ROAD TRAFFIC ACCIDENTS IN DEVELOPING COUNTRIES

Bibliographic Review

Technical Collection
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Olivier BARTHES

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- Vincent and all of the team at Handicap International Belgium for their comments and guidance.

We also wish to thank Tom Christoffel and Susan Scavo Gallagher, the authors of the book entitled "Injury Prevention and Public Health" which was a great source of inspiration to us when developing the theoretical aspect of this report.
INTRODUCTION

Road safety has become a real public health problem. WHO statistics illustrate this fact convincingly. Road accident injuries are the first cause of death and represent the tenth of all fatalities. In 2001, more than one million the deaths were estimated due to traffic accidents, that is to say approximately 3,000 per day!

The developed world has become aware of the scale of the road safety problem and tried to remedy it. This has been successful, shown by the fall of death rate. The same doesn’t apply to developing countries, where the number of road accidents has not stopped increasing. The forecasts are unfortunately pessimistic. The authorities of the majority of these countries do not provide sufficient measures to fight against this phenomenon.

There is clearly the need for further intervention in this field because only a few actors are able to bring concrete solutions forward.

In the face of this alarming report, Handicap International Belgium has launched an immediate response. This is

by accommodating handicapped people, caused by a road accident, in its centres. It was considered necessary to go further, as the association intended to implement projects that not only treated, but also prevented such causes of handicap.

A first step was to determine how Handicap International Belgium can intervene effectively and how to concretely implement road accident prevention projects. This document is the consolidation of these determinations. This report initially draws up a rapid overview of the world road safety situation, the problems, the basic concepts of the prevention and the possible approach types. To conclude, it resumes the various contributions made in this field in developing countries, including the funding of projects and a thematic bibliography.

The main purpose of this document is to serve as a working tool for any person intending to implement a road safety project. It also constitutes a basic information tool, enabling more in-depth research by people wishing to conduct further study on this subject.
EXTENT OF THE PROBLEM IN TERMS OF MORBIDITY, MORTALITY AND COST

MAGNITUDE AND SCOPE (DEATH, MORBIDITY AND DISABILITY)

Preliminary note: There are currently two principal sources of international road traffic accident injury statistics: the WHO statistics (for 1999) and the those produced by the Transport Research Laboratory (also for 1999). Unfortunately, these data are not perfectly in agreement because, while the WHO estimates that there are 1,171,000 deaths from road traffic accidents each year, the TRL estimates this same figure to be between 750,000 and 880,000 deaths. The problem is therefore not only serious but also poorly quantified. The data presented in this document are essentially those obtained from the WHO.

According to the WHO, road traffic accidents are the number one cause of death through injury in the world, the 10th leading cause of death from any cause and the ninth largest contributor to the "burden of disease (BOD)". In 2001, the WHO estimated that there were more than one million road traffic accident fatalities, equivalent to approximately 3,000 people per day. We can therefore effectively talk of carnage.

In view of the predicted growth in population, urbanisation and above all motorisation, the projections for the future are grim: the WHO anticipates that, on a worldwide level, road traffic injuries will become the 3rd leading contributor to the BOD by 2020, behind only cardio-vascular accidents and cancer.

The greater part of this growth will occur in the developing world (poor and transition countries) as the numbers of deaths in the majority of developed countries have been falling over the last few decades, thanks to the adoption of courageous policies. In developing countries, on the other hand, in spite of a much lower levels of motorisation we note that crude death rates continue to rise and are thus already as high as in the rich countries.

Within the group of developing countries, a determining factor in the number of road traffic accident injuries would appear to be the number of motor vehicles, or at least its growth over time. Yet this indicator, which depends on the economic growth of the country and its level of urbanisation is greatest in the "emerging countries". It is in these countries that the situation is currently deteriorating the most (e.g., South-East Asia, Uganda). Elsewhere, in many Third World cities that are already highly populated, urbanised and motorised (e.g., Mexico, Lagos, Cairo, etc.), the situation remains very serious, even though it has existed for a long time. In spite of this, the problem is frequently ignored by the public authorities. One reason for this is the lack of an efficient system of information, which results in a shortage of road traffic accident statistics. The other is that major interests are competing against road safety concerns.

1 As defined in the 1993 World Bank Report. The "Burden of disease" is measured in DALYs. The DALY (Disability Adjusted Life Year) theoretically allows disabilities and deaths to be measured on a same scale. For a given health problem, the DALY expresses the number of years lost added to an adjusted measure of the years of life spent with a handicap. The adjustment of the years of life spent with a disability is based on the severity, the duration of the healthcare problem studied, as well as the age and the type of person concerned. Characteristics such as the socio-economic status, race or the level of education are not taken into account in the measurement of DALYs.

2 A 5 Year WHO Strategy for Road traffic Injury prevention - source Krug, 1999 –WHO
Road traffic accidents not only kill, they also cause disability. This is why the WHO stresses the concept of the "Road Traffic Injuries Pyramid"\(^3\): in rich countries, for every person killed, approximately ten people will be admitted to hospital (some of whom will be left disabled) and approximately seven people will visit a hospital emergency department. Although the circumstances are very different, the proportions of dead, injured and disabled in developing countries are probably more or less identical to those noted in the rich countries\(^4\).

Road traffic accidents thus represent a significant burden for hospitals and the medical system in general. It is thus estimated that, on a worldwide basis, road traffic accident victims represent 30 to 86% of hospital injury admissions\(^5\).

Ultimately the situation is very costly for everyone: individuals, communities, healthcare systems and countries. A single figure: it is estimated that road traffic accidents in developing countries take 1 to 1.5% off the GDP, which is equal to approximately double the amount poor countries receive in external aid.

**Breakdown by geographical area**

**Breakdown of road traffic accident deaths by WHO region and by income group: High income (H) and low/medium income (L/M)**

<table>
<thead>
<tr>
<th>Region</th>
<th>Africa</th>
<th>America</th>
<th>Middle East</th>
<th>Europe</th>
<th>South-East Asia</th>
<th>West Pacific</th>
<th>World</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income</td>
<td>H</td>
<td>L/M</td>
<td>H</td>
<td>L/M</td>
<td>H</td>
<td>L/M</td>
<td></td>
</tr>
<tr>
<td>Total deaths (x 1,000)</td>
<td>170</td>
<td>49</td>
<td>126</td>
<td>72</td>
<td>66</td>
<td>107</td>
<td>336</td>
</tr>
<tr>
<td>Percentage of deaths worldwide</td>
<td>14.5</td>
<td>4.2</td>
<td>10.8</td>
<td>6.1</td>
<td>5.6</td>
<td>9.1</td>
<td>28.6</td>
</tr>
<tr>
<td>Crude death rate per 100,000 population</td>
<td>28.2</td>
<td>16.1</td>
<td>25.3</td>
<td>15.2</td>
<td>16.8</td>
<td>22.4</td>
<td>22.6</td>
</tr>
<tr>
<td>Percentage of all deaths in the region</td>
<td>1.8</td>
<td>1.9</td>
<td>4</td>
<td>1.9</td>
<td>1.7</td>
<td>2</td>
<td>2.5</td>
</tr>
</tbody>
</table>

*Source: Krug 1999*

\(^3\) *Road Traffic Injuries pyramid*, WHO: Violence and Injuries Prevention Department, [http://www5.who.int/violence_injury_prevention](http://www5.who.int/violence_injury_prevention)

\(^4\) even if cases won’t be seen by the hospital services (in particular minor injuries)

\(^5\) Odero W, Garner P Zwi A - road traffic injuries in developing countries: a comprehensive review of epidemiological studies Tropical Medicine and International Health 1997
We note, of course, very great differences between high-income countries and those with medium or low incomes, the difference being to the disadvantage of the latter. In all, the developing countries (low- and medium-income countries) account for more than 85% of deaths and 90% of DALYs lost due road traffic accidents. Within the group that concerns us, that of the developing countries, the figures presented here would tend to show that there are no significant differences between the various regions. If we disaggregate the figures further, however, by country, significant differences may appear within a given region.

**Variation over time**

*Increase in the annual number of deaths by region*

(Source: Jacobs et al, 2000 – reproduced from the WHO strategy document)
During the 90s, we note a 20% increase in the number of road traffic accident deaths worldwide over a decade. It is interesting to study this period, as it is during this time that the rich countries began to react to the problem of road traffic accidents, while at the same time the developing countries were experiencing major upheavals in terms of their demography, urbanisation and motorisation. Thus it is that during the 90s, the developed countries (highly Motorised Countries) managed to bring the phenomenon of road traffic accidents under control despite increasing numbers of cars on the roads. In some countries, following awareness of the problem and the adoption of suitable measures, the number of deaths was considerably reduced. According to the graph, the situation also appears to be under control in Central and Eastern Europe, without being able to give any simple explanation\(^6\).

In the other regions, i.e., more or less the entire developing world (Africa, Asia, Latin America and the Caribbean) we note a significant and constant increase in the number of road traffic accident deaths. Asia appears to be the region most affected by the increase in fatalities\(^7\).

**Example of change in a developed country, Belgium**

The experience of the developed countries proves that road traffic accidents are not inevitable, and that the resulting injuries can to some extent be reduced in frequency and severity. If the developed countries have done it, why not the poor countries. For example, the following graph shows how the figures have changed in Belgium.

---

\(^6\) Possible explanations: an error (deterioration of the system for recording cases) or a consequence of the fall of the Berlin wall.

\(^7\) Taking into consideration that the population of South-East Asia is much larger than that of the Middle East.
Variation in the number of road traffic accidents and the number of motor vehicles

(Source: Belgian road safety report 2000)

The number of vehicles doubled in Belgium between 1972 and 1999. At the same time, the total number of road traffic accident victims was reduced by 30% and the number of deaths after 30 days reduced by over 50%. We can attempt to understand why.

The important dates for road safety in Belgium are as follows:

- 1971: introduction of a 90 km/h speed limit, but this was not complied with as very few checks were performed,
- 1974: introduction of more severe sanctions in the event of speeding,
- 1975: wearing of seatbelt made obligatory, blood alcohol limit lowered to 0.8 g/l,
- 1976: wearing of crash helmet made obligatory class B motorcyclists,
- 1991: wearing of rear seatbelt made obligatory,
- 1992: speed limit in built-up areas reduced to 50 km/h,
- 1994: blood alcohol limit lowered to 0.4 g/l with higher fines above 0.8 g/l,
- 1996: priority given to pedestrians on pedestrian crossings. Child restraints (seats) made obligatory,
- 1997: priority rules at roundabouts changed,
- 1998: cameras installed at certain intersections,
- 1999: law against driving under the influence of drugs.
We can see that the reduction is not down to chance. Significant efforts have been made.

The improvements illustrated by the example of Belgium have been observed in most developed countries, with some countries doing particularly well: the United Kingdom, the Scandinavian countries (especially Sweden), and some particularly badly: the Mediterranean countries, for example (especially Greece and Portugal).

Further efforts therefore need to be made, even in the rich countries, as there are still thousands of reckless drivers in the developed countries who are ready to kill.

**Breakdown by sex**

According to the WHO, the road traffic accident mortality rate worldwide is 28.8 per 100,000 for men against 10.8 per 100,000 for women, i.e., a sex ratio of almost 3:1. This can be partly explained by the economic activity of each sex (men more often have to work away from home) but it is also probable that an explanation is to be found in the differing approach to "risk-taking" (speed, alcohol abuse, etc.). In Karachi, for example, a study has shown that men take many more risks when taking public transport (minibus) than women.

There would therefore appear to be no difference between rich and poor countries as far as this aspect is concerned.

---

8 Faraz MK; Munima J; Chotani H C; Luby S - Pedestrian Environment and Behaviour in Karachi, Pakistan
Breakdown by age group

Estimated breakdown of numbers of deaths and mortality rates by age group in 1998

<table>
<thead>
<tr>
<th>Age group</th>
<th>Number of deaths</th>
<th>Mortality per 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 4</td>
<td>82,400</td>
<td>13.6</td>
</tr>
<tr>
<td>5 – 14</td>
<td>162,000</td>
<td>13.6</td>
</tr>
<tr>
<td>15 – 44</td>
<td>600,000</td>
<td>21.7</td>
</tr>
<tr>
<td>45 – 59</td>
<td>172,000</td>
<td>22.7</td>
</tr>
<tr>
<td>60+</td>
<td>154,000</td>
<td>26.5</td>
</tr>
<tr>
<td>All ages</td>
<td>1,171,000</td>
<td>19.9</td>
</tr>
</tbody>
</table>


This figure, unfortunately, fails to hide the reality of developing countries: the age structure of road victims varies enormously from one country to another. Road traffic accident mortality rate of children aged between 0 and 4 years old is 4 to 7 times higher in India than in Europe or the United States.

The situation is more or less the same as far as children between 5 and 14 are concerned, although for this age group, it is Sub-Saharan Africa that comes first, with a mortality six times higher than in Europe. This has led to organisations such as UNICEF taking an interest in the problem.

