	$p = 0.015$
Yes	140	41.9	694	50.6	834	48.9	
Don't know	0	0.0	1	0.1	1	0.1	
Six months							
No	186	61.8	738	56.8	924	57.7	$p = 0.029$
Yes	114	37.9	562	43.2	676	42.2	
Don't know	1	0.3	0	0.0	1	0.1	

Source: Global Road Safety Facility.

Another key finding is the impact of emergency care at the crash scene on future disability. At all three follow-up time points, the mean disability score for patients treated at the crash scene by qualified personnel (ambulance staff and emergency medical technicians [EMTs]) was significantly lower than for those who received care from others such as bystanders, with an average difference of 5.2 points (23 percent) between the two groups of RTI patients (table 3.9). This has strong relevance for policy because ambulance services are often fragmented and limited, especially in low- and middle-income countries. However, investing in strengthening these services has the potential to reduce the incidence of RTI-related long-term disabilities.

Table 3.9. Disability Score at Follow-Ups by Type of Emergency Care Received at Crash Scene

Treated by ambulance or EMT	No.	Mean disability scores	SD of disability scores	95 percent CI		*p*-value
One month						
No	834	31.87	12.14	31.05	32.70	$p = 0.000$
Yes	197	25.60	9.21	24.30	26.89	
Three months						
No	766	22.80	16.20	21.65	23.95	$p = 0.000$
Yes	194	17.38	10.49	15.89	18.86	
Six months						
No	714	16.11	15.86	14.94	17.27	$p = 0.000$
Yes	175	11.93	9.85	10.46	13.40	

Source: Global Road Safety Facility.

Note: CI = confidence interval; EMT = emergency medical technician; SD = standard deviation.

Additionally, there is some evidence that at the one- and three-month assessment points, car occupants who wore seat belts had significantly lower disability scores than those who did not wear them, with an average difference of 5.3 points (32 percent; table 3.10). But no such difference was observed at the six-month follow-up, which indicates that this difference fades with time and emphasizes that seat belts help lessen injuries and short-term disabilities.

Table 3.10. Seat Belt Use and Disability Scores at One Month and Three Months

Seat belt use	No.	Mean disability scores	SD of disability scores	95 percent CI		*p*-value
One month						
No	292	26.97	12.81	25.50	28.45	$p = 0.000$
Yes	69	21.33	11.26	18.63	24.04	
Three months						
No	279	17.80	13.65	16.19	19.41	$p = 0.000$
Yes	63	12.89	11.38	10.02	15.76	

Source: Global Road Safety Facility.

Note: CI = confidence interval; SD = standard deviation.

Attrition Analysis

Data indicate that patients with more severe head and brain injuries likely ropped out the survey in the one-month follow-up survey, which had the largest attrition. Comparing the sample of RTI patients who failed to complete the one-month follow-up with those who did found some significant differences in injury characteristics ($p < 0.05$). GCS was more likely to be moderate or severe in patients who missed the one-month follow-up. Also, the most severe injury was more likely to be to the head and neck or abdomen versus the extremities in patients who were lost to follow-up. These differences suggest that more severely injured patients may have been less likely to complete the follow-up at one month.

Regressions Analysis

The multilevel mixed-effects linear regression confirmed that age, severity of injury, and barriers to care are all associated with a higher disability score. The following variables were all associated with higher disability score: age, undergoing an operation, multiple injuries, a GCS of severe, number of days in the hospital, previous disability, and barrier impact score (appendix A, table A.10).[3] Being a student (versus a daily wage laborer), having the most serious injury in the face (versus head and neck), and assessment time point were associated with lower disability score. The factor that had the largest positive impact on disability score was a severe GCS (coefficcient 3.22 [1.30–5.14]), and assessment time point (coefficient -4.48 [-4.97 to -3.99]) had the largest negative impact on disability score.

Analyses indicate that the disability score decreased at each of the three follow-up points, showing a consistent pattern of recovery. As level of functioning improved, a higher proportion of patients reported a return to normal life and work at six months compared with three months and one month after discharge. At three months, the mean disability score was 20 (confidence interval range: 10–27) compared with 19 in a study in the Islamic Republic of Iran (Abedzadeh-Kalahroudi et al. 2015) and 17 in another study in Ethiopia (Denu et al. 2021b). At six months, the Ethiopia study reported a mean disability score of 12, whereas this study reported 14 (confidence interval range: 6–20). The World Health Organization Disability Assessment Schedule 2.0 was a useful tool for assessing disability after discharge.

Although there was steady recovery, 74 percent of patients still reported some difficulty with everyday tasks at six months. Only 44 percent of patients had returned to normal life at six months, and there was an unmet need for assistive devices among 11 percent of the RTI victims at all three follow-up points. Longitudinal analysis indicated that severity of injury as measured by the GCS and barriers to care were significant predictors of disability score.

[3] Ukraine was excluded from these calculations because of the small sample size.

Strengths

This study has several important strengths. It was able to follow up with RTI victims from hospitals to three different time points to assess the impact of the RTI on the disability. The prospective design of the study is one of its major strengths because it allows for identifying the predictors of disability level while controlling for the effect of time itself on these outcomes because of recovery. Another strength is the extended follow-up time period of six months with regular follow-ups at one, three, and six months, which allowed for estimating the change in disability outcomes at different time points after discharge, telling a story about disability and recovery progression. Additionally, this is apparently the first time that the Craig Hospital survey questions were used with RTI patients. Furthermore, the multicounty design with sample pooling provides a larger sample size that increases the accuracy of the findings at the aggregate and provides an opportunity to compare patterns of RTI, demonstrating evidence that RTIs have common key features that need to be tackled with proven policies in both transportation and health across regions.

Limitations

This study has several limitations. First, it focuses only on moderate to severe nonfatal RTIs and thus does not present a complete picture of the burden of RTCs in low- and middle-income countries, which includes minor injuries and fatalities before the patient arrives at the hospital. Second, because it was conducted during the COVID-19 pandemic, related restrictions caused some hospitals to change their inpatient and outpatient case prioritization procedures, which affected patient recruitment and eligibility. Third, this is a hospital-based study. The sample in each country was not nationally representative, thus findings could not be extrapolated to the entire country. Additionally, the sample was also likely not fully representative of typical moderate to severe RTI cases, given that some hospitals received specific types of patients. For example, the hospital in Bangladesh was a referral hospital for orthopedic patients, and the hospital in Zambia was a referral hospital for traumatic brain injuries. As a result, some of the patients were transferred to these facilities, which might have some implications on the transfer time and length of stay. Moreover, because a combined sample was used for modeling, it is possible that some factors that are unique to each country were not apparent in the analysis of the aggregate data. Finally, the attrition analysis revealed that loss at follow-up may have biased the sample somewhat, causing underestimation of the disability level.

4. Discussion and Recommendations

The high rates of road crashes, injuries, deaths, and disabilities represent a significant cost for families and societies in low- and middle-income countries (LMICs). Among those who survive road traffic crashes (RTCs), a sizable share experience disability with long-term emotional, social, and economic consequences. However, it is difficult to measure disability because it is multifaceted and involves interactions between the person and their environment. This study collected primary data from victims of moderate to severe road traffic injuries (RTIs) at hospitals and followed up with them at one month, three months, and six months after discharge from the hospital across six LMICs.

Main Findings

The study confirms the considerable long-term burden of RTIs on victims of RTCs and highlights the need for better rehabilitation and support services. Almost 75 percent of patients in the study experienced disability that persisted six months after discharge from the hospital, and about 44 percent had resumed daily activities, suggesting that although recovery was steady, full recovery from RTIs may require an even longer timeframe. Yet these findings are consistent with similar RTI studies showing a steady decrease in disability score and an increase in return to work among RTI patients over time (Abedzadeh-Kalahroudi et al. 2015; Denu et al. 2021b; Giummarra et al. 2020; Kendrick et al. 2012).

Most RTI patients were young working-age men (ages 18–34)—that is, young working-age adults, suggesting that in addition to the physical and emotional toll of being in a crash and the cost of treatment, their disability had the potential to negatively affect income generation for their households. Previous studies in LMICs confirm that the consequences of RTIs affect young men disproportionately, can last several months after injury, and result in permanent disability (Odero, Khaysei, and Heda 2003; WHO 2019; Zafar et al. 2018; Zimmerman et al. 2012).

Use of protective equipment and safety measures such as seat belts and helmets among RTI victims was generally low, though with wide variation across countries. Female RTI patients were especially less likely to have worn seat belts and helmets at the time of the crash compared with male RTI patients. They were also more often the passengers instead of the drivers. It is likely that passengers are less likely to use helmets or wear seat belts in LMICs because of a combination of factors, such as limited knowledge, unavailability of appropriate safety equipment, or social norms and behaviors (Al-Hajj et al. 2022; Khaliq et al. 2020; Mahdavi Sharif et al. 2023; Şimşekoğlu 2009). Seat belt use—especially by those in the front seat of a car—reduces the risk of fatal injury by 45 percent, and helmet use by motorcyclists and cyclists reduces the risk of head injury by 42 percent and 48 percent, respectively (Høye 2018; Kahane 2017).

