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Differences in road safety 'logics' between high income countries (HICs) and low income countries (LMICs).

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Abstract

Existing models and frameworks in relation to road safety that had been developed in High Income Countries (HICs) may not be adequate for Low and Middle Income Countries (LMICs). Associations between various indicators were examined, providing further evidence of different 'logics' in relation to road safety in HICs and LMICs. Analyses were undertaken by comparing indicators from different sources, such as the WHO and ESRA. From these analyses it has appeared that relationships which hold in HICs do not necessarily hold in LMICs.
Examples are given in relation to factors affecting the road crash fatality rate, risky behaviour in traffic, and support for road safety policy measures. Given the importance of the road safety challenge in LMICs, more research is needed to develop models and frameworks that are more appropriate and fit better the road safety context in LMICs.

Keywords: HICs; LMICs; road safety; models.

1. Introduction

It is well known that road safety performance is often much lower in Low and Middle Income Countries (LMICs) than in High Income Countries (HICs). This is clearly visible from the world map (Figure 1), taken from Van den Berghe (2022), based on data collected by the World Health Organization (WHO, 2018). The poor road safety performance of LMICs is not a recent phenomenon; it has been observed and documented in the past (Onywera & Blanchard, 2013). In many LMICs, the of numbers of fatalities on the road are even still increasing (Wegman, 2017).

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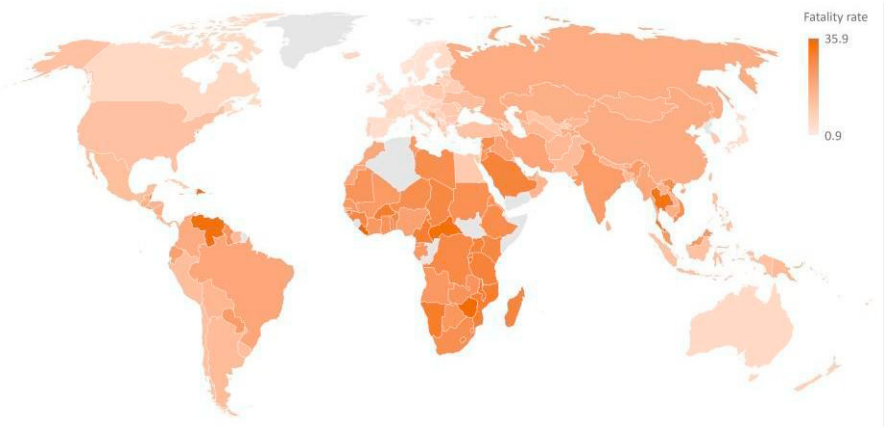

Fig. 1. World map of road crash fatality rates per capita.

Data source: WHO.

Since the road safety performance of many LMICs is comparable with that in HICs some decades ago, one may be tempted to believe that all road safety improvement measures that have been successful in HICs would also be applicable in LMICs. There are, however, indications that such transferability should not be taken for granted, because the underlying phenomena could be quite different.

Lund & Rundmo (2009) found that social cognition models claiming that attitudes are good predictors of behaviour are less suitable in low-income countries'. Nordfjærn et al. (2011) concluded that their predictive model of driver behaviour was poorly fitted for the African countries they considered. King, Watson, & Fleiter (2019) argued that the logics underlying traffic safety culture which have been developed in Western countries and are not fully transferable to LMICs. The authors observed that many psychological processes differ in important ways between HICs and LMICs, and that understanding of road safety culture in LMICs requires a more anthropological and qualitative approach. Results from the ESRA surveys, undertaken in both HICs and LMICs, have illustrated that in LMICs on average people take more risks when driving than in HICs and that the support for road safety policy measures is higher than in LMICs than in HICs (Meesmann et al., 2018; Pires et al., 2020; Van den Berghe et al., 2020).

Yet, despite higher levels of public support in LMICs, road safety measures are often not implemented, or only much later than in HICs. This is linked to both cultural and economic factors (Van den Berghe, 2022). For example, when seatbelts were gradually introduced in most of the developed countries in the 70s and 80s it led to heavy debate and opposition (Hingson et al., 1988; Leichter, 1986). Wearing a seatbelt was considered by opponents of the measure as ineffective and an attack to personal freedom. This debate seems absent these days in most HICs but is still alive in many LMICs.