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9 Vinand M Nantulya and Michael R Reich - Road Traffic Injuries in Developing Countries: strategies for prevention and control – Road Traffic Injuries and Health Equity Conference
Road traffic accident deaths among children aged 0 to 4 years old

Graph reproduced from Road Traffic Injuries in developing countries: strategies for prevention and control Vinand et al. – data obtained from the World Health Report- Krug 1999)

Road traffic accident deaths among children aged 5 to 14 years old

Graph reproduced from Road Traffic Injuries in developing countries: strategies for prevention and control Vinand et al. – data obtained from the World Health Report- Krug 1999)
Burden of Disease

Relative position of road traffic accidents relative to other health problems in terms of death and disability (measured in DALYs), 1998

<table>
<thead>
<tr>
<th>Region</th>
<th>0-4</th>
<th>5-14</th>
<th>15 – 44</th>
<th>45 - 59</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Deaths</td>
<td>DALY</td>
<td>Deaths</td>
<td>DALY</td>
</tr>
<tr>
<td>High-income countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Americas</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Europe</td>
<td>7</td>
<td>5</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>West Pacific</td>
<td>6</td>
<td>5</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Middle East</td>
<td>&lt;15</td>
<td>&lt;15</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Low- and medium-income countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>&lt;15</td>
<td>&lt;15</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Asia (India)</td>
<td>12</td>
<td>10</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Asia (others)</td>
<td>11</td>
<td>9</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>West Pacific (China)</td>
<td>&lt;15</td>
<td>12</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>West Pacific (others)</td>
<td>11</td>
<td>9</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>The Americas</td>
<td>13</td>
<td>10</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Middle East</td>
<td>&lt;15</td>
<td>&lt;15</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Europe</td>
<td>&lt;15</td>
<td>14</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>14</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: WHO World Health Report 1999

This table must be interpreted with caution: in the developing countries, there are numerous other unresolved health problems competing with road traffic accidents, particularly as far as the 0 to 4 and 4 to 15 year age groups are concerned (malaria, diarrhoea, lower respiratory tract infections, AIDS, etc.).

This does in any event show that road traffic accidents remain a poorly understood, or even ignored cause of death and disability, in particular in poor and transition countries. Unfortunately, demographic, urbanisation and motorisation forecasts show that, over the coming years, the burden of road traffic accidents is not going to stop increasing. The following table shows the WHO's predictions regarding the global Burden of Disease in 2020.

Changes in the Burden of Disease classification for the ten leading causes worldwide between 1998 and 2020

<table>
<thead>
<tr>
<th>1998</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower respiratory tract infections</td>
<td>Ischemic heart diseases</td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>Unipolar depression</td>
</tr>
<tr>
<td>Perinatal diseases</td>
<td>Road traffic accidents</td>
</tr>
<tr>
<td>Diarrhoeal diseases</td>
<td>Cerebral vascular diseases</td>
</tr>
<tr>
<td>Unipolar depression</td>
<td>Chronic obstructive pulmonary diseases</td>
</tr>
<tr>
<td>Ischemic heart diseases</td>
<td>Lower respiratory tract infections</td>
</tr>
<tr>
<td>Cerebral vascular diseases</td>
<td>Tuberculosis</td>
</tr>
<tr>
<td>Malaria</td>
<td>War</td>
</tr>
<tr>
<td>Road traffic accidents</td>
<td>Diarrhoeal diseases</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary diseases</td>
<td>HIV/AIDS</td>
</tr>
</tbody>
</table>

Source: WHO, Evidence, Information and policy, 2000
Cost of road traffic accidents by WHO region (USD billion)

<table>
<thead>
<tr>
<th>WHO region</th>
<th>Regional GNP 1997</th>
<th>Annual cost of road traffic accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cost GNP</td>
<td>Cost Cost</td>
</tr>
<tr>
<td>Africa</td>
<td>370</td>
<td>1%</td>
</tr>
<tr>
<td>Asia</td>
<td>2,454</td>
<td>1%</td>
</tr>
<tr>
<td>Latin America and Caribbean</td>
<td>1,890</td>
<td>1%</td>
</tr>
<tr>
<td>Middle East</td>
<td>495</td>
<td>1.5%</td>
</tr>
<tr>
<td>Central and Eastern Europe</td>
<td>659</td>
<td>1.5%</td>
</tr>
<tr>
<td><strong>Sub total</strong></td>
<td><strong>5,615</strong></td>
<td><strong>2%</strong></td>
</tr>
<tr>
<td>Highly motorised countries</td>
<td>22,665</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>517.8</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source: Jacobs et al., 2000

Macro-economic estimates suggest that the annual cost of road traffic accidents is approximately 1% of the GNP in low income countries, 1.5% in middle income countries and 2% in "highly motorised" countries. According to certain authors, the annual cost of road traffic accidents is two times greater than the total aid provided to these countries by the international community\(^\text{10}\).

These costs do not include the social costs (e.g. orphans) and psychological costs (e.g., pain, disfiguration) resulting from accidents.

**Problem of perception of the scale of the problem**

The traditional view of the accident as a "chance event" has led to the problem being neglected until very recently in the developed countries. During these last few decades, there has been a realisation in these same countries, which has led to some extent to the reduction in the number of deaths recorded.

Despite the improvements in the figures, we note that the problem is still perceived by some as being minor, while it is in fact a major public health challenge. This low awareness would appear to be due to various factors:

- In people's minds, an accident is something that occurs randomly, that is a hypothetical danger.
- Since the first death due to collision with a motor vehicle (1898), road traffic accidents have become routine. As noted by TJ Coats, the number of road traffic accident deaths in the United Kingdom, a country which is nevertheless considered to have a good road safety record, is equivalent to a Lockerbie plane crash once every four weeks\(^\text{11}\).
- The media bear some responsibility for the pervading ignorance. In spite of the alarming statistics, road traffic accidents rarely

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\(^{10}\) Vinand M Nantuya and Michael R Reich - Road Traffic Injuries in Developing Countries: strategies for prevention and control – Road Traffic Injuries and Health Equity Conference

\(^{11}\) TG Coat - Prehospital Care for road traffic casualties. BMJ vol 324 :1135 :1138
made the headlines of the newspapers.

Road safety is also in competition with much stronger economic interests that sometimes prevent courageous decisions from being taken: Drivers must arrive on time, alcohol must be drunk, sports cars must be sold, etc.

In our Judeo-Christian world, some people quickly tend to take shortcuts and only blame the "culprit" (he died because he was drunk), ignoring all the other factors that might have allowed the accident to be avoided, or limited its consequences.

Some professionals, in particular doctors, tend to show little interest in the field of road safety research. This does not involve finding a miracle cure for AIDS or cancer, but something much less "sexy" like, for example, ensuring that young people always wear a crash helmet.

Finally, data is sometimes lacking, which prevents an effective case from being made.

In less developed countries, some of these considerations will have a lot of influence: Fatalism and the esoteric view of life, that are very common in many poor countries, mean that there will be very little tendency to seek the real causes of an accident, and the blame will quickly be placed either on the victim, or someone else having influenced events from afar, e.g., using witchcraft.

In some places, the established media are sometimes very weak and have difficulty performing their information-carrying role. Research, being generally under developed and poorly organised, will also find it difficult to play its informational role. In all, many people in the poor countries will wrongly tend to minimise the situation.

The battle against road traffic accidents also involves proving to people that accidents are not inevitable, that they are preventable, that injuries incurred in an accident are caused by a number of different factors and that, by acting on these different factors, it is possible to reduce the number and the severity of these injuries. The non-fatalistic, multi-causal view must be promoted at all levels: not only to the beneficiaries, but also, and above all, to all those involved in "road safety": governments, politicians, media, medical professionals, communities, etc. Thus we can see the first benefit of the approach known as the Public Health Approach: a proper analysis of the various determining factors allows effective lobbying, among other things.
To begin with, and up until very recently, accidents were considered to have a single cause, related to the behaviour of the individual deemed responsible for the accident.

At the end of the 1st World War, however, Hugh De Haven, an American pilot having survived a plane crash sought to understand why he was still alive. He concluded that, even in a plane crash, under certain circumstances, the distribution of pressure can ensure survival. A crash is then, according to him, only the first phase in a process that may or may not result in an injury.

In the middle of the last century, John Gordon, an epidemiologist from Harvard, attempted to apply the principles of epidemiology to accidents. He therefore studied the distribution of injuries by age, location, time, etc., and showed that injuries could not be considered simply as chance events. He attempted to apply the traditional "Epidemiological Triad" to accidents, which up until then had been used for infectious diseases. He thus defined the host, the vector and the environment.

<table>
<thead>
<tr>
<th>Infectious diseases (e.g., tuberculosis)</th>
<th>Road traffic accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Host</strong></td>
<td><strong>Driver</strong></td>
</tr>
<tr>
<td>Patient</td>
<td>RF: absorption of alcohol, fatigue</td>
</tr>
<tr>
<td>RF: Malnourished, HIV positive man of 25 years of age</td>
<td></td>
</tr>
<tr>
<td><strong>Vehicle (vector)</strong></td>
<td><strong>Excess momentum</strong></td>
</tr>
<tr>
<td>Tuberculosis bacillus</td>
<td>RF: in particular those associated with speed and mass (E = \frac{1}{2} MV^2) (^{12})</td>
</tr>
<tr>
<td>RF: Multi Drugs Resistance</td>
<td></td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td><strong>(physical and socio-cultural)</strong></td>
</tr>
<tr>
<td>(physical and socio-cultural)</td>
<td>RF: Slippy road, poor visibility, defective brakes, etc.</td>
</tr>
<tr>
<td>RF: Promiscuity, poverty, level of education, etc.</td>
<td></td>
</tr>
</tbody>
</table>

\(^{12}\) Where \(E\) is the energy produced, \(M\) the mass and \(V\) the velocity (squared, hence the significance of this factor in road traffic accidents and their consequences in the form of injuries)
William Haddon, the "father of modern accident prevention" noted that this model works perfectly except in certain cases such as asphyxia or drowning. In these cases, it is not an excess of energy but the lack of a vital element that causes the injury. This observation thus leads to the now classical definition of injury.

**Definition of an injury**

Intentional or intentional corporal injury resulting from severe exposure to thermal, mechanical, electrical or chemical energy, or to the absence of viral elements such as heat or oxygen.  

Haddon noted that the host, the vehicle and the environment can be described in three time phases: before energy transfer, during energy transfer, and immediately after energy transfer. This leads to the classical Haddon Matrix used to describe the factors having contributed to the consequences of the accident. Using this conceptual framework, Haddon went from a unifactorial behavioural approach, in which the accident was an event that could only be anticipated and prevented with difficulty, to a multi-factorial environmental approach taking into account the various aspects of the accident (determinants).

This logic led to a much higher potential efficiency, in particular as far as primary prevention is concerned (the principle that prevention is better than cure being particularly applicable to the prevention of road traffic accident injuries). The aim is now to change the environment in such a way that, either the energy transfer does not occur or, if it does occur, its consequences are as minor as possible.

We refer to this as the Environmental Approach as, at the end of the day, it is the environment that conditions the vast majority of factors that cause injury, whether directly or indirectly the fault of the individual: if a person adopts a certain type of behaviour, such as alcoholism, it is largely because of his environment. It is by changing this environment that we can reduce the risk.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Human factors</th>
<th>Factors associated with the Vehicle</th>
<th>Physical environment</th>
<th>Socio-cultural environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-event</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Event</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-event</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13 We should note that injuries are generally classified as intentional or unintentional (to which road traffic injuries belong)
Following this initial conceptualisation of the problem of injury, the epidemiologists noted that there are three possible levels of intervention to reduce the transfer of energy and its consequences:

- Promotion and education methods,
- Legal methods (legislation and enforcement of the law),
- Modification of the physical environment.

These three type of intervention, known in English under the generic name of the 3Es (Education, Enforcement, Engineering), will be examined in greater detail below.

**GENERAL PRINCIPLES OF INTERVENTION**

**Public Health Approach: what does this mean?**

The public health approach consists of the surveillance, the epidemiological analysis, the implementation and assessment of an intervention focussing on a single, clear result — the prevention of a particular type of injury or disease.

The result must be unique and clear: in order to remain effective, the programmes must clearly define, from the outset, the types of injury they aim to prevent, as well as the population(s) on which they intend to work. Programmes must be planned, executed and evaluated to treat this type of problem. This requires information, and it is here that epidemiology comes into play.

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**Definition of epidemiology**

The study of the distribution and the determinants of the state of health in a population and the application of the results of this study to the control of health problems.

Modern epidemiology consists of two branches

- **Descriptive epidemiology**: within this area, the distribution of cases can be analysed according to a certain number of variables (age, sex, vehicle type, road type, presence of protection, etc.)
- **Analytical epidemiology**: studies are implemented to determine the causal links. This involves research (case-control studies, cross-sectional studies, longitudinal studies, etc.)