An important factor for the use of safety equipment is the existence and enforcement of road safety laws in different countries. Among the study countries, for example, Bangladesh and Mexico do not have a national seat belt "..law. Mexico also .." also does not have a national helmet law (WHO 2019). Even countries with national laws on road safety had differences in who is covered under the law (for example, passengers may not be required to wear seat belts in cars) and what is required (such as the type of helmet for motorcyclists), much less whether the law is enforced and how strictly. Appropriate legislation with effective enforcement can have a strong impact, as evidenced by the highly successful helmet legislation intervention that Vietnam launched in 2007, which increased helmet wearing from 40 percent to 93 percent (Nguyen et al. 2013).

There were significant gaps in pre-hospital (at the crash scene) emergency care. A little more than half of the study participants received care before being admitted to the hospital, in most cases provided by nonemergency personnel. A systematic review in developing countries estimated that pre-hospital trauma systems reduced the risk of dying from trauma by 25 percent (Henry and Reingold 2012). Pre-hospital care is an important component of a complete trauma response system that is often missing in LMICs. Of the patients in this study who received care at the scene, only 14 percent received it from ambulance staff and 6 percent from emergency medical technicians, with most receiving aid from another person involved in the crash or a bystander, which is helpful but is likely less effective than treatment from medical personnel.

Injuries to the extremities were the most frequent, followed by moderate to severe traumatic brain injuries. This demands distinct actions for post-crash care at the hospital and prevention. Lower extremity fractures can require surgical management to avoid longer-term disability, which emphasizes the importance of modern medical services, including surgical services, as the Global Burden of Disease 2017 study recommended (James et al. 2020). In addition, these findings show how disability from road injuries can lead to lifelong health loss in the form of conditions like traumatic brain injury that can have irreversible health consequences, emphasizing the importance of preventive strategies in reducing the future burden from road injuries.

More than 40 percent of RTI patients in the study were using assistive devices at six months after discharge from the hospital, and an additional 11 percent had unmet need for such devices, mostly mobility aids, which remained unchanged throughout the study. Globally, 1 billion people have an unmet need for assistive technology because of disabilities or older age (WHO and UNICEF 2022). Access to assistive technology has been identified as a human right, part of enjoying the highest attainable level of health and to exercise other rights (WHO and UNICEF 2022). Access to assistive technology is particularly lacking in LMICs, where only 5 percent to 15 percent of people who require them have access (WHO 2010). Enabling full access is essential to a full return to normal life, including education, work, and social opportunities.

The Glasgow Coma Scale (GCS) was a significant predictor of both mortality in hospital and higher levels of disability after discharge. Two previous RTI studies of death in hospital found that GCS had a significant association with mortality (Denu et al. 2021a). The GCS not only predicts worse health outcomes but likely contributes to high level of disability burden on RTI patients and their families because more severe injuries likely lead to higher hospital bills and longer-term impairment. Nearly 50 percent of the head and neck injuries were among moderate and severe GCS from RTIs of motorcycle drivers and passengers and for pedestrians. Because these users are not protected with the shield of vehicles, they sustain higher injury severities, leading to a higher level of disability. The finding corroborates the need for increased use of protective gear and by providing safer infrastructures for better road safety outcome.

The results also indicate that environmental barriers are an important predictor of disability level. Patients reported facing several barriers at the three-month follow-up, including limited availability of health care, transportation, and home help, along with problems with the natural environment. The average frequency and magnitude of these barriers decreased at six months, but they were found to be a significant predictor of higher levels of disability. These results illustrate the need for post-treatment interventions for RTI patients, specifically those that address environmental barriers that RTI patients face after discharge. Addressing these barriers can potentially speed up recovery and facilitate the return to pre-injury activities.

Evidence also highlighted gender heterogeneity in RTI outcomes. More women than men were victims of RTIs as vulnerable road users (pedestrians and passengers), with a significantly higher share of moderate to severe GSC scores and higher incidence of head and neck injuries. At the three- and six-month follow-ups, fewer women were using assistive devices than men, even though there was no significant difference in their disability scores (42 percent at three months and 38 percent at six months for women versus 51 percent at three months and 43 percent at six months for men). One reason for this could be their limited access to care. As the barrier impact score at the three- and six- months follow-ups showed, women faced more significant barriers than men in access to health care and support. These and earlier findings show the importance of applying a gender lens to road safety and particularly including a focus on women's road safety education and requirements, such as access to protective safety gear and assistive devices, health care, and transportation while recovering.

Policy Questions and Recommendations

Findings from this study help understand the circumstances that led to the RTI and higher severity of injuries and the consequences of RTI-related disabilities highlight the service needs to help improve functioning, the potential to return to normal life, and social integration. RTI-induced disability has longer-term implications for RTC, an aspect that is often missing in RTC-related policy-making. This type of disability assessment is useful for assessing health care needs and informing policy decisions, such as identifying needs and interventions, measuring outcomes and effectiveness, setting priorities, and allocating resources.

Policy Questions and Implications

Policy makers should consider the following questions:

- **Are country governments taking any actions to prevent RTIs?** Road safety must be addressed holistically, following a safe system approach through various policy measures and a well-balanced set of effective interventions. Such efforts require the involvement of multiple sectors through designing safer infrastructure and incorporating road safety features into land use and transportation planning, improving vehicle safety features, enhancing post-crash care for RTC victims, setting and enforcing laws relating to key risks, and raising public awareness through a strategic road safety investment plan targeting institutional leadership and coordination with a focus on results. However, the study results show that many safe system elements are missing, such as separation from speeding traffic that led to pedestrians being hit while walking along the road and crossing. In addition, increased use of protective gear such as helmets and seat belts is much needed. Improving road safety and achieving the Decade of Action for Road Safety 2021–30 by reducing road deaths and injuries by 50 percent, demands greater collaboration in effective road injury prevention involving different government departments and agencies interacting with civil society and the private sector.

- **Is the emergency response system strong, well-integrated, and centralized with adequately trained emergency medical personnel?** The study data highlight the need to strengthen emergency and ambulance services in most countries. In most cases, bystanders or persons involved in the crash provided immediate care. Exceptions are in Ukraine, where emergency personnel provided pre-hospital care to 66 percent of victims, and in Cambodia where it was about 47 percent. In Ethiopia and Zambia, less than 30 percent of RTC victims received care from emergency personnel. However, such emergency response is a strong predictor of survival and recovery from disability. Moreover, the average transport time to the hospital varied considerably in all six countries, with just about half reaching it within the hour. Such gaps often contribute to avoidable mortality and disability and can be reduced with improving ambulance networks. Strengthening ambulance and emergency medical technician networks that are strongly integrated with local health systems is essential for improving health outcomes for RTI patients.

- **Should the patient be in primary care, specialty care, rehabilitation, or another setting?** Trade-offs between type and level of care depend on a patient's condition and the protocols for their treatment, but weaknesses in the health care system can contribute to stress on service delivery systems. For instance, once a patient is recovered sufficiently, they may be better served through rehabilitation facilities that focus on recovery. However, as this study highlighted, such systems are often missing or fragmented, especially in LMICs. Only 9 percent of patients in this study were discharged to a rehabilitation facility, except for in Mexico, where 78 percent of RTI patients were discharged to a facility. Yet 74 percent of patients in the study still experienced disability six months after discharge from the hospital, indicating the need for rehabilitation support. Because RTIs have long-term consequences, and recovery is a slow road for many, follow-up medical rehabilitation services are much needed.

- **What are the patient's treatment and recovery needs after leaving hospitals?** In the six months after discharge, more than 40 percent of patients in the study reported using assistive devices, and about 11 percent reported having an unmet need for assistive devices, mainly mobility aids. Access to assistive technology is essential for these patients to return to normal life.

- **Will the patient receive any social protection or disability benefits to cover loss of income?** Does the country provide universal health coverage or viable health insurance? Except for Ethiopia, where 81 percent of patients had insurance coverage, most patients paid their own hospital bills either with their own money (84 percent) or with borrowed funds (56 percent). Longer hospital stays meant greater financial outlays and higher cost of care. In this study, the average length of hospitalization for all patients was 14 days, which is estimated to cost an average of US$229/-, or about 10 percent of some patients' annual household income. Considerable evidence points to the links between unexpected out-of-pocket health expenditures and falling into poverty. Enhancing disability benefits or increasing the availability of affordable health insurance are important aspects of supporting RTI patients. For example, assistive devices are clearly needed because injuries to lower extremities tend to be predominant across all six countries. Making these available through insurance may reduce the financial burden on victims. Helping countries create the fiscal space necessary to provide these services at a sufficient level and with appropriate targeting is important to address the burden of cost.

- **Will the patient return to work and perform as before the crash?** After discharge, the percentage of RTI patients who returned to work increased steadily over time. One month after discharge, the return-to-work rate was 58 percent, and at six months, the rate was 75 percent. This was often predicated by being the main income earner. However, it was not indicative of recovery as measured by the rate of return to normal life (a subjective measure), remained much low. Seventy-four percent of the patients who participated in this study reported some difficulty with daily duties at six months. Poorer health and well-being (though not measure explicitly in this study) are associated with lower productivity. Investing in rehabilitation systems and assistive devices is essential for enhancing RTI patients' quality of life and enabling recovery that allows a return to normal life and better performance at work.

