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Disability and Road Traffic Accidents

Assessing the Costs and Consequences of Rehabilitation and Living with a Disability Following a Road Traffic Injury

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Abbreviations and Acronyms

DALY	disability-adjusted life years
GBD	Global Burden of Disease
GDP	gross domestic product
GRSF	Global Road Safety Facility
HICs	high-income countries
LMICs	low- and middle-income countries
MVA Fund	Motor Vehicle Accident Fund of Namibia
N$	Namibian dollar
NRSC	National Road Safety Council, Namibia
PTSD	posttraumatic stress syndrome
R	South African rand
RAF	Road Accident Fund
RSIMS	Road Safety Information Management System
RTA	road traffic accident
RTC	road traffic crash
RTI	road traffic injury
SDG	sustainable development goals
TBI	traumatic brain injury
UIF	Unemployment Insurance Fund
UN	United Nations
UNCRPD	United Nations Convention on the Rights of Persons with Disabilities
WHO	World Health Organization

Executive Summary

Scope of Study

This study examines the medical, economic, and social costs– to individuals, families, communities, and societies of people becoming permanently disabled[1] in road traffic accidents (RTAs).

The World Health Organization's (WHO) Global Status Report on Road Safety (2023) identified RTAs as a major global public health concern. In fact, it is the eighth leading cause of death in all age groups and the leading killer of children and young adults. It disproportionately impacts people during their most productive years as well as people in low- and middle-income countries (LMICs). Everyone is at risk of becoming a victim of an RTA, regardless of gender, age, ethnicity, geographical location, or preexisting disabilities. This raises the question of whether RTAs are also a leading —although rarely acknowledged— cause of preventable disability.

The United Nations Road Safety Collaboration declared 2021–30 the Decade of Action for Road Safety, with the target of reducing RTA deaths by 50 percent by 2030. However, a reduction in deaths is only part of the story. The focus of the Decade of Action should be expanded to include reducing injuries and improving the quality of life for those who become disabled through road traffic injuries (RTIs).

The World Bank's recently published six-country report, Beyond Numbers: Estimating the Disability Burden of Road Traffic Injuries, (Mitra et al. 2023) studied the medical and rehabilitation costs to individuals and health systems of people injured in RTAs up to six months after their accident. The study estimated that at that point, 44 percent of all those injured had fully or largely recovered from their injuries, and some portion of the remaining 56 percent would continue to recover. What of those individuals who survive but have a permanent disability as a result?

This World Bank–funded project, building on the Beyond Numbers study, begins to answer this question. Through a literature review, an analysis of short- and long-term RTA-related disability costs in Namibia and South Africa, and a series of interviews with road traffic safety and disability experts, we hope to identify the impact of RTI-related disability on individuals and societies. We also aim to focus attention on the significance of RTIs as a major (though currently largely overlooked) concern for global health, economic development, international road traffic safety efforts, and disability policy research and advocacy.

Study Rationale

The initial title of this project, "Assessing the Availability and Cost of Rehabilitation following RTIs," spoke to a medical and rehabilitation focus, but once we began to explore what was known and unknown about people injured in RTAs, we identified a major gap in how RTIs are

[1] For the purposes of this report, disability is defined as stated in Article 2 of the 2006 United Nations Convention on the Rights of Persons with Disabil2ities (UNCRPD), to include people "who have long-term physical, mental, intellectual, or sensory impairments, which, in interaction with various barriers, may hinder their full and effective participation in society on an equal basis with others". See https://www.ohchr.org/en/instruments-mechanisms/instruments/convention-rights-persons-disabilities.

conceptualized and addressed. Studies of RTAs largely focus on accident prevention—certainly an admirable goal, and when an RTI occurs, the attention shifts to the cost of medical and rehabilitative care.[2] However, we found very few studies or initiatives that focus on the costs or long-term consequences to those individuals who acquire a disability in RTAs.

In this study, we bring together existing literature, data from Namibia and South Africa, and findings from a series of in-depth interviews with global road traffic safety and disability experts to begin reframing RTA-related disability as a major issue in global health. These two countries were selected for review in consultation with the World Bank because both have good motor vehicle accident funds (the Motor Vehicle Accident [MVA] Fund of Namibia and the Road Accident Fund [RAF] in South Africa) that provide economic support for people injured in RTAs and solid administrative systems and data collection mechanisms.

The key finding from this study mirrors the recent and otherwise comprehensive WHO Global Status Report on Road Safety (2023), which shows that data collection and analysis of RTAs continues to become increasingly comprehensive and insightful, (which means global and national road traffic safety efforts and initiatives can define, identify, and address morbidity and mortality patterns in both high-income countries (HICs) and LMICs). However, comparatively little is known about millions of people who become permanently disabled in RTAs once they leave medical or rehabilitative care.

Those disabled in RTAs are also largely invisible to the disability community. They are not seen as a unique or distinct group within the broader realms of disability policies, programs, or advocacy communities. While advances in road safety and enforcement of traffic laws and policies will hopefully continue to lead to a reduction of RTAs and RTIs, there will be an ongoing need to support those disabled due to RTIs to enable them to adjust to life with a disability and change their environments so they can participate equally in society.

Certainly, many of their needs and concerns are similar to those of people disabled through other causes, thus they are covered by the same overarching laws, funding schemes, and advocacy efforts that pertain to all people with disabilities. Many will need support in the form of assistive technology, conversions to ensure accessible homes, adaptation and provision of support in the workplace and school, and livelihood support (including income replacements where needed).

However, as will be argued in this report, many of those disabled in RTAs may also have specific concerns and issues that warrant focused attention and support. For example, a significant percentage of people will have brain injuries, whiplash, and psychological issues following a traumatic accident. Also, the economic implications of a sudden RTA may have specific and devastating implications for individuals and households. What support and services do these individuals need to ensure they have an active voice in their lives and the lives of their families and communities?

[2] Using the WHO definition, rehabilitation is “a set of interventions designed to optimize functioning and reduce disability in individuals with health conditions in interaction with their environment.” Put simply, rehabilitation helps an individual to be as independent as possible in everyday activities, enabling participation in education, work, recreation, and meaningful life roles such as taking care of family. It does so by working with the person and their family to address underlying health conditions and their symptoms, modifying their environment to better suit their needs, using assistive products, educating to strengthen self-management, and adapting tasks so that they can be performed more safely and independently. Together, these strategies can help an individual overcome difficulties with thinking, seeing, hearing, communicating, eating, or moving around. Rehabilitation includes not only physical but also psychological support and mental health services.

Costs of Road Traffic Accident-Related Disability

RTAs also cost societies. Putting a price tag on what RTA-related disability costs societies is difficult, but evidence suggests it is significant. In our literature search, we were able to identify only a small number of studies that attempted to estimate these costs, and they had limited definitions, sample sizes, and costing methodologies that made comparability difficult.

Nevertheless, the WHO (2023) estimates that RTIs impose an enormous economic cost on societies, with some estimates putting the global macroeconomic cost as high as US$1.8 trillion, equivalent to 10–12 percent of global gross domestic product (GDP). The WHO also estimates the burden of nonfatal RTIs on lost productivity to be far greater than the burden attributable to fatal injury. Alemany et al. (2013) and Marquez et al. (2013) argued that the annual costs of RTIs in LMICs are estimated to be more than the total yearly amount received in development aid.

As striking as they are, we believe these costs are significantly underestimated as they focus only on medical and rehabilitative care and, in some cases, lost income or wages, but do not include the full range of economic, social, and civic costs incurred by living with a disability across the lifespan.

Prevalence Rates

Estimates of numbers and costs must be based on the prevalence rates of disability linked to RTAs, which is currently unexplored territory. As will be discussed in this report, we could find only a small number of studies in the global literature that attempted to calculate the prevalence rates of people who, injured in RTAs, go on to have a permanent disability. The studies found vary so widely in methodology, definitions of both injury and disability, sample size, and time frame that comparisons are largely impossible. Rates ranged from estimates of 4.1 percent in Namibia and in a multicounty study of adolescents by Symonds et al. (2018) to 30–55 percent in populous countries like France, and Nigeria, to as high as 88 percent in small, hospital-based studies from Ethiopia. Even at the lowest estimated rates, we are discussing millions of people who survive RTAs but do so with a lifelong disability. Clearly, this is an issue that warrants much more research.

Disability Strengthens Arguments for Road Traffic Safety Funding

Finally, bringing together the fields of road traffic safety and disability helps generate a new series of questions that warrant further investigation. For example, major progress has been made in understanding road traffic safety through both the previous (201120) and the current (2021–30) UN Decades of Action for Road Safety (UN 2010; UN 2020). Research has identified a number of relatively easily implementable, low-cost adaptations to vehicle design (such as seat belts and crash helmets) and improved road design and law enforcement (for example, lower speed limits, pedestrian crosswalks, and rigorous enforcement of drink driving laws) that have significantly reduced RTA-related morbidity and mortality in HICs.

Many of the same road traffic safety laws and policies are already on the books in LMICs, but as the most current WHO Global Status Report on Road Safety (2023) clearly shows, these laws and measures are far less routinely enforced. The reason consistently given is financial constraints in LMICs, due in large part to the many competing demands on local and national budgets. However, if the costs of living a lifetime with a preventable disability are added to this equation, this could help justify more funding for better road traffic safety enforcement efforts.

Conclusion

We are not the first researchers to point out the devastating consequences of RTA-associated mortality and morbidity rates. In their landmark *British Medical Journal* paper, Nantulya and Reich (2002) labeled RTIs in LMICs as "the neglected epidemic" and state, "public policy responses to this epidemic have been muted at national and international levels. Policy makers need to recognize the growing problem as a public health crisis and design appropriate policy responses." Two decades later, this is no less true, but we would add that the health and well-being of people who become disabled in RTAs must be part of this discourse.

The links between RTIs and disability need to be better established to help reframe what is known and what more needs to be known about the health and well-being of people with an RTA-related disability. We believe that such disabilities are a major (and currently overlooked) component of road traffic safety efforts and disability initiatives and a major concern in global health and international development. A second important finding is that the lack of data and analysis regarding disability after an RTA currently limits our ability to identify and better address the needs and concerns of people injured in RTAs.

Introduction

Road traffic injuries (RTIs) are a major global health concern. The World Health Organization's (WHO) Global Status Report on Road Traffic Safety Report (2023) estimates there were 1.19 million road traffic deaths in 2021, which corresponds to 15 road traffic deaths per 100,000 people. RTIs are the eighth leading cause of death globally for people of all ages and the leading killer of children and young adults. Road traffic deaths disproportionately impact people during their most productive years, with 66 percent of fatalities being among people ages 18–59 (WHO 2023). Some 81 percent of these deaths were among males, 55 percent of whom were between 18–34 years of age. The impact is disproportionately felt in LMICs. While only half the world's vehicles are found in LMICs, 90 percent of all motor vehicle fatalities occur in these countries (WHO 2018).[3] Just as importantly, some 50 million people are injured in road traffic accidents (RTAs) globally yearly (WHO 2023). We know surprisingly little about people injured in RTAs and even less about those who survive with a disability.

The 2023 WHO report, as well as most other national and international studies, focus on deaths and hospitalizations. Some include data on the numbers needing rehabilitation. **Yet if RTAs are the largest cause of death among children and young adults and a significant cause of death in adults, are they also one of the leading causes of disability?** And if so, what are the economic, social, and political implications of these disabilities? In this study, we begin to answer the last question.

Because RTIs impose an enormous economic cost, not just on individuals and households, but on societies, they also pose a significant concern to national budgets and economic development initiatives. Some estimates suggest that the global macroeconomic cost of RTIs is as high as US$1.8 trillion dollars. This is equivalent to 10–12 percent of GDP (WHO 2023). The WHO estimates the burden of nonfatal RTIs on lost productivity to be far greater than the burden attributable to fatal injury (WHO 2023). Alemany et al. (2013) and Marquez et al. (2013) argued that the annual costs of RTIs in LMICs are estimated to be more than the total yearly amount received in development aid.

However, we believe these costs are significantly underestimated as they focus only on medical and rehabilitative therapeutic care and, in some cases, lost income or wages, but they do not include the full range of economic, social, and civic costs incurred by living with a disability across the lifespan. As such, RTIs are an important health and development challenge impacting not just individuals and households but national budgets and the global economy.

Background

To better understand the economic burden of RTIs in 2022, the World Bank commissioned George Washington University to undertake a study in six LMICs (Bangladesh, Cambodia, Ethiopia, Mexico, Ukraine, and Zambia) on the costs associated with medical and rehabilitative care for individuals who sustained RTIs (Mitra et al. 2023). According to the results, costs varied due to differences in national health systems, public and private insurance and support

[3] RTA-related mortality rates are 24.1 per 100,000 persons in LMICs, compared to 9.2 per 100,000 persons in HICs (WHO 2018).

schemes, and the availability of rehabilitation services. However, the costs of RTIs to governments and individuals in all six countries were high.

For seriously injured individuals and their households, the costs of an RTI were universally catastrophic. For individuals, these costs averaged around 10 percent of annual household income (Mitra et al. 2023). In the months following the injury, 84 percent of patients reported using their own funds to pay for at least some care, and over half (56 percent) reported borrowing money to pay for treatment and expenses. These expenses may also be a serious underestimation as they did not include loss of income and additional costs, such as out-of-pocket costs for patients and their families (for example, for travel, parking, or childcare). Moreover, they focused on short-term costs and not the long-term expenses for things such as assistive technology, medication, personal assistance, and home adjustments, or routine costs such as transportation and daily living expenses.