In practice, any road safety programme must therefore at least include the descriptive epidemiological aspect (as a minimum: police monitoring of road traffic accidents, hospital statistics). Using the data collected, those responsible for the programmes will be able to analyse the situation in order to implement programmes that best suit the circumstances. The effectiveness of the programs implemented will subsequently be able to be evaluated. Finally, it will be possible to adopt a very pragmatic approach to respond specifically to the problems identified (e.g.: in the case of correcting accident black spots, by intervening to reduce a particular environmental risk factor).

Analytical epidemiology, which is of less immediate use, can be applied as part of an operational research programme, but only subsequently.

**Haddon matrix**

The Haddon matrix that presents the causal factors in their epidemiological and

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14 see the WHO Internet site: Violence and Injury prevention Department [http://www5.who.int/violence_injury_prevention](http://www5.who.int/violence_injury_prevention)
temporal dimensions, is commonly used to analyse causes and determine possible types of action. Rather than presenting this matrix once again, we will look at an example of a study of causal factors in the case of an accident involving a driver returning from a nightclub in a drunken state, whose car leaves the road and crashes into a tree (outcome: "single, clear element"). Hence, as long as we are studying a unique, clear result, the Haddon matrix should allow us to model the causal factors behind the occurrence and severity of the injuries resulting from a particular type of road traffic accident.

<table>
<thead>
<tr>
<th>Factor Phase</th>
<th>Human factors</th>
<th>Vehicle</th>
<th>Physical environment</th>
<th>Socio-cultural environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-event</td>
<td>Driver's basic knowledge of the highway code</td>
<td>Condition of tyres, maintenance of brake system</td>
<td>Quality of road markings</td>
<td>Public attitude to alcoholism</td>
</tr>
<tr>
<td></td>
<td>Level of nervous depression</td>
<td></td>
<td>Presence of rain</td>
<td></td>
</tr>
<tr>
<td>Event</td>
<td>Speed of vehicle</td>
<td>Space within which the human being moves inside the car</td>
<td>Presence of fixed objects on the road side (trees)</td>
<td>Extent to which the law requiring the wearing of seat belts is applied,</td>
</tr>
<tr>
<td></td>
<td>Use of seat belt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-event</td>
<td>General condition of the victim</td>
<td>Presence of a fuel tank designed not to explode</td>
<td>Presence of a nearby accident and emergency service</td>
<td>Public support for the provision of rehabilitation</td>
</tr>
<tr>
<td></td>
<td>Age of the victim</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Conceptual approaches to intervention

The Haddon matrix allows the possible type of intervention to be highlighted: if we exclude the treatment of the injured, which is mainly a medical matter, the prevention of road traffic injuries depends essentially on the three areas already referred to. Enforcement: involving forbidding or imposing; Education: involving persuasion; Engineering: involving the modification of the physical environment to make it less hazardous.

From a conceptual point of view, Haddon describes ten measures of intervention:

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Example of drunken driver</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Prevent the creation of the hazard causing the injury</td>
<td>Introduce ignition keys connected to a breathalyser; cut down the trees</td>
</tr>
<tr>
<td>2 Reduce the amount of the hazard (or energy) causing the injury</td>
<td>Install speed calming devices (speed bumps)</td>
</tr>
<tr>
<td>3 Prevent the release of an existing hazard</td>
<td>Protect fuel tanks to avoid them exploding</td>
</tr>
<tr>
<td>4 Modify the rate of spatial distribution of the hazard (or the energy)</td>
<td>Require seat belts to be worn. Install airbags</td>
</tr>
<tr>
<td>5 Separate the hazard in time and space from that which is to be protected</td>
<td>Screening of people having drunk too much at the exit of nightclubs</td>
</tr>
<tr>
<td>6 Place a barrier between the hazard and that which is to be protected</td>
<td>Safety barrier to avoid people crashing into trees</td>
</tr>
<tr>
<td>7 change the basic qualities of the hazard</td>
<td>Prevent the windscreen from exploding. Avoid dangerous edges in cars</td>
</tr>
<tr>
<td>8 Make what is to be protected more resistant to damage</td>
<td></td>
</tr>
<tr>
<td>9 Begin by countering the damage caused by the hazard</td>
<td>Train the public in first aid</td>
</tr>
<tr>
<td>10 Stabilise, repair and rehabilitate the object of the damage</td>
<td>Treat in the ambulance, the hospital, etc.</td>
</tr>
</tbody>
</table>

Not only are these ten types of measures conceptually distinct, but together they cover the prevention of every type of injury caused by accidents. Measures 1 to 8 are primary prevention measures and in practice are based on the three areas of enforcement, education and engineering. Measures 9 and 10 are based on the field of medicine.

General principles for effective prevention

A certain number of principles established by Haddon and his colleagues are now traditionally accepted:

- As with traditional public health problems, the strategies must be combined. They must therefore simultaneously incorporate actions relating to each of the three different areas (3E) and, as far as possible, relating to the three different phases (pre, per, post energy transfer)
- In prioritising actions, the choice of the strategy to be adopted does not so much depend on the significance of the causal factor but rather on the likelihood that the intervention will have an effect (effectiveness of intervention). It is not, for example, because underlying psychological problems are very frequently at the root of risk-taking behaviour where drink-driving is concerned, that priority should be given to such a strategy.
- Insofar as is possible, passive, automatic, constant measures (i.e., that do not depend on man) are more likely to be effective than active protection measures which require human intervention.
Finally, evaluations of road traffic injury reduction strategies have shown that, in developed countries, the effectiveness of the measures taken varies according to the area concerned:

Engineering measures prove by far to be the most effective, while educational strategies are ineffective in most cases (in any case where used on their own). The need for combined actions should therefore be stressed, even when the intervention concerns a single factor of the Haddon matrix. This is particularly true where education is concerned 15.

**Implementation**

In practice we see that road traffic injuries are due to a combination of several factors and that the occurrence of injuries can be modelled using the Haddon matrix. A multi-factorial strategy can therefore be implemented acting at the level of the individual, the vehicle, the physical and the socio-cultural environment, and this at each of the three phases of the accident: pre, per and post collision.

As the initial analysis is only possible if good information concerning the circumstances of the accidents is available, this approach presumes that there is an efficient surveillance system in place allowing the circumstances of the accidents most frequently encountered in a given population to be described in statistical terms. Upon completion of the analysis, action can be taken on the various causal factors identified as being likely to respond to intervention.

If we exclude the post accident medical aspect, the answers are to be found in the three Es:

- **Enforcement**: The aim here is to change the behaviour of humans involved in road traffic accidents, as well as to ensure that the different individual or collective elements of protection or of risk meet a suitable standard (e.g., crash helmet standards). It is not simply a matter of introducing a law but also, and this is the hard part, ensuring that it is actually applied.

- **Education**: Information and education of the general public regarding the circumstances in which accidents occur and the causal effects. An attempt is made, in particular to change certain risky behaviour noted in the target groups identified by the surveillance system. Finally, it is attempted to raise the awareness of the different players liable to enter into the causal chain, including political decision-makers and other parties (e.g., the media, police forces, etc. Lobbying can also be included within this area of intervention).

- **Engineering**: This involves, among other things, attempting to improve the highway infrastructure and vehicle design in such a way as to reduce the frequency and severity of accidents. Preference is given to "passive, automatic, constant protection systems" requiring no human input.

To these three Es, some people add a fourth: **Encouragement**, i.e., all the various incentives that can be given to encourage the individual to adopt a protective measure 16.

Regarding the post accident phase, other than avoiding the aggravation of accidents, the intervention will be essentially medical, both immediately following the crash, at the crash scene, and later in hospital.

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15 Injury Prevention and Public Health: Practical Knowledge, Skills and Strategies – Tom Christoffel; Susan Scavo Gallagher

16 E.g., a programme to provide crash helmets to target populations free of charge.
PREVENTION OF ROAD TRAFFIC INJURIES: EDUCATIONAL STRATEGIES

Theoretical basis

The educational approach applied to road safety is based on the precept that injuries are the result of inadequate knowledge, skills and attitudes. It is thus a matter of improving the knowledge of individuals and changing attitudes in such a way as to encourage safe behaviour and reduce the taking of risks.

Intervention can be envisaged in three areas:

- Improving the knowledge of the individual: For example, it is not obvious that the general public will instinctively be aware that wearing a protective helmet reduces the severity of bicycle accidents.
- Improving skills: theoretical and practical instruction can be given to improve the driving skills of future drivers in particular.
- Changing attitudes: while people generally consider that alcohol reduces the driving ability of the general population, for various reasons they often consider that they are the exception and that they are thus able to drive properly, even when intoxicated. An attempt can be made to change this state of mind.
- Changing behaviour: It is not because people know that seat belts save lives that they will use them. They must make the decision, attach their seat belt and continue to do so over time.

In the end, the expected result is always a change of behaviour. Yet the process followed by patients and leading to this change is far from easy to understand. According to the studies of James Prochaska, the process of change involves a series of well-defined stages over a period of time (Pre-contemplation, Contemplation, Preparation, Action, Maintenance). This process is not linear and the intervention of the “educationalist” must be adapted to each stage. Readers who are interested in the theory of change can refer to the websites referred to in the appendix (Transtheoretical Model).

Approaches and techniques of education and persuasion used in the area of prevention

A number of methods and techniques exist:

The educational approach

The educational approach is based on the principle that, if they have properly understood why they must do what is suggested to them, people will indeed change their behaviour and do as suggested. A number of factors influence whether individuals will decide to adopt the recommended preventive action: firstly, they must be personally at risk and the risk must seem to them to be serious. They must also consider that the advantages they will gain by changing their behaviour outweigh the cost they will have to bear (Health Belief Model). Insofar as the characteristics of the risk are effectively as described, the task of the educationalist would simply involve communicating the information as fully and correctly as possible.

The persuasive approach

Bearing in mind that the action will only occur if people are sufficiently motivated, the supporters of this theory search in all the areas for methods that will allow the target public to be motivated. The educationalist’s role is to find the right argument and touch the raw nerve by

17 Consult the Cancer Prevention Research Centre Web page http://www.uri.edu/research/cprc/TTM/detailedoverview.htm
18 See slide presentation available at http://www.byu.edu/health/courses/health365/karen/health.ppt
whatever means. In the field of road traffic accident prevention, one might for example use strong or even unbearable images to persuade the targeted individuals to change their behaviour. This model is now much criticised, in particular because this approach corresponds to a normative view of the world: The educationalists know what is good for you, and wish to impose it. The less than limited impact of the "Just Say No" campaign launched by Ms Reagan and directed at American drug addicts illustrates the weakness of this approach.

The behavioural approach

The supporters of this approach minimise the importance of thoughts and feelings and consider simply that if a person does something its because 1- they have learnt to and 2- because it gives them satisfaction. It is thus a question of training the target populations to adopt a different behaviour and ensuring that the desired behaviour is rewarded when it occurs. There are a number of programmes in the United States, for example, that provide incentives to professional drivers if they have no accidents over a certain period of time 19. Elsewhere, there is talk of penalty points licences on which points would have to be won before being able to lose them. Young people would start off with a low points capital, which would not allow them to drive powerful cars, for example. This approach is interesting, but the fundamental problem is that it is necessary to act directly at the level of the individual, which is costly.

The social influence approach

This approach considers that campaigns aimed at changing the standards of the community and collective behaviour are more likely to change the behaviour of individuals from that community. The standards having changed, the individual must adapt his behaviour if he does not wish to remain isolated. Where road safety is concerned, the best demonstration is provided by the studies conducted into alcohol abuse among American students 20. The problem with this approach is that the new standard must be fully understood and accepted and that, for that particular problem, the pressure of the community on the individual must be significant.

The Social Marketing approach

This new approach, which appears in the 1970s, is derived from and inspired by the four others already presented.

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21 Kotler and Zaltman, Journal of Marketing, July, 1971

22 Andreasen AR Marketing Social Change: changing behaviour to promote Health social Development and the Environment

23 Social change Media http://www.media.socialchange.net
Who might be targeted by the educational programmes?

It should be noted that educational strategies can target either the general population or sub-groups for which the incidence or severity of road traffic accidents are particularly high. It is therefore desirable, at the start of any programme, to define not only the problem it is wished to prevent but also the population it is wished specifically to target.

Beyond this, the educational strategies are not only aimed at those people directly implicated in road traffic accidents. They can also be targeted at healthcare professionals, the media, the political decision-makers, private business, and the law enforcement agencies. Of these groups some, in particular the media and political decision-makers, may play a critical role in changing public attitudes and especially in making certain behaviour (such as drink-driving) unacceptable.

Limitation of educational programmes

Isolated educational programmes appear to have proven their use in a limited number of circumstances:

- Learning new types of behaviour that will remain with people for the rest of their lives (e.g., teaching children to wear seat belts),
- Changing the perception of what society considers acceptable or unacceptable (e.g., drunk-driving),
- Changing public demand for safer products.

Apart from these circumstances, specialists now believe that an educational strategy conducted in isolation can only have a very limited impact. In some cases, it has even been proven that certain educational strategies can have the opposite effect to that anticipated. For example, a literature search in the United States shows that giving driving lessons to high school students not only failed to reduce the involvement of these young people in road traffic accidents, but in fact increased it (because these lessons generally allow them to obtain a driving licence younger).