- **Will the patient return to the community and perform as before?** The barrier impact score decreased over time, averaging 1.4 three months after discharge and 0.7 six months after discharge. The lower barrier impact score meant that patients' likelihood of reintegration into community life increased over time. At the six-month follow-up, patients reported availability of transportation, health care, home help, and natural environment as significant environmental barriers. Addressing these barriers can facilitate better social engagement and inclusion.

- **How can the gaps in women's road safety, treatment, and recovery needs be met?** Public health and road safety campaigns need to have targeted messaging for women, and efforts to make protective gear and assistive devices more accessible to women will be helpful. However, because women RTI victims are more likely to face socioeconomic barriers to care, other interventions may be needed, such as cashless treatment options and special support programs that provide assistance during recovery.

Recommendations

The following recommendations for the immediate term for the transport and health sectors are based on the study results across the six countries:

- **Invest in protective infrastructure targeted for vulnerable road users.** Vulnerable road users such as pedestrians, motorcyclists, and three-wheelers represented more than 80 percent of crash victims (except for in Ukraine). The injuries and disabilities they sustained indicate that more investment is needed in protective infrastructure that follow a safe system approach. The relevant policy instruments for protection are segregation of modes, speed limits, and enforcing speed limits. Investments in pedestrian infrastructure are needed, such as footpaths and safe crossing facilities. More than 55 percent of pedestrians across the six countries were involved in a road crash on highways and main roads, where speed is generally high. Most pedestrians were victims of RTCs while standing or walking on the side of the roads or while crossing them.
- **Legislate, promote, and enforce the use of road safety protective measures such as helmets and seatbelts.** The limited use of road safety protective gear among victims was common across countries. Only 30 percent of motorcycle users wore helmets, and less than 20 percent of riders wore seatbelts in cars, buses, minibuses, and vans. Countries need to increase the proportion of correct helmet and seat belt use to close to 100 percent by 2030 as per the UN global road safety performance targets, which will require concerted efforts and support to pass legislation and promote and enforce road safety measures. Reviewing current traffic laws and penalties, promoting safe driving, and enforcing penalties for violating traffic rules could provide some benefits.
- **Implement targeted interventions to improve motorcycle safety.** Motorcycle riders are clearly at very high risk. Targeted safety interventions such as dedicated lanes and safe infrastructure, campaigns and promotion of helmet wearing, and safe road use will reduce the disability burden of RTCs and the number of fatalities.
- **Develop targeted interventions to enhance bus and fleet safety.** RTIs involving heavy vehicles are often the reason for more severe injuries and longer hospital stays. Safety training for commercial bus and fleet drivers will go a long way toward improving road safety. Corporate contributions toward better vehicle safety and driver training could have positive effects on global supply chains using road networks and on vehicle fleets in LMICs. There is a real opportunity for safety gains in company vehicle fleets, company contractors, and public bus operators through implementation of established safety practices and new technologies.
- **Promote gender-based design interventions to address gender gaps in transportation.** Transportation agencies can conduct assessments of women's safety needs, safety audits, and universal accessibility requirements to assess road safety concerns and the quality of urban transportation infrastructure to evaluate gender gaps and address them.
- **Strengthen emergency and ambulance services and boost the training of medical staff.** In most countries, considerable gaps exist in the provision of emergency care by qualified health personnel at the scene of the injury or as pre-hospital care. Only 13.2 percent of the victims in this study received care at the scene, highlighting the need to strengthen emergency and ambulance services, which are often missing or extremely limited and fragmented in LMICs. Civil society and public-private partnerships can also play a major role in addressing this gap. Study results show that the mean disability score for patients treated at the crash scene by qualified health personnel was significantly lower than for those who received care from others such as bystanders.

- **Expand post-hospitalization services in countries with few or no facilities, or limited access to them.** Only 10 percent of patients across countries were discharged to a rehabilitation facility (except in Mexico), which indicates that countries may not have rehabilitation facilities, or they may not be easily accessible. Addressing the need for integrated rehabilitation services would aid in faster recovery and better health and well-being for RTI patients in LMICs, which aligns with the World Health Organization's recent landmark resolution on expanding and integrating rehabilitation care within universal health coverage, particularly at the primary care level.

- **Reduce the financial burden on road traffic injury patients.** RTI patients faced enormous out-of-pocket costs equivalent to 10 percent of their annual household income. Interventions such as disability benefits or coverage under health insurance can help mitigate these costs. This includes coverage for assistive devices and rehabilitation support. Countries need support in their efforts to create the fiscal space necessary to provide and target these services at a sufficient level.

- **Conduct public health communication campaigns to raise awareness of key road safety risk factors.** Conducting a public health communication campaign together with enforcement can raise public awareness of the key risk factors and risky driving behavior and help mitigate them. Governments can partner with civil society in efforts to raise vulnerable road users' awareness of their risks, rights as road users, safe road use, and information on emergency calling numbers in case of a road crash.

- **Engage with organizations of persons with disabilities to strengthen public health messaging.** Engaging with representative organizations will help strengthen public health messaging and raise awareness by leveraging the firsthand experiences and insights of those who became disabled as a result of RTCs, and who live with disabilities on a daily basis.

- **Address the disproportionate long-term gender impact of RTIs through participatory decision-making and targeted interventions for women.** Support countries to implement interventions to reduce gaps in women's access to health care and follow-up rehabilitative services as part of health systems strengthening and expanding universal health coverage. Women's participation in policy-making and decision-making will help identify and address women's specific needs.

Opportunities for Further Investigation

The study achieved its intended objectives of assessing post-crash moderate and severe RTI disabilities. However, several factors warrant further investigation, such as the impact of vehicle speed and the state of the drivers on RTI occurrence and their outcomes to understand the ratios of fatalities to severe and minor injuries, which can be used to estimate the burden of road fatalities and injuries. Data on disability in general is minimal. Thus, disability assessments and surveys can also help to gain more comprehensive information on disability origin, characteristics, prevalence, health conditions associated with disability, and the use of and need for services, including rehabilitation. Such research will close the knowledge gap about the total economic impact of RTIs, including minor injuries and fatalities.

Bibliography

Abedzadeh-Kalahroudi, Masoumeh, Ebrahim Razi, Mojtaba Sehat, and Mohsen Asadi Lari. 2015. "Measurement of Disability and Its Predictors among Trauma Patients: A Follow-up Study." *Archives of Trauma Research* 4 (3): e29393.

GBD 2017 Diet Collaborators. 2019. "Health Effects of Dietary Risks in 195 Countries, 1990–2017: A Systematic Analysis for the Global Burden of Disease Study 2017." *The Lancet 393* (10184): 1958–72. https://doi.org/10.1016/S0140-6736(19)30041-8.

Ahmed, Saeed, Muzammal Mahmood, Syed Asad Hasan Rizvi, Amna A. Siddiqui, Naureen Shahid, Wafa A. Akram, and Sajila Bano. 2019. "Frequency and Nature of Road Traffic Injuries: Data of More than 10,000 Patients from Ha'il, Saudi Arabia." *Cureus* 11 (1): e3830.

Alemany, Ramon, Merecedes Ayuso, and Montserrat Guillén. 2013. "Impact of Road Traffic Injuries on Disability Rates and Long-Term Care Costs in Spain." *Accident Analysis and Prevention* 60 (November): 95–102.

Al-Hajj, Samar, Majed El Hechi, Mohamad Chahrour, Sarah H. Farran, and Haytham Kaafarani. 2022. "Factors Affecting Road Safety Compliance in a Low- and Middle-Income Country: An Observational Study from Lebanon." *PLOS Global Public Health* 2 (3): e0000154.

Ameratunga, Shanthi, Robyn Norton, Derrick A. Bennett, and Rod Jackson. 2004. "Risk of Disability Due to Car Crashes: A Review of the Literature and Methodological Issues." *Injury* 35 (11): 1116–27.

Asia Foundation. 2023. *Report on Accessibility and Disability Inclusion on the Public Transport System in Phnom Penh*. San Francisco: Asia Foundation.

Barbareschi, Giulia, Mark T. Carew, Elizabeth Aderonke Johnson, Norah Kopi, and Catherine Holloway. 2021. "'When They See a Wheelchair, They've Not Even Seen Me'"—Factors Shaping the Experience of Disability Stigma and Discrimination in Kenya." *International Journal of Environmental Research and Public Health* 18 (8): 4272.

Berecki-Gisolf, Janneke, Alex Collie, and Rod McClure. 2013. "Work Disability after Road Traffic Injury in a Mixed Population with and without Hospitalisation." *Accident Analysis and Prevention* 51 (March): 129–34.

Bhalla, Kavi, Saeid Sharaz, Jerry Abraham, David Bartels, and Pon-Hsiu Yeh. 2011. *Road Injuries in 18 Countries: Methods, Data Sources, and Estimates of the National Incidence of Road Injuries*. Boston: Harvard School of Public Health.

Bjørnshagen, Vegar, and Elisabeth Ugreninov. 2021. "Disability Disadvantage: Experimental Evidence of Hiring Discrimination against Wheelchair Users." *European Sociological Review* 37 (5): 818–33.

Chang, Fang-Rong, He-Lai Huang, David C. Schwebel, Alan H. S. Chan, and Guo-Qing Hu. 2020. "Global Road Traffic Injury Statistics: Challenges, Mechanisms, and Solutions." *Chinese Journal of Traumatology* 23 (4), 216–18.

Craig Hospital. 2001. *Craig Hospital Inventory of Environmental Factors: Version 3.0.* Englewood, CO: Craig Hospital.