There is increasing evidence, therefore, that existing models and logics that have been (successfully) applied in HICs may not be (fully) transferable to LMICs. As part of a PhD project (Van den Berghe, 2022) several additional findings were made illustrating the differences in road safety logics between highly developed and less developed countries. Some of these findings are reported in this article.

2. Methodology

Associations between national indicators from twenty different sources were undertaken. The full list of indicators and sources can be found in Van den Berghe (2022). The level of association was examined through correlation, partial correlation and linear regression analyses, using SPSS 25-27. Two main groups of associations were examined: (1) the association between the road fatality rate (WHO, 2018) and a range of economic, social and cultural indicators; and (2) the association between public support for 15 policy measures, which were part of the ESRA2 survey (Meesmann et al., 2021), and the same range of national indicators. In the next sections we provide several examples, taken from these analyses and reported in Van den Berghe (2022). These examples illustrate that the relationships between phenomena can be different between HICs and LMICs, or that relationships that exist within a particular region in the world, may no longer hold when regions are compared with one another.

3. Results & discussion

3.1. Factors affecting road safety performance

It is well known that higher exposure to traffic increases the crash risk (Hesjevoll & Elvik, 2016). But an interesting finding is that this relationship when considering differences in traffic volume between countries in different parts of the world. There are no specific comparable indicators on traffic volume globally, but there are some proxies. The correlations of these proxies for traffic exposure with the fatality rate per capita are negative: r = -0.312 for gasoline consumption per capita, r = -0.382 for road length per capita, and r = -0.667 for motor vehicles per capita (all $p < 0.001$). In other words, and surprisingly at first sight, at global level the higher the traffic volume in a country, the lower the fatality rate tends to be. The association with motor vehicles per capita is shown in Figure 2.

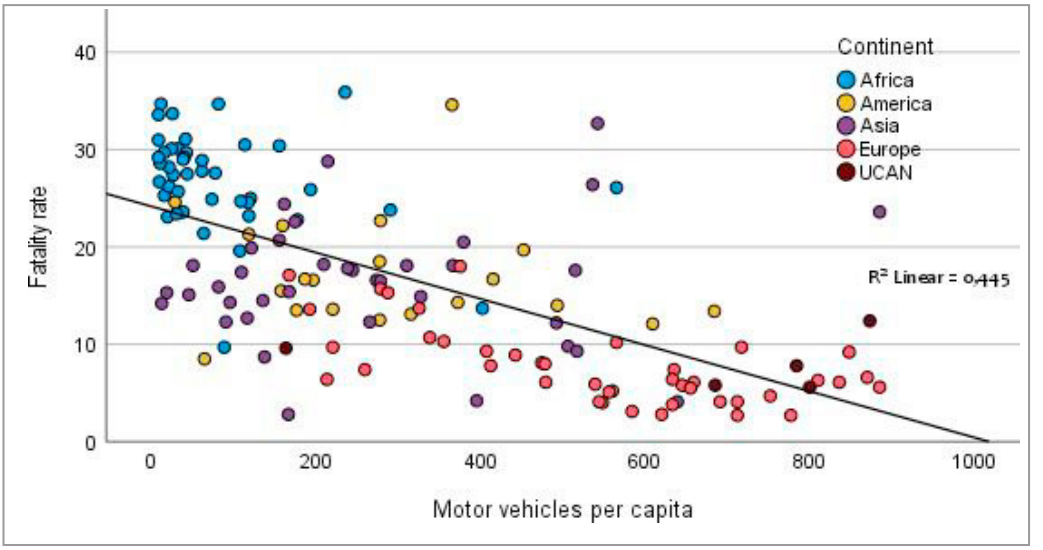

Fig. 2. Crash fatality rate by number of motor vehicles per capita
Data sources: WHO (fatalities) and World Bank (vehicles); UCAN = United States, Canada, Australia, New Zealand

The correlations appear to be negative because the highest traffic volumes are found in high income countries (HICs), with much more effective road safety policies that eventually result in fewer road deaths despite the much higher traffic volume. When limiting the analyses to Europe, the correlation between, e.g., gasoline consumption and fatality rate is positive ($r = 0.318$, $p = 0.045$), confirming the positive association between exposure to traffic and road crash risk, within an economic and cultural homogeneous cluster of countries. But the relationship does not apply when a global perspective is taken.

