ROAD TRAFFIC INJURY

ROAD TRAFFIC INJURY AND TRAUMA CARE: INNOVATIONS FOR POLICY (ROAD TRIP)

Report of the Road Traffic Injury and Trauma Care Working Group

Professor Adnan A Hyder with
Dr Prasanthi Puvanachandra
and Katharine A Allen

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CONTENTS

Professor The Lord Darzi

Professor Adnan A Hyder

FOREWORD

Over a million people die each year – the equivalent of a jumbo jet crashing every day – from road traffic injuries around the world. Millions of people become injured or disabled as a result of these injuries, while many more suffer the impoverishing economic and social impact both in the short and the long term. A large majority of these deaths and disabilities occur in low- and middle-income countries or in the rapidly developing economies of the Middle East. And yet the world has not given enough attention, policy support, and dedicated investment for stemming and controlling this "epidemic."

Road traffic injuries are both predictable and preventable, and that makes the case for urgent attention. The science of injury prevention has identified specific risk factors – such as speed, alcohol, and lack of helmets and seat belts – that increase the risk of a crash or injury. Effective interventions are available for many of these risks, but they need to be implemented. There are new risks too – such as the use of cell phones and texting – that challenge us to develop new, appropriate interventions.

At the same time, medical breakthroughs and clinical advances have enabled us to care for the injured and disabled. Trauma care is a critical element in managing road injuries, and emergency medical systems play a key role in saving lives. However, many health systems have ignored the development of acute care services, and in many parts of the world, pre-hospital care is either non-existent or embryonic. Clearly, there is a serious need for innovation and change in developing health systems for the future.

The World Innovation Summit for Health (WISH) has provided a major opportunity for profiling the health, social, and economic impact of road injuries, and the innovations that can help in easing this burden. Creative thinking and evidence-based solutions are the key to the future, and our amazing group of thought leaders in the WISH Forum for Road Traffic Injury and Trauma Care have collated a fantastic resource in this paper. We hope that it will stimulate the global health community – policy-makers, funders, and activists – to adopt the available innovations in addressing the challenge of road traffic injuries. It is time to make innovations work.

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EXECUTIVE SUMMARY

Road traffic injuries (RTIs) are the eighth leading cause of death globally, and the leading cause of death for young people aged 15-29. The global cost of dealing with the consequences of these crashes – including trauma care – runs into billions of dollars.[1] While much has been done, the reality remains that over a million people die each year from road traffic crashes, while many more are injured. This unacceptable situation represents a major call to action for the global health community.

The overall goal of this report is to identify the best available evidence, good practices, and promising innovations that are emerging around the world on RTI prevention and trauma care, and to synthesize this knowledge into practical policy recommendations for decision-makers. We propose a unique analytical framework to assess the current spectrum of available innovations to address RTIs and trauma care, and to contextualize the work that needs to be undertaken to move the field forward.

In identifying the relevant key innovations, by highlighting best practices and presenting a range of case studies from around the world, this report takes a global and multi-sectoral perspective, with sensitivity to those regions of the world that face specific social, economic, and financial challenges. The intent is not only to be concise and practical but also to be bold and provocative, especially in those areas requiring immediate action or urgent re-tooling of approaches.

It is clear that the field of RTI prevention and trauma care is ripe for a breakthrough. Such a change is needed not only to drive, but also to sustain the development of innovations that can successfully reduce the heavy burden of RTIs and road deaths. We believe that all stakeholders in road safety and trauma care across health and allied sectors have a key role to play in developing and diffusing innovative solutions and supporting their effective implementation. This report concludes by putting forward ten recommendations that we hope will be taken up by decision-makers.

KEY RECOMMENDATIONS OF THE REPORT

1. We urge policy-makers and non-governmental organizations to understand and use road safety data and disseminate it to their populations.

2. We urge donors, governments, and the private sector to invest in research and development for road safety and trauma care.

3. We urge governments to ensure that they adopt and implement the recommendations of the 2004 World Report on Road Traffic Injuries Prevention.

4. We urge all stakeholders to adopt the principle of promoting and using evidence-based innovations for road safety and trauma care systems.

5. We urge all sectors, especially non-governmental organizations, academia, and civil society, to promote global diffusion of road safety and trauma care innovations using traditional and new technologies.

6. We urge governments to adopt and implement the strategies in the UN Decade of Action's Global Plan for 2011-2020.

7. We urge global health leaders and the UN agencies to ensure the incorporation of road safety and trauma care as a key concern for sustainable global health and development goals.

8. We urge civil society, victim groups, and non-governmental organizations to be effective advocates, and engender a strong demand for road safety and trauma care in populations around the world.

9. We urge all stakeholders, especially academia and researchers, to widely share evidence-based successes and models for best practices in road safety and trauma care.

10. We urge all stakeholders, especially governments and donors, to ensure that capacity development is integrated in all road safety and trauma care efforts.

BACKGROUND

GLOBAL BURDEN OF ROAD TRAFFIC INJURIES AND OVERVIEW OF RISK FACTORS

Currently, more than 1.2 million people each year are killed in road traffic crashes around the world, while an additional 20 to 50 million are injured by them.[2] According to the Global Burden of Disease Study 2010, road traffic injuries (RTIs) were responsible for over a third of the world injury burden, and resulted in the loss of 76 million Disability-Adjusted Life Years (DALYs).[3] That represented a substantial increase in the burden of RTIs since 1990, when RTIs were responsible for 57 million DALYs.[3] If no significant action is taken to curb RTIs, this burden is predicted to rise, and by 2020 an estimated 1.9 million people will lose their lives annually to road traffic crashes.[4]

Figure 1: Road traffic deaths and registered motorized vehicles by country income status Source: WHO Global Status Report 2013

This growing burden falls disproportionately on developing countries, on the young, and on vulnerable road users. Low- and middle-income countries (LMICs) experience 80 percent of all road traffic fatalities, though they have only 52 percent of the world's registered vehicles (see Figure 1).[2] Over 75 percent of all those killed in road traffic crashes are male.[2] About 59 percent are young adults aged 15-44.[2] And about 50 percent are vulnerable road users – notably, pedestrians, cyclists, and motorcyclists (Figure 2).[2] Owing in part to this burden of RTIs on economically-active young individuals, road traffic crashes and RTIs are estimated to cost most countries 1-3 percent of their gross national products.[4]