Denu, Zewditu Abdissa, Mensur Yassin Osman, Telake Azale Bisetegn, Gashaw Andargie Biks, and Kassahun Alemu Gelaye. 2021a. "Prevalence and Risk Factors for Road Traffic Injuries and Mortalities in Ethiopia: Systematic Review and Meta-Analysis." *Injury Prevention* 27 (4): 384–94.

Denu, Zewditu Abdissa, Mensur Yassin Osman, Muhammed Yesuf, Telake Azale, Gashaw Andargie Biks, and Kassahun Alemu Gelaye. 2021b. "Disability Scores Rate Changes and Predictors among Road Traffic Injury Victims Admitted at Gondar Specialized Comprehensive Hospital Northwest Ethiopia: A Prospective Follow-up Study." *Traffic Injury Prevention* 23 (1): 40–45.

Elshambaty, Yasir, Abdulmajeed Alzahrani, Aimun AbdulGafar, Bader Alzahrani, Waleed Shahwan, and Abdullah AlFalah. 2019. "An Unusual Cause of Road Traffic Accident with an Unusual Outcome in Saudi Arabia." *International Journal of Medicine in Developing Countries* 3 (8): 694–98.

Eşiyok, Burcu, Irfan Korkusuz, Gurol Canturk, Hanife Alkurt Alkan, Asude Gökmen Karaman, and I. Hamit Hanci. 2005. "Road Traffic Accidents and Disability: A Cross-Section Study from Turkey." *Disability and Rehabilitation* 27 (21): 1333–38.

Fitzharris, Michael, Brian Fildes, Judith Charlton, and Thomas Kossmann. 2007. "General Health Status and Functional Disability Following Injury in Traffic Crashes." *Traffic Injury Prevention* 8 (3): 309–20.

Galasko, Charles S. B., P. Murray, M. Hodson, R. J. Tunbridge, and J. T. Everest. 1986. *Long-Term Disability Following Road Traffic Accidents*. London: Transport and Road Research Laboratory.

Gissane, William, John Bull, and Barbara Roberts. 1970. "Sequelae of Road Injuries: A Review of One Year's Admissions to an Accident Hospital." *Injury* 1 (3): 195– 203.

Giummarra, Melita J., Darnel Murgatroyd, Yvonne Tran, Sam Adie, Rajat Mittal, Jennie Ponsford, Peter Cameron et al. 2020. "Health and Return to Work in the First Two Years Following Road Traffic Injury: A Comparison of Outcomes between Compensation Claimants in Victoria and New South Wales, Australia." *Injury* 51 (10): 2199–2208.

GRSP (Global Road Safety Partnership). 2017. "Poverty and Road Safety: A GRSP Positioning Paper." Global Road Safety Partnership, Geneva.

Gururaj, Gopalkrishna. 2005. "Injuries in India: A National Perspective." National Commission on Macroeconomics and Health, Ministry of Health and Family Welfare, New Delhi.

Gururaj, Gopalkrishna. 2008. "Road Traffic Deaths, Injuries, and Disabilities in India: Current Scenario." *The National Medical Journal of India* 21 (1): 14–20.

Henry, Jaymie Ang, and Arthur Lawrence Reingold. 2012. "Prehospital Trauma Systems Reduce Mortality in Developing Countries: A Systematic Review and Meta-Analysis." *Journal of Trauma and Acute Care Surgery* 73 (1): 261–8.

Holder, Yvette, Margie Peden, Etienne Krug, Johan Lund, Gopalakrishna Gururaj, and Olive Kobusingye, eds. 2011. *Injury Surveillance Guidelines*. Geneva: World Health Organization.

Hossain, Saddam, Elena Maggi, and Andrea Vezzulli. 2022. "Factors Associated with Crash Severity on Bangladesh Roadways: Empirical Evidence from Dhaka City." *International Journal of Injury Control and Safety Promotion* 29 (3): 1–12.

Hours, Martine, Marlène Bernard, Pierrette Charnay, Laetitia Chossegros, Etienne Javouhey, Emmanuel Fort, Dominique Boisson, Pierre-Olivier Sancho, and Bernard Laumon. 2010. "Functional Outcome after Road-Crash Injury: Description of the ESPARR Victims Cohort and Six-Month Follow-up Results." *Accident Analysis and Prevention* 42 (2): 412–21.

Høye, Alena. 2018. "Bicycle Helmets—To Wear or Not to Wear? A Meta-Analyses of the Effects of Bicycle Helmets on Injuries." *Accident Analysis and Prevention* 117 (August): 85–97.

IHME (Institute for Health Metrics and Evaluation). 2020. Global Burden of Disease Study 2019 (GBD 2019) Results. Global Burden of Disease Collaborative Network. Seattle, United States: Institute for Health Metrics and Evaluation (IHME).

Islam, Bushra Zarin, Samiun Nazrin Bente Kamal Tune, Nahitun Naher, and Syed Masud Ahmed. 2023. Trauma Care Scenarios Following Road Traffic Crashes in Bangladesh: A Scoping Review. *Global Health: Science and Practice* 11 (2): e2200053.

James, Spencer L., Lydia R. Lucchesi, Catherine Bisignano, Chris D. Castle, Zachary V. Dingels, Jack T. Fox, Erin B. Hamilton et al. 2020. "Morbidity and Mortality from Road Injuries: Results from the Global Burden of Disease Study 2017." *Injury Prevention* 26 (Supplement 2): i46–i56.

Jette, Alan M., Julie Keysor, Wendy Coster, Pengsheng Ni, and Stephen Haley. 2005. "Beyond Function: Predicting Participation in a Rehabilitation Cohort." *Archives of Physical Medicine and Rehabilitation* 86 (11): 2087–94.

Juillard, Catherine, Mariam Labinjo, Olive Kobusingye, and Adnan A. Hyder. 2010. "Socioeconomic Impact of Road Traffic Injuries in West Africa: Exploratory Data from Nigeria." *Injury Prevention* 16 (6): 389–92.

Kahane, Charles J. 2017. "Fatality Reduction by Seat Belts in the Center Rear Seat and Comparison of Occupants' Relative Fatality Risk at Various Seating Positions." Report DOT HS 812 369, US Department of Transportation, Washington, DC.

Kendrick, Denise, Yana Vinogradova, Carol Coupland, Nicola Christie, Ronan A. Lyons, and Elizabeth L. Towner. 2012. "Getting Back to Work after Injury: The UK Burden of Injury Multicentre Longitudinal Study." *BMC Public Health* 12 (August): 584.

Khaliq, Abdul, Muhammad Naseem Khan, Fayaz Ahmad Ahmed, Farhad Ali Khattak Khattak, Irfan Ullah, Mohammad Akram, Nauman Arif, and Zia U.I. Haq. 2020. "Seat-Belt Use and Associated Factors among Drivers and Front Passengers in the Metropolitan City of Peshawar, Pakistan: A Cross Sectional Study." *Critical Care Innovations* 3 (2): 1–15.

Lin, Ting, Ning Li, Wei Du, Xinming Song, and Xiaoying Zheng. 2013. "Road Traffic Disability in China: Prevalence and Socio-Demographic Disparities." *Journal of Public Healt*h 35 (4): 541–47.

Mahdavi Sharif, Pouya, Sara Najafi Pazooki, Zahra Ghodsi, Ahmad Nouri, Hamed Abbasizade Ghoroghchi, Reza Tabrizi, Mehdi Shafieian et al. 2023. "Effective Factors of Improved Helmet Use in Motorcyclists: A Systematic Review." *BMC Public Health* 23 (1): 26.

McEwan, Cheryl, and Ruth Butler. 2007. "Disability and Development: Different Models, Different Places. *Geography Compass* 1 (3): 448–66.

Meena, Dharmendra Kumar, R. K. Punia, Sumant Dutta, R. K. Verma, and N. L. Diania. 2015." Study of Permanent Physical Disability Pattern in Motor Vehicle Accident Cases Presenting at SMS Hospital, Jaipur during the Year 2012–2013: A Prospective Study." *Indian Journal of Forensic Medicine and Toxicology* 9 (1): 68–72.

Nguyen, Ha Trong, Jonathon Passmore, Pham Viet Cuong, and Nam Phuong Nguyen. 2013. "Measuring Compliance with Viet Nam's Mandatory Motorcycle Helmet Legislation." *International Journal of Injury Control and Safety Promotion* 20 (2): 192–96.

Nik Hisamuddin, N. A. R., Rainis Ruslan, N. Syed Hatim, and S. M. Sharifah Mastura. 2016. "A Combination of Geospatial and Clinical Analysis in Predicting Disability Outcome after Road Traffic Injury (RTI) in a District in Malaysia." *International Archives of the Photogrammetry, Remote Sensing, and Spatial Information Sciences* XLII-4/W1:361–65.

Odero, Wilson, Meleckidzedeck Khayesi, and P. M. Heda. 2003. "Road Traffic Injuries in Kenya: Magnitude, Causes and Status of Intervention." *Injury Control and Safety Promotion* 10 (1–2): 53–61.

Palmera-Suárez, Rocío, Teresa López-Cuadrado, Javier Almazán-Isla, Rafael Fernández-Cuenca, Enrique Alcalde-Cabero, and Iñaki Galán. 2015. "Disability Related to Road Traffic Crashes among Adults in Spain." *Gaceta Sanitaria* 29 (Supplement 1): 43–8.