The harshest criticisms are frequently aimed at mass campaigns that do not differentiate between the different sections of the population (e.g., public poster campaign). This thus leads us to recommend educational strategies that are properly targeted and combined with the two other approaches (in particular the legal approach).

PREVENTION OF ROAD TRAFFIC INJURIES: ENVIRONMENTAL STRATEGIES

Why change the environment?

On the Escape of Tigers – William Haddon, 1970

An escaped tiger in a town can be considered as an uncontrolled transfer of energy with sudden and potentially disastrous consequences. In such a case, society does not attempt to teach the population how to deal with a tiger. Instead, by putting in place various

24 E Petridou Matina stappa, Yannis Tsoufis Effectiveness of a Comprehensive Multisector Campaign to Increase Seat Belt Use in The Greater Athens Area, Greece, Am. J of Public Health Vol 89 1861:1863

barriers, it controls the environment in such a way that the tiger cannot escape in the first place.

The example of the tiger allows us to highlight a certain number of principles relating to the environmental approach:

- The most effective approach for a safe environment is to eliminate or reduce the source of danger (Conceptual Approach N°1 – car accidents can be reduced by encouraging the use of public transport, for example).

- If it is impossible to eliminate a hazard, it is preferable to adopt risk-reducing measures that do not involve changing human behaviour. These measures have a passive, automatic and constant protective effect. These characteristics are specific to a great many environmental interventions.

- After all, the majority of hazards to which society is exposed have been created by man (including the tiger, as it was brought into the town by man). That which has been created by man, can be recreated by man (Leon S Robertson). A society thus has the level of safety for which it is willing to pay.

Once the environment has been changed, human intervention is minimal or even non-existent. Thus it is that the environmental approach has been identified as being the most effective of the three types of intervention (at least in the United States).

**What role can public healthcare professionals play?**

Most of the work involved in creating a safer environment concerns engineers, planners and architects rather than healthcare professionals. Healthcare professionals can be involved, however: by identifying the hazards, in particular though the surveillance system implemented, educating professionals and the media about prevention, and finally assisting communities in setting up pressure groups for implementing environmental changes.

Through the coordinating agencies and units, healthcare professionals (including NGOs) also have a role to play in informing, educating, supplying data to the public authorities and evaluating the results. This work requires a great deal of effort and tact, particularly since accident prevention frequently goes against the interests of certain operators, such as private business or the trades unions for example.

**PREVENTION OF ROAD TRAFFIC INJURIES: THE ROLE OF THE LAW**

**Principles for effective action**

By implementing laws or local regulations, the public authorities are able to pursue several aims: change the behaviour of individuals (e.g., use of seat belts, speed limits), change the characteristics of products (e.g., in-car protection) or change the physical characteristics of certain localities (e.g., speed bumps).

The problem with implementing measures that otherwise effective in theory, may come from the fact that the law envisaged limits individual autonomy or that it threatens certain economic or corporate interests. Three types of argument are thus put forward to counter the implementation of accident prevention legislation. It is generally argued that the law is unconstitutional, that it will not achieve its aim, or that it mitigates against philosophical, political or economic values such as individual freedom or spending restrictions.

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In all, it has been possible to identify six criteria that permit the implementation of new legislation to be envisaged:

- The action must be effective,
- The judges and the law enforcement authorities must support its imposition,
- It must not involve excessive additional expense,
- The law must be constitutional,
- It must also be compatible with the other laws that are already in place,
- It must have wide public support.

In order to maximise the chances of obtaining a positive impact, the public must be aware that the law has been introduced, realise that it will be applied and believe that there is a high likelihood of being caught in the event of failure to comply.

Once the law has been promulgated, legal measures will only be effective if they are combined with educational strategies and insofar as the law concerned can be imposed. Thus, once promulgated, one of the most important problems to be resolved by the states concerns the resources to be made available to police forces and the justice system to allow the law to be imposed. The effectiveness of a law is therefore largely dependant on "legal logistics" (the efficiency of police procedures, fairness of sentencing, speed of dealing with cases, effectiveness of penalties imposed), etc.

With respect to this, we should note that:

- In certain cases, the application of the law faces problems of responsibility. In a federal state, for example, one can therefore imagine that a law would not be able to be properly enforced because the entity having promulgated it has no direct authority over those responsible for ensuring its application.

Laws do not only apply nationally and local regulations can also be passed. This exercise could provide a method of testing theories in the area of road safety.

What role can public healthcare professionals play?

Public healthcare professionals should first of all determine to what extent the law effectively prevents accidents. Their expertise can serve to determine in what way the proposed legislation could be improved without reducing its effectiveness, and how it might be applied in practice. Finally, once the law has been implemented, public healthcare professionals are involved in evaluating its impact through the surveillance system.

DIFFERENCES BETWEEN DEVELOPED AND DEVELOPING COUNTRIES, CONSEQUENCES FOR THE MANAGEMENT OF THE PROBLEM

WHY ARE THERE MORE DEATHS IN DEVELOPING COUNTRIES?

85% of deaths and 90% of disabilities from road traffic accidents are attributable to the poor and transition countries. We can effectively talk of carnage and the situation is worsening daily with the constant rise in urbanisation and motorization. It is already estimated, for example, that the probability of a motor vehicle being involved in a fatal accident in Africa is 100 times greater than in the United States.

In the rich countries, following significant growth in the number of road deaths up until the 1970s, a more or less constant reduction has been noted since then, and the rate of reduction is probably also proportional to the level of awareness of the problem. In seeking to define programmes for low- or middle-income countries, it is worth gaining inspiration from the methods that proved their efficiency in the rich countries.

Most of the so-called emerging countries have gone from being rural societies to urban societies within the space of less than thirty years. During this short period of time, road safety in most cases has been sacrificed at the altar of modernity: the attitude of many people, and of course that of most leaders, is that accidents are the inevitable cost of development. Towns have mushroomed in size, vehicles have become faster, highways have become more congested, but there has been no effort to legislate or educate for road safety. The infrastructures have been changed, but not at all in such a way as to improve road safety. On the contrary, the aim being to improve the economic efficiency of the "town", preference has been given to faster, more crowded transport.

Added to this is the fact that during the past 30 years, the attitudes of these originally rural populations have not had time to change accordingly, particularly as education has often been neglected. The situation is more or less the same in the area of enforcement: while the number of vehicles has increased, the numbers employed by the police and the justice system to enforce the law has not generally kept pace. In the city of Sao Paulo in Brazil, for example, the population increased from 640,000 to 3 million between 1970 and 1990, while the number employed by the police forces remained unchanged. In all, we therefore note that the situation has considerably worsened in all areas.

This is why the approaches adopted in the high-income countries must be examined with great caution because, as we have seen, the characteristics of the infrastructure, the means of transport used and the user populations in each of the two groups of countries are fundamentally different. Not only are there major differences between the developed and the developing countries, but the situation within this group itself is also vary variable. There is a great diversity, because the social, political and cultural contexts are different. In all, as the WHO observes, even if a certain number of principles

29 WHO World Health Report 1999
30 African Road Safety review final report
http://safety.fhwa.dot.gov/fourthlevel/toc.htm
31 In only very few countries, for example, has road safety been included in the school syllabus
32 E A Vasconcellos Urban - Development and traffic accidents in Brazil. Accident Analysis and Prevention vol. 31 319-328
discovered are universally applicable, their implementation is not necessarily so.

In order to illustrate the specific problems of developing countries, we can attempt to describe a certain number of characteristics that are specific to these countries, and that result in the increased frequency and fatality of accidents. We will do this using the Haddon matrix. We should note from the outset that this list does not correspond to all poor countries and is obviously not exhaustive.

<table>
<thead>
<tr>
<th>Factor Phase</th>
<th>Human Factors</th>
<th>Vehicle</th>
<th>Physical Environment</th>
<th>Socio-cultural Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-event</td>
<td>Poverty, large gap between rich and poor, with the result that the poor have no other choice but to use hazardous public transport Carriers paid according to performance. They must transport as much as possible in as little time as possible Drivers poorly trained for driving on the road (driving licence fraudulently acquired, etc.) Low level of literacy Fatalism</td>
<td>Old, poorly maintained vehicles (brakes, lights, etc.) Large proportion of two-wheeled vehicles compared to cars Numerous pedestrians and public transport users Poorly regulated public transport (too many per vehicle, unscheduled stops)</td>
<td>Lack of road markings Poor lighting In some large cities: the road network is saturated (e.g., Lagos). Deficiency of alternative transport network (railway network)</td>
<td>Corruption, nepotism, difficulty enforcing the law (one of the traditional investments who are quickly successful is to buy busses). These self-made men are often above the law and their vehicles enjoy a certain impunity) No strong social pressure to stop drink-driving and speeding.</td>
</tr>
<tr>
<td>Event</td>
<td>Co-morbid conditions (AIDS, Tuberculosis, etc.)</td>
<td>Vehicles not in accordance with standards (no working seat belts, no air-bags, dangerous customisations) ; poor maintenance (brakes) Average number of passengers per vehicle (There are always more than five deaths when a bus is involved in an accident)</td>
<td>Condition of road surface</td>
<td>Insufficient political awareness of the problem, especially as the wealthy and the political decision-makers are well protected in their 4x4s</td>
</tr>
<tr>
<td>Post-event</td>
<td>Impossibility for some to pay for high-quality care</td>
<td>Mediocrity or lack of emergency medical/evacuation service Evacuation by people with no first-aid training Poor health cover Obsolete, unsuitable equipment, shortage of medicine (blood), poor quality hospital infrastructure Little special training in medico-surgical emergency treatment</td>
<td>Fatalism, esotericism</td>
<td></td>
</tr>
</tbody>
</table>

In addition to these factors, as previously stated, there is also the fact that political awareness of the problem has been slow to dawn in the poor and transition countries, unlike in the rich countries where, once the high economic and social cost of road traffic accidents was recognised, the public authorities began to take the problem seriously. We therefore note that in the poor countries, the political authorities remain insensitive to the problem of the road traffic accidents that affect the majority of the popular masses. The industry of the emerging countries is producing, and that is the main thing.

It is obvious that, without effective lobbying, the sum of other problems
requiring resolution and competing economic interests will lead to road traffic accidents continuing, wrongly, to be considered as secondary. Moreover, in the absence of an efficient surveillance system, there risks to be a shortage of arguments to persuade key people that this is indeed a problem and that solutions exist. This is why the WHO stresses the need to provide evidence of the problem and constantly raise awareness, while at the same time as setting-up an efficient surveillance system.\(^\text{33}\)

Finally, we would point out that most of the factors referred to in the above table are directly or indirectly linked to poverty, which means that the margin for manoeuvre of the programmes remains small. On an individual level, for example, people may be aware of the risks they are taking but often have no choice but to use unsafe means of transport. In Nigeria, the users of public transport call the yellow mini-busses in which they travel “flying coffins”. They nevertheless use them, as they have no other choice from an economic point of view.\(^\text{34}\) Any strategy aimed at reducing road traffic accidents must take account of the potential secondary micro-economic effects.

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VULNERABLE GROUPS IN THE DIFFERENT REGIONS OF THE WORLD

When we calculate the road accident death rate by age group, we observe that children of 5 to 14 years of age and young adults are those who pay the highest price. This is logical, as these are the most active age groups. In Africa, however, the death rate for the 5 to 14 year age group is six times higher than in Europe or the United States.\(^\text{35}\)

Nantulya and his colleagues have been able to show that in Ethiopia, Kenya and Malawi, there is a very definite predominance of pedestrians and passengers among those killed in road accidents, while in the United States it is the drivers of the vehicles who are the most affected. These data are not surprising given the different patterns of road transport usage in the developed countries and the developing countries. In the developing countries, there are many more cyclists, motorcyclists and pedestrians, and it is known that accidents involving pedestrians (and probably cyclists) are much more serious. A study conducted in Brazil thus shows that an accident involving a pedestrian has a 1 in 10 probability of being fatal against 1 in 210 for an accident involving a motor vehicle.\(^\text{36}\)

Vulnerability profiles of rural areas also appear to differ from those of urban areas. In urban areas, it would appear that it is the pedestrians who are most affected, while in rural areas it is rather the users of minibuses and other forms of public transport. Here again, this does not seem at all surprising, given the behaviour of the commercial lorry drivers.

Despite there being many similarities between the different countries, we note that there are regional differences, as well as differences between countries of course. Once again, this leads us to consider strengthening the system of surveillance to provide a better suited response.

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\(^{33}\) A 5-year WHO Strategy for Road Traffic Injury Prevention – WHO/NMH/VIP.01.03

\(^{34}\) Vinand Nantulya and al. The neglected epidemic: road Traffic injuries in developing countries – BMJ May, 11 2002

\(^{35}\) See graph, page 12

\(^{36}\) E A Vasconcellos Urban development and traffic accidents in Brazil. Accident Analysis and Prevention vol. 31 319-328
WHAT ARE THE INDICATORS THAT ALLOW IT TO BE STATED THAT A ROAD SAFETY INITIATIVE IS A PUBLIC HEALTH PRIORITY WITHIN A COUNTRY OR A REGION?