Another finding is that within Europe, confidence of the population in their police, government, legal system, etc. is highly correlated with lower fatality rates (correlations around 0.7); however such strong relationships are not found and sometimes even reversed in other regions of the world.

3.2. Differences in the relationship between behaviour and fatality rate

One might expect that alcohol consumption in a country is positively associated with higher road crash risks or and higher numbers of alcohol related crashes. However, at global level, it appears that the correlation between alcohol consumption per capita is negatively correlated with the overall crash fatality rate (r = -0.399, $p < 0.001$). In other words, higher alcohol consumption in a country tends to be associated with lower numbers of fatal crashes on the road. The relationship is displayed in Figure 3. Inspection of the distribution of countries across the chart provides part of the explanation for this somewhat surprising result: alcohol consumption is much higher in HICs but in such countries the fatality rate is often much lower than in LMICs. In particular the difference between Africa and Europe is striking.

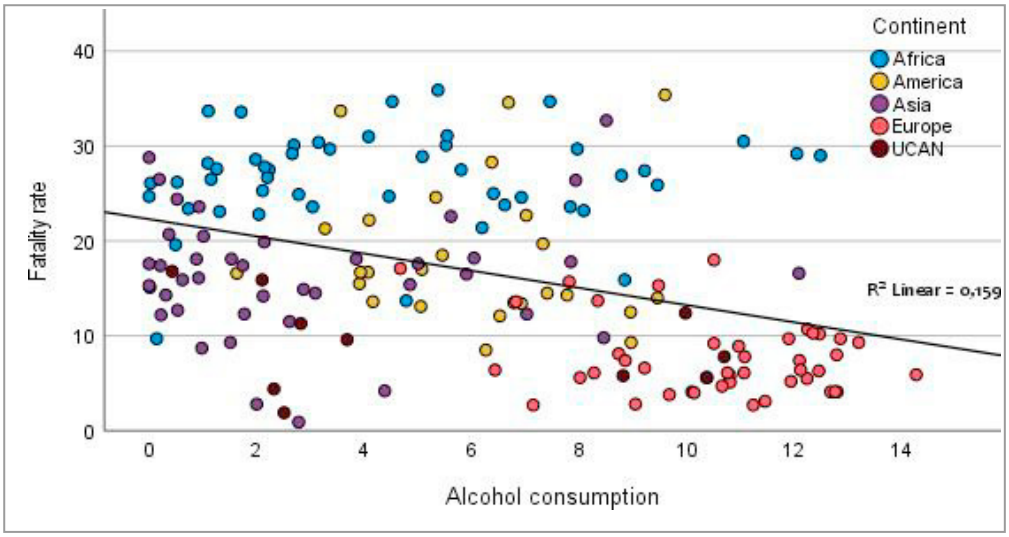

Figure 3. Fatality rate by alcohol consumption.

Data source: WHO.

We found that at global level, the more car drivers tend to speed in a country, the lower the fatality rate. This is a surprising result, since he relationship between speeding and crash risks is well established (European Commission, 2020). Figure 4 shows the association between the fatality rate and the self-reported exceeding of the speed limit in rural areas (at least once during the last 30 days) for 60 countries. The explanation is that in many LMICs, which have the highest fatality rates, speed limits are higher than in HICs. Moreover, the quality of the road infrastructure, the amount of traffic on the roads and the technical state of the vehicle fleet make it often difficult for drivers to exceed the speed limit. The 'risky speeding behaviour' that causes higher numbers of crashes in LMICs consists much more of driving at inappropriate speed than of exceeding the speed limits.