The objectives of this study were to

- Increase knowledge of the costs and issues involved in the transition from immediate medical and rehabilitation care following an RTI, to living with a disability;
- Estimate both monetary and opportunity costs to individuals, households, and societies of living with a permanent RTA-related disability with particular attention to concerns of gender equity;
- Identify the gaps in what is currently known about the costs and impact on individuals, households, and societies due to RTA-related disabilities; and,
- Using these findings, develop a road map for policy makers, government administrators, development practitioners, and disability organizations and advocates to better guide resource allocation, support, and research on people disabled through RTIs to ensure their full and equitable participation in their communities.

We were able to provide evidence for some of these objectives. For others, we found that data are not currently being collected or analyzed in ways that allow us to answer the questions Therefore, this project proposes a methodology to allow future research in this domain. We also identify a series of key issues and propose a road map with recommendations for future policies, research, and advocacy to better address the long-term costs of an RTA-related disability.

Methodology

Findings and recommendations were gathered using a combination of different methods including a comprehensive literature review of available evidence, analysis of databases from two case study countries Namibia and South Africa, and key informant interviews. A detailed description of the methodology is provided in Appendix B.

The literature review included publications on the costs and impact on daily life for individuals and households coping with RTA-related disabilities. This included peer-reviewed literature from LMICs and reviewed papers from HICs where relevant, and grey literature on RTAs, RTIs, and disability. The review allowed the identified of gaps in evidence and literature as well. Particular attention was paid to identifying relevant literature from Namibia and South Africa, the two countries that were the focus of our data analysis. Because of the limited number of studies, all identified studies were included irrespective of the strength of their research design.

The review identified 836 reports, policy statements, and articles in a range of disciplines: epidemiology, injury and accident prevention, road traffic safety, rehabilitation, and disability literature. Only a very limited number of articles—only 19 out of the 836 found—specifically addressed the links between RTIs and disability (in any form). However, a considerable amount of additional relevant materials was found in rehabilitation literature and accident and injury databases.

Namibia and South Africa were selected for case studies because both countries have good national motor vehicle accident funds and disability grant schemes, solid administrative expertise, and viable RTA data collection and analysis systems at the national level. They are also two LMICs with high rates of road traffic accidents, injuries, and deaths (WHO 2023).

In Namibia and South Africa, national data on individuals disabled in RTAs fell into two categories: road traffic data and disability data. In Namibia, data are maintained by the Motor Vehicle Accident (MVA) Fund, which oversees most individuals with RTIs from the point of injury to discharge from the hospital to rehabilitation center or homes. Additional funds for equipment, adaptation of housing, rehabilitative and medical care, and cost of living expenses are available up to N$1.5 million. After this limit has been reached, the fund does not provide any additional support. People who are disabled can qualify for the disability grant scheme before their MVA Fund grant reaches the N$1.5 million limit.

In South Africa, the system is less unified. There are several pathways through which individuals can qualify for services and support. For those with RTIs who did not cause the accident, the South African Road Accident Fund (RAF) provides medical support and covers other expenses. Individuals can apply for compensation and support after the accident. Where the injured individual was the person who caused the accident, private insurance funds or the public health system may provide the services. As in the case of Namibia, people with RTI-related disabilities who have little or no income can apply for the disability grant if they meet the requirements. Those injured in an RTA who qualify through the RAF can also apply for income compensation if they earned an income before the accident.

To provide greater insight into current understandings of the links between RTAs and disability, the team also undertook semi-structured interviews with global experts in international organizations knowledgeable about and/or involved in road traffic safety efforts and experts and leaders in the global disability community.

Limitations

There are several limitations to this study that are important to note.

The literature review was done in English, but it is anticipated that we may have missed other relevant publications, studies, and databases as well as reports and articles in the grey literature in languages other than English.

In many countries, national administrative systems have data on RTAs but retrieving this information is difficult because health and insurance records are confidential.

Also, in many countries, including Namibia and South Africa, there is an underreporting of RTIs because some individuals do not seek medical support after an accident. Depending on the data collection systems, not infrequently deaths that occur within 24 to 48 hours of an RTA are listed as related to the RTA, fatalities that occur days or weeks later are often not recorded as associated with the RTA.

Unfortunately, at this point, there is a lack of data to compute the prevalence. In the case of Namibia, we have two proxy sources—the MVA Fund and the National Household Income and Expenditure Survey 2015–2016. In the case of South Africa, the RAF collects data only from those who qualify for support. Private insurance may supplement funding for some people injured, and the national public health service provides care for those who do not qualify for the RAF or other support sources. However, data on those supported following an RTA are not collected or merged into a single useable data set.

Findings

The following findings were identified in the literature review, quantitative analysis of data from Namibia and South Africa, and expert interviews. We present findings from these three project components and bring them together in the **Discussion** section to provide an overarching interpretation of what we know and what we have yet to understand concerning RTA-related disability both generally and specifically in Namibia and South Africa.

Literature Review

In the first part of this study, we undertook a global literature review on RTAs and disability. The most striking finding is the very limited amount of data on or discussion of the numbers, costs, and consequences of RTIs on those with RTA-related disabilities either in HICs or LMICs, despite the fact that there are millions of people who live with these disabilities.

We began by reviewing the WHO's Global Status Reports on Road Safety, which presents extensive RTA-related mortality and morbidity statistics as well as national data on accident laws and patterns (WHO 2018; WHO 2023).

In our initial search to identify articles, reports, and data that discussed the intersection between RTIs and disability, we could only identify only 19 of 836 relevant articles. Several provided an overarching discussion of the links between RTIs and disability (Alghnam et al. 2022; Allen et al. 2024a, 2024b; Berecki et al. 2013; Gururaj 2005; Hours et al. 2010p; Mitra et al. 2023; Symonds 2018) and the remainder discuss RTAs and specific types of injuries, services, or impacts on adolescents and young adults.[4]

Some of the articles also address components of the links between RTIs and disability or a combination of issues. For example, several papers discussed the potentially disabling implications of a lack of safe emergency transportation from the site of an accident to the hospital with the dangers posed by well-intentioned bystanders who incorrectly moved seriously injured individuals, creating or worsening disabilities (Alghnam et al. 2022; Mitra et al. 2023; World Bank 2021).

[4] These studies included the following by country: Australia: Berecki-Gisolf et al. 2013; Bangladesh, Cambodia, Ethiopia, Mexico, Ukraine, and Zambia: Mitra et al. 2023; China: Lin et al. 2013; Ethiopia: Denu et al. 2021a; France: Hours et al. 2010; India: Gururaj 2005; Gururaj 2008; LMICs: Symonds et al. 2018; Malaysia: Nik et al. 2016; Namibia: Namibian National Household and Expenditures Survey 2015–2016; Netherlands: Weijermars et al. 2016; Nigeria: Juillard et al. 2010; Saudi Arabia: Alghnam et al. 2022; Rwanda: Allen et al. 2024a, 2024b.

Several additional papers focused on medical costs or costs for medical and rehabilitative care (Mita et al. 2023). The literature also reported a significant lack of access to assistive devices (for example, wheelchairs, chains, and crutches) primarily due to a lack of funding in the health system. Only two studies were identified from LMICs that looked at the limited availability of psychological and mental health support services for those injured in RTAs (De Lima et al. 2009 in Brazil and Chatukuta et al. 2021 in Namibia). In both countries, the limited number of mental health professionals available, particularly in rural areas, was the cause.

We were able to identify only a few in-depth studies that undertook an assessment of the economic impact of RTIs, particularly in LMICs. For example, in a recent systematic review of existing literature in Sub-Saharan Africa, Ryan-Coker et al. (2021) identified 11 relevant studies and stated that evidence shows that the economic burden of RTIs in Sub-Saharan is high. However, they also report that data availability is limited, and the poor quality of existing evidence and heterogeneity in costing methods limit the generalizability of costs reported. In the 11 studies that met the inclusion criteria for Ryan-Coker and her colleagues, RTI costs ranged between US$119 and US$78,634 per injury and US$486 and $12,845 per hospitalization. Just as importantly, in the studies reviewed, the focus was only on injury and hospitalization. The cost of living with a disability across the lifespan was not addressed.

The most striking finding from our literature review was the lack of a coherent conceptual framework that brought together RTIs and disability. Even in large studies and reports on the Global Burden of Diseases (Vos et al. 2019; WHO 2021), people with RTA-related disabilities were not identified or discussed as a distinct group. Once the person was defined as disabled, he or she was placed in the “disabled” category and then ignored.

Very few of these studies focus on those permanently disabled by RTIs, even though major studies up to and including the Institute for Health Metrics and Evaluation’s (IHME) Global Burden of Disease study (2021) lists RTIs as one of several causes of disability. Most of these studies report the issue in terms of disability-adjusted life years (DALYs). Likewise, the WHO’s Global Report on Health Equity for Persons with Disabilities (2022) discussed RTIs only from the perspective that people already living with a disability are at a higher risk of nonfatal unintentional injury from road traffic crashes. Likewise, reports or articles in the grey literature where RTIs and disability intersect are rarely given more than a passing mention or discussed in depth. A small number of studies (summarized in the 2022 paper by Ryan-Coker et al.), exist on the economic burden of RTIs in sub-Saharan Africa.

Of particular concern to us, however, is that studies significantly underestimate the costs of RTIs as they focus mostly on medical and rehabilitative care, and, in some cases, lost income or wages, but exclude the full range of economic, social, and civic costs incurred by living with a disability across the lifespan. This is too frequently overlooked in global health and international development. In fact, Nantulya and Reich (2002) labeled RTIs “the neglected epidemic” in their landmark *British Medical Journal* paper on RTIs in LMICs and state, “public policy responses to this epidemic have been muted at national and international levels.”

Relevant Literature from Other Sources

Interestingly, we were able to identify a significant body of research in the medical, epidemiological, and global health literature where RTI data are included within broader studies on injuries and accidents (for example, Lyons 2011, Gabbe et al. 2015, Gabbe et al. 2017, and Vos et al. 2019). In this literature, the emphasis was not exclusively on RTI patients but on the medical costs and availability of hospital and rehabilitation services for patients injured due to a range of accidents, and medical conditions such as strokes and heart attacks.

While long-term RTA-related injuries are equated with disability in some of these studies, the exact links between RTIs, rehabilitation, and disability are rarely articulated, nor are those disabled in RTAs identified as a distinct group. Consistently combining RTIs with a range of other types of injuries also obscures their scope and impact as a significant contributor to global disability rates.

It may also potentially overlook medical, psychological, and economic concerns that are specific to people disabled in RTAs but less relevant to people disabled due to other types of injuries. For example, traumatic brain injury is regularly reported as a common occurrence in RTIs, which is not to say that it does not occur through other types of injuries.

For example, in the six-country George Washington University study (Mitra et al. 2023), 71 percent of individuals who had an RTI reported traumatic brain injury. The WHO estimates that brain injury, including traumatic brain injury (TBI), continues to be the most important cause of neurodisability, with physical, cognitive, and mental consequences that may persist for many months or years after injury.

RTIs are regularly reported to be the most common cause of TBIs globally (Johnson and Griswold 2017). Dewan et al. (2018) estimated that 69 million (95% percent confidence interval 64–74 million) individuals suffer TBIs from all causes each year, with the Southeast Asian and Western Pacific regions experiencing the highest rates. Head injury following RTAs is more common in LMICs, and the proportion of TBIs secondary to RTAs is, likewise, greatest in these countries.

In those who acquire disabilities due to RTIs, TBIs may be overlooked unless severe, especially when someone is also recovering from and adjusting to several other life-changing injuries. Furthermore, within the road safety literature, posttraumatic stress syndrome (PTSD) and psychological trauma are routinely reported in the aftermath of an RTI, but the availability of treatment for such trauma is rarely cited as a routine component of rehabilitation programs, particularly in LMICs. In the literature review, we did not find any mention of the provision of psychological services for persons with an RTA-related disability after they leave rehabilitation.

Finally, our ability to pull together data from studies and reports on accidents, injuries, and access to rehabilitative care is further fragmented because these findings are reported in a range of different disciplinary forums: in epidemiological, medical, and rehabilitation journals as well as reports and newsletters targeting specific audiences, including physicians (emergency room doctors, trauma surgeons, neurologists, and so on); nurses; physical, occupational, and speech therapists; psychologists and other mental health professionals; prosthetists; orthotists; and practitioners in many other disciplines. Seeing the big picture is even more difficult when data, findings, and research are divided among so many different disciplines.

Country studies

In this section, we provide an overview of the two national systems that support those injured in RTAs and analyze some of the associated medical, rehabilitation, and nonmedical costs. The following section provides an in-depth discussion of what these statistics mean regarding the cost of living with an RTA-related disability.

Namibia

In Namibia, we called upon data and expertise from the MVA Fund as well as the disability grant data maintained by the Namibian Ministry of Gender Equality, Poverty Eradication and Social Welfare. Both funds are supporting those involved in RTAs deemed to meet the eligibility requirements following an RTI. Unfortunately, how an individual's disability is acquired is not documented in the disability grant scheme, making us unable to identify who is disabled by RTIs.

