Features of Low-Income and Middle-Income Countries making Road Safety more Challenging

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Key Findings

- The road crash death and injury risks in low-income countries and middle-income countries are systematically higher than for high-income countries and deserve great global focus and resourcing.
- LMICs suffer significantly more vulnerable road user deaths, especially pedestrians, in part due to weak provision of pedestrian safety infrastructure.
- LICs and MICs differ significantly from each other on road safety and should not be treated as one group.
- Road safety performance also differs widely between countries with similar income levels, and this deserves further research attention.
- Despite the growing urbanization of human living, it is critically important that we also focus on rural road safety as well as urban safety with rural dwellers being at much greater risk of crash death than are urban dwellers.

Abstract

Low- and Middle-Income Countries suffer the large majority (93%) of global road crash deaths and face particular challenges in managing this crisis. This paper presents global data and trends revealing underlying features of the problem for LMICs. LMICs are commonly grouped and described together in road safety commentaries, yet appreciation of the substantial differences between LICs and MICs is vital. While global deaths per 100,000 people have stabilized during the UN Decade of Road Safety, the population rate has increased in LICs (by 8.2%), while decreasing in HIC and MIC. LICs have less resources to address road safety and younger populations adding to risk. Wide variations on road safety performance exist within country income groups, with some of this variance occurring systematically between regions. Absolute numbers of deaths are increasing due to increasing population and increasing vehicle fleets in LMICs compared with HICs. The capacity of MICs, and especially LICs, to manage road safety is hampered by poor crash data to guide action as well less available funding and resources to achieve safer road engineering, safer vehicles, and protect the large proportions of vulnerable road users. Road crash deaths and injuries are retarding the economic growth of LMICs and investing road safety is a cost-effective means by which LMICs can move towards becoming HICs. Vital opportunities for cost-effective savings of lives and debilitating injuries in LMICs include better management of speed (especially through infrastructure), improving safety infrastructure for pedestrians, increasing seatbelt use, and shifting travel from motorcycles to buses through provision of Bus Rapid Transit systems.

Keywords

Low-income countries, Middle-income countries, Speed management, Speed limits, Road safety engineering, Crash under-reporting, Safety barriers, Pedestrians, Motorcycles, Rural road safety, Urban road safety.

Introduction

Globally road crashes kill 1.35 million people and injure up to another 50 million each year (WHO, 2015, 2018). Although the population rate of death has stabilized at around 18.2 per 100,000 people (and slightly improved over the last 20 years: WHO, 2018), the absolute numbers of victims continue to increase as population increases. In addition, both the extent of the problem and the extent of progress are inadequately measured yet profoundly unevenly distributed. This paper briefly considers the scale of the concentration of the road safety crisis in Low- and Middle-income countries (LMICs), and presents data on the trends and features of LMICs which cause this concentration, as well as presenting the substantial differences between countries within income groups, and the systematic differences between LICs and MICs, which are too often treated together.

Relative Performance and Progress

In 2016 (the latest year for which WHO data are available), 93% of road crash deaths occurred in LMICs, up from 90% in 2013 (WHO, 2015, 2018). Table 1 shows the change in death rate per 100,000 people for each category of country income. These data identify the poorer and worsening of the population risk rate in LICs, in particular, highlighting the importance of considering LICs and MICs separately. People living in LICs have, on average, a 330% higher risk of dying in a crash compared with HIC residents, and 43% higher than MIC residents.