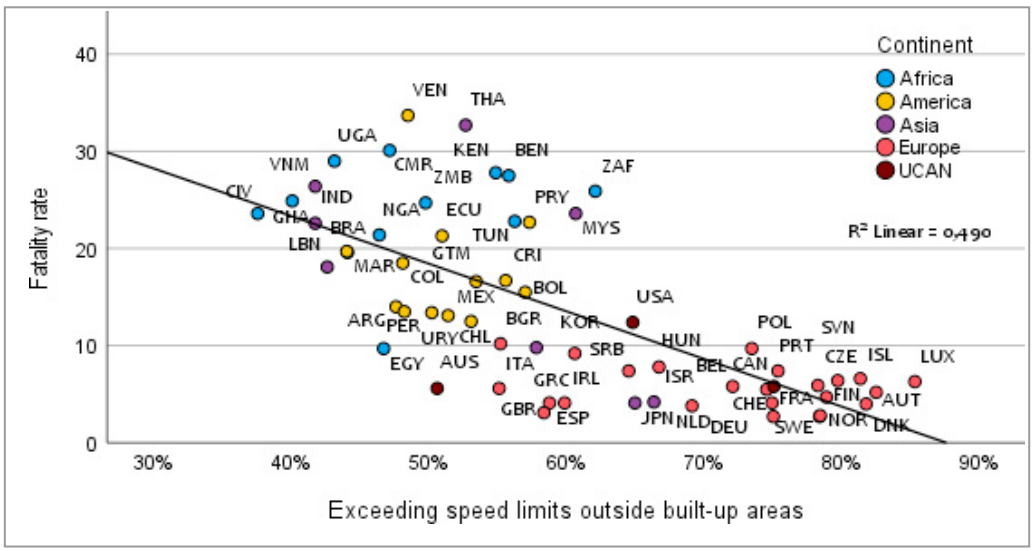

Figure 4. Crash fatality rate by percentage of car drivers self-reporting to exceed the speed limit in rural areas.
Data sources: ESRA (speeding) and WHO (Fatality rate).

3.3. Support for policy measures

In the ESRA2 survey (Meesmann et al., 2021) respondents needed to indicate to what extent they supported certain measures to become a legal obligation. The list of measures is given in Table 1. The analysis, based on 48 countries, shows that in general lower income countries tend to be most supportive of the measures proposed (Figure 5).

Table 1. Code and formulation of the 15 policy measures in ESRA2.

Code	Formulation of the measure
ALC	Install an alcohol 'interlock' for drivers who have been caught drunk driving on more than one occasion (technology that won't let the car start if the driver's alcohol level is over the legal limit)?
ZEN	Have zero tolerance for alcohol (0,0 ‰) for novice drivers (licence obtained less than 2 years ago)
ZER	Have zero tolerance for alcohol (0,0 ‰) for all drivers?
ISA	Install intelligent speed assistance (ISA) in new cars (which automatically limits the maximum speed of the vehicle and can be turned off manually)
SWS	Install dynamic speed warning signs (traffic control devices that are programmed to provide a message to drivers exceeding a certain speed threshold)
SRE	Have a seatbelt reminder system for the front and back seats in new cars
HEL	Require all cyclists to wear a helmet
HEC	Require cyclists under the age of 12 to wear a helmet
HEP	Require all moped drivers and motorcyclists to wear a helmet
RFL	Require pedestrians to wear reflective material when walking on the streets in the dark
RFC	Require cyclists to wear reflective material when cycling in the dark
RFP	Require moped drivers and motorcyclists to wear reflective material when driving in the dark
NMP	Have zero tolerance for using any type of mobile phone while driving (hand-held or hands-free) for all drivers
NHP	Not use headphones (or earbuds) while walking on the streets
NHC	Not use headphones (or earbuds) while riding a bicycle