The MVA Fund was established in 1994. A levy is added at the pump to all gas sold in Namibia and these funds go into the MVA Fund, run by the national government. This fund pays for anyone injured in an RTA—driver, passenger, or pedestrian. Coverage is available regardless of who is at fault.

The injured are entitled to compensation and reimbursement for the costs of medical care and rehabilitation. Those injured in an RTA can obtain additional compensation to adapt their homes or motor vehicles, pay for assistive equipment, and cover loss of income for the person with a permanent loss of work capacity. The maximum amount that a person can receive is N$1.5 million for medical care and rehabilitation services over the course of a lifetime.

Road crashes are reported to the Namibian police under the Road Traffic and Transportation Act 22 of 1999.[5] They collect information about the accident, the vehicles and people involved, the type of injuries suffered, and the area where the accident occurred. These forms are kept at the regional police offices, collected from these regions by National Road Safety Council (NRSC) staff and entered into a national database.

However, the official data used by the NRSC underreport injuries as they are based solely on police reports. The NRSC acknowledges this and reports a lack of consistent follow-up on people admitted to hospital with serious injuries. Deaths are considered RTA-related if the accident victim dies within 24 hours, but this system misses individuals who may die from their RTIs in the following days or weeks (NRSC 2015a). In the most recent reports (2015 and 2016), the NRSC applied a standardized 1.3 fatality adjustment factor to the number of deaths to try to account for the problem with the 24-hour limit. However, there is no clarification as to why this specific adjustment factor was used or how reliable it is.[6]

Access to the fund is initiated as soon as an individual with an RTI is brought to the hospital (the fund also pays for ambulance services where available). Once an RTI individual enters the hospital, the MVA Fund assigns a care manager to follow the injured person, coordinating and advocating for needed medical and rehabilitative support. Funding is also available for rehabilitation, and a study of RTIs one year post-injury found that most who needed rehabilitation were receiving it (Chatukuta et al. 2022b). A modest stipend is provided to meet the cost of living expenses, such as food, rent, and transportation. Money from the fund can also be used to pay for assistive technology such as wheelchairs, and to adapt a car or home

[5] The data used in this report are retrieved from the Road Safety Information Management System (RSIMS). The RSIMS provides data which are captured from the National Road Accident Form/ Pol.66 and Pol.24 and completed by the Namibian police for every reported crash.

[6] To put this into context, the 2016 NRSC report, which analyzed data for 2012, presented a total of 3,507 injuries and 382 deaths, with an injury rate of 162.5/105 population and death rate of 17.7/105 population (NRSC 2016b). In comparison, Chatukuta (2019), using more comprehensive data for that same year, found 6,444 injuries and 598 deaths were reported, with an injury rate of 285.2/105 population and a death rate of 26.5/105. Therefore, despite the 1.3 fatality adjustment, there is still a marked difference for the absolute number of deaths and death rates between the two data sets.

to improve accessibility (adding a ramp, making alternations to a kitchen or bathroom, and so on).

However, funding for adaptations has some constraints. Adaptations to homes are available only if the house is owned by the individual experiencing an RTI. These funds are restricted if they rent or live with parents or friends. Individuals who do not fulfill this requirement cannot access these funds, which adversely affects young adults who might not own their own homes. This is reflected in the limited number of people receiving these services. Indeed, between 2021 and 2023, only three people qualified for this benefit. Total funding is capped at N$1.5 million.

There is not a clear link between the MVA Fund and the disability grant scheme. Individuals are left to find their way to the scheme independently and there appear to be no formal links or processes that transfer individuals from one fund to the other in a systematic way.

Disability Grant Scheme

The Namibian government provides a grant to people born with or who acquire a disability. The grant is provided after individuals are assessed and the disability is certified by a doctor. While intended to be enough to live on, realistically, the N$1,600 per month grant (roughly US$87.38)—the same amount as the old age pension—would cover food or rent for only part of the month for most individuals as it is less than half of the Namibian poverty line amount.

South Africa

South Africa has a levy scheme set by the National Treasury for all road users as part of the gas price at the pump. This scheme is intended to cover the cost of accidents to drivers, passengers, and pedestrians. Some people also carry private insurance to cover damages to vehicles and injuries to drivers and passengers.

The South African system is more complicated than Namibia's as medical and rehabilitative care, wage reimbursement, and disability allowance support may follow several different pathways. If an accident occurs, the RAF will consider the case and cover medical and rehabilitative care (in addition to the free public health care service), but only for those who were not solely the cause of the accident. However, the person needs to send a request for compensation to the RAF, and only after an assessment of the claim will a decision be made on whether or not to provide compensation.

This process can take more than a year. In cases where a person was at fault or does not fulfill the criteria established by law, they are entitled to receive medical and rehabilitation services through private insurance (if they carry insurance) or the public health system, but will not be covered by the RAF.

The long and complicated process of applying for compensation is a major stress on most households, but potentially catastrophic for poorer people injured in RTAs. It can also take a significant toll on middle-class individuals.

If an individual is at fault but has no insurance or limited insurance, medical care may be provided by the national health system. South Africans have access to free public health care. However, individuals not covered by private insurance may be moved from higher quality, more expensive hospitals to lower quality, less expensive ones where the amount of care and

length of stays may be shorter but waiting times for rehabilitative care or assistive devices may be long.

Because there are several different pathways for those injured in RTAs, it is difficult to estimate the costs of medical care, rehabilitative care, and long-term disability in South Africa.

South Africans can access two types of income replacement schemes. With the first, any employed person losing their job can apply to the Unemployment Insurance Fund (UIF) as long as they or their employer has paid into the UIF. With the second, the RAF itself has a wage replacement scheme for those who have not caused the accident. This scheme favors those in formal employment positions, however, and is intended to replicate the individual's income prior to their RTA-related disability. This means that upper- and middle-class people are at an advantage, receiving more wage replacement.

People who qualify for neither scheme—those who were not employed prior to their accident or who have not paid into the UIF—can access the disability grant program as long as they meet the medical qualifications and the threshold of having no or minimal income. Individuals do not need to wait for the completion of medical or rehabilitative therapy to apply for the disability grant. It provides a minimum source of funding to cover medical assistive technology needs as well as basic income.

Poorer individuals, including the significant number of South Africans who work in informal employment, receive less, as do women who are homemakers. Individuals will be able to get general damage compensation as well as income loss, which depends on the percentage of capacity to work lost due to the accident. The compensation will depend on the medical evaluation and the amount will depend on the injury (RAF 2024). Those who are unemployed at the time of the accident may not be eligible or receive far less, even though the costs of living with a disability may be the same for them as wealthy individuals. Furthermore, these compensation mechanisms do not consider the level of needed assistance and how this is related to extra costs.

Insights from Road Traffic Safety and Disability Experts

In this study, we undertook semi-structured interviews with 13 experts in the fields of road traffic safety and disabilities from a range of international agencies, foundations, and research centers.[7]

These interviews revealed other important findings. Overall, road traffic safety experts reported that they and their organizations focused on deaths and injuries, but no group had focused on people or issues related to disability among those with RTIs. Once disabled, these people become largely invisible, and it was assumed they become a concern for disability organizations and government agencies.

[7] Interviews were conducted with representatives of the following organizations: the African Development Bank, the African Road Safety Observatory, the FIA Foundation, the Global Road Safety Facility, the Global Alliance of NGOs for Road Safety, Les Ambassadeurs de la Securite, the RAC Foundation, the Road Ethics Project, the Road HH Victims Trust; RoadPeace, People's Trust Jaipur, the International Road Assessment Programme, and the World Health Organization. Given the scope and time frame given to complete this report, we focused on interviewing experts in road safety and disability. In future studies, extensive interviews with people disabled through RTAs would be an important addition to the field.

At the same time, among disability experts and advocates, unlike polio support groups or the Deaf community, people with RTI-related disabilities are not conceptualized as a distinct group. They also do not typically come together to advocate on their own behalf, with few exceptions such as RoadPeace, the national charity for road crash victims in the United Kingdom, which collects and presents the voices of people injured in RTAs. Disability experts were asked if they could recall a project or initiative focusing on RTI-related disability at major disability meetings such as the Conference of States Parties. None could. Yet, as will be discussed in this section, those with RTA-related disabilities may have some specific needs and concerns that warrant attention.

Experts compared those with RTIs to other individuals with injuries or health problems with associated impairments. They are reported to be a highly unique group because unlike these other individuals, some of them had to contend with investigations, and, in many cases, were facing lawsuits or criminal charges while dealing with life changing injuries.

Several experts also reported that those injured in RTAs faced accident-related stigma and contended that the health sector has not engaged with RTIs in the same way it has for other major issues like HIV/AIDS, cancer, or tuberculosis. For example, several experts noted how health professionals have been strongly involved in campaigns for smoking cessation and fighting obesity but have been mostly silent when it comes to road safety.

One expert noted that campaigns were in place for men over 50 to prevent prostate cancer, yet could recall no major public campaigns targeted to young men between 18 and 30 who are more vulnerable to RTIs, which contributes to their lack of awareness.

Experts also reported that for other types of unintentional injuries, such as falls, the long-term impacts are better understood because there is a growing body of related research and data. They believe this is because it is easier to follow up on those with unintentional injuries as their numbers are smaller than the numbers of those injured in RTAs.

Additionally, the experts reported that individuals who become disabled as a result of RTIs frequently face a range of issues compared to those disabled through unintentional injuries. Several noted that due to the mechanical impact or force that occurs during RTAs, many of those with even minor physical injuries show higher rates of mental health problems. They attributed this both to high rates of TBI, which is estimated to occur in up to 80 percent of all those injured in serious motor vehicle accidents (Mitra et al. 2024), and factors such as PTSD and anxiety.

One expert interviewed underscored this observation as being a rationale for why medical and rehabilitative care should include psychological support as soon as possible. He noted:

I think of stroke survivors. It's a known entity, and there's a clearer pathway there … in road crashes I don’t think enough rehabilitation is delivered, and it isn’t delivered as soon as possible, even in HICs.

Another expert expanded on this point by noting that rehabilitation itself has often been overlooked in planning, advocacy, and research as well as in responses by major health bodies. One WHO expert stated;

…It is not only about the acute stage of injuries. We're trying to change the narrative there to really reflect that this is the postcrash response. In other words, it’s far more long-term than just the immediate acute phase of the crash and any sort of immediate stabilization of injuries, and a huge part of that does extend to the need for rehabilitation. Rehabilitation has to be seen as a crucial component of emergency medical services, and this was actually an

oversight the WHO made in its publication a few years ago that looked at the various stages of the postcrash response…We talked about definitive care, but indeed, mistakenly did not extend into the rehabilitation sites. So that's something that I think that we will slowly but surely get more traction.

In our interviews, we were interested in finding key reasons why there is a lack of prioritization of rehabilitation services for RTI management. Most of the experts interviewed concluded that the primary reason for this lack of attention has been due to a lack of awareness of the numbers and implications of living with a permanent disability.

In countries where there has been little or no research or data collection to prove the need, costs, and benefits of rehabilitation services for those injured in RTAs, funds are channeled to other health or social problems that already have clearly demonstrated associated cost benefits. In some cases, rehabilitation services and supports for those injured through RTAs have been cut and the funds redirected to other more clearly documented populations in need of rehabilitation. One such country is Namibia, where road safety funding was cut from 2020.

In Namibia, the government cut funding because the annual reports produced were severely underreporting RTIs and using only police data and not hospital information, which had the information on the injured and those dying in hospital.

It becomes a negative feedback cycle—the lack of data obscuring the extent of the problem, which leads to further justification for why rehabilitation funds are not made available for those injured in RTAs. As one expert stated, “We are only starting to scratch the surface in terms of long-term data on RTIs.”

Finally, the experts were asked about how data on long-term impacts of RTIs can be improved. They reported that fuel levy–type funds, such as those in Namibia and South Africa, can help to improve individualized long-term data on RTIs via case managers following up on each injured person needing care.

Certainly, some of these data are already being collected or could be collected. LMICs like Namibia and South Africa already have some long-term data on individualized RTIs and could collect longer-term profiles of injured people. This would enable them to produce more detailed financial reports to highlight costs associated with RTI-related disability, such as housing, transportation, support needs, and income replacement across the lifespan.

Unfortunately, most LMICs currently lack funds and do not collect extensive data on those injured in RTAs. Some countries do not collect or maintain mortality records, including records related to rates of RTAs. In addition, these figures are often underestimated as they are regularly based on police reports of death only occurring within 24 hours of an accident.

Such data collection difficulties in many LMICs is concerning as a disproportionate number of these countries lack funds and linked data collection mechanisms. Thus, there is often almost no useable data at all. As one expert working with the WHO stated, “There is a critical need for such data but also significant barriers in establishing how to fund and establish such efforts.”

Another expert interviewed suggested that one way of financing research, support funds, and rehabilitation initiatives could include an alcohol tax. This expert also highlighted how both political parties and the public often hold those injured at fault for dangerous driving practices. On the other hand, another expert noted that the primary purpose of funds for those injured in RTAs should be to help people, no matter what the cause of the accident might be.

Certainly, a consensus of the experts interviewed for this project is that there is currently little or no global or national focus on individuals injured in RTAs once they complete rehabilitation programs. In many cases, this group receives little attention as soon as they are released from hospital care. They are seen as the responsibility of the medical or rehabilitation fields, not as individuals with whom the road traffic safety field needs to be involved.