How do we decide when to begin road safety intervention? Is there a threshold that allows us to say: OK, now we must go for it?

We can obviously analyse the various indicators:

- Demographic indicators (density, level of urbanisation)
- Economic indicators: GNP per inhabitant, GINI coefficient (an indicator that provides a measure of the difference between the rich and the poor within a given country)
- The road fatality rate per 100,000 inhabitants (the fatality risk)
- The level of motorisation, expressed in kilometre-vehicle per 1,000 inhabitants
- The mortality per 10,000 vehicles (the fatality rate)
- The mortality per kilometre-vehicle,

and attempt to understand whether the country actually is one of the "at risk" countries 37. This method must, however, be applied with some caution, insofar as the statistics, and in particular road statistics are often wrong and underestimate the true situation38. In reality, there is a need for road safety intervention almost everywhere. Thus, with the exception of a few very quiet, very rural areas, intervention could probably be envisaged everywhere.

According to the Violence and Injuries prevention department of the WHO, it is rather level of motivation of the partners that should win the day 39. The public servants within the relevant department of the Ministry in charge must obviously want to get things moving. Beyond that, the project must have the support of the rest of the government, political circles and the civilian community. Political personalities and high-ranking civil servants must thus give their full backing to the cause and be persuaded that a) it is a problem, b) solutions exist, and c) it is cost-effective to intervene.

Obviously, the reliability of the person consulted must be examined before being able to confirm that someone is motivated. The second point to be examined is perhaps the efficiency of the network in which the NGO finds itself40. Are there any reliable, motivated, well organised government partners? What is the position of the NGO itself within this area? Is it in a position to act as a catalyst? If it is able to open doors, this probably makes things much easier.


38 See, for example, the differences between the WHO estimates of global mortality and those of the TRL

39 Personal communication with Ms Margie PEDEN road traffic accident manager in the WHO’s Violence and Injury prevention Department

40 See the chapter dealing with the parties involved with road safety
ROAD SAFETY PREVENTION PROGRAMMES: PRACTICAL ASPECTS

GENERAL ASPECTS

The actions of road safety programmes can be directed towards a number of main areas:

- Epidemiological surveillance and research of road accidents
- The implementation of preventive measures (following analysis of surveillance data). Here, there are three possible areas of intervention
- Enforcement: legislation aimed at driver behaviour as well as legislation relating to the different aspects of individual or collective protection or risk. Implementation and enforcement of the law.
- Education: Information and Education aimed at general populations and certain target groups, as well as others who may play a role in the causal chain, including political decision-makers and other involved parties (e.g., the media, police forces, etc. We can also talk about recommending or lobbying).
- Engineering: improvement of highway infrastructure and vehicles, giving preference to "automatic protection systems" requiring no human input.
- Pre-hospital care and hospital treatment.
- The reduction of disabilities (not covered in this document).

To this range of interventions should be added "Capacity Building", a characteristic part of any long-term intervention, but that is particularly necessary where road safety is concerned, an area in which very little expertise exists in the developing countries.

By way of introduction, we present below the outline of the British Government’s strategic road safety plan for 2001. The British example gives some idea of the implementation of a road safety policy in a country that has already made much progress in that area.

The British example

The government firstly bases itself on epidemiological data to establish the strategies to be followed:

In spite of a dramatic improvement over the past decades, the number of deaths has stabilised at 3,500 deaths per year with 40,000 serious injuries and 300,000 causalities. Detailed analysis of the epidemiological data shows that:

- the actual number of accidents has not fallen as much,
- the number of minor injuries also remains high,
- in particular, the number of child fatalities is high compared to other European countries.

The state wishes to consolidate the recorded improvement by attacking the weak points, in particular those for which its previous strategy more or less failed. It defines the target populations and the three year objectives:

- A 40% reduction in the number of people killed or seriously injured,
- A reduction of 50% in the number of children killed,

Extract from "Tomorrow’s Road – Safer for Everyone" British Department of the Environment, Transport and the Regions – March 2000). It should be noted that this plan does not include the medical aspect.

Against 8,000 people killed in France for a similar population. The results are therefore quite good.
- A reduction of 10% in the number of minor injuries per million kilometre-vehicles\textsuperscript{43}.

With the help of a panel of experts, it defines a three year strategy. The actions taken involve the three Es:

- The creation of a safer environment for children with traffic calming measures and educational strategies specifically aimed at children and their parents: training, information, etc.;
- Introduction of measures aimed at young people, to ensure that they have a better knowledge when they begin their driving carriers: improvement of the curriculum before and after obtaining the driving licence;
- Emphasising the campaign against driving under the influence of drink and drugs, improved implementation and application. Public information;
- Road infrastructure improvements: given all that has already been done, it is now a matter of improving the "black spots". Emphasis is placed on the quality of the works, the importance of maintenance and decentralised planning of the actions to be taken;
- Measures aimed at reducing speed, which is responsible for one third of deaths. This is not a simple problem, and the authors stress the need for detailed analysis;
- Safer vehicles: by encouraging both research and the dissemination of information;
- Effective legislation concerning individual road safety behaviour: properly enforced dissuasive measures that are genuinely feared by the public;
- A high-quality marketing campaign based around road safety\textsuperscript{44}.

Strictly in terms of its format, this plan is quite standard, comprising analysis of data, definition of target populations, objectives and the indicators, definition of the strategy, definition of the activities to be implemented and probably a plan of evaluation. This sort of logical framework for the presentation of projects and proposals is to be recommended, and it is also closely based on the Haddon matrix type of model.

As for the contents, we note that despite the improvements achieved, the government is not sleeping on its laurels and continues to undertake dynamic action, in particular by attacking the remaining sticking points. The proposed plan thus suggests specific actions that are to be taken to unblock some of these stubborn points of resistance.

**TARGET POPULATIONS**

Although, in order to define priorities, it is essential to know who the victims are (in general young people, especially men and young children, living in poor communities, close to the roadside, passengers, pedestrians and cyclists), a project must also examine to see which populations are most involved in the genesis of the accidents in order to properly target the actions taken.

Within this context, even though in theory claims should always be based on an examination of the statistical evidence, it seems obvious that some dangerous populations are already perfectly well identified: professional lorry, bus and minibus drivers. Many of them drink, take drugs to prevent themselves from falling asleep, drive for hours without a break, have no respect for the highway code and, in some cases, no morality (the spread of AIDS along the main roads unfortunately proves this). Some authors recommend that this population should be targeted in particular\textsuperscript{45}.

In general, however, it only after defining the problem and analysing the actions that a decision can be made as to who is to be protected and whose behaviour needs to be changed. Let us remember that if we follow the Public Health Approach, the

\textsuperscript{43} Number of kilometres covered by all motor vehicles

\textsuperscript{44} The British are well known for their very effective advertising campaigns

\textsuperscript{45} C Mock. Injury control overview: policy issues to address in strengthening surveillance, injury prevention and Trauma treatment Road Traffic Injuries and Health Equity Conference
intervention must focus on a unique, clear result and thus a well defined target population.

**ORGANISATION**

Clearly, responsibility for the organisation of a country's road safety remains with the state, the role of the NGOs being only to respond to the requests of the state. It seems desirable to clarify a few points in connection with this:

According to the Transport Research Laboratory, there are two factors that appear to limit the efficiency of road safety management (46):

1. Firstly, road safety involves and/or affects many organisations, whether public, private, national, regional or local.
2. Secondly, and more importantly, road safety is not the priority for most of these same organisations (the ministry of transport is above all interested in building new roads, the ministry of health is particularly concerned with diseases, etc.).

Road safety coordination is therefore generally difficult and it is essential that the NGOs do not add to the confusion. On the contrary, they should encourage any initiative that aims to strengthen the coordination structure. In itself, facilitating efficient coordination could therefore form part of the specific objectives of an NGO project.

Once responsibilities have been properly established by the government, the NGO will thus act as a facilitator, in particular through involvement in the various road safety task forces and technical committees. It is through these committees that the NGO will be able to conduct some of its lobbying on behalf of road victims. It is also at this level that capacity building will be initiated.

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48 – Samuel N. Forjuoh - Traffic-related injury intervention options for low-income countries. Road traffic injuries and Health Equity conference
upon the expertise of engineers, architects and town planners.

As resources are limited, the decision to replan a given accident black spot can, however, only be taken based on an analysis of the surveillance data. This is done using a procedure that engineers call the "feedback loop":

- Compilation of statistics
- Summary of statistics and identification of particularly hazardous locations/behaviours
- Recommendations for corrective action
- Evaluation of the success or failure of the corrective actions by monitoring of statistics

This is the standard evaluation cycle and in itself justifies the setting-up of an accident surveillance system. This analysis can be performed in a routine manner, but it is also possible to conduct something known as a Safety Audit, e.g., for a section of road known to be particularly dangerous.

Where the modification of infrastructures is concerned, we distinguish automatic measures (e.g., changing the curvature of a dangerous bend) and measures that still require the intervention of the beneficiary (e.g., installation of a footbridge to allow pedestrians to cross a dangerous road: the pedestrian must make a conscious decision to use the footbridge).

As we have seen previously, automatic measures have a good change of being effective, on condition that the causal analysis has been properly carried out and the right corrective actions adopted. In the event that the protective measure requires human intervention, many experts stress that a thorough analysis must be performed to ensure that the individuals will perform the required gesture and that it will have a positive impact (people will actually use the new system as it is intended). It is therefore essential to consult the community concerned before taking any planning decision. In order to improve the chances of success, educational measures aimed at the community concerned may prove useful.

Finally, it should be noted that it is often easier for institutions and states to build than to improve. Preference will therefore be given to investing in a new road rather than altering one that is already built. This can be explained not only by the attraction of the new, but also by the fact that new construction is often paid for using external aid whereas the money for rehabilitation must usually come from the state coffers.

**Vehicles**

Given the state of dilapidation in the majority of developing countries, improving their technical qualities should normally have a positive impact. This could therefore be a priority.

Essentially there are two types of factors that can be acted on:

- Those factors that reduce the probability of accidents occurring (Haddon matrix: Vehicle, pre-event; e.g., brakes, lights)
- The factors that reduce the transfer of energy and thus the consequence of the accident and the severity of injuries (Haddon matrix: vehicle, event: movement of the human body, collision resistance)

We could consider using legal measures to introduce a firm safety quality standard for all cars entering the country. Unfortunately, we note that the vehicles used in the countries concerned are often second hand and it is very difficult for a state to impose such standards. There would be major political and economic resistance to any change. Areas worth investigating could, however, include the safety standards of locally produced vehicles.
vehicles, such as rickshaws in Asia, for example.\textsuperscript{49}

Vehicle inspection standards could be implemented. To succeed in this aim, it is necessary to combine the environmental strategy with a legal strategy involving the implementation and enforcement of the law. We note, unfortunately, that despite the fact that vehicle inspections are frequently already obligatory, in particular for commercial vehicles, they are not enforced. These strategies would therefore probably have little impact.

Innovative measures could be taken where spare parts are concerned: In Ghana, it was noted that some drivers replaced standard brake fluid with a solution of soap and water. They were of course aware that it was less effective but claimed that they could not afford the cost of genuine brake fluid. It was envisaged to grant an import subsidy on these products, together with a marketing campaign.\textsuperscript{50}

\textbf{Seat belts, helmets and other active protection measures}

The introduction of protective measures such as seatbelts and crash helmets have evidently proven their effectiveness in the developed countries (\textsuperscript{51, 52}). These are, however, non automatic protective devices. Action is therefore required on the part of the user and its successful adoption requires a combination of the three Es.

In the developed countries, the seat belt has proven to be the most effective accident prevention measure to date. It is estimated to have saved 123,000 lives in the United States between 1975 and 1999.\textsuperscript{53} Unfortunately, there is no point deluding ourselves as to the feasibility of such a measure in poor countries. Indeed, in these countries, the majority of people travelling in four-wheeled vehicles use private mass transport such as the Toyota minibus. These minibuses are packed and it is difficult to imagine them being fitted with seat belts \textsuperscript{54}. Thus, in such countries, it is probably not possible to implement a strategy involving seatbelts that will have any real impact, other than changing the means of transport that, from an economic point of view is not feasible. In more developed countries such as Thailand, for example, strategies to encourage and impose the wearing of seatbelts can be envisaged, however, even though the problems of enforcing the law remain difficult to manage.