Figure 2: Road traffic deaths in vulnerable road users
Source: 2013 Global Status Report on Road Safety

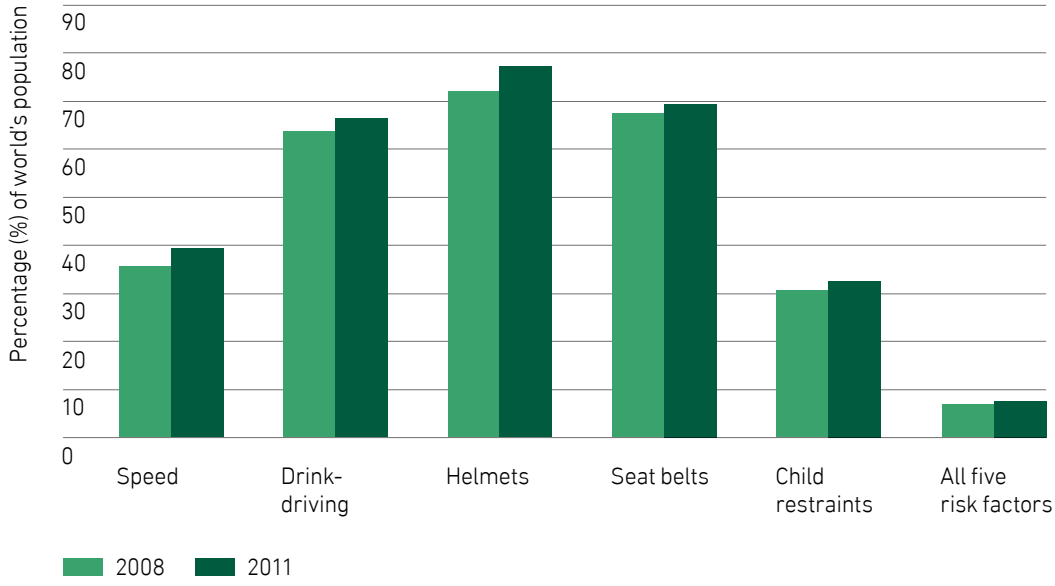
50% **of all road traffic deaths are among pedestrians, cyclists, and motorcyclists.**

RISK FACTORS ASSOCIATED WITH RTIs

The majority of RTIs and road traffic deaths are preventable. Speeding remains a major risk for crashes: studies have found that with every 1 km/h decrease in speed, the risk of a crash decreases by 2 – 3 percent.[5] Accordingly, the setting and enforcing of safe speed limits has proved to be a highly effective road safety intervention.[5] The use of seat belts reduces the risk of death for front-seat passengers by an estimated 50 percent, while properly used child restraints can reduce deaths among infants by an estimated 70 percent.[6] For motorcyclists, the use of helmets reduces the risk of death by about 40 percent, and of severe injury by over 70 percent.[7] To reduce alcohol-related crashes, laws specifying a blood alcohol concentration (BAC) of 0.05 g/dl or below have proved effective.[8]

So, by mandating and enforcing seat belts, child restraints, and helmets, and by limiting speed and alcohol levels, governments can dramatically reduce RTIs. Yet only 28 countries, representing 7 percent of the world's population, currently have laws that cover all five of these risk factors (Figure 3).[9]

Figure 3: "Comprehensive" legislation on five key road safety risk factors since 2008 Source: Global Status Report 2013, WHO



There are further risk factors too – poor road infrastructure, lack of trauma care, complex changes in transportation patterns, lack of enforcement, and rapid motorization among others – that create a high-incidence environment for RTIs. This shortfall highlights the need for further action to combat the growing epidemic of RTIs and deaths.

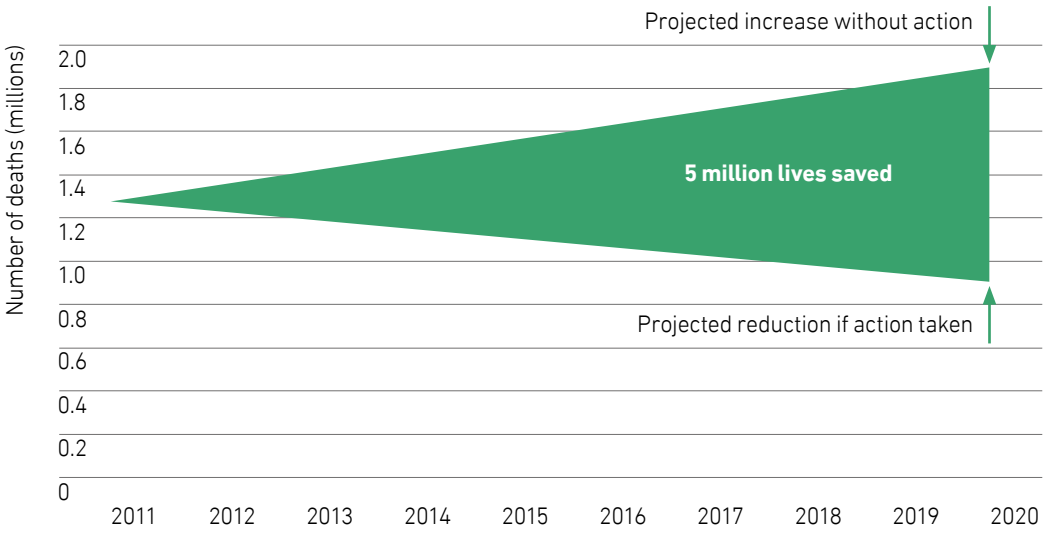
DECADE FOR ACTION

In 2004, the World Report on Road Traffic Injury Prevention was published, presenting valuable information about the causes, risks, and interventions related to RTIs.[10] It was a hallmark report and greatly increased awareness of RTIs as a major health

burden on the global community. Since then, the political momentum for road safety has gathered strength, with the UN General Assembly proclaiming 2011-2020 as the Decade of Action for Road Safety.[4, 11] The overall goal of the Decade of Action is to stabilize and then halve the level of road traffic fatalities around the world. If successful, an estimated 50 percent reduction could avoid five million fatalities and 50 million non-fatal injuries, and save US$3 trillion in social costs (Figure 4).