If this is true for those individuals transferred from hospitals to rehabilitation facilities—individuals still in recovery from an RTI—it is even more true for those disabled in an RTA. The responsibility for their health and well-being falls to local primary health programs, with little access to rehabilitative services or psychological or mental health programs. Not infrequently, they fall through the cracks entirely. In many other countries, particularly LMICs, those who have been disabled in RTAs are on no one's list of priorities. There are no government agencies or funds that respond to their needs or concerns.

In countries where people have access to national health systems, these individuals may receive some care in the immediate aftermath of an RTA. After that, however, they become part of the general disability community with little or no access to physical or psychological rehabilitation or economic support beyond whatever disability grant scheme is available.

There was a consensus among the experts interviewed for this study that a concerted rethinking is needed about those injured in RTAs. There is also a need for more funding and better data collection and analysis to more clearly identify and prioritize the needs of those who are permanently disabled in RTAs.

Calculating the Cost of Disability

The following model can assist in understanding the extra costs of disability and how the compensation mechanism may mitigate the impact of these costs. See figure 1.

Indirect costs relate primarily to lost income. RTI-related disability may lead to weeks or months of lost income before an individual can either return to their previous work or find a new job. It may also result in a permanent loss of employment or earning power either because the individual is unable to return to work because of their injuries or because available workplaces are now inaccessible. Overall, a household is likely to have a reduced income because of an RTI-related disability among one of their household members. However, RTA survivors may gain income support either through the RAF's income compensation program, an insurance payout, or a disability grant if they do not qualify for the other support programs. This may help financially, but often not replace all lost income.

On a household level, a person with a disability may require care and support, which reduces the caregiving family member's ability to earn an income. This can impose extra constraints on the household because not all costs for therapy, assistive technology, healthcare, transport, home adaptations, assistance, and support are carried by public health care or insurance coverage. Many of these costs are borne by the households of those disabled in RTAs. Even if they are covered, the household income is reduced due to out-of-pocket costs). Taxpayers may be able to write off some of these costs through their tax return; however, this only applies to people who pay taxes and to tax-deductible expenses.

Analysis of the South African system revealed that these out-of-pocket costs are often not covered. In these cases, people with disabilities and their households often have to prioritize what they can and cannot afford, making decisions between using a minimum amount of the fund payout to cover costs that provide goods and services to ensure survival (for example,

medical costs and rehabilitation), those that are not critical to survival but speak to improved quality of life (for example, improving accessibility in the home), and those that allow them to actively participate in the environment around them (for example, transportation to attend family and community events, better their education, or receive training in a skill or trade) and have a voice in their communities (Hanass-Hancock et al. 2021).

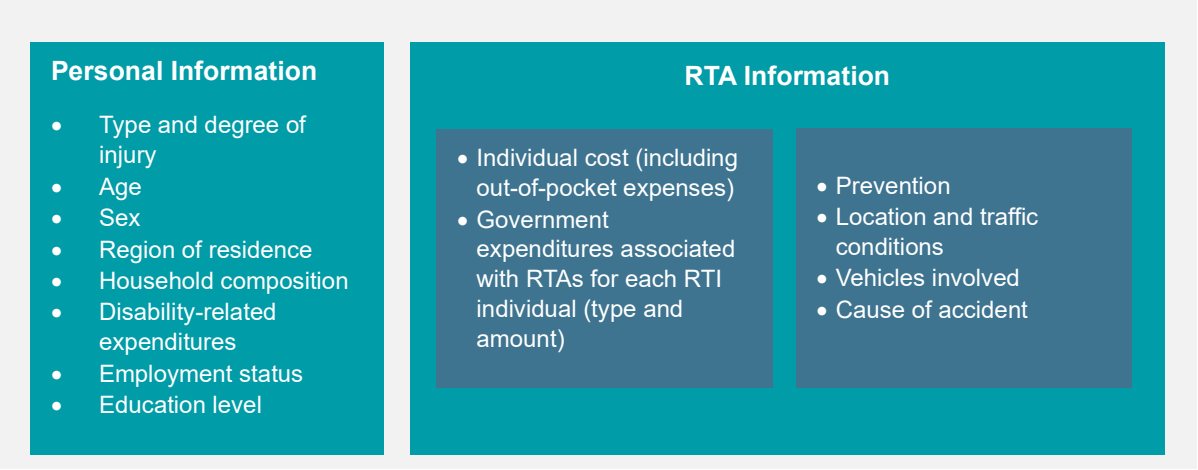
Proposed Methodology to Estimate Costs

Unfortunately, the data needed to accurately estimate the full cost of living with an RTI-related disability are not available. However, the data that are available can provide some insight into the scale of these costs. In the following section, we propose a methodology through which costs of RTA-related disabilities can be calculated and then go on to provide what can, at this point, be said regarding available results.

In estimating the costs of RTAs, it is important to separate the direct costs necessitated by the accident and subsequent functional limitations from the indirect costs of foregone income stemming from work limitations. Both costs are important and can be significant, but addressing them often focuses on different policy responses. This paper concentrates on the former.

These expenditures can be made by households, government programs, or even charities. To calculate the actual direct costs and to further assess the economic returns of various road safety efforts, it is best to use microdata from each person experiencing an RTA with the information shown in figure 2.

Figure 1. ***Calculating the Costs of Disability***



Source: Based on data collected for this study. World Bank 2024.

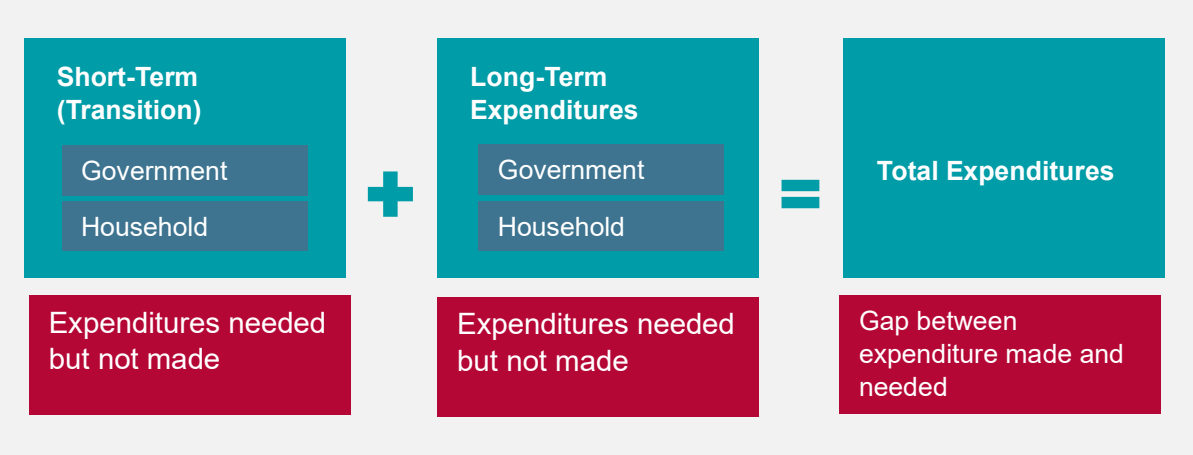
Personal information, beyond type and degree of disability, is important for several reasons. Age can help estimate the length of time these costs will be incurred. The region and area of residence will provide rough information on access to services, and sex and household composition may be correlated with the type of expectations and supports available within the household. Information about the injury will be associated with the type and amount of goods and services required to ensure equal participation.

Information about the nature of the accident can be helpful in assessing the impact of various interventions to promote road safety and prevent accidents causing disability. For example,

investments in highway safety will presumably not have an impact on accidents occurring between cars and bicycles within the city limits. We will not focus on the potential savings of various road traffic safety interventions, but those data are clearly important for any cost/benefit analysis of policy interventions.

Our focus will be on the disability costs associated with the total number of accidents per calendar year. There are two ways to consider those costs. The first is to evaluate the total expenditures associated with the accident. These include those experiencing short-term "transition costs" associated with the immediate treatment of the injuries sustained (including rehabilitation) and those whose accidents occurred earlier and are incurring the long-term costs associated with a permanent disability. However, looking only at the expenditures currently may not represent the goods and services required to restore the participation levels of the person experiencing an RTA-related disability, leading to a lower quality of life. To assess the cost of fully accounting for the injury, the costs of those unmet needs must be included (figure 2).

Figure 2. ***Breakdown of Expenditures Associated with Disability Caused by Road Traffic Accidents***



Source: Based on data collected for this study. World Bank 2024.

Moreover, the degree to which short-term expenditures are covered will impact long-term expenditures. Appropriate goods and services in response to an injury could lessen the degree of functional difficulty experienced in the long term, lowering these costs. That, also, is beyond the scope of this paper, but needs to be considered when weighing policy options about RTA responses. To what extent will fully addressing the short-term needs of people experiencing RTA-related disabilities impact the government and household expenditures, as well as any unmet needs?

The more limited goal of this paper is to estimate the costs to governments and households each year from those having experienced RTA-related disabilities. Because costs are highly associated with the type and degree of disability, doing that requires microdata—that is, information on each person and the nature of their disability. Unfortunately, those data were unavailable, but this section will still describe what could be accomplished with full microdata, and the next section will provide rough estimates based on the data that were provided.

Short-term costs—six months is the length of time considered short-term in the Namibian and South African programs—consist of government expenditures and household expenditures.

However, not all those experiencing RTA-related disabilities, even controlling for the same injuries, receive benefits. This may be because of the nature of the accident or the spending caps incorporated into the program. We can sum over each person experiencing an accident that year to get total short-term expenditures (*ES*) equal to:

$$ES = \sum_{i=1}^{A} (GS(a,d) + HS(GS,x,d))$$

Government short-term benefits (*GS*) are summed over all the accidents (*A*) occurring in that year, and are dependent on the characteristics of the accident (a_i, its coverage under the program, whether sufficient funds existed at the time of the accident, and so on) and the type of the disability (d_i), for example, spinal cord injuries, TBI, or blindness. The household's short-run expenditures (*HS*) depend on what the government provides, the household characteristics (x_i) and d_i. Included in those characteristics would be the private insurance coverage they may have.

Government data may not include information on accidents not covered by the health system. In that case, the data would have to come from households, as would data on additional expenditures they made (*HS*) beyond what the government provided.

Long-term expenditures for this year (*EL*) are summed over all the people from previous accidents still living (*P*). Notice that households' long-term spending is a function of the funding they received in the short term, which could have influenced the nature of long-term costs.

$$EL = \sum_{t=1}^{T} \sum_{i=1}^{P} (GL(a,d) + HL(ES,x,d))$$

To get this year's average expenditures for people with disabilities from RTAs, one only needs to sum the total long- and short-term expenses and divide by the number of people in each category.

$$Average\ expenses = (ES + EL)/(A + P)$$

Government records, of course, only provide us (*GS*+*GL*)/(*A*+*P*). To get the full amount of spending requires a household survey. However, that part of total expenses is not currently available. Moreover, average expenses hide the great variability in costs that might be associated with different types of injuries.

Indeed, studies estimating goods and services required (*GSR*) for equal participation demonstrate the vast differences in required expenditures by type and degree of disability. It is important to estimate those required costs to understand how well government benefits are meeting the needs of people with disabilities. Those estimates only consider the ongoing long-term costs. Using averages of what is being spent would not tell us what percentage of people with disabilities are not getting their needs met.

If one were to estimate the long-term *GSR* by disability type (*T*), (Mont et al, 2023) people with disability type *T*, one could then use data to compute the gap in needed spending in the population of people with that disability.

$$Gap = \sum_{i=1}^{J} GSR(T) - (GL(a,T) + HL(ES,x,T))$$

Again, *GSR(T)* requires a special study. *GL* (government long-term benefits) requires administrative data, and *HL* (household's long-run expenditures) requires data from a household survey.

Of course, this only looks at the direct expenditures and the gap in direct expenditures needed. It does not address the indirect costs of lost income because of a disability. That would require the analysis of household survey data, where one would estimate the impact of disability of a household member on that person's earnings and on any other household member(s) who might have to limit their earnings to provide support.

Results

Namibia

The data from Namibia, provided by the MVA Fund, reveals that from 2021 to 2023, 1,010 individuals sustained injuries from road crashes. Notably, 40 percent of these were women and 60 percent were men. This gender distribution provides a clear picture of the demographics of the affected population. Regarding the services provided, 541 individuals received orthopedics, 433 received medication, and 249 received physiotherapy. Interestingly, individuals received orthopedic services a higher number of times on average (eight per accident victim), followed by physiotherapy (five on average).

On a per-service basis, the requested service with the highest cost was step-down facilities (care facilities), with two individuals requesting this service and an average cost per case equal to N$105,324 (approximately US$5,800). Sixteen individuals requested house modification (builders, plumbers, and electricians) with an average cost of N$79,508 (US$4,380). The highest cost reported by the MVA Fund was the one spent on private hospitals—more than N$20 million (approximated US$1.1 million), with 333 individuals receiving this service. The total amount of money paid by the fund was N$43 million (approximately US$2.3 million), with the largest overall spending being on private hospitals, representing more than 50 percent of total costs.

Of the 110 individuals who claimed a loss of income, 24 percent were between 31 and 35 years. Notably, only one person older than 70 and one younger than 20 claimed the loss of income grant. Although only 11 individuals claimed the loss of income grant, the amount provided was the highest, with an average of N$51,753 (approximately US$2,850). In contrast, individuals between 21 and 25 years received an average of N$5,944 in 2023 (approximately US$327).