One interpretation of the poorer safety records of LICs, often advanced at political levels, is that for LICs to manage road safety they must first become HICs, and thus the focus of road development should be on higher speeds and improving economic efficiency of transport. A similar focus on increased speeds to improve the economy and reduced urban congestion is often apparent in HIC road transport policy, with road improvement decisions driven by travel time savings. These perspectives ignore fundamental evidence, which supports the following assertions. First, in many circumstances increasing speeds increase congestion (OECD, 2006), probably by expanding the gap (headway drivers allow) between moving vehicles. Furthermore, a faster journey yields a time gain typically erroneously perceived as large and far in excess of the objective time gain, which is in fact only marginal, especially for shorter trips (ETSC, 1995). Second, crash deaths and injuries create huge economic costs in HICs as well as LMICs. The costs of crash injuries and deaths represent deeply disturbing percentages of Gross Domestic Product (GDP) each year in all world regions, although these costs are highest in Africa (see Table 2). The economic importance of road safety is vital as part of the advocacy for investment. In LMICs these costs of crashes are shown to substantially retard long-term economic growth (World Bank, 2017). Thus, improving road safety is a means of helping LICs to become HICs, not vice versa. Third, road safety interventions regularly result in higher benefit cost ratios than other road engineering projects by reducing the costs of crashes, and in many cases (such as speed management) also reducing the costs of greenhouse gas emissions, air pollution, noise pollution and their health impacts (Sakashita & Job, 2016).

Within each income group road safety performance varies widely, supporting the value of sound road safety policy regardless of country income. Figure 1 shows the scatterplot of deaths per 100,000 people by GNI per person, demonstrating the wide range of road safety outcomes within income groups. Part of the variability is attributable to region. For example, MICs in Africa average 23.6 deaths per 100,000 people versus 14.4 for MICs in Europe (WHO 2018). Even among HICs the variation is wide, with HICs in Europe averaging 5.1 deaths per 100,000 people versus 11.4 for HICs in the Americas (WHO, 2018). The reasons for these systematic regional differences are not obvious, but may include cultural differences in lifestyle, legislation and enforcement (for example a number of countries in the Americas are unable to conduct effective random breath testing due to constitutional rights similar to those of the United States: Job, Lancelot, Gauthier, Silva, Howard, Ledesma, et al., 2015). The leading road safety countries in Europe had also shown strong improvements even before the impacts of the COVID-19 pandemic, with Norway, Sweden and Switzerland all dropping to below 2.2 deaths per 100,000 people in 2019 (ETSC, 2020). These impressive results demonstrate achievements which should be set as

Table 1. Change in crash death rate per 100,000 for HICs, MICs, and LICs (Sources: WHO, 2013, 2015, 2018).

Year	Rate HIC	Rate MIC	Rate LICs
2010	8.7	20.1	18.3
2013	9.3	18.5	24.1
2016	8.3	19.2*	27.5
% Change 2010 to 2016	-4.6%	-4.5%	+ 8.2%

* Not directly provided. Estimated from other percentages provided by WHO.

Table 2. Annual Costs of Crashes as a Percentage of Annual GDP and Estimated Life Years Lost to Disability by World Bank Region (Source: Wambulwa & Job, 2019).

World Bank Region	% of GDP paid in Crash Costs	Estimated Life Years Lost due to Crash Disability per 100,000 people
Africa	9.0	1,149
East Asia & Pacific	6.1	1,017
Europe & Central Asia	4.8	695
Latin America & Caribbean	6.0	878
Middle east & North Africa	5.5	910
South Asia	6.9	863