Figure 4: Goal of the Decade of Action for Road Safety 2011-2020

Source: Commission for Global Road Safety



The UN Road Safety Collaboration (UNRSC) developed the 'Plan for the Decade', which has five main pillars of action: building road safety management capacity, improving the safety of road infrastructure and broader transport networks, further developing the safety of vehicles, enhancing the behavior of road users, and improving post-crash care. In consultation with key stakeholders around the world, the Plan identifies key capacity-building and injury-prevention measures for each of the five pillars. For details of all the recommended activities, see the report by the Commission for Global Road Safety, *"Make Roads Safe – Time for Action."*[12]
www.makeroadssafe.org/publications/Documents/mrs_iii_report_lr.pdf

The five pillars are based on the 'Safe Systems' approach to road injury prevention – an approach that treats the user, vehicle, and road as an interactive system. The key idea is that human error should be tolerated in a forgiving system that has been designed to prevent crashes and reduce the risk of injury. This represents a new performance frontier in road safety management, and requires the developing and strengthening of a country's institutional management capacity in order to achieve the ambitious target of zero deaths and serious injuries.

Building on the momentum of the Decade of Action, the 2012 'Rio +20 UN Conference on Sustainable Development' recognized the wider impacts that road safety has on the environmental and developmental objectives of the Sustainable Development Goals (SDGs). A recent report by the Commission for Global Road Safety, *Safe Roads for All: a post-2015 agenda for health and development*, calls for road safety

to be included in the post-2015 SDGs framework, alongside international efforts to improve global health, combat climate change, and tackle inequality and poverty. Specifically, the framework promotes a 50 percent reduction in road traffic fatalities by 2030, as measured by the Global Status Report compiled by the World Health Organization (WHO).[2]

JUSTIFICATION FOR THIS REPORT

The need for a global report such as this is based on eight key challenges described below:

1. CONFRONTING THE PERSISTENT BURDEN OF ROAD INJURIES

The WHO Global Status Report reveals that 88 countries managed to reduce the number of deaths on their roads between 2007 and 2010. However, 87 countries saw an increase in road deaths over the same period.[2] For LMICs, the challenge is to avoid the same high fatality and injury rates that high-income countries (HICs) experienced, and to shift towards a Safe Systems approach – one that refuses to accept that RTIs are an inevitable consequence of economic advancement.[13,14] For HICs, the challenge is to shift towards a "Vision Zero," where no road traffic deaths are accepted. This shift will require innovative thinking, going beyond known effective interventions in order to achieve the highest safety standards possible.

2. ROLE OF THE HEALTH SECTOR

In 2004, the World Report on Road Traffic Injury Prevention proposed that the health sector should take on a new and broader role in preventing RTIs.[10] Traditionally, the health sector has focused on post-crash care along with injury surveillance and research, while advocating for implementation of evidence-based interventions in trauma care and rehabilitation. Its role needs to be expanded. By shifting towards the Safe Systems approach, and advocating for zero tolerance of road traffic fatalities, the health sector can pursue its mandate of protecting the fundamental human right to health. In many settings, particularly within LMICs, medical professionals have a very powerful advocacy voice: they can greatly advance the cause of road safety, so that it becomes a built-in key performance indicator of road transport systems.[15] They can also leverage the traditional doctor-patient relationship, built on trust and respect, to promote enforcement of behavior changes in high-risk road users – avoiding drink-driving, encouraging seat belt usage, and so on.

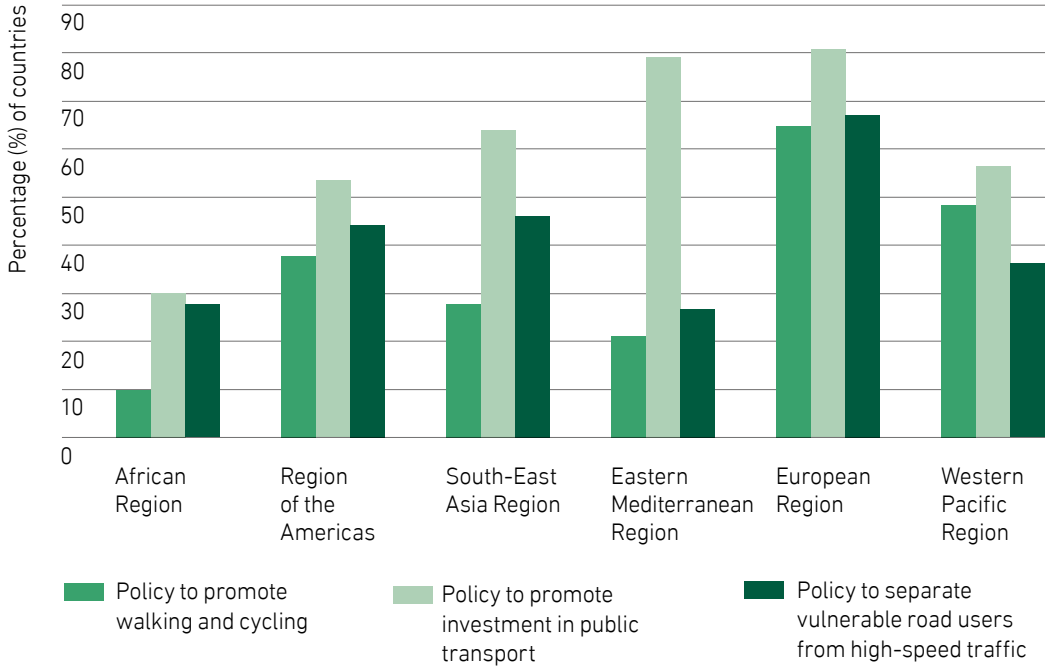
3. UNACCEPTABLE INEQUITY

A challenge that remains within road safety and trauma is the disproportionate burden that vulnerable road users face. It hinders the pursuit of equity in health among populations. In Delhi, India, more than 80 percent of those killed in road traffic crashes are vulnerable road users, with pedestrians being the largest group. In Thailand, 70 percent of road fatalities relate to motorcycles. In fact, only 79 countries have reported policies in place to protect vulnerable road users by physically separating them from high-speed road users (Figure 5). This inequity is unacceptable for the health sector.