According to the data provided by the MVA Fund, four houses were built in 2023 after the RTAs. The cost of the houses was N$150,125 (approximately US$8,271), with an average cost of N$30,025.13 per household that receive the benefit. (approximately US$1,600). Based on the cost, these may have been modifications rather than new buildings.

Without microdata, we cannot report on total costs on a case-by-case basis. However, we can construct case studies that indicate expected costs. The following case is based on the assumed services from a severe trauma incident and suggests an upper bound of what a person might receive.

Case 1: Higher Bound

A severe trauma incident requires receiving services from private hospitals, surgeries, and step-down facilities. We are going to assume that medical and rehabilitative treatment includes the following costs:

Table 1. ***Potential Costs for Trauma Services Following a Road Traffic Accident***

Service	Average costs (N$)
Step-down facilities – Acute	105,324.00
Private hospitals	61,541.25
Orthodontics	43,994.19
Clinical services	32,390.43
Maxillo-facial and oral surgery	15,186.21
Orthotist or prosthetist supplier	13,823.45
Plastic and reconstructive surgery	11,268.74
Ambulance services	8,135.21
Neurosurgery	7,663.42
Orthopedics	6,168.10
Diagnostic radiology or nuclear medicine	6,017.80
Neurology	5,751.85
Biokinetics	5,731.59
Pharmacies	5,686.56
Speech therapy or audiology	5,627.84
Physiotherapy	5,391.25
Occupational therapy	4,882.30
Housing adaptation	30,025.13
Total	**374,609.32**

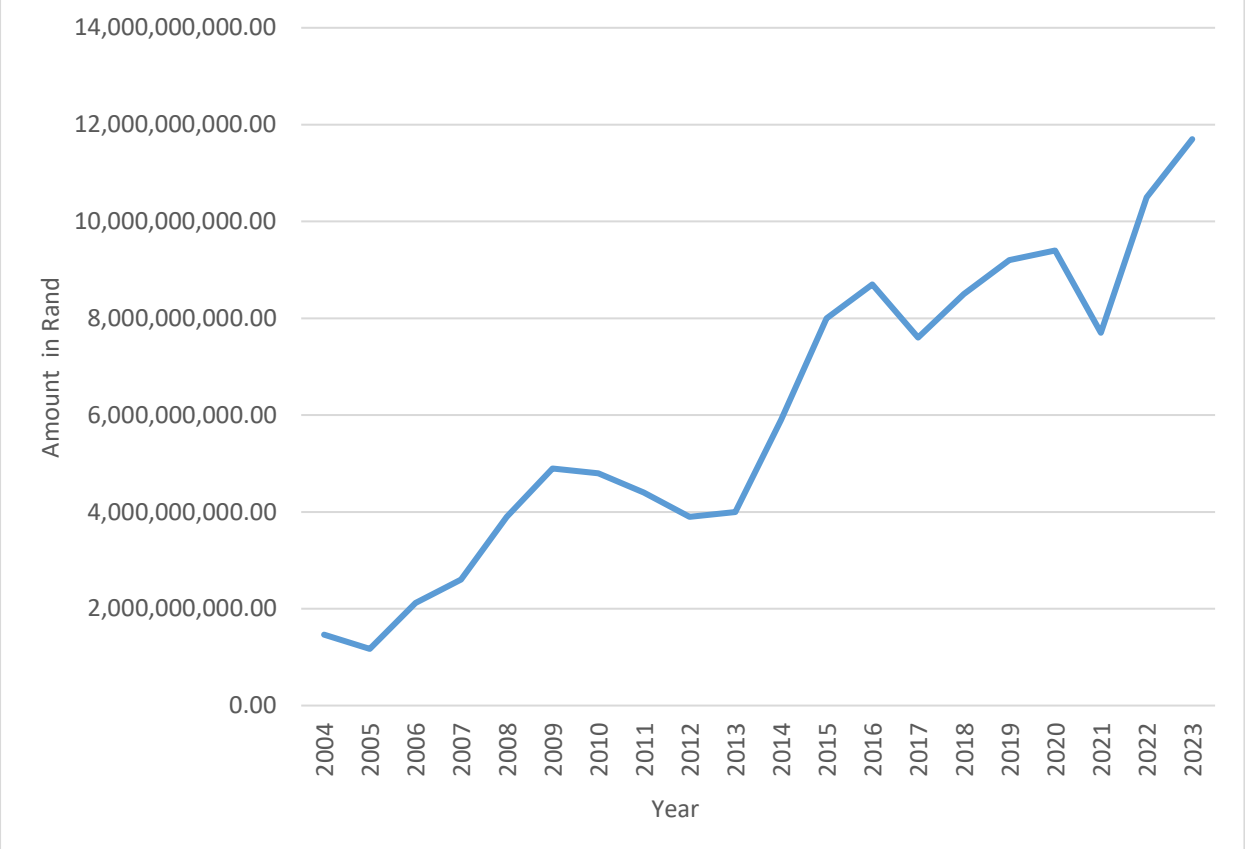
Source: World Bank 2024.

The total amount, not including additional disability costs, is N$374,609,32 (approximately US$20,000). A person will face additional costs related to a physical disability. According to the Department of Social Development of the Republic of South Africa (2015), the average monthly cost for a person who needs partial support is N$2,710 per month (approximately US$150). Therefore, it is expected that the total monthly cost to a person disabled because of an RTA will be more than N$40,000 (approximately US$2,202 US Dollars), but the amount may be higher depending on the types and amount of services and support needed.

South Africa

In South Africa's case, the available data only allow the analysis of the total amount paid on general damages grants and loss of earning grants per year. In general, there has been an increase in the total amount spent on the general damages grant since 2004 (figure 3). On average, over the last 10 years, the RAF has paid more than R 6,000 million per year, with the highest amount paid in general damages (more than R 11,000 million per year) disbursed in 2023.

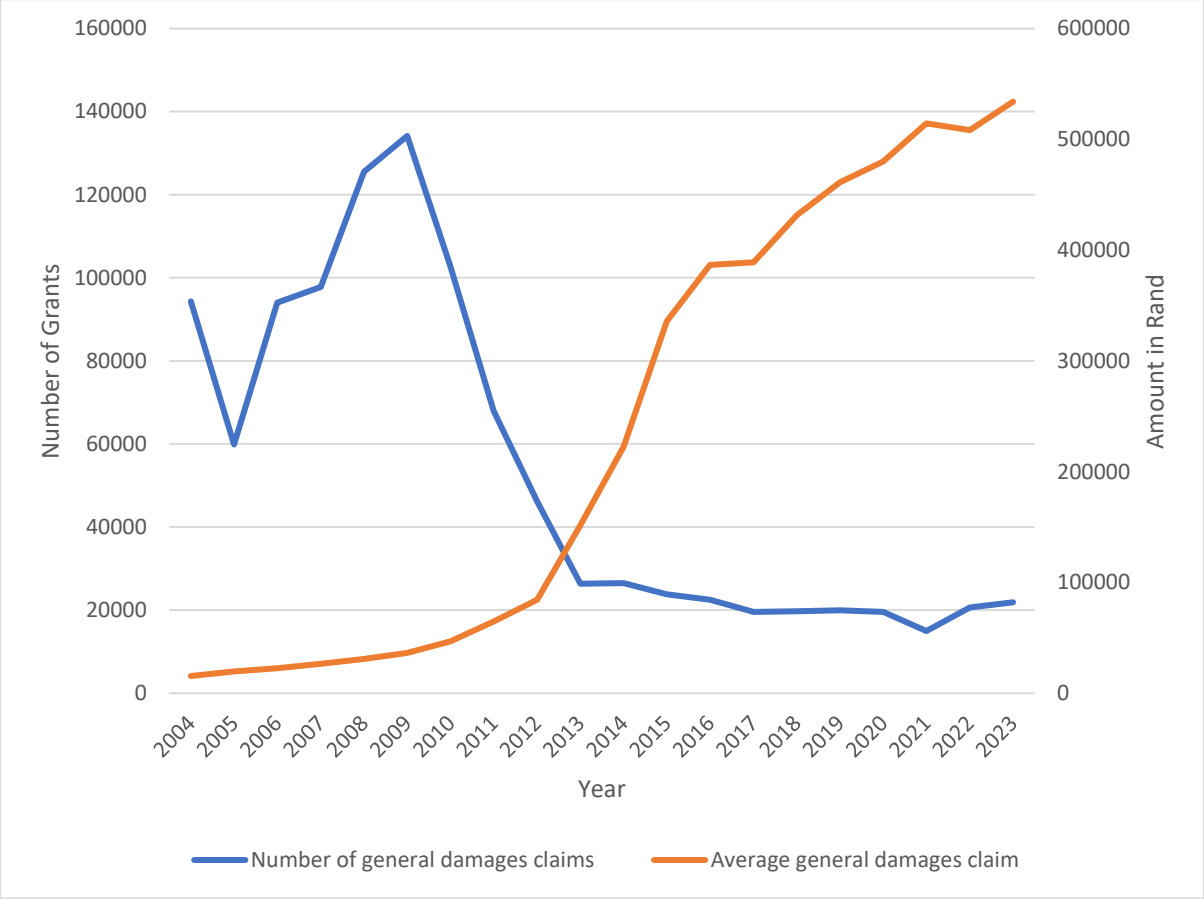
Figure 3. ***Amount Used in General Damage Grants (In South African Rand)***



Source: Compiled using data from South Africa Traffic Accident Fund. World Bank 2024.

The total amount of general damages grants has reduced over time, with an annual average of 52,000 grants per year. However, as shown in figure 4, the number of grants per year has decreased, but the average amount each person receives has increased.

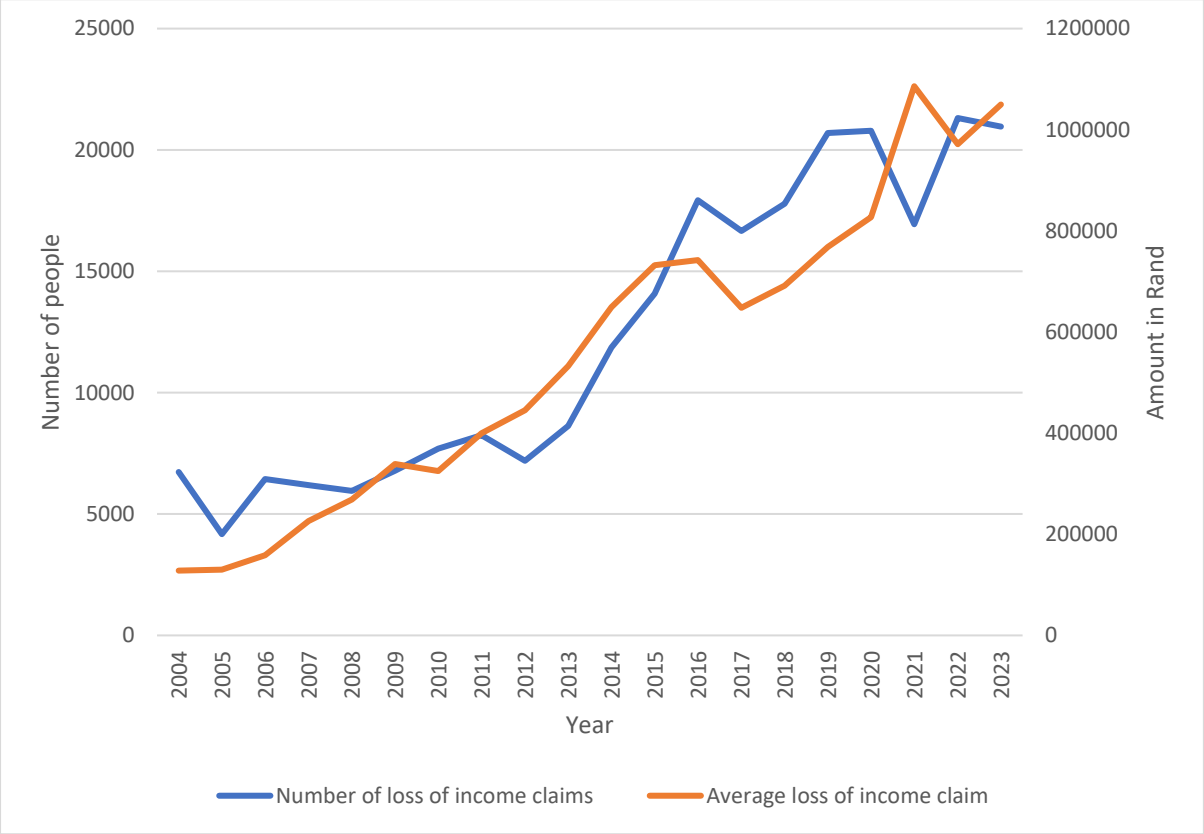
Figure 4. ***Number of General Damages Grants with the Average Amount (in Rand) Paid per Year***



Source: Compiled using data from South Africa Traffic Accident Fund. World Bank 2024.

In the case of income loss, the total amount spent on this grant has significantly increased over the last two decades (both the average amount disbursed and the number of claims). Indeed, in 2003, 6,730 individuals received the loss of income grant, compared with 20,957 in 2023. The amount received was R 128,117 in 2003 and R 1,069,769 in 2023 (figure 5). It is important to highlight that, compared with the general damages grant, the loss of income grant has a lower coverage, but it pays a higher amount.