Peden, Margie, Richard Scurfield, David Sleet, Dinesh Mohan, Adnan A. Hyder, Eva Jarawan, and Colin Mathers, eds. 2004. *World Report on Road Traffic Injury Prevention*. Geneva: World Health Organization.

Pons-Villanueva, Juan, María José Rodríguez de Armenta, Miguel A Martínez-González, and María Seguí-Gómez. 2011. "Longitudinal Assessment of Quality of Life and Its Change in Relation to Motor Vehicle Crashes: The SUN (Seguimiento Universidad de Navarra) Cohort." *The Journal of Trauma and Acute Care Surgery* 70 (5): 1072–77.

Prinja, Shankar, Jagnoor Jagnoor, Deepshikha Sharma, Sameer Aggarwal, Swati Katoch, P. V. M. Lakshmi, and Rebecca Ivers. 2019. "Out-Of-Pocket Expenditure and Catastrophic Health Expenditure for Hospitalization Due to Injuries in Public Sector Hospitals in North India." *PLOS ONE* 14 (11): e0224721.

Roy, Subarna, Mohammad Delwer Hossain Hawlader, Mohammad Hayatun Nabi, Promit Ananyo Chakraborty, Sanjana Zaman, and Mohammad Morshad Alam. 2021. "Patterns of Injuries and Injury Severity among Hospitalized Road Traffic Injury (RTI) Patients in Bangladesh." *Heliyon* 7 (3): e06440.

Rus Ma, Diana, Corinne Peek-Asa, Erika Andrada Baragan, Razvan Mircea Chereches, and Floarea Mocean. 2015. "Epidemiology of Road Traffic Injuries Treated in a Large Romanian Emergency Department in Tîrgu-Mureş between 2009 and 2010." *Traffic Injury Prevention* 16 (8): 835–41.

Sánchez-Vallejo, Patricia G., Ricardo Pérez-Núñez, and Ileana Heredia-Pi. 2015. "Costo económico de la discapacidad causada por lesiones de tránsito en México durante 2012." *Cadernos de Saúde Pública* 31 (4): 755–66.

Sanyang, Edrisa, Corinne Peek-Asa, Paul Bass, Tracy L. Young, Babanding Daffeh, and Laurence J. Fuortes. 2017. "Risk Factors for Road Traffic Injuries among Different Road Users in The Gambia." *Journal of Environmental and Public Health* 2017, 1–9.

Şimşekoğlu, Özlem. 2009. "Factors Related to Seat Belt Use: A Turkish Case." PhD dissertation, University of Helsinki, Finland.

Trani, Jean-Francois, Jacqueline Moodley, Paul Anand, Lauren Graham, and May Thu Thu Maw. 2020. "Stigma of Persons with Disabilities in South Africa: Uncovering Pathways from Discrimination to Depression and Low Self-Esteem." *Social Science and Medicine* 265 (November): 113449.

Üstün, Tevfik Bedirhan, Nenad Kostanjsek, Somnath Chatterji, and Jürgen Rehm, eds. 2010. *Measuring Health and Disability: Manual for WHO Disability Assessment Schedule WHODAS 2.0*. Geneva: World Health Organization.

Weijermars, Wendy, Niels Bos, and Henk Stipdonk. 2016. "Health Burden of Serious Road Injuries in the Netherlands." *Traffic Injury Prevention* 17: (8): 863–69.

WHO (World Health Organization). 2010. *Community-Based Rehabilitation: CBR Guidelines*. Geneva: WHO.

WHO (World Health Organization). 2018. *Global Status Report on Road Safety 2018*. Geneva: World Health Organization.

WHO (World Health Organization). 2023. "Landmark Resolution on Strengthening Rehabilitation in Health Systems." World Health Organization, May 27, 2023.

WHO (World Health Organization) and UNICEF (United Nations Children's Fund). 2022. *Global Report on Assistive Technology*. Geneva and New York: World Health Organization and United Nations Children's Fund.

WHO (World Health Organization) and World Bank. 2011. *World Report on Disability*. Geneva: World Health Organization.

Woyessa, Ashenafi Habte, Worku Dechasa Heyi, Nesru Hiko Ture, and Burtukan Kebede Moti. 2021. "Patterns of Road Traffic Accident, Nature of Related Injuries, and Post-Crash Outcome Determinants in Western Ethiopia—A Hospital Based Study." *African Journal of Emergency Medicine* 11 (1): 123–31.

Zafar, Syed Nabeel, Joseph K. Canner, Neeraja Nagarajan, Adam L. Kushner, and SOSAS4 Research Group. 2018. "Road Traffic Injuries: Cross-Sectional Cluster Randomized Countrywide Population Data from Four Low-Income Countries." *International Journal of Surgery* 52 (April): 237–42.

Zimmerman, Karen, Ali A. Mzige, Pascience L. Kibatala, Lawrence M. Museru, and Alejandro Guerrero. 2012. "Road Traffic Injury Incidence and Crash Characteristics in Dar es Salaam: A Population-Based Study." *Accident Analysis and Prevention* 45 (March): 204–10.

Appendix A.

Table A.1. Demographics by Country

Variable	Bangladesh		Cambodia		Ethiopia		Mexico		Ukraine		Zambia		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Age group[a]														
18 to 24	208	24.9	146	33.0	105	20.9	44	32.1	4	12.5	70	18.7	577	24.8
25 to 34	208	24.9	117	26.4	174	34.6	46	33.6	6	18.8	139	37.1	690	29.7
35 to 44	181	21.7	77	17.4	100	19.9	21	15.3	8	25.0	89	23.7	476	20.5
45 to 54	131	15.7	39	8.8	56	11.1	12	8.8	7	21.9	50	13.3	295	12.7
55 to 64	59	7.1	34	7.7	44	8.7	9	6.6	3	9.4	21	5.6	170	7.3
65+	49	5.9	30	6.8	24	4.8	5	3.6	4	12.5	6	1.6	118	5.1
Sex														
Female	95	11.4	110	24.8	114	22.7	24	17.5	10	31.3	101	26.9	454	19.5
Male	741	88.6	333	75.2	389	77.3	113	82.5	22	68.8	274	73.1	1872	80.5
Education														
No formal education	183	21.9	23	5.2	98	19.5	8	5.8	1	3.2	15	4.0	328	14.1
Primary school	218	26.1	174	39.3	96	19.1	28	20.4	0	0.0	48	12.8	564	24.3
Secondary or High School	273	32.7	210	47.4	230	45.8	95	69.3	3	9.7	223	59.5	1034	44.5
Bachelor's degree or beyond	161	19.3	36	8.1	78	15.5	5	3.6	21	67.7	78	20.8	379	16.3
Other	1	0.1	0	0.0	0	0.0	1	0.7	6	19.4	11	2.9	19	0.8
Employment														
Daily wage laborer	150	17.9	36	8.1	85	16.9	89	65.0	3	9.7	61	16.3	424	18.2
Salary worker	298	35.6	131	29.6	107	21.3	22	16.1	10	32.3	78	20.8	646	27.8
Self-employed	169	20.2	111	25.1	213	42.4	3	2.2	8	25.8	136	36.3	640	27.5
Homemaker	63	7.5	12	2.7	31	6.2	9	6.6	0	0.0	3	0.8	118	5.1
Not working	49	5.9	105	23.7	30	6.0	8	5.8	4	12.9	84	22.4	280	12.0
Student	103	12.3	44	9.9	36	7.2	5	3.6	3	9.7	7	1.9	198	8.5
Other	4	0.5	4	0.9	0	0.0	1	0.7	3	9.7	6	1.6	18	0.8

Source: Global Road Safety Facility.

Note: a. Mean age and (standard deviation) for each country are Bangladesh: 36 (14.3); Cambodia: 34.9 (15.6); Ethiopia: 35.5 (13.8); Mexico: 33.3 (13.7); Ukraine: 43.9 (16.4); Zambia: 35.1 (11.7). Total: 35.5 (14.1).