4. GOVERNANCE AND LEADERSHIP CHALLENGES

The WHO Global Status Report highlights interventions that have demonstrably reduced the burden. However, bringing about this reduction requires strong political will and increased financial investments. Strengthening of national lead agencies is critical, particularly in developing countries where there is weaker institutional capacity, insufficient funding, and often limited political will. Though many countries are taking the right steps, progress is slow: 89 percent of the countries surveyed had established a lead agency for road safety, yet only 28 countries covering 7 percent of the world's population had been able to enact legislation across all the major risk factors.

Figure 5: Proportion of countries with policies to encourage non-motorized modes of transport, by WHO region Source: Global Status Report 2013, WHO



5. ADDRESSING ECONOMIC GROWTH

The current decade is seeing an unprecedented growth in passenger car use, with numbers almost doubling to reach 1.5 billion by 2020. In 2010, for the first time, sales of light-duty vehicles in LMICs exceeded those in HICs. The world is facing major social and environmental issues – and safety issues, particularly in LMICs. The challenge will be to promote vehicle safety regulations in LMICs as attentively as the industrialized West has been doing in its own road systems.

6. DRIVER DISTRACTION

Another issue relates to the increasing reliance on technology that is emerging globally. Use of the car as a mobile office is becoming increasingly viable.[16] More and more evidence points to driver distraction as an important cause of RTIs. In New Zealand, research suggests that distraction contributes to at least 10 percent of fatal crashes, with an estimated social cost of NZ$ 413 million in 2008.[17] Insurance companies in Colombia reported that 9 percent of all road traffic crashes in 2006 were caused by distracted drivers, and of all cases where pedestrians were hit by cars, 21 percent were caused by distracted drivers.[18]

7. LACK OF FUNDING

Lack of financial investment in road safety is another key issue to address in the effort to reduce road traffic fatality and injury rates. Without stable funding, many effective interventions fail, so sustainable resources are crucial. Traditionally, the fiscal responsibility has fallen on governments and in particular the road authorities. However, given the multi-sectoral nature of RTI prevention, responsibility should be shared between various governmental sectors and the private sector. For that to happen a strong business case should be made for road safety investments; that requires cost-effectiveness and cost-benefit studies, which are at present noticeably lacking within the field.

8. IMPROVING THE EVIDENCE BASE

One of the most important contributions that the health sector can make to road safety is the provision of evidence-based information. The health sector has a leading role in monitoring and reporting RTIs and death and also risk factors – data that can then be used by other sectors to inform transport systems and their performance. Not only can the health sector develop a strong evidence base for effective interventions; it can also promote the use of injury surveillance systems, develop good-practice guidelines for trauma and pre-hospital care services, and provide cost data of RTIs.

In summary, while much has been done, the reality remains that over a million people die each year from road traffic crashes. This unacceptable situation represents a major call to action for the global health community – to which this report hopes to contribute.

GOAL OF THIS REPORT

This report has been specially compiled for the World Innovation Summit for Health 2013 (WISH 2013). The *overall goal* of the report is to identify the best evidence, good practices, and promising innovations that are emerging from around the world on RTI prevention and trauma care, and to synthesize this knowledge into practical policy recommendations for decision-makers.

The *specific objectives* of this report are to:

1. Identify global innovations that have the potential to address key challenges in RTIs and trauma care.
2. Synthesize available evidence about these innovations and other best practices for a global audience.
3. Identify practical recommendations and actions for governments, international organizations, non-profit organizations, private organizations, and other key decision-makers.
4. Help to spur the international exchange of knowledge and catalyze the uptake of health innovations, in order to reduce the burden of RTIs.
5. Form the basis of a panel discussion of very senior leaders at WISH 2013.

In identifying the relevant key innovations and best practices, the report takes a global and multi-sectoral perspective, with sensitivity to those regions of the world that face social, economic, and financial challenges. The intent is not only to be concise and practical but also to be bold and provocative, especially in those areas requiring immediate action or urgent re-tooling of approaches.

In view of the above, the following types of criteria influenced this report as it reviewed evidence, tools, and solutions for RTIs:

- **Innovation-related:** New ideas, new implementation models, new applications.
- **Evidence-based:** Science-driven approaches that build on data.
- **Practical:** Operational approaches that policy-makers can support.
- **Sustainable:** Long-term social and financial approaches that work at scale.

The primary audience for the report consists of government ministers, secretaries, technocrats, and other senior policy-makers. In addition, the report is aimed at business leaders, civil-society leaders, and other health leaders with the ability to make decisions that affect people's health and well-being. Our key concern is that the report, and associated thinking and discussions at WISH 2013, should lead to action in the cause of reducing the growing global burden of RTIs.

METHODOLOGY

In compiling this report, we used a systematic method to explore innovations. In order to gain a deeper insight into ways of improving road safety and trauma care, we took four approaches:

1. A thorough **review of the literature**, both published and gray, looking at what has emerged from the field in the last 25 years as best practices in road safety and trauma care.
2. Recommendations of a **panel of experts** in the field through forum discussions.
3. An **online survey**, which helped to stimulate dialogue about current challenges in road safety and potential ways forward.
4. A series of **in-depth semi-structured** interviews with a broad range of experts, to draw on their years of experience in the field and to solicit a wider perspective in the search for new thinking in road safety.

For full details of all the methods used, see the technical appendix (Appendix A1 – Review of Methods www.wish-qatar.org/reports/2013-reports). The rich data from each of the approaches above was analyzed for challenges, innovations, and new ideas to address the health burden of RTIs. In addition, the combined data from panel discussions, the online survey and the in-depth interviews underwent a thematic analysis, using the framework presented below.