Figure 5. ***Number of People and Average Amount (in Rand) Received in the Loss of Income Grant per Year***



Source: Compiled using data from South Africa Traffic Accident Fund. World Bank 2024.

In both Namibia and South Africa, disability allowance or motor vehicle allowance is provided up until the age of 60, at which point the recipient is transferred to the old age pension systems.

Discussion

What are the lifetime costs and consequences of living with an RTA-related disability? Using existing literature, quantitative data from Namibia and South Africa, and in-depth interviews with road traffic safety and disability experts, can we begin to conceptualize the issues involved and how to move forward with policy, programming, and research?

The medical and rehabilitation costs alone are daunting. Acquiring a disability in an RTA and then living with a disability for a lifetime can be expensive. The need for medical and rehabilitative care often continues indefinitely, or appears intermittently, often with new complications as individuals age.

Depending on the type and severity of disability, there will be a host of medical and rehabilitation expenses in the weeks, months, and often years following an RTI. In addition, loss of income will compound the economic impact on individuals and families, and there will be a host of out-of-pocket expenses during and after hospitalization (food, hotel, parking, child care, and so on).

The range of costs include one-time large expenses like retrofitting a house for accessibility. Others will be occasional but regular costs, for example, for medical equipment such as wheelchairs, hearing aids, or the purchase of a modified vehicle.

There are also smaller, routine costs for disability-associated goods (for example, pads and cushions) and carers to help with some activities of daily living, and there are many costs that are not related to health care. Daily costs for things like paying someone to deliver groceries, carry water from the well, or collect firewood can quickly add up. A review by Mitra et al. (2017) concluded that living with a disability may add an extra 30 percent to the individual's personal and household budget. However, this is on average; for some families, the costs can be significantly higher.

These costs can be divided into direct (additional out-of-pocket) expenses and indirect costs (foregone income), such as the income the individual or household could have earned if they were able to remain employed or to attend school (Palmer et al. 2015).

Based on a series of focus group discussions with people with a range of disabilities, Hanass-Hancock et al. (2017a; 2017b) rank these costs in a linked hierarchical manner:

- Providing care and support for survival and safety.
- Accessing essential services (medical, transportation, or assistance with activities of daily living.
- Participating in home life and community activities.

This study revealed that in the absence of state support, households must prioritize what disability related costs they cover and decide which ones they are unable to cover. Often, care and support for survival and safety are prioritized and little money is left over to ensure appropriate access to essential social, medical, and transportation services. Even less is available to spend on participation on an equal basis with others in the community.

It is likely that these findings also apply to people with RTA-related disabilities. While most of the limited amount of research, policies, and programs on these individuals are discussed in terms of the economic impacts, there are wider implications of increased expenses and income loss. Individuals permanently disabled in RTAs will often also face significant barriers to participation in the social, political, and civic lives of their families and communities.

Because of these costs, disability can create a cycle of poverty. RTA-related disability can also result in an opportunity cost, such as the loss of education and employment, with profound impact not only on individuals but households. It can deprive an individual of the ability to achieve goals and result in dependence on others for economic support, routine physical care, and a decline in mental well-being.

The initial shock for medical costs, longer-term rehabilitation, and permanent costs of living with a disability result in a considerable loss of income not only for the individual but for family members who need to take time off work or leave employment altogether to provide care. RTA-related disability may also have an intergenerational impact as children miss or leave school to care for disabled family members, or families sell houses, land, or other valuables to pay for care and support over time.

Extrapolating to a Global Level: RTIs As a Major Cause of Disability

The old saying, "If it's not counted, it doesn't count" is never more true than with RTIs and disability.

In this study, we have identified a conceptual gap in understanding the pathway from RTA-related injury to disability. The lack of "joined-up" thinking at many critical junctures in the intersections between RTAs and disability is striking and represents a lost opportunity to more systematically approach and provide needed care and support for this population.

As part of this study, we set out to see if we could identify reports that estimated prevalence rates on the number of people with RTIs who suffer long-term or permanent disability. Interestingly, we found only 19 such studies.[8] Extrapolating from these studies to arrive at an accurate global prevalence rate is problematic because they use widely different methodologies, sample sizes, and time periods after the accident, and there are additional complications reflected in these statistics. For example, RTA-related disability rates in LMICs may be higher due to poor emergency medical, clinical, and rehabilitative services. Disability rates in HICs may also be high but for a different reason: better ambulance services, emergency room care, medical, and rehabilitative systems may enable more individuals to survive RTAs, but with a disability.

Table 2. ***Road Traffic Injury-Related Disability Prevalence Rates***

Country	Type of study	Length of time after injury	Sample size	Percentage disabled
Namibia	National Household and Expenditures Survey 2015–2016	Permanent disability	Self-reported cause of disability and people with disability surveyed	4.1%
India	National study	Permanent disability	Population-based study: 1,300,000	10%
Bangladesh, Cambodia, Ethiopia, Mexico, Ukraine and Zambia	World Bank and George Washington University six-country study	Six months (continuing limitations in activity or return to work)	Sample of hospital or rehabilitation RTIs: 4,000	56%
Saudi Arabia	Alghnam et al. 2022, quoting *Saudi Gazette*	All patients 17 years or older hospitalized at King Abdulaziz Medical City, Riyadh, following RTIs and required rehabilitation care	299	7%
Multicounty study of adolescents	Symonds et al. 2019	Permanent disability data on deaths and injuries by age, gender, and accident type for 75 countries—a modelling framework	No numbers given	4.1%
Nigeria	Juillard et al. 2010	Study of 3,082 RTI subjects in seven Nigerian states	127	30%

[8] There may be additional studies that we have missed, but it is fair to say that the number of such studies appears to be extremely limited.

China	Lin et al. 2013	Permanent disability	A weighted total of 1.5 million Chinese with RTA-related disabilities was identified, This was the number of people identified as being disabled in RTAs	Prevalence of 1.12 (95% CI: 1.07–1.17) per 1,000
Malaysia	Nik Hisamuddin et al. 2016	Discharged from district hospital	439 cases	48%
Ethiopia	Denu et al. 2021b	Discharged from hospital	Systematic review of 26 studies of RTAs for the prevalence of RTIs (n=37 424)	25–88%
India	Gururaj et al. 2005 and 2008	Review of a series of hospital-based studies	Total of 2,710,019 accidental deaths; related rate of injury and/or disability unspecified	20–40%
Rwanda	Allen et al. 2024a; and 2024b	Unable to return to work, restrictions on activities of daily living	National police	35.6%
France	Hours et al. 2010	At six-month follow up	ESPARR cohort (1,168 RTAs ages 16 and above in hospitals in the Rhône Administrative Department[9]	55%
Netherlands	Weijermas et al. 2016	National study	2009 estimate of years living with a disability compared to years of life lost	20%

Source: World Bank 2024

The reported rates in the literature reviewed here range widely. On one end, 4.1 percent of all people with disabilities asked to identify the cause of their disability in the Namibian National Household and Expenditures Survey 2015–2016 and on the other, a small, hospital-based

[9] ESPARR = Étude de Suivi d'une Population d'Accidentés de la Route dans le Rhône; RTA = road traffic accident; RTI = road traffic injury.

study from Ethiopia reported that up to 88 percent of those leaving the facility after an RTI still have significant impairment.

Comparable difficulty in estimating a prevalence rate was reported more than a decade ago in the "World Report on Disability" (WHO 2011), where the authors concluded that data on the magnitude of motor vehicle accidents on global disability rates were "very limited," with surveillance focusing on near-term and acute injuries. The number of people disabled because of these crashes, the report states, "is not well documented."

As with our study, Ameratunga et al. (2004), in a systematic review of the risk of disability among motor vehicle drivers, reported prevalence rates from 2 percent to 87 percent and came to the same conclusion that the great variability is attributable to methodological differences. The Global Status Report on Road Safety (WHO 2013), attempting to establish a global disability prevalence rate for those injured in RTAs, also found that these figures ranged widely based on reporting practices and methodological differences, from lower than 1 percent in some countries, such as Croatia, Mexico, and the Russian Federation, to as high as 25 percent in Poland. The study concluded that around 5 percent overall (or 1 in 20) of those injured were left with a permanent disability. The only conclusion that we can draw from a review of the literature is that currently, lack of data is a further impediment in our ability to view the links between RTIs and disability in a wholistic fashion, either nationally or globally. It interferes with the ability of global health experts, road safety advocates, and national governments to conceptualize, discuss, and address the needs of this population.

In addition to the current methodologies being used, alternative ways of measurement and data gathering should be considered and discussed. Health surveys, censuses, and household surveys are conducted in most countries. There are a number of national surveys of disabled populations. Many of these data collection efforts now use the Washington Group on Disability Statistics' Short or Extended Set of Questions, a very cost-effective addition to data collection instruments that allows national and cross-country comparisons. (Washington Group 2019). Low-cost options for digital surveys of disabled populations, hospitals, and rehabilitation programs could also be considered.

At this point, the one conclusion that we can draw is that even if the lowest estimate of permanent disability following an RTI (4.1 percent) is used, millions of people worldwide are living with an RTA-related disability.

Creating a "Joined–Up" Reimbursement System Supported by a Unified System of Data Collection and Analysis

There is a need to link the data systems and qualitative information used by police and emergency services, hospital and rehabilitation systems, insurance schemes, pension plans, and nonprofit and for-profit organizations that provide community support, services, and advocacy to people with RTA-related disabilities that could allow us to better understand their expenses, experiences, and needs from the point of injury through old age.

Although we reviewed literature on Namibia or South Africa and interviewed road safety experts, we did not find any countries or programs where administrative oversight or data collection was linked from the point of injury through to living long-term with a disability. There seems to be gaps at every point of transition, largely because becoming disabled in an RTA is not conceptualized as a unified experience. It is addressed as a series of discrete events: an accident under the auspices of police and ambulance services, hospitalization, and rehabilitation through the health care system, and then living with a disability under the

auspices of disability grant schemes and administrative systems. However, for the individual involved, it is all part of the same journey.

There are often gaps for individuals with RTA-related disabilities between hospital and rehabilitative care, including poor referral systems, postdischarge planning and communication with patients, transition from hospital to rehabilitation services, and from rehabilitation services to their home communities. This often leads to long waiting lists, discontinuation of, or lack of rehabilitation treatment altogether, and a concomitant creation or intensification of disability. [10]

The issue of gaps continues after rehabilitation ends and motor vehicle funds or insurance schemes run out. Transition from rehabilitation to funds that support those disabled in RTIS is rarely automatic.

In each of these stages, rigid assessment rules and complex application systems also means that many people may drop out or find themselves ineligible for further support. This does not mean they do not need support, only that they do not receive it, compounding poverty issues for many people with RTI-related disabilities.

While both men and women are affected, studies suggest that women were more likely to have limited access to posthospital care, including rehabilitation, assistive technology, and mental health services, because of their inability to take time from household responsibilities and because their rehabilitative needs are not considered a priority in household budgets (Hartmann et al. 2022)

When do those who are permanently disabled in RTAs make the transition, both administratively and socially, from being under the auspices of motor vehicle accident funds into a disability pension scheme, and when are they considered part of the broader disabled community? There are often large gaps that need to be addressed.

Neither Namibia nor South Africa has a centralized data source or social service system that follows individuals from the point of injury to growing old with an RTA-related disability. Also, in both countries, once an individual is no longer eligible for the motor vehicle accident funds, he or she will have to register for and being accepted by the disability grant scheme, which takes time and can be complicated, particularly for people who are not knowledgeable about the system or who have limited literacy skills.

Some report that there may be a gap of up to two years between when someone is injured in an accident and when they begin to receive support through the grant, and the complexities of qualifying for disability allowance may be enough to cause some people to drop out of the system altogether. This does not mean that they do not need a disability grant, only that they may not get it. After this transition, people disabled in RTAs become part of the general disability community, although, as noted earlier, they may have specific concerns or needs that should be addressed.

[10] Following are some examples: In Brazil, see Deslandes et al. 2006; de Lima et al. 2010; de Lima et al. 2012; Sousa et al. 2017a; Ribeiro and Barter 2010; and de Santas Sexel et al. 2024. In Namibia, see Chatukuta 2022a and 2022b; Ashipala and Langerdorph 2022; and Sumba and Moodley 2018. In Ghana, see Tinney et al. 2007 and Christian et al. 2011. In Madagascar, see Locke et al. 2021, and in Pakistan, see Barki et al. 2023. In Bangladesh, Uddin et al. (2022) found that not even the National Trauma Institute. had enough faculties and staff to adequately meet the needs of patients sent there after traumatic injuries.

Pulling Together Road Safety and Disability: Data and Insights

A critical finding of this study is that far more research is needed to understand the scope of RTI-related disabilities as a major and currently overlooked concern in international health and global disability.

Creating successful policies to prevent RTIs and manage their impacts requires strong, evidence-based knowledge. This includes data on factors contributing to RTIs, the nature of injuries sustained, and posttreatment factors influencing the duration and severity of disabilities (Mitra et al. 2023). This lack of accurate and reliable data is of additional concern beyond the individual because knowledge of the long-term consequences of road injuries is critical in facilitating the design of appropriate strategies and institutional responses to assist those injured (Nhac-Vu et al. 2014; Tournier et al. 2014).