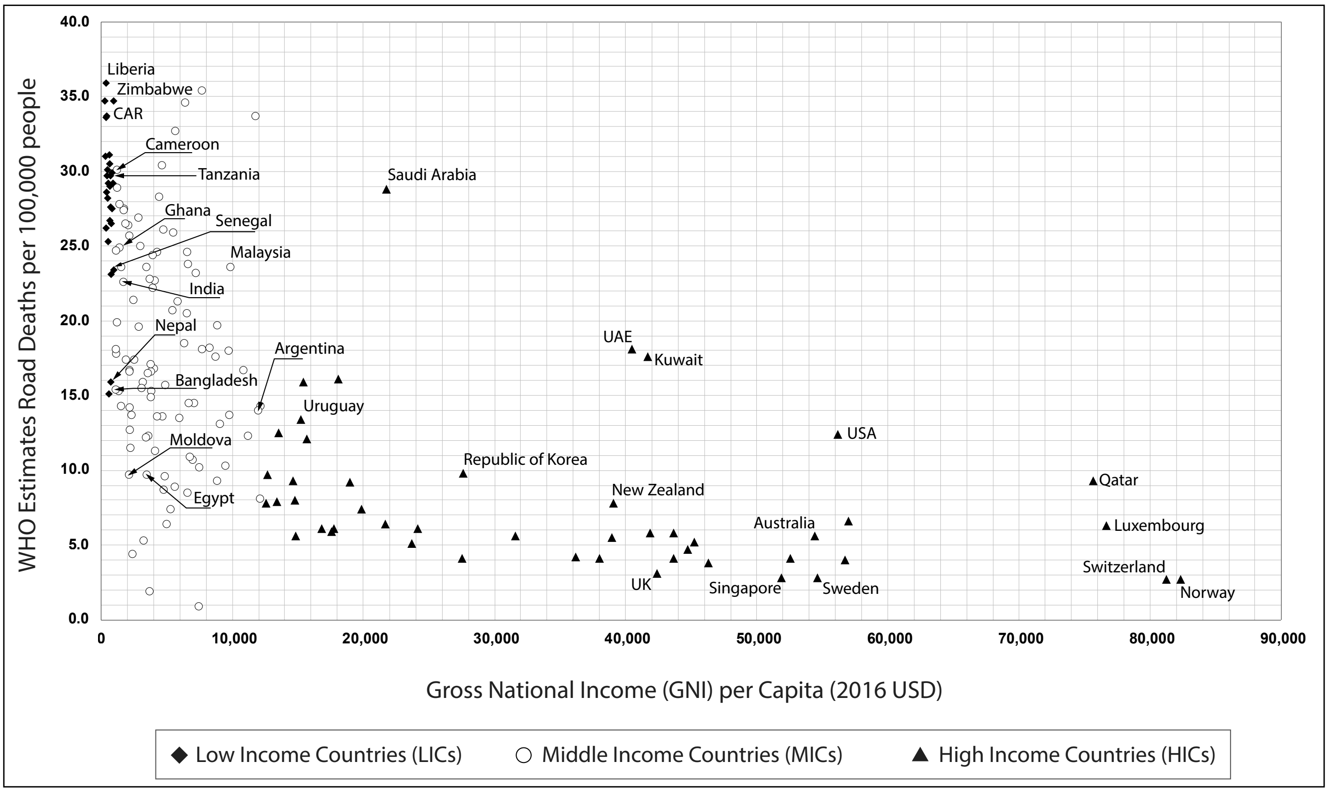

Figure 1. Road death rates per 100,000 people with GNI per Capita of countries in different income regions (Source Heydari, et al., 2019 with data labels added from WHO 2018)

targets for other HICs such as Australia and New Zealand, which now also lag behind Singapore, the regional leader in road safety performance. Nonetheless, Singapore's advantages as largely a city country must be acknowledged.

Demographic and topographic influencers

Many factors contribute significantly to the much greater death (and also serious injury) rates for LMICs. While much of the variation in performance is derived from factors directly related to management of road safety, as briefly considered below, demographics and social geography also play important roles. Five are considered here. The first example is population age which is well recognized to influence consumption and risk (Liddle & Lung, 2010), including risk taking and exposure to road travel which vary with age, resulting in risk of death steadily increasing from birth the around age 18-21 years, then gradually decreasing. Thus, countries with younger populations face greater challenges, and this correlates with country income: 8 of the 10 countries with the lowest median population ages (all with 50% or more of the population below 18 years old) are LICs in Africa (with the other two being fragile states) whereas all 10 countries with the highest median age (with more than half the population aged over 44 years) are HICs (Wikipedia, 2020a).

Second, rural populations are at higher risk of road crash death than urban dwellers (Zwerling, Peek-Asa, Whitten, Choi, Sprince, & Jones, 2005). Based on various countries for which sound crash data are available, rural dwelling people have long suffered 6 or more times the risk of road crash death compared with metropolitan people. For example, in NSW in 2009 metropolitan areas with most of the population suffered 143 deaths, while the rest of the state suffered 310 deaths (NSW Centre for Road Safety, 2010). This trend continues with metropolitan NSW having a rate of 1.8 deaths per 100,000 people versus non-metropolitan NSW with around 6.5 times the death at 11.6 deaths per 100,000 inhabitants (NSW Centre for Road Safety, 2019, with population data from Wikipedia, 2020).