Promoting the wearing of helmets could be envisaged, as Handicap International is doing in South East Asia, in Cambodia and Laos. The attitudes and behaviour of the main beneficiaries, the young, being very complex phenomena, where interventions regarding the wearing of helmets (or even of seatbelts) are concerned, a detailed sociological analysis of the problem is required from the very start. The preliminary analysis could use qualitative information methods, in particular community investigations (Focus Group discussions, directed interviews, etc.). Generally speaking, the NGO will require to be well accepted locally, and the capacity of local partners will require to be built quickly, as they are familiar with the

\textsuperscript{49} Samuel N. Forjuoh - Traffic-related injury intervention options for low-income countries. Road Traffic Injuries and Health Equity Conference Boston, April 2001

\textsuperscript{50} C Mock - Injury control overview: policy issues to address in strengthening surveillance, injury prevention and Trauma treatment. Road Traffic Injuries and Health Equity Conference Boston, April 2001

\textsuperscript{51} Petridou E, Skalkidou A, Ionnou N, Trichopoulos D. Fatalities from non use of seat belts and helmets in Greece: a nationwide appraisal. Accident Analysis and Prevention

\textsuperscript{52} Thompson DC, Rivar FP, Thompson R. Helmets for preventing head and facial injuries in bicyclist. Cochrane Database Syst Rev 2000, 2:CD001855

\textsuperscript{53} Tho Bella Dinh Zarr et al., Review of evidences regarding interventions to Increase the use of safety belts. Am J Prev Med 2001; 21

\textsuperscript{54} In many African countries, these mini-busses are referred to as "19-seaters" whereas they are originally intended by the manufacturers to seat 12.
local culture and thus the problems within the locality concerned.

The engineering, educational and legal approaches always need to be combined where "active" protection is concerned. The strategies will also require to take considerable account of the socio-economic context.

**Automatic protection devices in vehicles**

In most cases, we should not expect to find many of these automatic protection devices (e.g., airbags) in developing countries. This option cannot therefore be easily envisaged \(^{55}\).

We can, on the other hand, envisage removing some of the obstacles inside the car that are hit by the human body in motion at the time of the impact. This applies in particular to the taxis and commercial vehicles found in poor countries, which are not only crammed but also filled with numerous locally added internal elements, which are potentially very lethal. Improving the safety of the interior environment of commercial vehicles constitutes a possible avenue of research.

**Measures mainly involving education and enforcement**

It seems very obvious that it is not by remonstrating with drivers that we will change their behaviour. Beyond this, the experience of the rich countries shows that isolated educational strategies have a very limited impact. It is therefore a matter, in most cases, of combining the educational and legal approaches.

It is quite evident that two essential determinants of the probability and the severity of road traffic accidents are alcohol consumption and speed. These will be dealt with in this section, even though the engineering may sometimes be used.

**Speed**

It has been proven that speed is one of the most common factors contributing to road traffic accidents \(^{56,57}\). In Ghana, it is thus estimated that speed is involved in 50% of all road traffic accidents \(^{56}\).

Speed can be linked to road safety in two ways: firstly, the higher the speed, the shorter the time that is available to the driver to react to a hazard. Secondly, at the moment of the accident, the energy transferred being proportional to the square of the speed, the higher the speed, the lower the probability of survival \(^{59}\). We can therefore see that it is essential to influence this factor, particularly so in the developing countries where the vulnerability profiles are to the disadvantage of pedestrians and cyclists.

Speed can be controlled by:

- Introducing speed limits
- The enforcement of the law by means of police measures
- Traffic calming measures, such as the installation of speed bumps

\(^{55}\) we are not referring here to automatic protection outside the vehicle (e.g., barriers separating vehicles from pedestrians) which are easier to envisage in developing countries.

\(^{56}\) Johnson et al.  speed limitation and Motorways casualties. A time series count data regression approach, Accident Analysis and Prevention. Vol 28 N°1

\(^{57}\) Turner Fairbank Highway Research -Synthesis of safety research related to speed and speed limits http://www.tfhrc.gov/safety/speed/speed.htm

\(^{59}\) The relationship is virtually logarithmic: e.g., the survival of a pedestrian hit by a motor vehicle is 50% at 30 mph against only 10% at 40 mph
The possible installation of speed control devices on certain vehicles (lorries, buses)

The experience of the developed countries shows that introducing a speed limit without police enforcement is ineffective, even when accompanied by any kind of educational initiative: Individuals will reduce their speed if, and only if, 1) they perceive that there is a genuine risk of being caught (by the police), 2) they know that this will lead to a heavy penalty being imposed (by the law)\(^{60}\). It thus seems to have been proven that apart from engineering measures such as speed bumps and other traffic calming devices, only coercive measures by the police and the law succeed in significantly reducing speeding\(^{61}\).

It appears, however, that coercive measures have, to date, failed to have the anticipated effect in the developing countries. A number of factors would appear to contribute to this failure: the inability of the police forces to force individuals to slow down because of widespread bribery, the weakness of the police and the justice system, both quantitatively (numbers) and qualitatively (competence, motivation), the low level of political support for road safety measures and the low level of public enthusiasm for this cause.

The question is therefore not whether speed reducing measures are desirable, but rather what is the feasibility of their introduction:

- Once again, engineering measures, such as the placing of speed bumps or physically separating motor vehicles from pedestrians and cyclists have more chance of achieving their aims, as these are automatic measures, or virtually so.

- The installation of speed control devices on vehicles (tachographs), although non-automatic, these devices would appear to provide an opportunity to control the speed of a certain number of commercial vehicles. It would also require that there is no opposition to this type of measure from the "economic lobby". Collaboration with commercial transport companies could be envisaged in order to get this measure accepted\(^ {62}\).

- Investment in speed control measures should only be made if there is a certainty that the law will be able to be enforced, at least to a certain extent. If this is the case then, in addition to the assistance to be given to the police and the justice system (equipment, training, etc.), it will also be necessary to envisage educational measures within the community aimed essentially at raising awareness of the importance of the effective control of speeding by the individual and the community.

It should be noted in connection with this, that speeding is commonplace behaviour, individuals determine their speed according to their own (incorrect) perception of what is dangerous. Certain authors believe that introducing speed limits that are excessively strict or that cannot be enforced can have a negative impact, in particular on compliance with other parts of the traffic regulations\(^ {63}\).

In conclusion, we can but recommend a very pragmatic approach to speeding. The measures to be implemented must be acceptable and fair, insofar as it is the minority of drivers that must be punished.

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\(^{60}\) Behavioural Educational Approach: see related chapter – educational strategies Page 23


\(^{62}\) In Cameroon, for example, the lorries of certain international oil companies are already fitted with tachographs

\(^{63}\) Fukaar F K, Antwi P Ofosu-Aamaah Samuel – The Burden of road Traffic injuries and control in Ghana
Road traffic accidents in Developing countries

Drunk driving

Driving when drunk has been identified as an essential determinant of the probability and severity of road traffic accidents in the developed countries. It is estimated that approximately 50% of fatal accidents in the United States involve people driving while under the influence of alcohol. It was therefore logical that the prevention of drunk driving should constitute one of the cornerstones of road safety policy in that country.

Example of intervention aimed at reducing the consumption of alcohol in the United States

The intervention claims, above all, to be an environmental approach, in other words it aims to "establish or change the attitudes of the community, the laws and the regulations that support the conditions under which alcohol is made available, sold and advertised". The means of prevention thus involves several community systems (healthcare, education, transport, the law, physical sciences and town planning) and requires a concerted effort on the part of the citizens, the public authorities and private business.

The authors specify five areas in which action is to be taken:

- Prevent the easy availability of alcohol for young people. This involves legal measures to reduce the probability of traders selling alcohol to children.

- Increase taxes on alcohol (in accordance with the economic theory that a high cost reduces consumption).

- Make those involved in the sale of alcohol more responsible regarding excess consumption. This implies training personnel selling alcohol to recognise those who have drunk too much and how to dissuade them from driving.

- Change the conditions under which alcohol is made available: by changing the retail opening hours, e.g.: preventing alcohol being made available at community events such as sports matches.

- Act at the level of the community so that they can put pressure on the individual to avoid risky behaviour (e.g., raising the awareness of groups of students in the universities).

To these measures aimed at reducing alcohol consumption must be added those intended specifically to reduce drunken driving. These measures will be legal (breathalyser tests, repression) and educational (information; raising the awareness of communities to the problem). This combination of measures appears to have some result in the rich countries: The measures introduced in the United States have led to a reduction of approximately 30% of drink driving related accidents.64.

To what extent must drink driving be considered a determining risk factor of road traffic accidents in developing countries? To what extent must we therefore invest in measures aimed at reducing this risk? Odero shows, through an analysis of 26 articles on the subject, that drink driving is implicated in 30 to 50% of accidents in developing countries65. A study recently conducted in Ghana shows that 21% of motor vehicle drivers tested positive in a breathalyser test and that 7.3% of them had an alcohol level of over 0.8 g/l of blood66. A study conducted in the four largest cities of Brazil, showed that 27% of those injured had alcohol in the blood67. It would therefore appear that the evidence indeed exists to also justify firm action to curb drink driving in the developing countries.

The strategies adopted will obviously have to be based on enforcement and education. Over and above this, it seems useful to also adopt this "community based approach" by involving everyone

64 Jacobs et al. Drinking and driving in the United States. The 1996 national roadside survey
66 C. Mock. strengthening trauma systems in developing countries – Crash injury research and Engineering network
67 ABDETRAN: Impacto do uso de alcool e outras drogas em vítimas de acidentes de trânsito, Brasilia
(individuals, the community, the state). According to Charles Mock, it would be particularly desirable to target sub-groups of professional drivers such as lorry and bus drivers.\(^{68}\)

**Other interventions**

Without entering into details, we can list a certain number of interventions that have either been conducted or that are currently being experimented in the rich countries. The reader will probably be able to draw his or her own conclusions regarding the feasibility and the relevance of these measures to the developing countries. Once again, this list is not exhaustive:

- A curfew for young drivers (USA)
- A progressive penalty points driving licence allowing more powerful vehicles to be driven only after having first gained a certain number of points (New Zealand)
- Immediate suspension of the driving licence of drunk drivers (USA)
- Vehicle ignition system only operating in the absence of alcohol in the blood for repeat drunk drive offenders (experimentation in the USA)
- Integration of road safety in the school syllabus. Specific training for children according to the risks incurred at that age…
- Advertising campaigns…

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\(^{68}\) C. Mock; injuries control overview: policy issues to address in strengthening surveillance, injury prevention and Trauma treatment.

**In conclusion**

Finally, those responsible for the programmes must closely analyse the socio-economic context, the feasibility and the acceptability of the proposed measures before undertaking any intervention, whether related to "hardware" (planning the physical environment) or "software" (behavioural changes). All too often, the measures taken have had the opposite effect to that expected.

There is nothing better than implementing pilot schemes and evaluating the impact of the actions taken. This is probably an interesting place for an NGO such as Handicap International. It should, indeed, be remembered that one of the great advantages of Non Governmental Organisations compared to governments is their flexibility.
Without valid data, healthcare planners are severely handicapped. They are unable to allocate resources in such a way as to have the best impact on injury prevention, reducing the harm caused by injury, and treating and rehabilitating the injured. This applies to planners at all levels, whether they are concerned by the problem of injury at the international, national, regional or local level.\(^\text{69}\)

**Definition of epidemiological surveillance (WHO - Injuries Surveillance Guidelines):**

The systematic and ongoing collection, analysis, interpretation and dissemination of health information.

The surveillance system produces information describing:

- size and characteristics of a health problem;
- risk populations;
- risk factors;
- trends.

Armed with this data, it is possible to:

- Develop and apply appropriate interventions,
- Monitor the results and evaluate the impact of these interventions.

Information regarding road accident injuries can be obtained from police reports, the "vital statistics" system, hospital statistics and possibly community-based surveys.

From a practical point of view, the majority of countries have some form of system for gathering information on road traffic accidents, but it cannot really be considered as surveillance as such. It is therefore preferable to begin by reviewing the situation in this area. Besides informing us about the existing situation, this review should also allow the following questions to be answered\(^\text{70}\):

- For those countries that are less advanced in this respect: what minimum standard of the accident and road traffic injury surveillance system that can feasibly be set-up? For a country already having good resources in the area of surveillance: to what improvements should priority be given?
- What policies can be promoted to improve the information system in place?
- What policies can be introduced to improve the dissemination and utilisation of existing data?

**Police service accident records:**

What does this consist of?

This essentially consists of data collected by the police at the scene of an accident. They contain a fairly large number of variables, including the type of victim (generally classified as: deceased, serious, minor), as well as data concerning the circumstances and site of the collision.

We would note that the Transport Research Laboratory has developed a software package called MAAP (Microcomputer Accident Analysis Package) that allows detailed data analysis. This system is already used in a number of countries with apparent success\(^\text{71}\).

\(^{69}\) Injuries surveillance guidelines – WHO/NMH/VIP/01.02

\(^{70}\) Charles Mock; injuries control overview : policy issues to address in strengthening surveillance, injury prevention and trauma treatment.

\(^{71}\) see [www.trlsoftware.co.uk](http://www.trlsoftware.co.uk)
Advantages and limitations

In developing countries, the quality of data obtained from this system appears to vary from satisfactory to frankly poor: A recent study in Ghana shows that the police under-record the number of road traffic injuries by over 90%\textsuperscript{72}. In Pakistan, it is reckoned that between 61% and 86% of cases are not recorded\textsuperscript{73}.

We would also note that, regardless of the quality of the data collected, these will never be able to truly portray either the characteristics or the severity of the injuries. For one thing, policemen are not specialists, for another, only the numbers of deaths at the scene of the accident can be recorded.