FRAMEWORK FOR ROAD SAFETY INNOVATIONS

While there have been some positive gains in the field, substantial work remains to be done to move road safety forward. This report uses a broad analytic framework to identify and contextualize that work.

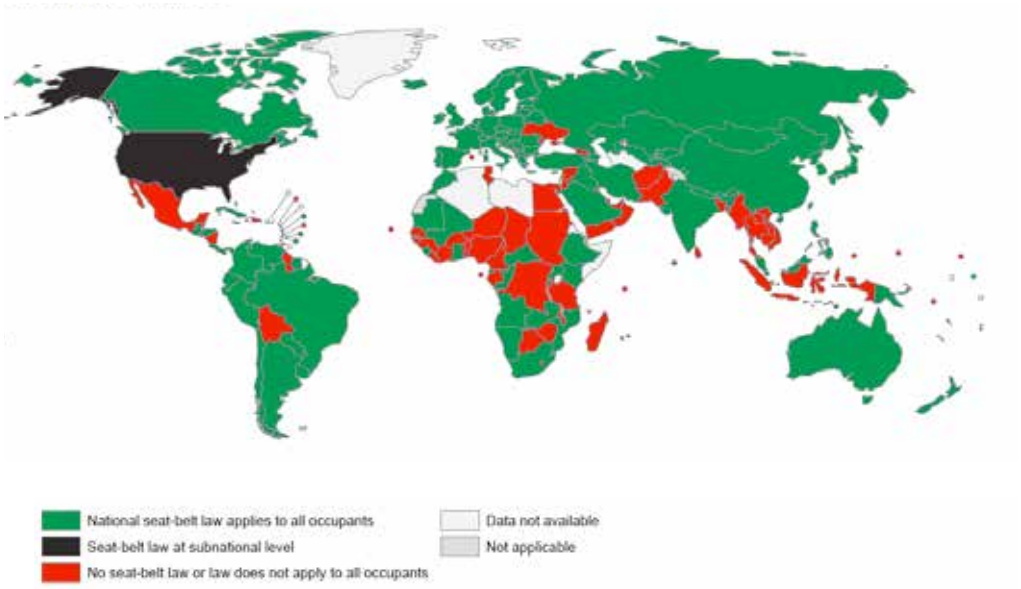
SPREAD OF INNOVATIONS

As is widely known, the rate of diffusion of innovations can vary according to the population in question. There is a long history of trying to understand the variation and the mechanisms by which the spread occurs within social systems.[19] Three factors appear to influence the dissemination of an innovation:

1. Perceptions of the innovation (based on five attributes: benefit, compatibility, simplicity, trialability, and observability).
2. Characteristics of the individual who may (or may not) adopt the change.
3. Contextual factors (including communication, incentives, leadership, and management).[20]

Although the field of road safety has many evidence-based interventions, knowledge and practice disseminate slowly, if at all. For example, even though the value of seat belts in reducing RTIs and deaths has been well documented for over 40 years, only 69 percent of the world's population is fully protected by a seat belt law for all car occupants (Figure 6).

Figure 6: Seat belt law by country/area Source: Global Status Report 2013, WHO



For interventions to be taken up, individuals, institutions, and communities have to change their behavior, existing policies, and norms. Since such changes are often resisted, the interventions themselves face the prospect of resistance and rejection. When LMICs, in particular, try to disseminate research evidence, they are hindered by weak health systems, lack of professional regulation, and limited access to the evidence.[21,22] There is a need to strengthen institutions and systematically promote interactions between researchers, governments, policy-makers, and health workers – only in that way, can countries bridge this gap and influence the dissemination, implementation and promotion of evidence-based innovations in road safety.[23]

In view of this understanding, this paper used a framework to review and analyze innovations for RTI prevention and trauma care. This is elaborated in the two sections below.

APPROACH TO INNOVATIONS

Our report adopts a broad-based definition of innovation – one that includes not only new ideas or solutions within the field itself, but also ideas from other fields that could be relevant to road safety, and also new models of programming, implementing, and financing road safety interventions that already exist (Table 1).

The framework also favors solutions that are grounded in *scientific evidence*. Evidence derived from the systematic collection and interpretation of data is crucial – such evidence constitutes a strong foundation on which to build new thinking. The literature review in this report provides the basis for our list of best practices in road safety and trauma care, and enables existing interventions and models of injury prevention to be prioritized by the scientific levels of effectiveness (see Appendix A2 www.wish-qatar.org/reports/2013-reports).

Interventions based mainly on theoretical approaches will all too often fail when translated into reality. So another criterion for our framework, particularly relevant given the limited resources of many LMICs, is that the solutions must be *operational* and *transferable*, ie, that they can be put into practice in the real world.

Finally, the report is based on the belief that innovation must be *sustainable* and *scalable*. RTIs do not just affect small sub-populations; they have far-reaching consequences, so the best solutions are those that can be successfully scaled up to cater for the vast numbers of victims and their families and communities. Of course, the solutions have to be *acceptable* to the public as well.

In addition to the best practice examples included in the report, there are also innovative practices listed which as yet only have an emerging evidence base. All interventions described are categorized by type: Legislation and policy, Behavioral, Infrastructure, and Technology. Table 1 presents one part of the framework used in this paper.

Table 1: Domains and types of Innovations for Road Safety and Trauma Care

INTERVENTION CATEGORY	INNOVATIVE SOLUTION	INNOVATIVE USE/ UTILITY OF EXISTING NON-RTI SOLUTIONS	INNOVATIVE IMPLEMENTATION OF EXISTING RTI INTERVENTIONS
Legislation and Policy			
Behavioral			
Infrastructure			
Technology (IT/ICT/m-health/ e-health)			

SCOPE OF ANALYSIS

We considered broad themes of road safety, in order to explore as wide a range as possible of interventions and practical solutions to road safety and trauma care (Table 2).