More research is certainly important, but in this case, it is not just a question of more but of making better use of existing research. Most countries collect data on RTA-related death and injury rates, although in many LMICs, underreporting and poor record keeping on RTAs are serious problems (WHO 2013, 2018, and 2023; Chatukuta et al. 2022a; 2022b).

A growing number of countries now maintain increasingly accurate data on people living with disabilities (Washington Group 2019. However, data specifically on those with permanent RTA-related disabilities are rarely collected. They are not conceptualized or discussed as a component of road traffic safety efforts, nor are they part of the global disability discourse.

As noted in the literature review, while national and global data specifically on people with RTA-related disabilities is limited, a large number of studies and data sets do exist, although not explicitly labeled for disability. These studies and data sets look at injuries or unintentional injuries. People with RTA-related disabilities may be part of these numbers but are not specifically identified as such. For example, in the United Kingdom, a number of significant reports (for example, Gebbe et al. 2015 and 2017; Lyons et al. 2011) clearly find that RTIs constitute a significant number of all unintentional injuries, but do not identify these numbers within their larger statistical analysis. This further obscures the toll that RTIs are taking on societies and means that the numbers and needs of those permanently disabled because of RTIs are often not compiled as a group distinct from the larger category of all injuries.

Estimating the number of people living with RTA-related disabilities can also call upon several different methods. Different approaches are used to compute DALYs and disability prevalence after an RTI. DALYs use a wholly medical definition of disability, while the WHO definition, used for this report, focuses on how people with an impairment function within the surrounding environment. Both sources of information are important, but they differ as to how data are collected and the assumptions underlying these perceptions.

RTIs in global disability research receives insufficient attention. Where RTIs are given attention, the subject is often folded into larger discussions regarding injury prevention. See, for example, the “WHO/World Bank World Report on Disability” (2011) and the WHO Global Report on Health Equities for Persons with Disabilities (2002).

Bringing together research in the fields of road traffic safety and disability not only provides greater insight but can also generate new questions and perspectives. Box 1 presents an example based on linking the issues of poverty, road traffic accidents, and disability.

Box 1: An Example of Combining Road Traffic Accidents and Disability Issues

Two relevant but rarely related bodies of data exist on poverty in the road traffic safety and disability literature. One is the increased risk of RTAs among the poor. The other is the negative feedback loop between poverty and disability.

While anyone can be involved in an RTA, in both HIC and LMIC's, a large body of research now clearly shows that accidents follow one of the steepest curves of all health inequities. Poorer people are more likely to drive or be passengers in crowded, unsafe vehicles. They are also more likely to walk, use bicycles, and drive motorbikes—modes of transportation that increase the severity of injury if an accident occurs (WHO 2018). They are also less likely to have insurance, although they are eligible for national health care in a number of countries.

Once in a medical facility, they may be unable to afford all the needed care, elect to be discharged early, and refuse (or be refused) rehabilitation service. In some countries, including in most of Sub-Saharan Africa, public health systems may provide care after an accident, but this care may be of lower quality or have more limited services.

Poverty and lower socioeconomic status; difficulty understanding how to navigate government, insurance, or nonprofit systems; lack of basic literacy skills; and lack of access to computers or smartphones to apply for services may further limit their ability to access the needed care and support from motor vehicle accident funds or government disability allowance schemes.

Poor individuals are also more likely to have jobs in the informal employment sector that have little or no insurance and depend on physical ability or manual labour—jobs to which they may be unable to return. They are also more likely to have limited assets to cover out-of-pocket expenses.

The disability literature has a substantial body of research on the negative feedback loop between poverty and disability. We already know that people with disabilities are at increased risk for multidimensional poverty (Banks and Polack 2013; Banks et al. 2021; Groce et al. 2011; Hanass-Hancock et al 2017a; International Labour Office 2009; Mitra et al. 2009; Mitra et al 2013; Pinilla-Roncancio and Alkire 2021).

For poor people with RTA-related disabilities, their preexisting poverty, lack of education, and unfamiliarity with strategies for living with a disability may compound the challenges they face as recently disabled individuals. It may also make them less likely to utilize whatever services or advocacy initiatives are available or to engage with disability advocacy and support organizations.

The unique combination of barriers faced by this group may make them a distinct subgroup within the disability community, harder to reach and potentially poorer, being largely invisible to those working in disability services and advocacy.

Note: HIC = high-income country; LMIC = low- and middle income country; RTA = road traffic accident; RTI = road traffic injury.

People with RTI-Related Disabilities Share Common Concerns

People disabled by RTIs are rarely thought of or addressed collectively. They also do not come together to provide a unified voice concerning their interests, needs, or concerns in the same way that other populations like the Deaf community or people disabled by polio do.

Road traffic safety experts, researchers, and advocates focus on preventing road traffic deaths and injuries, but we could find few groups that considered people disabled in RTAs as a part of their constituency. Once disabled, for many road safety organizations, such individuals become invisible. Their numbers are not routinely assessed or followed once they leave the realm of RTIs and enter the realm of people with disabilities.

A comparable gap is currently found in the disability community. People permanently disabled due to RTIs are rarely considered a distinct group within disability circles. While they may be active in Organizations of Persons with Disabilities (OPDs), they do not collectively identify as a unique group.[11] While they may share and benefit from participation as members of the wider disability community, as a group, people disabled by RTAs are not a prominent presence in local or global disability realms.

Support of Road Safety Initiatives

As the WHO's Global Status Report on Road Safety (2023) shows, almost all countries now have an established body of laws and policies on road safety built on decades of improvement in motor vehicle and road design, traffic laws, and public awareness campaigns. However, the WHO report also shows that, particularly in many LMICs, these laws and policies are rarely fully enforced. This lack of enforcement is often justified by the argument that local and national governments do not have enough funding for such police, courts, and public awareness campaigns.

Some authors have already argued that if funds and resources spent on RTA-related medical care and rehabilitation were redirected to improve road traffic safety, a significant number of RTAs would be avoided in the first place (for example, Alghman et al. 2022; Mitra et al. 2023; World Bank India Report 2021). We support this argument and also believe that the financial burden of living with a preventable disability over the course of a lifetime—currently not added to estimated costs of RTA injuries—is an important and currently overlooked additional point in this argument. Prevention of RTIs would mean significant cost savings to individuals and society and reduce unnecessary human suffering.

We are not the first researchers to point out the chaos that RTAs cause in terms of death, injury, and DALY. Nantulya and Reich (2002) labeled RTIs "the neglected epidemic," stating, "…public policy responses to this epidemic have been muted at national and international levels. Policy makers need to recognize the growing problem as a public health crisis and design appropriate policy responses." Two decades later, we firmly support this statement but add that the health and well-being of people permanently disabled by RTAs must be part of the ongoing discourse.

[11] There may be several reasons for this. First, sudden injury moves formerly able-bodied people who may know little or nothing about disability into a new realm. They come to accept their disability only after long and often stressful, isolated periods in hospitals and rehabilitation facilities. Psychological and mental health services are often not provided or available. RTI disabilities disproportionately occur in adult males, who may rely on existing family or friend networks rather than identifying with or participating in the disability community. Not uncommonly, medical or rehabilitation professionals know little about and do not routinely refer newly disabled patients to local or national organizations of people with disabilities to benefit from their expertise on living with a disability, and these people may return home and live in isolation.

Additionally, improving road safety practices also has an additional benefit for people with preexisting disability. Crowded or inaccessible sidewalks, overpasses, and underpasses as well as a lack of traffic controls such as lights or speed limits forces children and adults with disabilities to venture out into roadways or take longer to cross a road, which increases their risk of being hit by motor vehicles (World Report on Disability 2011; WHO 2022Ziang et al. 2006).

Major Findings

1. RTAs are a major but currently poorly understood cause of disability worldwide. RTAs are the leading killers of children and young people and the eighth leading cause of death in all age groups globally. We argue here that they are also a significant cause of preventable disability globally and much more research is needed to understand the numbers, patterns, and issues involved.

2. Road traffic funds and road traffic safety organizations do not focus on or include people disabled by RTAs as part of their mandate. People disabled by RTAs are not followed by related initiatives after they leave medical or rehabilitative care.RTA-related support systems or pension schemes and the prevalence of disability after an RTA are also poorly understood.

3. People disabled by RTAs are not perceived to be or addressed as a distinct group by disability organizations and advocacy groups. Because of this, we know little of their specific needs and concerns and how to ensure they live their "best lives." Presumably, many of their needs will be the same as those of people disabled by other causes, but there may also be specific economic, physical, and mental health concerns that need to be understood and addressed in light of the sudden, unexpected, and traumatic onset of their disability.

4. A better understanding of the costs of RTA-related disability in both HIC and LMICs is needed. Currently, the costs of RTA-related disability are calculated in terms of medical and rehabilitative expenses with a focus on short-term costs. Data on lost wages are also included in some countries, including Namibia and South Africa. However, this information is limited to those who were formally employed, and there is little or no analysis of potential losses for those who were not in the workforce, those who were marginally employed, or those who were stay-at-home mothers prior to their accidents. Furthermore, these estimated costs—as significant as they are—do not consider nonmedical expenses of living with a disability across the lifespan, including the costs of disability pensions, out-of-pocket expenses, and multidimensional and intergenerational poverty. We also do not know much about the indirect costs of RTA-related disability across the lifespan,including opportunity costs and barriers to full participation in family, community, and society.

5. Administrative data on disability resulting from RTAs are often limited, as evidenced by findings from Namibia and South Africa. The MVA Fund in Namibia and the RAF in South Africa do not include disability as a variable in their analysis, and little information exists on what happens to individuals after they finish their initial rehabilitation or the amount provided for the fund reaches its maximum. In addition, the RTA funds do not align with the disability assessment in either country. The main purpose of the funds are to cover the costs associated with RTAs, not to identify who becomes disabled after an RTA. As a result, little or no evidence exists on the costs of living with a disability as the result of an RTA. Importantly, however, the Namibian National Household Income and Expenditure Survey 2015–2016 found that 4.1 percent of all those who reported living with a disability were disabled through RTAs. Comparable data from South Africa is not available.

Such data could be collected using different sources, including administrative and medical records (for example, the number of consultations, types of services, and amount and types of support received). However, this requires that these data be disaggregated by disability status. Disaggregation can only happen if data collection includes disability questions or if RTA cost data can be merged with disability assessment data. Such disaggregation will allow researchers to identify how many are injured in RTAs, which types of injuries lead to a disability, the numbers of people living with an RTI-associated disability, and what costs are associated to which types disability.

6. A gap exists between road traffic safety and disability support services. In our review of data from Namibia and South Africa and of the global literature, road accident support services and disability services are available, but there appears to be little administrative or programmatic contact between the two systems, and little attention is paid to how individuals transition from one to the other. This lack of a "joined-up" administrative system appears to be present in many countries and often leaves people with RTA-related disabilities waiting for long periods between when RTA support ends and disability pension schemes begin. Insurance schemes and disability grant schemes, where they are available, need to provide a unified response.

7. RTAs are potentially a significant contributor to global disability poverty. We believe that RTI-related disability and the direct and indirect costs people face once disabled can contribute to multidimensional and intergenerational poverty for millions of people worldwide, the mechanisms of which are currently poorly understood or addressed. The two countries studied, Namibia and South Africa, have good motor vehicle accident funds that provide economic support for people disabled in RTAs who qualify. However, in the future, it will be important to study countries with no motor vehicle accident funds or limited disability benefits to understand the economic and social costs to those disabled in RTAs and how this may lead to these individuals and their households facing poverty.

8. Enforcement of existing traffic laws, policies, and policing is increasing, but could potentially progress faster if associated disabilities were considered. Great strides have been made over the past decades in vehicle design, road safety, and law enforcement that have been extremely effective in reducing RTA-related mortality and morbidity (WHO 2023). This knowledge has been incorporated into national initiatives and global campaigns up to and including the UN Decade of Action for Road Safety (2011; 2020) and the Sustainable Development Goals (2015).

Laws and policies to improve road traffic safety now exist in countries around the world, although implementation and enforcement of these laws are often limited because of lack of funding and government commitment, especially in LMICs (WHO 2023). If the costs of RTA-related disabilities are added to this discussion, it may bolster the argument for more funding and better enforcement of road safety initiatives.

9. There is a great need to bring together and increase road traffic safety and disability research to understand the lived experience of learning to adjust to an RTA-related disability from the point of injury and across the lifespan. Even with a comprehensive literature review, we were only able to identify 19 out of 836 articles that specifically addressed the intersection between RTAs and disability.

However, we did locate several relevant publications, reports, and data sets in a range of disciplines (including medicine, public health, rehabilitation, road traffic safety, accident prevention, law enforcement, international development, employment, poverty, social

inclusion) that could shed light on RTA-related disabilities and help remove barriers to cross-disciplinary comparisons and collaborations.

There is a comparable lack of attention to RTIs in global disability research, with limited attention to RTIs as a major and potentially preventable cause of disability. Where mention is made, the subject is limited to a few lines (WHO 2011; WHO 2020; WHO 2022).

RTI-related data are currently folded into larger discussions on injury prevention, as is the case in the World Report on Disability (WHO 2011) and the more recent WHO Global Report on Health Equities for Persons with Disabilities (2022).