Similarly, consistently over years, Adelaide's population of 70 to 75% of the total for the state of South Australia has around half the serious casualty crashes and only a little over 25% of deaths (e.g., Department of Planning, Transport and Infrastructure, 2014). Finally, in New Zealand, the rest of the country has a crash death rate per 100,000 people which is 60% higher than the rate for the three major cities (Auckland, Wellington, and Christchurch: crash data from Transport New Zealand, 2020; population data from Wikipedia, 2020). These data confirm the broad pattern, though they under-estimate the differential of rural dwelling versus urban because many regional cities are included as non-metropolitan. The increasing preponderance of more severe outcomes in rural areas reflects the high-speed environment, delayed post-crash care, less enforcement pressure, and unforgiving roads for the travel speeds. Rural communities, especially in LMICs, are affected by higher-speed roads including through built up villages or settlements, in which the function of the transit road is in reality residential and commercial. Engineering measures (gateway treatments, speed humps, raised platform

Figure 2. High risk cliff-side roads in western Nepal with and without crash barriers added by GRSF with UK Aid funding (source: Photos by RFS Job)

crossings, etc.) are already widely applied in HICs to ensure a smooth transition from outside built up area high speeds, to lower speeds appropriate for the safety of vulnerable road users. These engineering measures to reduce speeds are much less common in LMICs, though gradually increasing in application (Welle, Sharpin, Adriazola-Steil, Job, Shotten, Bose, et al., 2018). Urban road safety nonetheless remains a critical focus due to deaths (though in lower population rates) and higher proportions of serious injuries.

Third, in addition to population density, topography influences risk. Mountainous roads present more risk than roads on flat terrain, through typically having more unpredictable curves, and presenting high risk in the event of error when driving near cliffs and drop-offs. These roads are more expensive to build, and more costly to make safe with roadside barriers to protect users from falling over cliffs. This risk is more challenging for LICs to manage. This also offers major opportunities for improvement in LMICs. For example, the installation of 7.3 km of barriers on cliff-side roads in western Nepal by GRSF has already saved 270 lives in the first year and will save 3,450 lives over the life of the project (GRSF, 2020; and see Figure 2).

A fourth factor, sometimes seen as an external demographic for road safety, is the road vehicle mix. In direct statistical terms, the safest form of transport is a large bus, and the least safe is a motorcycle (Sustainable Mobility for All, 2017). Motorcycles typically allow for high speed but do not provide the protection of an enclosed vehicle, making motorcycles the most difficult vehicle to manage in road safety including presenting serious challenges when implementing the safe system approach. Thus, different traffic mixes generate different challenges, with LMICs having much higher proportions of motorcycles (which are inexpensive to run) compared with HICs. Consequently, in Europe 11% of crash deaths are motorcyclists compared with 43% in Asia (WHO, 2018). Even this is an under-estimation of the extent of the problem in LMICs because under-reporting of crashes is systematically biased by crash type, with crashes involving vulnerable road users less likely to be reported than other crashes of similar severity (Kira, Sigal, Tove, Jens, & Carlo, 2016; Bauer, Steiner, Kühnelt-Leddhin, Lyons, Turner, Walters, et al., 2017). It is vital to appreciate that the vehicle mix is not simply a demographic ‘given’ in road safety but rather a feature subject to influence by various policy levers, including provision of safer alternative transport such as Bus Rapid Transit (BRT) systems which are being adopted increasingly in LICs, BRT pricing policies, vehicle registration and insurance cost policies. Less obviously, regulation and enforcement addressing indiscriminate parking of motorcycles can facilitate the shift to safer transport. Motorcycle parking

Figure 3. Motorcycles parked across footpaths in Asia (panel a) and improved parking allowing for a usable footpath (panel b). Source: Photos by RFS Job

Table 3. Levels of Under-reporting of fatalities by country income comparing official data and WHO estimates (Source: WHO 2018)

Country Classification	Government Reported Fatalities, 2016	WHO Estimated Fatalities, 2016	Difference between WHO and Government Reported Fatalities	% Difference between WHO and Government Fatalities
Low-Income	27,143	171,098	143,955	84%
Middle-Income	517,594	1,057,313	539,719	51%
High-Income	84,628	95,255	10,627	11%

left unchecked incentivises motorcycle use though greater convenience at the cost of increased risk for pedestrians forced to walk on the road by parked motorcycles (Job, 2020; and for examples see Figure 3, which also shows an example of better parking management in Asia).