Table A.2. Crash Characteristics by Country

Variable	Bangladesh		Cambodia		Ethiopia		Mexico		Ukraine		Zambia		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Type of road where crash occurred														
Highway	56	6.7	1	0.2	289	57.5	9	6.6	7	21.9	95	25.3	457	19.7
Main road	738	88.3	77	17.5	185	36.8	62	45.3	3	9.4	212	56.5	1277	54.9
Side street	31	3.7	274	62.1	15	3.0	26	19.0	20	62.5	60	16.0	426	18.3
Village road	9	1.1	89	20.2	12	2.4	1	0.7	1	3.1	6	1.6	118	5.1
Other	2	0.2	0	0.0	2	0.4	39	28.5	1	3.1	2	0.5	46	2.0
Type of road user														
Pedestrian	165	19.7	22	5.0	205	40.8	15	10.9	12	37.5	182	48.5	601	25.9
Driver (includes cyclists)	318	38.0	362	82.1	92	18.3	96	70.1	15	46.9	61	16.3	944	40.6
Passenger	353	42.2	57	12.9	206	41.0	26	19.0	5	15.6	132	35.2	779	33.5
Type of vehicle involved in crash														
Car	3	0.4	8	1.9	44	14.8	14	11.5	11	55.0	55	28.5	135	7.8
Bus	33	4.9	1	0.2	13	4.4	0	0.0	0	0.0	41	21.2	88	5.1
Truck	41	6.1	5	1.2	58	19.5	1	0.8	1	5.0	24	12.4	130	7.5
Minibus or van	28	4.2	2	0.5	90	30.2	0	0.0	0	0.0	34	17.6	154	8.9
Bicycle	21	3.1	24	5.7	2	0.7	8	6.6	3	15.0	13	6.7	71	4.1
Auto-rickshaw	271	40.4	15	3.6	41	13.8	1	0.8	1	5.0	1	0.5	330	19.2
Motorcycle	269	40.1	360	85.9	48	16.1	98	80.3	4	20.0	24	12.4	803	46.6
Other	5	0.7	4	1.0	2	0.7	0	0.0	0	0.0	1	0.5	12	0.7
How pedestrian was injured														
Boarding or exiting bus	7	4.3	0	0.0	2	1.0	0	0.0	2	16.7	2	1.1	13	2.2
Boarding or exiting other vehicle	0	0.0	1	4.5	3	1.5	0	0.0	0	0.0	5	2.7	9	1.5
Standing or walking on side of road	88	53.7	7	31.8	140	68.6	7	46.7	2	16.7	84	46.2	328	54.8
Crossing the road	68	41.5	14	63.6	54	26.5	7	46.7	7	58.3	85	46.7	235	39.2
Other	1	0.6	0	0.0	5	2.5	1	6.7	1	8.3	6	3.3	14	2.3
Crash counterpart (what was struck)														
Car	26	3.1	117	26.5	92	18.3	50	36.5	22	68.8	171	45.6	478	20.6
Motorcycle	83	9.9	149	33.8	16	3.2	15	10.9	1	3.1	10	2.7	274	11.8
Skid or rollover (non-collision)	179	21.4	36	8.2	138	27.5	34	24.8	3	9.4	40	10.7	430	18.5
Minibus or van	57	6.8	38	8.6	83	16.5	4	2.9	0	0.0	51	13.6	233	10.0
Bicycle	3	0.4	1	0.2	1	0.2	0	0.0	1	3.1	2	0.5	8	0.3
Fall from moving vehicle	24	2.9	0	0.0	9	1.8	7	5.1	1	3.1	11	2.9	52	2.2

Variable	Bangladesh		Cambodia		Ethiopia		Mexico		Ukraine		Zambia		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Bus	59	7.1	2	0.5	27	5.4	1	0.7	0	0.0	11	2.9	100	4.3
Nonmotorized vehicle	1	0.1	0	0.0	3	0.6	0	0.0	0	0.0	4	1.1	8	0.3
Stationary or fixed object	20	2.4	8	1.8	17	3.4	15	10.9	1	3.1	22	5.9	83	3.6
Animal	1	0.1	12	2.7	1	0.2	3	2.2	0	0.0	0	0.0	17	0.7
Auto-rickshaw	236	28.2	28	6.3	19	3.8	0	0.0	1	3.1	0	0.0	284	12.2
Truck	143	17.1	37	8.4	95	18.9	6	4.4	1	3.1	39	10.4	321	13.8
Other	4	0.5	13	2.9	1	0.2	2	1.5	1	3.1	14	3.7	35	1.5
Mobile phone use														
No	480	99.4	341	95.3	289	99.3	102	95.3	25	100	222	94.5	1459	97.3
Yes	3	0.6	17	4.7	2	0.7	5	4.7	0	0	13	5.5	40	2.7
Seat belt														
No	102	97.1	7	53.8	165	82.5	5	38.5	5	41.7	113	76.4	397	80.9
Yes	3	2.9	6	46.2	35	17.5	8	61.5	7	58.3	35	23.6	94	19.1
Helmet														
No	314	69.0	163	45.9	235	93.3	72	59.5	14	70	198	91.2	996	70.1
Yes	141	31.0	192	54.1	17	6.7	49	40.5	6	30	19	8.8	424	29.9
Alcohol use														
No	829	99.6	315	83.1	466	96.9	106	80.9	26	89.7	272	73.9	2014	90.7
Yes	3	0.4	64	16.9	15	3.1	25	19.1	3	10.3	96	26.1	206	9.3
Substance abuse														
No	829	99.5	378	99.7	476	99.0	128	98.5	29	100	305	84.7	2145	97.0
Yes	4	0.5	1	0.3	5	1.0	2	1.5	0	0	55	15.3	67	3.0

Source: Global Road Safety Facility.

Table A.3. Pre-hospital Care by Country

Variable	Bangladesh		Cambodia		Ethiopia		Mexico		Ukraine		Zambia		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Care at scene														
No	244	29.3	224	55.7	273	55.5	34	25.4	7	22.6	197	59.50	979	44.0
Yes	589	70.7	178	44.3	219	44.5	100	74.6	24	77.4	134	40.50	1244	56.0
Mode of arrival at hospital														
Auto-rickshaw	40	4.8	75	17.0	45	8.9	0	0.0	0	0.0	0	0.0	160	6.9
Car	24	2.9	83	18.8	248	49.3	18	13.1	2	6.3	203	6.3	578	24.9
Ambulance	756	90.4	202	45.7	122	24.3	105	76.6	29	90.6	126	90.6	1340	57.6
Taxi	8	1.0	21	4.8	69	13.7	8	5.8	0	0.0	26	0.0	132	5.7
Other	8	1.0	61	13.8	19	3.8	6	4.4	1	3.1	20	3.1	115	4.9

Source: Global Road Safety Facility.

Table A.4. Patient Care by Country

Variable	Bangladesh		Cambodia		Ethiopia		Mexico		Ukraine		Zambia		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Injury region 1														
Head and neck	5	0.7	45	10.2	197	39.2	36	26.3	9	29.0	113	30.1	405	18.2
Face	0	0	31	7.0	14	2.8	6	4.4	0	0	17	4.5	68	3.1
Chest	0	0	22	5.0	36	7.2	7	5.1	11	35.5	11	2.9	87	3.9
Abdomen	2	0.3	12	2.7	10	2.0	4	2.9	2	6.5	13	3.5	43	1.9
Extremities	730	99.1	330	74.8	243	48.3	84	61.3	9	29.0	216	57.6	1612	72.5
External	0	0	1	0.2	3	0.6	0	0.0	0	0	5	1.3	9	0.4
Injury region 2														
No injury	341	49.3	244	57.7	270	53.7	91	66.4	0	0	241	64.3	1187	55.2
Head and neck	6	0.9	19	4.5	30	6	14	10.2	3	13.6	18	4.8	90	4.2
Face	8	1.2	17	4.0	30	6	4	2.9	1	4.5	17	4.5	77	3.6
Chest	1	0.1	7	1.7	46	9.1	1	0.7	6	27.3	11	2.9	72	3.3
Abdomen	0	0	4	0.9	9	1.8	3	2.2	2	9.1	5	1.3	23	1.1
Extremities	304	44.0	122	28.8	112	22.3	24	17.5	10	45.5	82	21.9	654	30.4
External	31	4.5	10	2.4	6	1.2	0	0	0	0	1	0.3	48	2.2
Injury region 3														
No injury	658	96.3	409	96.9	433	86.1	122	89.1	0	0	352	93.9	1974	92.3
Head and neck	1	0.1	1	0.2	11	2.2	2	1.5	6	31.6	1	0.3	22	1.0
Face	0	0	5	1.2	8	1.6	2	1.5	3	15.8	6	1.6	24	1.1
Chest	1	0.1	1	0.2	9	1.8	4	2.9	6	31.6	0	0	21	1.0
Abdomen	0	0	0	0	1	0.2	1	0.7	1	5.3	1	0.3	4	0.2
Extremities	18	2.6	4	0.9	39	7.8	4	2.9	2	10.5	14	3.7	81	3.8
External	5	0.7	2	0.5	2	0.4	2	1.5	1	5.3	1	0.3	13	0.6
Number of injuries														
1	384	52.1	262	59.4	269	53.5	91	66.4	9	29.0	241	64.3	1256	56.5
2	331	44.9	166	37.6	165	32.8	31	22.6	3	9.7	111	29.6	807	36.3
3	22	3.0	13	2.9	69	13.7	15	10.9	19	61.3	23	6.1	161	7.2
Any operation														
No	400	55.6	88	20	373	74.9	83	60.6	10	33.3	281	77.2	1235	56.4
Yes	319	44.4	353	80	125	25.1	54	39.4	20	66.7	83	22.8	954	43.6
ICU stay[a]														
No	832	99.9	21	4.8	487	96.8	125	91.2	0	0	368	98.1	1833	80
Yes	1	0.1	420	95.2	16	3.2	12	8.8	1	100	7	1.9	457	20
ER patient														
No	226	27	10	2.3	2	0.4	70	51.1	20	60.6	240	64	568	24.4
Yes	610	73	433	97.7	501	99.6	67	48.9	13	39.4	135	36	1759	75.6
Transferred from other facility														
No	421	50.4	125	28.6	140	27.8	120	87.6	28	84.8	150	40.2	984	42.5
Yes	414	49.6	312	71.4	363	72.2	17	12.4	5	15.2	223	59.8	1334	57.5

Variable	Bangladesh		Cambodia		Ethiopia		Mexico		Ukraine		Zambia		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Disposition[b]														
Died in hospital	0	0.0	6	1.4	17	3.4	5	3.7	2	7.1	10	2.7	40	1.7
Discharged to rehabilitation	50	6.0	1	0.2	3	0.6	106	77.9	1	3.6	55	14.8	216	9.4
Transferred to other hospital	1	0.1	6	1.4	21	4.2	5	3.7	1	3.6	5	1.3	39	1.7
Discharged home	778	93.6	413	93.7	448	89.1	4	2.9	24	85.7	223	60.1	1890	81.8
Absconded or left against medical advice	1	0.1	1	0.2	14	2.8	16	11.8	0	0.0	0	0.0	32	1.4
Other	1	0.1	14	3.2	0	0.0	0	0.0	0	0.0	78	21.0	93	4.0

Source: Global Road Safety Facility.