The spectrum of time: While primary prevention of RTI has been the traditional public health approach to road safety, this report looks at the full spectrum, from primary prevention through to acute trauma care and long-term management of disabilities resulting from RTI. Examples of innovations within this theme include:

- Primary prevention (eg, alcohol-detection systems in cars).[24]
- Acute trauma care (eg, the use of tranexamic acid to control bleeding in acute trauma).[25]
- Long-term management of disability (eg, mindfulness-based stress reduction for long-term fatigue following traumatic brain injury).[26]

The inequity of RTIs: RTIs disproportionately affect the most vulnerable populations within society – groups that up to now have been the most neglected in transport and planning policy. Innovations may address the following, among others:

- Dependents (eg, foam head-protective devices in child seats).[27]
- Risk-takers, such as adolescents (eg, a ban on texting while driving).
- Vulnerable groups (eg, low-speed zones in residential areas).[28,29]

The life cycle of RTIs: RTIs affect both genders and all ages. Road injuries do not discriminate; they impact on all people across the life cycle – from young children to senior citizens.

Levels of society: Road safety is commonly considered from the point of view of the individual – the personal risk, the personal-injury protection measures, and the individual treatment plans for those suffering RTI. This report goes beyond the individual level, and explores interventions at the institutional, population, and system-wide levels.

Table 2 presents the second part of our framework, capturing the element of time and the level of application of interventions.

Table 2: Levels of Application for Innovations

		LEVELS OF APPLICATION				
		Individuals			**Institutional**	**System**
Time Horizon		General population	Vulnerable groups	Young dependants/ adolescents		
Pre-event						
Event						
Post-event	Sub-acute					
	Long-term management					

SUMMARY OF THE LITERATURE REVIEW

Table 3 presents a summary of the types of road safety interventions that have been implemented over the past 30 years. Please refer to the technical appendix (Appendix A2 www.wish-qatar.org/reports/2013-reports) for the full literature review, including references.

Table 3: Summary of Road Safety Practices

GOOD PRACTICES	PROMISING PRACTICES	EMERGING PRACTICES	INEFFECTIVE PRACTICES
These practices have shown consistent evidence of reduced vehicle crashes, RTIs or fatalities.	These practices may show beneficial outcomes such as improved road safety knowledge or behavior, but no evidence is available as to whether this translates into reduced vehicle crashes, RTIs and fatalities.	These practices are backed by an extremely limited body of evidence, often with no evaluation studies. They are new and possible approaches to road safety, and require evaluation to assess their effectiveness.	This practice has shown no evidence of improved road safety knowledge or behavior, or of reduced vehicle crashes, RTIs and fatalities. It has been associated with an increased risk of vehicle crashes.
• Graduated driver licensing programs • Road safety campaigns with enforcement • Improved lighting for roadways and vehicles • Guardrails and crash cushions • Continuing education courses for trauma care • First responders • Vehicle Data Recorders • Red light cameras • Speeding cameras • Traffic-calming measures	• Pedestrian behavior programs • Improved pedestrian/cyclist Visibility • Pedestrian safety measures • Political advocacy approaches • Booster seat Programs • Incentive programs • Police patrols • Alcohol ignition locks	• Automatic Crash Notification (ACN) systems • Built-in Geographic Information Systems (GIS) • Non-vehicle-dependent travel systems	• Driver education programs

INNOVATIONS IN ROAD SAFETY AND TRAUMA CARE

The online and in-person discussions enabled an in-depth analysis of the challenges facing road safety and trauma care. These challenges have been categorized by type and sector. The challenges fall into the broad domains of Knowledge, Attitude, Engagement, Management, Capacity, and Infrastructure. They are presented in Table 4.

Innovations identified or refined by the online survey and the in-depth interviews were categorized according to the matrix presented in the previous section on "Framework for Road Safety Innovations" (see Table 5). The following pages highlight some of the interventions within each of the eight domains. For full details, case studies and supporting references, please see Appendix A3 – Innovative Practices in Road Safety www.wish-qatar.org/reports/2013-reports.

Table 4: Identified challenges and barriers to road safety and trauma care

	KNOWLEDGE	ATTITUDE	ENGAGEMENT	MANAGEMENT	CAPACITY	INFRASTRUCTURE
GOVERNMENT (ALL SECTORS)	Limited knowledge of road safety interventions	Unaware that road safety is a government problem	Lack of political will Corruption	Absence of lead agency Investment in ineffective campaigns	Inadequate finances Under-funded police forces	Lack of systematic planning of transport systems
HEALTH	Unclear estimates of burden of trauma on health sector	Road safety not perceived as a health sector issue	Health is not a partner in larger transport and infrastructure development programs	No systems approach to road safety and trauma care Silo management of activities by different sectors	Inadequate post-crash care Growing costs of trauma care Under-funded rehabilitation services	Lack of national policies and programs on trauma care Lack of integrated trauma facilities No EMS system
COMMUNITY	Limited knowledge of first aid	Fatalistic attitudes	Need for CSOs/NGOs to take ownership of road safety initiatives	Few CSOs focused on road safety	Lack of training for CSOs/ NGOs in RTI prevention and post-crash care	Rapid urbanization → increased demand on infrastructure and car dependency
ACADEMIA	Lack of translational and cost data		Resistance/barriers to engaging with policy-makers and government		Road safety research poorly funded	
PRIVATE SECTOR		Focus on business case for engagement	Lack of corporate social responsibility to improve road safety	Non-standardization of safety regulations Weak local safety standards Industry competition → de-specification of safety features		Surge in demand for cars

CSO: civil society organization, EMS: emergency medical service, NGO: non-governmental organization

1. LEGISLATIVE

Comprehensive legislation – incorporating strict and appropriate penalties, and backed by consistent enforcement – has been shown to be effective in changing behavior, norms and public perceptions about road safety.[30,31]

SPEED ENFORCEMENT

Speed enforcement aims to discourage drivers from exceeding the speed limit by penalizing those who do. Fixed and covert cameras send out a strong message that speeding will not be tolerated and that controls are in place.