The fifth factor is vehicle fleet growth. Regional difference in vehicle growth also highlight the growing LMIC problem, with HIC dominated regions growing the least (the European Union vehicle fleet increased only 9% from 2005 to 2015, Japan and South Korea by only 7%, whereas Africa grew by 35% and Asia by 141%: Wambulwa & Job, 2019 based on International Organization of Automobile Manufacturers, OICA, data).

Data, Management, and Delivery of Road Safety

The under-reporting of even serious crashes is a major issue for road safety in HICs, but a larger issue for MICs and an even larger challenge for LICs, with official records in LICs estimated to be missing 84% of crash deaths, let alone serious injuries (See Table 3). There are many reasons for this level of under-reporting and thus it is important not to attribute all these to Police. These omissions cause many problems for road safety including under-representing the extent of the problem, reducing the business case and political demand for road safety actions, and misleading both the nature and location of the problem through systematic biases in which crashes are reported relating to the nature of the crash and its location (Bauer et al., 2017; Wambulwa & Job, 2019). Thus, poor data add to the many other challenges for LICs especially in managing road safety: inadequate funding of road safety, under-funded or absent strategies, and the common absence of a road safety managing/lead agency (Wambulwa & Job, 2019).

The delivery of road safety is also made more challenging for MICs and even more so for LICs across a range of factors. Road infrastructure differences are profound, for example with 94% of pedestrian travel on iRAP 1- and 2-star safety roads in LICs versus 55% for HICs (Wambulwa & Job, 2019), though this remains a disappointing percentage even for HICs reflecting a global neglect of pedestrian safety (Job, 2020). LICs and MICs also diverge on fundamental safe system related policies: 11% of LICs have no national speed limit law versus only 3% of MICs. This reflects a common under-estimation of the importance of speed to both crash occurrence and survivability. Only 52% of LICs regulate used vehicle imports, versus 76% of MICs; No LIC has effective periodic vehicle inspection; Only 22% of LICs have a national seat belt law covering front and rear seat passengers, versus a still inadequate 56% for MICs; While national motorcycle helmet laws are more common: 85% of LICs and 97% of MICs (Wambulwa & Job, 2019), more could be done. Enforcement processes are often hampered by readily avoidable penalties systems. Attempts are made to address this by removing direct interactions of road users and police through speed cameras and other automated enforcement. However, a series of background systems such as vehicle registration and identification, driver licensing, and means of contact (address, mobile phone number) to issue penalties, are often inadequate. Perfection is not required but basic processes are needed (see Job, Cliff, Fleiter, Flieger, & Harman, 2020 for a guide on requirements for camera enforcement).

Conclusions

This paper has briefly described some of the core challenges and features of road safety management in LICs and MICs. These point to vital opportunities for improvement. This brief review of road safety policies and performance shows deep challenges for LMICs in road safety. However, the tendency to treat LMICs (developing countries) as generally similar should be resisted with appreciation that LIC on average differ significantly from MIC on road safety outcomes, implementation of many road safety interventions and policies. Large variations also exist within country income categories, with some noteworthy consistencies within regions. It is worthwhile to research the mechanisms by which similar income countries appear to have systematically different road safety performance from one region to another. Within countries road safety will be well served by maintaining a focus on the rural safety problem as well as urban safety.

Stronger global focus on the suffering of MICs and especially LICs, with 93% of deaths in road safety, is vital. Although the UN Sustainable Development Goal (SDG 3.6) of halving road crash deaths may appear to be met through dramatic inadvertent circumstances (stay-at-home orders and greatly reduced road use due to COVID-19) this is likely to be a short-lived benefit of a tragic global pandemic. Thus, the road safety SDG must be continued with a 2030 target setting up another decade of road safety. The international outreach of the Australasian College of Road Safety to Asia is a welcome contribution towards assisting more LMICs in road safety.

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