Note a. Mean and (standard deviation) of days in ICU for each country are Bangladesh: 2 (0); Cambodia: 1.2 (0.7); Ethiopia: 19.9 (17.6); Mexico: 7.8 (5.7); Ukraine: 18.9 (20); Zambia: 7.9 (12.2). Total: 2.5 (6.3).

b. Mean and (standard deviation) of days in hospital for each country are Bangladesh: 11.8 (22.4); Cambodia: 13.3 (8.8); Ethiopia: 15.8 (21.9); Mexico: 8.9 (9.8); Ukraine: 22.4 (32.2); Zambia: 18.9 (22.4). Total: 14 (20.1).

Table A.5. Key Characteristics by Gender

Variable	Female[a]		Male[b]		*p*-value
	No.	Percent	No.	Percent	
Education					
No formal education	83	18.3	245	13.1	$p = 0.005$
Primary school	111	24.4	453	24.2	
Secondary or high School	171	37.7	863	46.1	
Bachelor's degree or beyond	85	18.7	294	15.7	
Other	4	0.9	15	0.8	
Employment					
Daily wage laborer	43	9.5	381	20.4	$p = 0.000$
Salary worker	110	24.2	536	28.7	
Self-employed	77	17.0	563	30.1	
Homemaker	113	24.9	5	0.3	
Not working	77	17.0	203	10.9	
Student	34	7.5	164	8.8	
Other	0	0.0	18	1.0	
Care at scene					
No	186	43.5	793	44.2	$p = 0.787$
Yes	242	56.5	1,002	55.8	
Type of road user					
Pedestrian	173	38.2	428	22.9	$p = 0.000$
Driver (includes cyclists)	83	18.3	861	46.0	
Passenger	197	43.5	582	31.1	

Variable	Female[a]		Male[b]		*p*-value
	No.	Percent	No.	Percent	
Type of vehicle					
Car	33	11.8	102	7.1	$p = 0.000$
Bus	21	7.5	67	4.6	
Truck	8	2.9	122	8.5	
Minibus or van	54	19.3	100	6.9	
Bicycle	10	3.6	61	4.2	
Auto-rickshaw	44	15.7	286	19.8	
Motorcycle	106	37.9	697	48.3	
Other	4	1.4	8	0.6	
Seat belt					
No	103	91.2	294	77.8	$p = 0.002$
Yes	10	8.8	84	22.2	
Helmet					
No	224	81.2	771	67.5	$p = 0.000$
Yes	52	18.8	372	32.5	
Glasgow Coma Scale					
Mild	303	67.5	1341	72.3	$p = 0.104$
Moderate	98	21.8	331	17.9	
Severe	48	10.7	182	9.8	
Most severe injury region					
Head and neck	95	21.3	310	17.4	p = 0.346
Face	17	3.8	51	2.9	
Chest	17	3.8	70	3.9	
Abdomen	9	2.0	34	1.9	
Extremities	306	68.8	1306	73.4	
External	1	0.2	8	0.4	
Any operation[c,d]					
No	264	60.6	971	55.4	p = 0.052
Yes	172	39.4	782	44.6	
Prior disability					
No impairment	421	93.1	1,764	94.6	p = 0.099
Mild	16	3.5	32	1.7	
Moderate	12	2.7	58	3.1	
Severe	3	0.7	10	0.5	

Source: Global Road Safety Facility.

Note: a. Female mean age is 37.6, standard deviation 15.6. p = 0.0005 for male and female.
b. Male mean age is 35, standard deviation 13.7.
c. Female mean days in hospital is 12.9, standard deviation 14.5; male mean days in hospital is 14.2, standard deviation 21.2; p = 0.2272.
d. Female mean total amount paid (US dollars) is $191.10, standard deviation $297.20; male mean total amount paid (US dollars) is $238, standard deviation $888.40; p = 0.3818.

Table A.6. Predictors of Death during Hospital Stay

Variable	Adjusted odds ratio	Standard error	z	*p*-value	95 percent confidence interval
Country					
Cambodia	Reference				
Ethiopia	1.94	2.06	0.63	0.5320	0.24–15.54
Mexico	2.46	2.54	0.87	0.3820	0.33–18.57
Zambia	1.21	1.21	0.19	0.8490	0.17–8.63
Age	1.03	0.02	1.98	0.0480	1.00–1.06
Sex					
Female	Reference				
Male	1.42	0.90	0.55	0.5800	0.41–4.90
Employment					
Daily-wage laborer	Reference				
Salary worker	0.66	0.43	-0.63	0.5260	0.18–2.39
Self-employed	0.39	0.23	-1.61	0.1080	0.12–1.23
Homemaker	0.94	1.04	-0.05	0.9570	0.11–8.14
Not working	0.45	0.35	-1.04	0.2980	0.10–2.03
Student	0.97	0.87	-0.03	0.9770	0.17–5.59
Other	1.39	2.27	0.20	0.8420	0.06–34.49
Education					
No formal education	Reference				
Primary school	1.07	0.85	0.09	0.9300	0.23–5.07
Secondary or high school	1.80	1.35	0.79	0.4310	0.42–7.80
Bachelor's degree or beyond	0.30	0.34	-1.07	0.2850	0.03–2.69
Other	3.96	7.49	0.73	0.4680	0.1–161.92
Household income (US$)	1.00	0.00	0.95	0.3400	1.00–1.00
Care at scene					
No	Reference				
Yes	1.02	0.47	0.04	0.9710	0.41–2.50
Type of road user					
Pedestrian	Reference				
Driver (includes cyclists)	0.77	0.48	-0.42	0.6740	0.22–2.63
Passenger	0.56	0.35	-0.92	0.3560	0.17–1.90
Type of Road					
Highway	Reference				
Main road	1.67	0.93	0.92	0.3570	0.56–4.95
Side street	1.09	0.95	0.10	0.9180	0.20–6.01
Village road	0.69	0.89	-0.29	0.7720	0.05–8.68
Other	0.18	0.31	-0.99	0.3230	0.01–5.45
Crash counterpart (what was struck)					
Car	Reference				
Motorcycle	0.74	0.55	-0.40	0.6860	0.17–3.17
Skid or rollover (non-collision)	1.03	0.75	0.04	0.9660	0.25–4.32
Minibus or van	0.83	0.57	-0.27	0.7880	0.22–3.17

Variable	Adjusted odds ratio	Standard error	z	*p*-value	95 percent confidence interval
Auto-rickshaw	2.85	2.82	1.06	0.2900	0.41–19.84
Truck	3.58	2.43	1.88	0.0600	0.95–13.57
Other	1.64	1.21	0.67	0.5000	0.39–6.95
Glasgow Coma Scale					
Mild	Reference				
Moderate	2.24	1.13	1.60	0.1100	0.83–6.01
Severe	11.92	6.73	4.38	0.0000	3.94–36.07
Most severe injury region					
Head and neck	Reference				
Face	0.42	0.41	-0.90	0.3690	0.06–2.80
Chest	0.09	0.13	-1.68	0.0920	0.01–1.49
Abdomen	0.27	0.39	-0.91	0.3610	0.02–4.51
Extremities	0.06	0.04	-4.10	0.0000	0.02–0.24
External	1.55	2.34	0.29	0.7720	0.08–29.98
Multiple injuries					
No	Reference				
Yes	1.01	0.44	0.02	0.9810	0.43–2.36
Operation					
No	Reference				
Yes	1.30	0.65	0.53	0.5940	0.49–3.44
Disability					
No	Reference				
Yes	2.28	1.87	1.00	0.3160	0.46–11.38

Source: Global Road Safety Facility.

Table A.7. Return to Normal Life at One Month, Three Months, and Six Months

Variable	Bangladesh		Cambodia		Ethiopia		Mexico		Ukraine		Zambia		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Returned to normal life at one month														
No	650	93.4	391	94.4	332	90.7	81	79.4	17	77.3	174	82.5	1,645	90.8
Yes	27	3.9	23	5.6	34	9.3	21	20.6	5	22.7	36	17.1	146	8.1
Don't know	19	2.7	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	20	1.1
Returned to normal life at three months														
No	479	74.0	292	75.1	287	70.3	55	57.3	13	68.4	65	44.2	1,191	69.8
Yes	165	25.5	97	24.9	121	29.7	40	41.7	5	26.3	76	51.7	504	29.5
Don't know	3	0.5	0	0.0	0	0.0	1	1.0	1	5.3	6	4.1	11	0.6
Returned to normal life at six months														
No	347	59.5	248	62.5	188	46.5	37	43.5	0	0.0	47	36.2	867	54.2
Yes	236	40.5	149	37.5	216	53.5	48	56.5	2	100	75	57.7	726	45.3
Don't know	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	8	6.2	8	0.5

Source: Global Road Safety Facility.