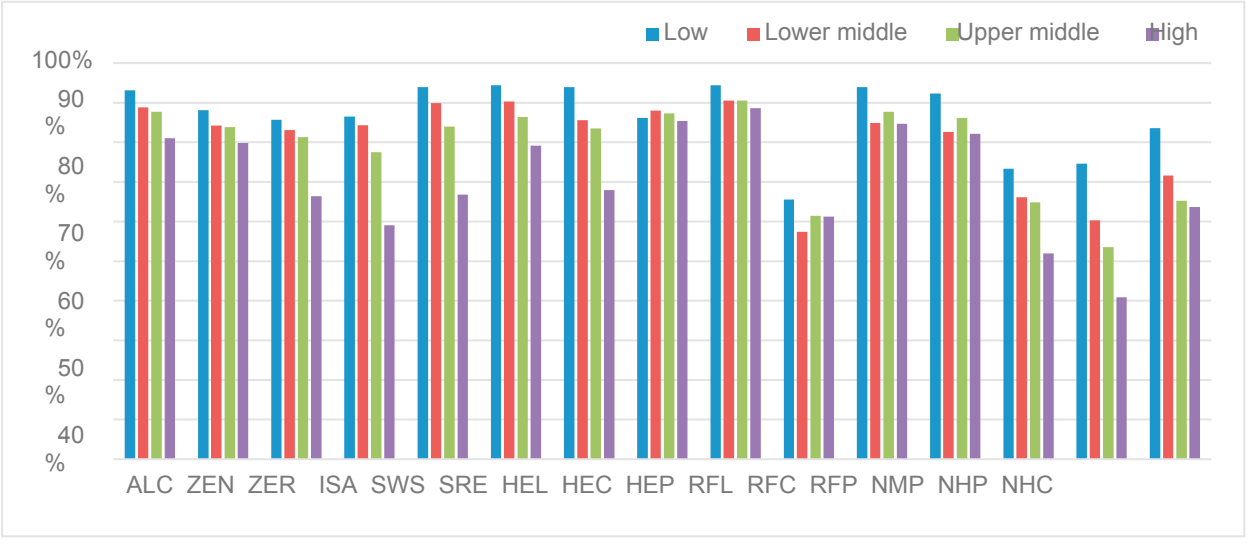

Fig. 5. Level of public support by income level of countries.
Data source: ESRA

The differences in behaviour and support for measures can be linked to national culture, which often differs strongly between LMICs and HICs. Hofstede initially introduced four dimensions of national culture and later expanded these to six (Hofstede, Hofstede, & Minkov, 2010). Recent research has led to an update of two of Hofstede's original dimensions: 'individualism versus collectivism' and 'long-term versus short-term orientation' (Minkov, 2018; Minkov et al., 2018, Minkov et al., 2017). Van den Berghe (2022) renamed the first dimension as "Independent". Independent societies stress the needs and rights of the individual while collectivist societies start from the needs of the group as a whole. Important values in 'independent' societies include personal freedom, autonomy, uniqueness, self-reliance, hedonism and assertiveness. Within collectivist societies, important attitudes are conformity, restrictiveness, power-seeking, dependency, conflict avoidance and in-group favouritism. In the more independent thinking cultures the distinction between in-groups and out-groups is much smaller than in more collectivistic countries; there is also more universalist treatment of all people the public sphere. (Minkov, 2018; Minkov et al., 2018, 2019, 2017). In general, the higher developed a country, the higher it scores on the Independent scale.

The Pearson correlations between most of the ESRA measures and the Independent dimension are negative. For example, between ISA and Independent r = -0.801** and between ZER and Independent r = -0.673**. The stronger opposition in Independent countries is not unexpected, because the more people think autonomously in a society, the higher the opposition against measures that restrict freedom. Most HIC societies are highly individualistic and tend to oppose strongly measures that are seen to restrict individual freedom. Given the fact that most LMICs score quite low in the Independent scale, this illustrates that at least part of the differences shown in Figure 5 are attributable to cultural differences.

It is also important to note that in more collectivistic and poorer countries, people may interpret a question on 'support for a policy measure' in a different way than in more independent countries. In LMICs there are many more people who support a measure because they think others should be restricted, but they would themselves feel less obliged to adhere to the requirements. Findings from ESRA show that many people think that the 'others' engage in unsafe traffic behaviours more readily than they do themselves – so there is less need of regulation for themselves. Pires et al. (2020) refer to this as belief of road users of moral superiority over others. Thus, when two people say that they support a forthcoming regulatory measure, this may actually hide different expectations, in particular when the respondents are from different countries or different socioeconomic or cultural strata. People stating to support a measure have certain assumptions on how it will be implemented in their country, to what extent it will affect them and how easy it will be to not comply with it.