DRINK-DRIVING

The recommendation is that countries set the legal limit for BAC at 0.05 g/dl for the general population, and at 0.02 g/dl for novice drivers and other groups such as commercial drivers and drivers carrying hazardous goods.

Random breath-testing (RBT) is another well-known measure that countries should incorporate into their road safety legislation. Drivers, regardless of whether they are suspected of drink-driving, are randomly stopped and tested to assess whether their BAC is above the legal limit. RBT is twice as effective as selective testing, ie, testing only those under suspicion.[32]

INNOVATIVE PRACTICE EXAMPLE: ARRIVE-ALIVE! – VICTORIA STATE, AUSTRALIA

In November 2001, the Victoria government in Australia started the Arrive-Alive! Road safety strategy with the aim of reducing road trauma by 20 percent by 2007. In this program, speed enforcement efforts were increased, with more active mobile speed cameras, new fixed speed camera locations, and increased enforcement. The strategy is conducted by a 'road safety partnership', comprising VicRoads, Victoria Police, and the Department of Justice and the Transport Accident Commission (TAC). They all have their own specific enforcement responsibilities, but they often act in consultation with one another and with other road safety partners, including NGOs. Evaluation by the Auditor General of Australia showed favorable results, with a 16 percent reduction in fatalities between 2002 and 2005. Many factors could have contributed to this decline, but it is significant that the most impressive trauma reductions were experienced in Melbourne's low-speed zones, where fatalities decreased by 40 percent.[33]

SEAT BELTS

Wearing seat belts should be required by law for all seating positions in every motor vehicle. In addition, to enhance the effectiveness of seat belt laws, legislation should be introduced for primary enforcement laws that allow a police officer to stop a vehicle solely for the observed violation of not wearing a seat belt.

LEVIES ON INSURANCE AND LICENSE FEES

Several countries have attempted to finance road safety interventions by such means as road tolls, licensing fees, compulsory vehicle insurance fees, surcharges on motor fuel, and weight-distance transportation charges. Other examples of innovations to raise road safety funds are the following: personalized licensing plates to finance the road safety trust (eg, New Zealand), a levy on tire manufacturers' profits (eg, Korea), and traffic fines from red light and speeding violations (eg, Western Australia, Vietnam).

BEST PRACTICE EXAMPLE: GLOBAL NEW CAR ASSESSMENT PROGRAMME

FOR SAFER CARS
GLOBAL NCAP
www.globalncap.org

Given the challenges posed by emerging trends in vehicle use, particularly in LMICs, innovative and market-based approaches to vehicle safety are required. One such approach is consumer information provided by New Car Assessment Programs (NCAPs), which is proving to be effective in creating a market for safety. By empowering the consumer, NCAPs also help civil society partnerships – involving consumer groups, automobile clubs, fleet managers, and NGOs – to raise awareness of the safety choices we all can make when buying an automobile.

The Global New Car Assessment Programme (GNCAP) is a newly established non-profit organization registered in the UK that aims to encourage the worldwide availability of independent consumer information about the safety of motor vehicles. It serves as a platform to promote the development of NCAPs and similar organizations worldwide, particularly in LMICs. GNCAP also supports cross-learning, and promotes the sharing of best practices to encourage the manufacture of safer cars across the global automotive market. GNCAP carries out research on innovations in vehicle safety technologies and their applications in global markets. Additionally, GNCAP studies the range of policies that accelerate the use of these technologies, and monitors the progress of vehicle safety improvements across the globe.

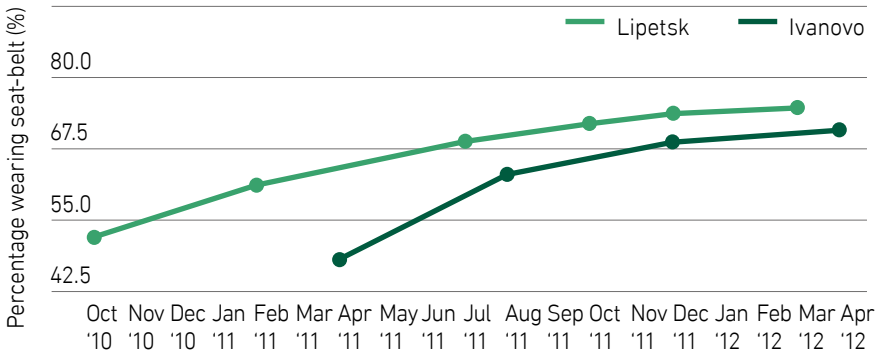
BEST PRACTICE EXAMPLE: BLOOMBERG GLOBAL ROAD SAFETY PROGRAM – ROAD SAFETY IN THE RUSSIAN FEDERATION

The Bloomberg Global Road Safety Program was launched in February 2010 in Moscow before a large audience of stakeholders. Initiatives relating to seat belt rates and speed commenced in two oblasts (Lipetskaya and Ivanovskaya) in September 2010. Following observational studies and focus group discussions, a large social marketing campaign was launched in Lipetskaya Oblast in November 2010 and then in Ivanovskaya Oblast in May 2011. The motto was "Do not break the line of life". The campaign, developed and conducted with the support of local police, was publicized through TV, radio, outdoor advertising, and public relations activities.

The initiative 'Dva Sh: shokolade/shtraf' received considerable attention from regional and federal media. In this initiative, drivers and passengers who were buckled up received a bar of chocolate with the logo of the campaign, whereas those who were not received a fine, in keeping with the legislation currently in force. During the period of the campaign, police officers strengthened enforcement activities up to ten times to the level of pre-campaign measures.

The social marketing campaign and other awareness-building efforts, followed by strong police enforcement, have significantly increased seat belt use. Observation studies conducted at baseline and throughout the intervention phase have shown positive results in both oblasts. In Lipetskaya Oblast, use of restraints for all occupants increased from 52 percent in October 2010 to 75 percent in March 2012, and has remained stable since then. In Ivanovskaya Oblast, restraint use for all occupants increased steadily from 48 percent in April 2011 to 93 percent in May 2013.