Table A.8. World Health Organization Disability Assessment Schedule: Disability Score at One, Three, and Six Months

Variable	Bangladesh		Cambodia		Ethiopia		Mexico		Ukraine		Zambia		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
One month[a]														
No difficulty	2	0.3	1	0.2	0	0.0	0	0.0	0	0.0	2	0.9	5	0.30
Mild difficulty	31	4.5	35	8.5	12	3.3	8	7.8	6	27.3	78	37.0	170	9.40
Moderate difficulty	48	6.9	165	39.9	119	32.5	38	37.3	7	31.8	99	46.9	476	26.30
Severe difficulty	146	21.0	187	45.2	186	50.8	44	43.1	6	27.3	25	11.8	594	32.80
Extreme difficulty or cannot do	469	67.4	26	6.3	49	13.4	12	11.8	3	13.6	7	3.3	566	31.30
Three months[b]														
No difficulty	117	18.1	13	3.3	58	14.2	3	3.1	2	10.0	21	14.3	214	12.5
Mild difficulty	71	11.0	123	31.6	84	20.6	33	34.4	10	50.0	84	57.1	405	23.7
Moderate difficulty	82	12.7	169	43.4	158	38.7	37	38.5	1	5.0	30	20.4	477	27.9
Severe difficulty	131	20.2	78	20.1	94	23.0	15	15.6	5	25.0	10	6.8	333	19.5
Extreme difficulty or cannot do	246	38.0	6	1.5	14	3.4	8	8.3	2	10.0	2	1.4	278	16.3
Six months[c]														
No difficulty	199	34.1	49	12.3	108	26.7	11	12.9	2	100.0	47	36.2	416	26.0
Mild difficulty	38	6.5	174	43.8	126	31.2	44	51.8	0	0.0	54	41.5	436	27.2
Moderate difficulty	91	15.6	154	38.8	129	31.9	16	18.8	0	0.0	24	18.5	414	25.9
Severe difficulty	145	24.9	17	4.3	37	9.2	6	7.1	0	0.0	4	3.1	209	13.1
Extreme difficulty or cannot do	110	18.9	3	0.8	4	1.0	8	9.4	0	0.0	1	0.8	126	7.9

Source: Global Road Safety Facility.

Note: a. Mean disability score and (standard deviation) for each country at one month are Bangladesh: 37.9 (10.4); Cambodia: 24.3 (8.1); Ethiopia: 27.4 (8.5); Mexico: 25.2 (10.6); Ukraine: 22.2 (12.1); Zambia: 16.1 (9.5). Total: 29.2 (12.1).

b. Mean disability score and (standard deviation) for each country at three months are Bangladesh: 27.2 (18.1); Cambodia: 16.5 (9.5); Ethiopia: 16.8 (10.9); Mexico: 16.8 (11.4); Ukraine: 15.3 (14.8); Zambia: 9.8 (9.1). Total: 20.1 (15).

c. Mean disability score and (standard deviation) for each country at six months are Bangladesh: 20.3 (17.7); Cambodia: 11.1 (8.1); Ethiopia: 10.6 (9.9); Mexico: 12.7 (12.4); Ukraine: 0 (0); Zambia: 6.4 (8.7). Total: 14 (13.9).

Table A.9. Craig Hospital Inventory of Environmental Factors Barrier Impact Score at Three Months and Six Months

Variable	Bangladesh		Cambodia		Ethiopia		Mexico		Ukraine		Zambia		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Three months[a]														
No impact	398	89.2	0	0.0	105	62.5	8	50.0	3	50.0	18	62.1	532	74.5
Low (1–2)	34	7.6	36	73.5	37	22.0	4	25.0	1	16.7	6	20.7	118	16.5
Moderate (3–4)	4	0.9	12	24.5	22	13.1	3	18.8	2	33.3	2	6.9	45	6.3
High (5–6)	10	2.2	1	2.0	4	2.4	1	6.3	0	0.0	2	6.9	18	2.5
Extreme (7–8)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.4	1	0.1
Six months[b]														
No impact	482	99.8	5	11.6	205	86.1	10	47.6	2	100.0	16	57.1	720	88.3
Low (1–2)	1	0.2	38	88.4	17	7.1	9	42.9	0	0.0	5	17.9	70	8.6
Moderate (3–4)	0	0.0	0	0.0	13	5.5	2	9.5	0	0.0	6	21.4	21	2.6
High (5–6)	0	0.0	0	0.0	2	0.8	0	0.0	0	0.0	0	0.0	2	0.2
Extreme (7–8)	0	0.0	0	0.0	1	0.4	0	0.0	0	0.0	1	3.6	2	0.2

Source: Global Road Safety Facility.

Note: a. Mean barrier impact score and (standard deviation) for each country at three months are Bangladesh: 0.7 (1.5); Cambodia: 2 (1); Ethiopia: 1.7 (1.6); Mexico: 1.6 (1.4); Ukraine: 1.5 (1.4); Zambia: 1.7 (1.8). Total: 1.4 (1.5).

b. Mean barrier impact score and (standard deviation) for each country at six months are Bangladesh: 0 (0.2); Cambodia: 1.1 (0.6); Ethiopia: 1 (1.5); Mexico: 1.3 (1.2); Ukraine: 0 (0); Zambia: 1.6 (1.8). Total: 0.7 (1.1).

Table A.10. Longitudinal Predictors of Disability Score

Variable	Coefficient	Standard error	z	*p*-value	95 percent confidence interval
Country					
Bangladesh	Reference				
Cambodia	−13.22	1.27	−10.39	0.0000	−15.72 to −10.73
Ethiopia	−12.17	0.98	−12.41	0.0000	−14.09 to −10.25
Mexico	−10.57	1.41	−7.50	0.0000	−13.34 to −7.81
Zambia	−17.61	1.22	−14.39	0.0000	−20.01 to −15.21
Age	0.18	0.03	7.33	0.0000	0.14–0.23
Sex					
Female	Reference				
Male	−0.58	0.72	−0.80	0.4220	−1.99–0.83
Education					
No formal education	Reference				
Primary school (grades 1–6)	−0.30	1.15	−0.26	0.7970	−2.55–1.96
Secondary or high school (grades 7–12)	−1.32	1.16	−1.14	0.2560	−3.59–0.95
Bachelor's degree or beyond	−1.43	1.41	−1.01	0.3120	−4.20–1.34
Other	−2.73	4.98	−0.55	0.5830	−12.49–7.02

Variable	Coefficient	Standard error	z	*p*-value	95 percent confidence interval
Employment					
Daily wage laborer	Reference				
Salary worker	−0.07	1.03	−0.07	0.9470	−2.09–1.95
Self-employed	−0.41	0.97	−0.42	0.6740	−2.31–1.49
Homemaker	−0.26	1.57	−0.17	0.8670	−3.34–2.81
Not working	−1.53	1.23	−1.24	0.2150	−3.94 to −0.89
Student	−2.83	1.38	−2.05	0.0410	−5.53 to −0.12
Other	−2.64	3.58	−0.74	0.4610	−9.67–4.38
Household income (US$)	0.00	0.00	0.27	0.7850	0.00–0.00
Care at scene					
No	Reference				
Yes	0.13	0.61	0.21	0.8300	−1.07–1.34
Type of road user					
Pedestrian	Reference				
Driver (includes cyclists)	−2.36	0.95	−2.49	0.0130	−4.22 to −0.51
Passenger	−1.35	0.83	−1.62	0.1050	−2.98–0.28
Type of Road					
Highway	Reference				
Main road	−0.32	0.84	−0.38	0.7020	−1.96–1.32
Side street	−0.50	1.15	−0.44	0.6620	−2.75–1.75
Village road	−0.73	1.32	−0.56	0.5790	−3.32–1.85
Other	3.90	2.52	1.55	0.1220	−1.04–8.84
Glasgow Coma Scale					
Mild	Reference				
Moderate	1.38	0.83	1.66	0.0980	−0.25–3.01
Severe	3.22	0.98	3.28	0.0010	1.30–5.14
Most severe injury region					
Head and neck	Reference				
Face	−2.73	1.20	−2.28	0.0230	−5.08 to −0.38
Chest	0.49	1.26	0.39	0.6980	−1.98–2.95
Abdomen	1.38	2.13	0.65	0.5170	−2.79–5.55
Extremities	0.98	0.75	1.32	0.1880	−0.48–2.45
External	−3.20	2.21	−1.45	0.1480	−7.54–1.14
Multiple injuries					
No	Reference				
Yes	1.61	0.63	2.55	0.0110	0.37–2.84
Operation					
No	Reference				
Yes	1.92	0.75	2.56	0.0100	0.45–3.38
Days in hospital	0.07	0.02	3.25	0.0010	0.03–0.10
Disability					
No	Reference				
Yes	3.15	1.38	2.28	0.0220	0.45–5.86
Assessment point	−4.48	0.25	−17.93	0.0000	−4.97 to −3.99
Impact score	1.80	0.19	9.59	0.0000	1.43–2.17

Source: Global Road Safety Facility.

FUNDED BY