It seems plausible that drivers who do not adhere to traffic rules will tend to oppose new and stricter road safety measures; this has indeed shown to be the case within countries (Van den Berghe, Sgarra, Usami, González-Hernández, & Meesmann, 2020). But do these associations also hold when comparing countries? In other words, if the percentage of people with a particular risky behaviour (e.g. speeding) is higher in a country, is the opposition against a measure limiting that behaviour also stronger in that country? Often, this is indeed the case. For instance, the correlation between speeding outside built-up areas and the obligation to instal an ISA system is very strong and negative (r = -0.787**). Also the correlation between cyclists riding without a helmet and the support for the requirement that all cyclists should wear a helmet is strongly negative (r = -0.635**). However, at global level, no significant correlations are found between the risky behaviour 'Read a text message while driving' and support for 'No use of any mobile phone by car drivers'. Analysing this association at regional level, I found for Europe and Africa the 'expected' negative correlations with distraction (r = -0.366 and r = -0.305 respectively), but the opposite for the Asian countries within ESRA2 (r = 0.544). The number of countries involved in each region is small and none of these correlations is significant at the $p < 0.05$ level, but at least they illustrate that the relationship is different. A scatterplot with regression lines is shown in Figure 6.

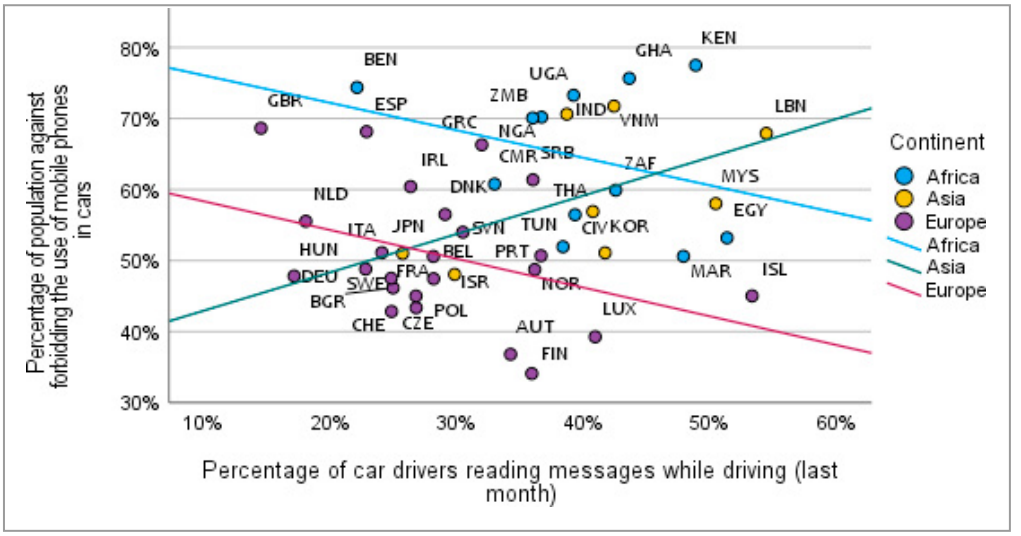

Fig.6. Support for forbidding use of mobile phones by reading a text message while driving.
Data source: ESRA

4. Conclusion

When it comes to road safety, there is a 'triple' difference between HICs and LMICs: (1) culture; (2) road safety performance; and (3) wealth. The cultural differences impact on behaviour in traffic and hence on the fatality rate, while the economic differences determine the capability to implement (expensive) measures. The combined effects of these differences lead to quite different 'road safety contexts'. Associations between variables that exist within Europe or other HICs may no longer hold when also LMICs are included in the analysis.

Given the importance of the road safety challenge in LMICs, more research is needed to develop models and frameworks that are more appropriate and fit better the road safety context in LMICs. It is important to come to a better understanding about when concepts/ methods in road safety are applicable for both LMICs and HICs and when they are not. Differences in economic development mean that both the behaviour and possible interventions will be different. For example, poor road infrastructure in LMICs leads to different types of road safety challenges than in HICs. Similarly, high coverage and affordability of data in HICs can lead to higher levels of mobile phone distraction than in LMICs. This illustrates the complexity of future analyses, with a strong need for situational analysis when comparing road safety performance and effectiveness of measures.

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