10. To understand the scope of the issue of RTA-related disability, a key question is whether it is possible to estimate the prevalence of people permanently disabled because of RTAs. A review of the limited number of studies and reports in the global literature finds the estimated prevalence of RTA-related disability between 4.1 percent and 88 percent of those hospitalized for RTIs, with differences in the quality of studies, methodologies used, population sizes, and definitions of injury and disability. Nonetheless, even the lowest estimated prevalence rate of permanent disability (4.1 percent of those hospitalized for RTIs in Namibia and in a multicounty study of adolescents by Symonds et al. 2018) would constitute a significant percentage of people with disabilities in all countries, making RTAs a leading cause of preventable disability. More research is needed at every level, but it is an issue that clearly affects millions.

Conclusion

We must focus more attention on people who have been permanently disabled in RTAs to better understand the medical, economic, and social costs they face. RTAs are the leading cause of death for children and young adults and the eighth leading cause of death for all age groups worldwide. We believe they are also a leading cause of disability worldwide. We have argued that the links between RTAs and disability are currently overlooked because it is not seen as a cohesive, overarching issue.

The road traffic safety community focuses on RTA mortality and morbidity, framing the morbidity component in terms of costs of hospitalization and rehabilitation. The millions of people who survive an RTA but become disabled as a result are largely invisible to both the road traffic safety and disability communities.

The lack of links between both communities is a lost opportunity. We currently lack a conceptual framework and data that provide a cohesive understanding of those injured in RTAs from the time of their accident to living a life with an RTA-related disability. Much more data are needed to provide a clear picture of the nature and extent of RTA-related disabilities.

Furthermore, a clearer understanding of the costs of RTAs to individuals and society should help bolster arguments for more funding for better law enforcement, road safety initiatives, and public awareness campaigns, allowing governments to redirect funds to efforts to prevent RTAs in the first place.

Finally, while we see a reduction of RTAs as a critical step in reducing not just death and injury but avoidable disability, realistically, millions of people worldwide already live with an RTA-related disability, and going forward, there will always be some who become disabled by RTAs. Therefore, it is imperative that these people receive the services and support they need and have a voice in decision-making so they can live as comfortably and productively as possible.

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Appendix A: A Road Map: Road Traffic Safety and Disability

1. **Disability must be an important component of global efforts to address road traffic safety.** The United Nations Road Safety Collaboration has declared 2021–30 The Decade of Action for Road Safety. The target is to reduce road deaths by 50 percent by 2030. However, this should not be the only focus. The health and well-being of individuals permanently disabled by road traffic accidents (RTAs) must be another key component of this global initiative.

2. **A "joined-up" approach is needed to understand the epidemiological scope of RTAs as a significant cause of preventable disability globally.** Our review of the global literature shows that we currently are not able to provide a global estimate of the number of individuals permanently disabled by RTAs. There are only a limited number of studies that attempt to calculate the rate of those injured in RTAs who go on to have permanent disabilities, and these studies differ so greatly in the definitions of what constitutes an injury or disability, in methodology, time frame, and study sample size that comparisons are not possible. Estimates range from 4.1 percent (Namibian National Household and Expenditures Survey 2015–2016) to 88 percent of one group discharged from hospital in Ethiopia (Denu et al. 2021). Even at the lowest of these prevalence rates, however, we can calculate that millions of people worldwide currently live with an RTA-related disability.

   We believe bringing together this data to follow people involved in RTAs from point of injury through the lifespan would provide far more accurate statistics and a new conceptual lens through which to better understand the needs and concerns of this large—and overlooked—population.

3. **Economic data: Concerted efforts are needed to collect and analyze data on the costs of RTIs from the moment of injury through living with a disability across the lifespan. With better understanding, these costs to individuals, households, and societies can be addressed in a more coherent and consistent way.** Currently, most collection, analysis, and reporting of costs for people with RTIs ends at the conclusion of their hospital stays or rehabilitative care, with some funds and insurance systems continuing to provide support for a period of time or until a prescribed amount of money runs out. At that point, those individuals transfer into disability pension schemes or are lost to follow-up as these programs do not specifically identify people disabled by RTAs. They also usually do not include estimates of what it costs to live with that disability across the lifespan.

4. **We need to link epidemiological data and economic costs of living with an RTA-related disability across the lifespan**. Currently, data and insights on the epidemiological scope and economic costs of RTA-related disabilities are divided between a number of different disciplines and rarely brought as an interrelated whole. The epidemiology and economic costs of living with an RTA-related disability must be brought together and analyzed so the scope of this issue can be better understood and addressed.

5. **We need to understand RTA-related disability as a contributor to disability poverty globally.** Millions of people with disabilities face a negative feedback cycle of poverty, unemployment, and social isolation. For people disabled in RTAs, we believe that they may share many of these issues with all people with disabilities but that there may be

specific unique pathways that further impact their economic status. The costs to those permanently disabled by RTAs is currently calculated only in terms of their medical and rehabilitative expenses.

These costs, as significant as they are, do not consider nonmedical costs of surviving and responding to a permanent injury. How similar and how distinct are people disabled by RTAs compared to those disabled through other causes? This is not well understood and warrants further study. While we anticipate that once disabled, those injured in RTAs will face many of the same expenses as all people with disabilities, as discussed in this report, we believe there may be issues specific to, or more regularly encountered by those disabled through RTAs, such as traumatic brain injury, psychological trauma and for some, legal issues related to the accident.

6. **Links between road traffic safety and disability funds and services need to be strengthened.** Our research identified a major gap between the road traffic support and disability services. In countries where road traffic funds exist to cover or partially cover the costs and help coordinate the care of those injured in RTAs, we have find that the accident funds routinely operate independent of disability pension schemes and grants. and administrators often know little about how the other operates. Consequently, there is little advice and guidance for those individuals who must eventually transition from road traffic accident funds to disability grants or other public support systems. There may be a gap of months or years, leading to significant challenges for the disabled individuals, and some are lost to follow-up altogether.

7. **There is a need for greater collaboration between road traffic safety and disability fields and initiatives.** Road traffic safety and disability are both represented by strong organizations and advocacy initiatives at local, national, and international levels. However, there is virtually no collaboration between these two fields. The road traffic safety sector is largely unaware of and uninvolved in disability initiatives and vice versa. Once people disabled in RTAs complete rehabilitation or exhaust the financial support fund and transfer into disability pension schemes, they become largely invisible to the road traffic safety sector.

   At the same time, the global disability community does not identify people disabled in RTAs as a distinct subgroup within the wider community. Even major global disability initiatives such as the WHO/World Bank World Report on Disability (2011) and the WHO Global Report on Health Equities for Persons with Disabilities (2022) give limited attention to RTAs as a major and potentially preventable cause of disability.

   There should be active collaboration and interchange between organizations in both fields. Bringing together these two constituencies would give greater visibility to the disabling consequences of RTAs and allow people who are disabled in this way to have a voice and visibility in road traffic safety advocacy.

8. **Disability is an additional argument for greater enforcement of road traffic safety laws.** Over the past two decades, major strides have been made in road traffic research, laws, and advocacy. As the most recent WHO Global Status Report on Road Safety (2023) shows, many of these laws and policies have already been introduced in countries around the world (for example, lower speed limits, seat belts, and motorcycle helmets). However, enforcement of these measures is often limited by lack of funding.

If the expense of living a lifetime with a potentially preventable disability is added to the equation, it could help justify increased funding for enforcement efforts by local and national governments and global organizations.

9. **More research is needed.** It is common in road maps such as this to conclude by calling for more research on the catastrophic costs to people, households, and society of RTA-related disabilities. More research is certainly needed on the impact of RTA-related disability from the moment of the accident through to how people navigate the transition into a life lived with disability. However, we need more than just additional research. We need better integration of existing research. Fields such as road traffic safety, epidemiology, health care, economics, international development, and disability already have established bodies of data and research around RTAs.

   Some of this new collaborative research will identify new fields and approaches to understanding the links between road traffic safety and RTIs, but we do not have to reinvent the wheel. A starting point would be to bring together these diverse bodies of data and expertise to identify what we currently know and where gaps exist so we can understand and more successfully address the needs of people disabled by RTAs.

   There is also a need to improve communications not just between road traffic safety groups and people with RTA-related disabilities. Currently, there is relatively little communication between road traffic safety groups, law enforcement, and the medical, rehabilitative, and disability communities. We strongly believe that better communication would be an important step forward.

Appendix B: Detailed Methodology

Literature Review

We began this study by conducting an in-depth literature review. We searched the literature specifically for publications on the intersection between RTAs, RTIs, and disability. Additionally, we searched for publications on the costs and impact on daily life for individuals and households coping with RTA-related disabilities. We focused on peer-reviewed literature from LMICs and reviewed papers from HICs where relevant. We took note of the available publications but also where gaps exist in the current literature.

An electronic search was conducted in the following databases: MEDLINE, Global Health, EMBASE, Africa-Wide, and Web of Science. We also manually scanned the references in articles meeting the inclusion criteria to check for additional related articles. The grey literature was searched for relevant materials on RTAs, RTIs, and disability using the Google Scholar and Internet Archive search engines.

Particular attention was paid to identifying relevant literature from Namibia and South Africa, the two countries that were the focus of our data analysis. Because of the limited number of studies, all identified studies were included irrespective of the strength of their research design. We included articles and reports from 2000 to 2024.

The following search strategy was used:

1. Road AND injury, crash, collision, casualty, accident, or incident
2. 1 AND Lower middle-income countries AND rehabilitation
3. 1 AND rehabilitation
4. 1 AND psychological counselling or therapy
5. 1 AND vocational rehabilitation
6. 1 AND gender
7. 2 AND costs
8. 2,3,4, 5, 6, 7 AND Namibia or South Africa or Africa.

We identified 836 reports, policy statements, and articles in a range of disciplines: epidemiology, injury and accident prevention, road traffic safety, rehabilitation, and disability literature. A review of grey literature on RTAs and RTIs included institutional reports, policy statements, and magazine and newspaper articles.

Only a very limited number of articles—only 19 out of the 836 found—specifically addressed the links between RTIs and disability (in any form). However, a considerable amount of additional relevant materials was found in rehabilitation literature and accident and injury databases. RTI data are also incorporated into broader discussions about enumerating or providing services to those with accidents, injuries, or patterns summarized through discussions of the Global Burden of Disease study. These will be addressed in the **Findings** section.

National Data Sources from Namibia and South Africa

We set out to understand the costs to governments, individuals, and households for people disabled due to RTIs. In consultation with the World Bank, Namibia and South Africa were selected because both countries have good national motor vehicle accident funds and disability grant schemes, solid administrative expertise, and viable RTA data collection and

analysis systems at the national level. They are also two LMICs with high rates of road traffic accidents, injuries, and deaths (WHO 2023).

In Namibia and South Africa, national data on individuals disabled in RTAs fell into two categories: road traffic data and disability data. In Namibia, data are maintained by the Motor Vehicle Accident (MVA) Fund, which oversees most individuals with RTIs from the point of injury to discharge from the hospital to rehabilitation center or homes. Additional funds for equipment, adaptation of housing, rehabilitative and medical care, and cost of living expenses are available up to N$1.5 million. After this limit has been reached, the fund does not provide any additional support. People who are disabled can qualify for the disability grant scheme before their MVA Fund grant reaches the N$1.5 million limit.

In South Africa, the system is less unified. There are several pathways through which individuals can qualify for services and support. For those with RTIs who did not cause the accident, the South African Road Accident Fund (RAF) provides medical support and covers other expenses. Individuals can apply for compensation and support after the accident. Where the injured individual was the person who caused the accident, private insurance funds or the public health system may provide the services. As in the case of Namibia, people with RTI-related disabilities who have little or no income can apply for the disability grant if they meet the requirements. Those injured in an RTA who qualify through the RAF can also apply for income compensation if they earned an income before the accident.

Interviews with International Experts

To provide greater insight into current understandings of the links between RTAs and disability, we also undertook semi-structured interviews with global experts in international organizations knowledgeable about and/or involved in road traffic safety efforts and experts and leaders in the global disability community.

We asked both groups to identify additional experts, databases, reports, support groups, and advocacy organizations. Interviews were approximately one hour in length. A list of open-ended questions was developed and piloted. We received written consent for all interviews, which were conducted in English via Zoom. The interviews were recorded, transcribed, and analyzed using theme content analysis.

Ethical Approval

Ethical approval for this project was provided by the University College London. The approval number is 7417/003.

Limitations

There are several limitations to this study that are important to note.

The literature review was done in English, but it is anticipated that we may have missed other relevant publications, studies, and databases as well as reports and articles in the grey literature in languages other than English.

In many countries, national administrative systems have data on RTAs but retrieving this information is difficult because health and insurance records are confidential.

Also, in many countries, including Namibia and South Africa, there is an underreporting of RTIs because some individuals do not seek medical support after an accident. Depending on the data collection systems, not infrequently deaths that occur within 24 to 48 hours of an RTA are listed as related to the RTA, fatalities that occur days or weeks later are often not recorded as associated with the RTA.

Unfortunately, at this point, we do not have proper data to compute the prevalence. In the case of Namibia, we have two proxy sources—the MVA Fund and the National Household Income and Expenditure Survey 2015–2016. In the case of South Africa, the RAF collects data only from those who qualify for support. Private insurance may supplement funding for some people injured, and the national public health service provides care for those who do not qualify for the RAF or other support sources. However, data on those supported following an RTA are not collected or merged into a single useable data set.


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