Where reasonably practicable, it would be desirable to strengthen the system in this area.

Vital statistics system: mortality records from death certificates

What does this consist of?

A record of causes of death was first introduced in Great Britain in 1830, to assign a cause to all deaths occurring throughout the country.

In France, for example, the death certificate is completed by a doctor and indicates three types of cause of death: the primary cause, the immediate cause, and the concurrent cause(s). The data is sent to a national centre that compiles the data and determines the exact cause of death from the information given on the certificate. It is this centre that then sends the information to the WHO.

The causes of death are classified according to a standard 3-figures code (plus a fourth figure for disease subgroups). This code is taken from the \textit{International Classification of Diseases}, which was revised for the tenth time in 2002. In the \textit{International Classification of Diseases}, Motor vehicle traffic accidents cover the codes from E810 to E819. These determine whether or not a collision occurred and with what type of vehicle. The fourth number, for its part, defines what type of victim the deceased person was (pedestrian, driver, etc.).

Advantages and limitations

In countries where the system works well, it has the advantage of being both exhaustive and carried out at the time of a non-ambiguous event. The whole dimension of the problem is thus represented, even if the circumstances of death are not distinguished\textsuperscript{74}.

In the majority of poor countries, this system is unfortunately frequently non-existent or non functional. In those countries where some form of system exists (certain emerging countries), it would be interesting to examine how exhaustive and of what quality are the data. Pilot improvement schemes could be envisaged in these countries.

Surveillance of road traffic accident morbidity statistics

Where road safety is concerned, the morbidity statistics specifically relating to road traffic accidents are often buried under the flow of data relating to the general health information system of the Ministry of Health. A certain amount of information on injuries is available, but these are partial, as well as being difficult to retrieve and put together. This information is, however, essential for the planning and evaluation of actions insofar as, even in those places where the police statistics and vital statistics work reasonably well, information on non fatal

\textsuperscript{72} Mock et al. Incidence and outcome of injury in Ghana: result of a community-based survey

\textsuperscript{73} Abdul Ghaffar, Motor vehicle crashes in Pakistan: case study from the developing world

\textsuperscript{74} In the European countries, the variation in the number of deaths recorded from death certificates provides an excellent indication of the overall impact of the road safety measures taken
injuries is severely lacking. In particular, in the developing countries, we note that:

- injury profiles vary considerably from one country to another
- these injury profiles can suddenly vary in a given country as a result of economic and social changes (variation in the level of industrialisation, urbanisation and motorisation).
- there is practically no standard method of collecting injury data, hence the significant difficulty in comparing countries.
- the lower a country’s resources, the greater the range of potential hazards (although not a road safety issue, we could take the explosion of pipelines, which appears to be a Nigerian "speciality" as an example).

The WHO therefore recommends the introduction of a specific accidental injury surveillance system (including, but not limited only to road traffic accidents) at least in hospitals. For more information regarding the practical implementation of an injury surveillance system within the healthcare system of a country, the reader is referred to the injury surveillance guidelines published by the WHO\textsuperscript{75}.  

\begin{footnote}[75]{Injury Surveillance Guidelines – WHO/NMH/VIP/O1.02; available on line.}
Steps in a surveillance system

Defining the problem
Collecting the data
Entering the data
Processing the data
Interpreting the data

Evaluating the surveillance system

Using the results to plan prevention/treatment

Reporting the results

Other stake-holders
International agencies
Private sector & NGOs
Health departments
Other public sector agencies

Injuries Surveillance guidelines WHO CDC 2001
INJURY TREATMENT INTERVENTIONS

Several types of post-accident interventions can be envisaged:

- Pre-hospital care (at the scene of the accident),
- Hospital care (emergency and orthopaedic surgery departments),
- The rehabilitation of disabilities incurred in accidents

As the rehabilitation of disabilities is an extremely specialized field, and also occurs some time after the event constituted by the accident, this subject will not be dealt with here. As the hospital care of injuries is intimately linked with the general medical care provided by a healthcare system, we will deal only very briefly with this subject. It is very clear, however, that both of these areas need to be considered in the attribution of resources and the determination of priorities at a national level.

A recent study comparing the mortality profiles of cohorts of severely injured patients in three cities, one in an industrialised country (Seattle, USA), another in an emerging country (Monterrey, Mexico) and the third in a developing country (Kumasi, Ghana), shows that even if the overall mortality is higher in the poor countries, in all three cases, the majority of deaths occur before arrival at the hospital. This principle, which is already familiar to the emergency specialists of the rich countries, and which is still called the "Golden Hour", fully applies to the poor countries: the majority of people do not die at the hospital but at the scene of the accident, or en-route to the hospital. On condition that the means and the expertise are available, it is therefore potentially possible to many lives through efficient intervention at this level. This study shows that the proportion of pre-hospital deaths is inversely proportional to the level of development of the country concerned (81% of pre-hospital deaths in Ghana against 72% in Mexico and 59% in Seattle)\(^{77,78}\). The situation is thus more serious in the developing countries during the "golden hour". There is therefore theoretically room for improvement in this area where the poor countries are concerned.

The first question that can be asked when considering a pre-hospital intervention is the following: given the limited resources of the healthcare system of most poor countries, are these golden hour deaths really avoidable? In other words, if a more efficient pre-hospital intervention allowed more of the injured to be brought to hospital, can we be certain that these people would not die in hospital anyway? Opinions differ but there can be very serious doubts about this, at least as far as the least developed countries are concerned.

Another question that it is sadly of interest to consider, is that of the cost-efficiency of pre-hospital interventions. If we were to envisage, for example, setting up an emergency first-aid ambulance system (similar to the French SAMU) in a poor country, the cost to be paid would inevitably be very high. For what gain? Are there not alternative solutions that would be more cost-effective in reducing the consequences of injury? Thus Hauswald and Yoeoh were able to evaluate the

\(^{76}\) TJ Coats G Davies Prehospital Care for road traffic casualties BMJ Vol. 324 1135 :1138

\(^{77}\) Mock C N, Jurkovick GJ, NiiAmon-Kotey D, Arreola-Risa C Maier RV : Trauma mortality patterns in three nations at different economics levels : implication for global trauma system development J Trauma 1998; 44:804 - 814

\(^{78}\) The same trends seem to have been observed when examining pre-hospital deaths in the USA from a historical point of view.
potential cost-effectiveness of setting-up a SAMU type service in the capital of Malaysia, Kuala Lumpur: according to their study, this system would only save seven lives for a cost of 2.5 million dollars\textsuperscript{79}.

What then can be done? In America, a differentiation is made in pre-hospital treatment between ALS (\textit{Advanced Life Support}, i.e., a sophisticated system of care provided by professionals at the scene of the accident) and BLS (\textit{Basic Life Support} – i.e., minimum first-aid provided by non specialists). The WHO, with the help of the Cochrane Collaboration\textsuperscript{80} showed that on worldwide level there is no firm evidence that each of these traditional ALS measures are really efficient in reducing mortality (including pre-hospital perfusion, systematic spinal immobilisation and training staff to perform ALS compared to BLS training). Under these conditions, and if we also add the fact that the countries concerned are predominantly rural, meaning that only exceptionally will it be possible to intervene during the "Golden Hour", ALS type intervention does not, sadly, seem desirable in poor countries.

On the other hand, it seems necessary to find interventions that cost less but are adapted to the local situation. Some experts thus recommend adopting a similar approach to that used in primary health care, by defining "essential" trauma treatment services\textsuperscript{81}. Based on notions of cost-efficiency, the idea would be to define which are the minimum resources required in terms of equipment, medicine and level of competence of the personnel concerned to treat a minimum number of injuries considered to be those that occur most frequently, the most severe and above all those where intervention would be effective.

If this option is adopted,

- in pre-hospital treatment, it would in particular be possible to envisage providing BLS training for the personnel required to intervene at the scene of an accident, where this need is identified;
- BLS training could also be envisaged for the nurses in charge of primary healthcare centres, particularly in rural areas, which, despite well-trafficked roads, are remote from the hospitals;
- in hospitals, over and above additional equipment (\textsuperscript{82}) and technical assistance in the organisation of emergency services, we could introduce specific training courses for doctors in emergency trauma treatment, particularly since experience has shown that this is an area that is sometimes ignored by traditional courses.

Finally, original experiences could be attempted, as has been done in some countries, such as BLS and first aid training for lorry drivers.

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\textsuperscript{79} Hauswald M, Yeoh E: designing a pre-hospital system for a developing country: estimated costs and benefits. American Journal of Emergency Medical Services. 1997; 15:600 - 603

\textsuperscript{80} American Institute specialising in research into healthcare interventions – see: www.cochrane.org

\textsuperscript{81} C Mock Injury control overview: policy issues to address in strengthening surveillance, injury prevention and Trauma treatment

\textsuperscript{82} E.g., pneumothorax drainage equipment and Guedel cannulas
THE KEY ORGANISATIONS INVOLVED IN ROAD SAFETY IN THE DEVELOPING COUNTRIES

INTERNATIONAL AGENCIES

This chapter will concentrate only on the organisations involved in poor or transition countries, insofar as the efforts of Handicap International are focussed on these countries. Also, there are very many public and private organisations involved in road safety in the developing countries that, unfortunately, often show little interest in the problems of the developing countries.

World Health Organisation

Organisation of the department dealing with injuries

In the WHO's departmental structure, the road traffic injury prevention comes under the Injuries and Violence Prevention Department, which also deals with all other unintentional, as well as intentional injuries (violence).

Position, objectives and strategies

The WHO notes that the magnitude of the problem in terms of mortality, morbidity and cost is very high in the developing countries and that there is generally insufficient awareness of the problem, with the result that health policy and research are sometimes neglected. There is insufficient data at a national and sub-regional level to really allow suitable political decisions to be taken in this area, trends to be monitored over time or the impact of interventions to be evaluated.

The WHO therefore recommends the adoption of the public health approach as defined above, i.e.: a clear definition of the problem, the identification of the risk factors based on epidemiological data, the implementation and evaluation of interventions. According to the WHO, the prevention of injury due to road accidents in the developing countries requires solutions that are adapted to the particular circumstances of the country, but that also inspired by the experience of the developed countries. With regards to this, the WHO notes that even if a certain number of the principles discovered are universally applicable, their implementation is not necessarily so. The challenge is therefore to adapt to local circumstances.

Strategic plan 2001 - 2005

In 2001, the WHO defined its strategy for the prevention of road accident injuries. The aims of this strategy are:

- Capacity Building at the national and local level in order to evaluate the magnitude, severity and burden of disease of road traffic accidents and injuries;
- To incorporate road traffic injuries and their control in the Nations' public health agenda;
- To promote research action to prevent and control the health consequences of road accidents.

The strategy implemented includes the following interventions:

- The promotion of long term epidemiological surveillance using standardised data gathering methods founded on a scientific basis;
- The implementation of a research agenda concentrating on the influencing factors of road traffic accident injuries, in particular in low- to mid-income countries;
- The facilitation of regional networks for low- or mid-income countries and national capacity building;
- The strengthening of links between road safety, the environment and transport;
Support for interventions targeting the most vulnerable road users, based on skills acquired and using models of intervention applicable to the different regions of the world;

The compilation of road safety expertise acquired through systematic reviews of best practice in low- and mid-income countries;

Guidance to governments and institutions to manage road safety efficiently and in the long term;

The development of new skills taking account of different contexts and concentrating especially on vulnerable populations;

The improvement of general awareness that a significant potential exists for improving road traffic accident prevention;

The promotion of an inter-sectoral approach to road safety in low- and mid-income countries;

The promotion of research in the area of road safety;

Lobbying for more resources to be allocated to road safety;

All in all, it will be observed that this agenda is vast but quite standard for a department of the WHO (research, capacity building, inter-sectoral coordination, regional coordination and lobbying). We can also not the emphasis placed by the WHO on vulnerable populations: to the extent that the distribution by age, type of collision, professional activity and income differs between the rich and the developing countries (in which it is pedestrians, cyclists, children and the poor who are the most affected), the programmes must target these populations as a matter of priority.

In practice

A manual of good practice in this area is currently under preparation

In view of the relative recent validity of this section of the Injury and Violence department, over and above its role in the establishment of rules and guidelines and of coordination which it of course performs worldwide, the WHO concentrates its intervention to a limited number of countries: Cambodia, Ethiopia, Mexico, Poland, Sri Lanka and Vietnam.

The WHO has received funding for three years from: the Fédération Internationale Automobile (FIA), which has allowed it to run a number of programmes in the above countries.

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World Bank

In view of the cost of road traffic accidents, the World Bank considers road safety to be a poverty-reduction initiative, especially since between now and 2020, road traffic injuries will move from being the ninth to the third major cause of burden of disease in the world. Despite the attempts of the World Bank to increase awareness of this problem in the assisted states since 1982, its efforts appear to have had little effect since of the sums it loans to the states, very little is allocated to road safety (particularly so in the African countries where an average of less than 3% of loans is allocated to this area83). Moreover, despite the technical assistance given by it and by other institutions, the World Bank notes that there has been little notable impact up until now in the area of road safety in the developing countries (and particularly in Africa).

On account of its institutional position, the recommendations of the World Bank are essentially addressed to the states. It is a matter of:


Road traffic accidents in developing countries
gaining a better understanding the problem and in particular understanding who is at risk in the developing countries and what are the risk factors;

- implementing national strategic plans covering the different aspects of the problem of road accidents, in particular using a Haddon matrix-based model;

- seeking funding from various sources (road infrastructure users, insurance companies, private business and the communities will have to be solicited in addition to the state);

- setting-up a partnership between the state (ministries of health, transport, education and justice), on the one hand, and civil society (universities, NGOs, private sector) on the other.

In connection with the last of these, the World Bank has joined forced with other donors to set up the Global Road Safety Partnership (see next paragraph).

### INSTITUTES AND ASSOCIATIONS INVOLVED IN ROAD SAFETY IN THE DEVELOPING COUNTRIES

#### Global Road Safety Partnership (GRSP).

The GRSP is an informal network made up of private companies, civil society organisations, and ministerial departments involved in road safety, working together to achieve a common goal:

**Mandate of the GRSP:**

The GRSP aims to find more effective and innovative ways of dealing with road safety in developing and transition countries. Through a comprehensive approach to road safety, GRSP partners collaborate and coordinate road safety activities. This approach aims to build the capacities of local institutions and by enhancing the ability of professionals and communities to pro-actively tackle safety problems.

**Strategies of the GRSP:**

- Forging a partnership between all the key groups in society with a strong vested interest in improving road safety. Using coalition as the focal point for working on road safety projects and pressing governments to play their roles and in particular to deliver on those interventions which only they can implement (e.g., modification of road infrastructure, legislation, surveillance)

- Involving private business

- Undertaking small-scale projects with finance provided by private business to demonstrate that road safety can be improved in achievable and cost-effective ways

- Stressing a collaborative, global approach to road safety.

- Sharing lessons learned from the different projects already being implemented and demonstrating that partnership can improve the impact of interventions

**In practice**

Up until now, the GRSP has been active in 11 countries: Ghana, South Africa, India (Bangalore only), Thailand, Vietnam, Hungary, Poland, Romania, Brazil and Costa Rica. In each of these countries, the GRSP forms a coalition of organisations (private businesses, ministerial departments and civil society), analyses the situation and needs, and implements projects.

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Site: [http://www.grsproadsafety.org/](http://www.grsproadsafety.org/)

#### Global Forum for Health Research

Over 70 billion dollars are spent on medical research each year. Of this sum, it is estimated that only 10% is used to...
Road traffic accidents in developing countries

resolve 90% of the health problems encountered in the world. This is what the GFHR calls the 10/90. The aim of the GFHR is to help to correct the 10/90 imbalance by concentrating the efforts of research on diseases representing the greatest burden on world health and encouraging networking between private- and public-sector partners.

Road safety in the developing countries is naturally one of the areas in which the GFHR is involved. It should be noted that the GFHR is above all a research institute and not a funding body. In addition to producing a number of concept papers, the GFHR conducts a certain number of operational research programmes in the field. In accordance with its mandate, the GFHR, attempts locally to stimulate the research networks, in particular by systematically involving local researchers present in the field.

In practice

In those countries where it has set-up its networks, the GFHR could be of great use insofar as Handicap International works in the area of operational research. It would also obviously serve to establish contacts.

The GFHR is currently involved in Uganda, Kenya and Pakistan.

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URL: http://www.globalforumhealth.org/pages/index.asp

Boston Group

Harvard University, through the Harvard Center for Population and Development Studies, runs a group that is mainly concerned with road safety in developing countries. In connection with this, it has recently organised an international conference on road safety, on which our document is largely based.

Apparently this group, which is still called the "Boston Group" is involved in scientific collaboration in a number of countries:

Ghana, Kenya, Mozambique, Zambia, Republic of China, South Korea, Thailand, Vietnam, Colombia, Mexico, Trinidad and Tobago.

Institut National de Recherche sur les Transports et leur sécurité (INRETS)

France collaborates with a certain number of countries (in particular the French-speaking African countries) in the area of road safety through its cooperation mission and the Institut National de Recherche Sur les Transports et la Sécurité (INRETS). As part of this collaboration, the INRETS has analysed the national road safety policies of seven African countries: Benin, Burkina Faso, Ivory Coast, Mali, Niger, Senegal and Togo. It has also cooperated in the areas of research and capacity building in Morocco, China and India.

It should be noted that the INRETS is a WHO collaborating centre in the area of road safety.

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PIARC (World Road Association)

An international association founded in 1909, the PIARC sees itself as a leading authority for the analysis and discussion of various questions relating to roads and road transport. It aims to spread best practice worldwide and enable the development of more efficient decision-making tools. Special emphasis is placed on developing and transition countries.

The membership of the PIARC is made up of representatives of the various member states (97, of which 2/3 from developing countries), representatives of civil society, such as research associations and institutes, as well as certain private companies.
Activities

- Organises an international conference every four years (the last was held in Kuala Lumpur, Malaysia in 1999)
- Runs technical committees that implement studies into various transport and road problems
- Produces a certain number of publications on the subject, including a quarterly magazine (Routes/Roads)

Operation:

The PIARC has a large number of technical committees, one of which is specifically involved with road safety and is currently producing a road safety manual.

The PIARC has also set up national committees in the member countries. The main role of the committees is to act as a relay to spread outside information inside the country and vice versa. Unfortunately, most of the national committees in place are in developed countries.

URL: [http://www.piarc.org/](http://www.piarc.org/)
POTENTIAL SOURCES OF FUNDING

Even if the cost of road accidents is such that most interventions could potentially be cost-effective, in practice they all require specific funding. What options are then available to the government of a developing country for financing road safety? Apart from the general resources of the state, the World Bank recommends obtaining funding from two sources:

- By charging road users in the form of fuel taxes or road tolls;
- Levying taxes on car insurance premiums as has been tested in Australia and Finland.

NGOs must obviously consider external funding sources, as one of their roles is to mobilise resources that would not otherwise be obtained by governments. We were able, during the course of our investigation, to identify a number of such sources of funding.

FUNDING BY FOUNDATIONS

_Fédération Internationale Automobile (F.I.A.)_

The very powerful governing body of Formula 1 racing, the _Fédération Internationale Automobile_, is very active in many car-related areas including motor sport and touring. Road safety is very logically one of its subjects of interest. As for its other interventions, such as those relating to problems of the environment for example, the FIA’s intervention in this area is organised through the FIA foundation (www.fiafoundation.com).

Objectives:

- To promote research, the dissemination of results and to provide information in any matters of public interest relating to road safety, automobile technology, the protection and preservation of human life and health, public mobility and the protection of the environment.
- To promote improved safety in motor sport.

Of the eleven priorities established by the FIA, there are five that can be considered to concern the developing world:

- The improvement of the crash worthiness of vehicles
- The protection of pedestrians
- The safety of road infrastructures
- The prevention of road accidents in low- to mid-income countries
- The promotion of technical skills for vulnerable users

Applications for funding can thus be submitted to the FIA and are examined according to the quality of the submissions and their compatibility with the objectives and priorities of the foundation.

_The Volvo Research and Educational Foundations_

The automobile manufacturer Volvo has also been interested and involved in research for a very long time. There are three Volvo foundations, which go under the generic name of the Volvo Research and Educational Foundations. The global aim of these foundations is to promote structured actions for the development and implementation of transport solutions for large urban areas.

The VREF funds research and training in a limited number of areas, in particular those that seek to find ways of coping with the increasing complexity of urban transport problems.

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84 Third African Road safety Congress
Applications can be made by Internet
www.volvoresearchfoundations.com

PRIVATE FUNDING OBTAINABLE THROUGH LOCAL NETWORKS

Networks have been set up by various organisations (e.g., GRSP). These networks are not themselves sources of funding but they can greatly assist in finding funds, either from external sources or sources within the country (e.g., private business):

The networks identified up until now are those previously presented, i.e.,

- The "WHO" network, covering Cambodia, Ethiopia, Mexico, Poland, Sri Lanka and Vietnam;
- The "Boston Group" network derived from Harvard University, that covers China, Colombia, Korea, Ghana, Kenya, Le Mexico, Mozambique, Thailand, Trinidad and Tobago, Vietnam and Zambia;
- The GRSP network: Ghana, South Africa, India (Bangalore only), Thailand, Vietnam, Hungary, Poland, Romania, Brazil and Costa Rica;
- The Forum For Health Research network: Pakistan, Kenya, Uganda.

We note that world coverage is not perfect, and is probably limited by the lack of interest that the international community continues to show in road safety in the developing countries.

BILATERAL COOPERATION

The Scandinavian countries, Sweden, Finland and Norway, which were also among the pioneers in this field, appear to be particularly interested in road safety.

France, through INRETS, seems to be interested in this area where the French-speaking countries are concerned.
WEB SITES OF INTEREST IN THE AREA OF ROAD SAFETY

Besides the sites dealing specifically with a particular problem, and of which a part is referred to in the footnotes to this document, the following sites can be recommended for those wishing an overall view of the problem:

First of all the WHO page dedicated to the Violence and Injuries prevention department: http://www5.who.int/violence_injury_prevention/main.cfm?s=0009

You can also consult the page dealing with road accidents on the World Bank website concerning poverty reduction initiatives (Public Health at a Glance), which also contains some interesting references http://wbln0018.worldbank.org/HDNet/hddocs.nsf/c840b59b6982d2498525670c004d3ef60/26705f1f0d0a5e3585256b840072b49d?OpenDocument or the following page: http://www.worldbank.org/html/fpd/transpo rt/roads/safety.htm

Following the "Road Traffic Injury and Health Equity" conference, the Boston Group has also set up a site dealing with road traffic accidents which contains some very interesting documents http://www.hsph.harvard.edu/traffic/ (new page currently under construction)

Finally, the sites of the GRPS http://www.grsroadssafety.org/

the PIARC http://www.piarc.org/

the GFHR http://www.globalforumhealth.org/pages/index.asp

the INRETS http://www.inrets.fr/

the FIA foundation http://www.fiafoundation.com/

the three Volvo foundations http://www.volvoresearchfoundations.com/

are interesting and will also allow you to find references on more specific subjects.
BOOKS AND JOURNALS OF INTEREST IN THE AREA OF ROAD SAFETY

Two books can be recommended for an understanding of injury prevention theory in general and road traffic injury prevention in particular. These two books explain the origins of the main public health principles applied to the prevention of road traffic accidents:


As far as scientific journals are concerned, the leading journal appears to be ACCIDENT ANALYSIS AND PREVENTION, which regularly deals with highly scientific subjects relating to road traffic accidents in the developing countries. Several others, such as the BRITISH MEDICAL JOURNAL (the 11 May 2002 edition deals at length with road traffic accidents in developing countries), the AMERICAN JOURNAL OF PREVENTIVE MEDICINE and the AMERICAN JOURNAL OF PUBLIC HEALTH have also published a number of articles on the subject.
CONCLUSION

The scale of the problem of road traffic accidents in the developing countries is much greater than might otherwise be imaged. This is a major problem in terms of mortality, morbidity, disability and cost, even if it is neglected or even covered up by the public authorities of poor countries. There is thus a clear need for intervention in this area. Some developing countries, however, are now beginning to recognise that the problem exists. Unfortunately, not only are there too few players involved in the area of road safety, but expertise is also severely lacking.

In the rich countries, it has been possible to show that road accidents are not inevitable, and that intelligent, multi-factorial intervention can considerably reduce the number of deaths and disabilities resulting from these accidents.

From a methodological point of view, the experience of these countries shows that the intervention should be managed according to the standard model used in public health, i.e.,

- An initial analysis of the problem based on existing epidemiological data and identification of the causal factors. In connection with this, the so-called Haddon matrix is an excellent tool for modelling road accident injuries
- Development of a strategy after seeking a consensus. This strategy will in any event have to combine the three types of intervention, called the three Es: Engineering, Education, Enforcement, as well as measures for treating the injured, if applicable.
- Evaluation of the intervention and adaptation of the strategy on the basis of epidemiological data obtained by the surveillance systems

From a practical point of view, everything seems possible and the diversity of situations does not allow any line of intervention to be rejected out of hand. What is important, on the other hand, is to perform as detailed an analysis as possible of the socio-economic context, as well as the feasibility and acceptability of the proposed measures. For this, it seems essential that, other than in exceptional cases, all programmes should include the epidemiological aspect. If the undertaking is to succeed, it also seems fundamental that the local partners and communities should be involved in the conception and implementation of the programmes, as they have a better knowledge of the situation.

Given the current shortage of organisations involved in road safety in the developing countries, it seems that there is clearly room for an NGO such as Handicap International which, by virtue of its mandate, already treats disabilities caused by road traffic accidents. Any intervention will have to be conducted in conjunction with the government, through what we can call “Capacity Building”, plus by lobbying the different public and private sector players that might be closely or remotely involved with road safety.