Overall seat-belt use in Ivanovo & Lipetsk, Russian Federation, 2010-2012
Source: John Hopkins International Injury Research Unit, Ivanovo State Technical University: unpublished data



Tackling seat belt under-utilization requires a coordinated effort from multiple sectors. This campaign shows the success that is possible when experts and stakeholders in transport, health, business, and public sectors are mobilized and work together.

2. BEHAVIORAL

THE ROLE OF THE MEDIA

With its wide target population, the media has the ability to increase awareness and educate the public in a way that many programmatic approaches fail to do. Training has been carried out successfully, as part of the Bloomberg Road Safety Grants Program, in Russia, Turkey, Egypt, Kenya, and Cambodia. Widespread use of the media can help to create a "theater of policing," which in turn leads to a general perception that police enforcement is being increased throughout a city or state, leading to a corresponding reduction in risky driver behavior.

INNOVATIVE PRACTICE EXAMPLE: DRIVER INCENTIVES FOR SAFE DRIVING – VITALITYDRIVE, SOUTH AFRICA

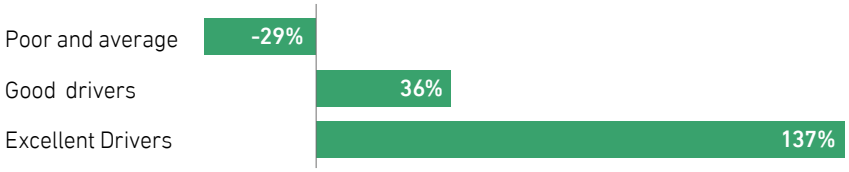
Discovery was established as a small specialist health insurer two decades ago, with a goal of improving people's health. It has subsequently grown into a multifaceted, integrated financial services organization that spans over four continents. Discovery Insure in South Africa encourages safe driving through its *Vitalitydrive* driving program, which rewards its clients for improving their driving. The program uses an innovative motor vehicle telematics technology to develop a scientific measure of driver behavior. With a focus on addressing modifiable driver behaviors, Discovery Insure rewards its members for driving well, improving their knowledge and awareness, and making sure that their vehicle is safe to drive.

Driving well: Drivers can earn points through reducing their use of harsh braking, risky acceleration and cornering, speeding, and driving late at night.
Improving knowledge: Drivers can earn points by completing an annual driver safety review and quarterly online quizzes. Accredited driving courses are also available to encourage skillful driving and help to promote safe road use.
Safe Vehicles: Drivers are rewarded for taking their car in for annual checks and keeping their car service history up-to-date.

In addition, Discovery Insure teams up with two innovative transport companies in South Africa that provide a chauffeur-based service to its members in order to reduce drink-driving and driving late at night.

The Discovery Insure program database records a positive change in driver behavior:

Percentage change in number of drivers per risk category from month 1 to month 12



*Results based on driving status of 12,000 clients over a consecutive 12 month period

GRADUATED DRIVER LICENSING

Graduated drivers license (GDL) programs are emerging as a means of controlling crash rates among young drivers. The basic premise is that novice drivers should begin driving under relatively safe conditions, and be exposed only gradually to more complex scenarios.

3. COMMUNITY EMPOWERMENT

Community programs are a practical and successful means of promoting road safety in a targeted and sustainable way. They are particularly helpful in rural and suburban areas, where community feeling may be stronger and where regular enforcement is harder to implement owing to limited police resources.

INNOVATIVE PRACTICE EXAMPLE: PROACTIVE PARTNERSHIP STRATEGY (PPS) TO IMPROVE ROAD SAFETY AT THE COMMUNITY LEVEL

GLOBAL ROAD SAFETY PARTNERSHIP

In 2002, the Global Road Safety Partnership (GRSP) introduced the Proactive Partnership Strategy (PPS) as a model to address road safety at the community level. PPS is a process methodology used for fostering partnerships between communities, government, local businesses, and civil society. In turn, these sustainable partnerships aim to improve local road safety conditions through the creation of measurable targets and the implementation of a structured action plan. The process is predicated on six steps: partnership building, data collection and analysis, integrated road safety action systems, monitoring and evaluation, program review, and program renewal and expansion.

PPS has been successfully implemented in Brazil and Cambodia with the assistance of GRSP. In the city of São José dos Campos (Brazil), PPS was introduced in 2010, and brought together actors from the private and public sectors along with civil society groups. Numerous road safety measures were implemented, including large-scale public awareness campaigns, road engineering projects, and a heavy enforcement area. Between 2010 and 2011, fatal crashes declined by 41 percent, even though the city's vehicle fleet grew by 9 percent.

PPS is a viable option for communities where robust governmental entities have the motivation to address road safety, and citizens are both empowered and eager to improve their roads.

SOCIAL ACCOUNTABILITY

In Kenya, an initiative to influence bus drivers has used posters to encourage passengers to "heckle and chide" the drivers if they are driving too fast or recklessly. The initiative is proving successful in reducing the level of RTIs. According to preliminary data, social accountability innovations result in a significant reduction (25-50 percent) in insurance claims.

ENFORCEMENT

Local communities can help enforcement by providing traffic police with information on the location and circumstances of unreported crashes, as well as identifying "black-spots," where offenses such as illegal turns or speeding are a problem.

ADVOCACY

Civil society groups and the local community play an important advocacy role. Advocacy can be used to strengthen political will, correct public misconceptions about the causes and preventability of RTIs, promote changes in national policies, build effective partnerships and coalitions, and increase funding for road safety programs.

4. ROAD SAFETY MANAGEMENT

Ensuring effective road safety management systems is a strong indicator for success in tackling road safety, and underpins the first pillar of the Decade for Action. The World Bank Global Road Safety Facility is promoting good road safety management as key to producing general improvements in road safety.

MULTI-SECTORAL WORK

To reverse the rise in global RTIs and deaths, the Bloomberg Global Road Safety Program committed US$125 million over five years (2010-2014) to support proven and effective interventions in ten LMICs. The Program works with six partner organizations to implement road safety activities and co-ordinate with in-country governmental and non-governmental stakeholders. The Program's overall goal is to support the ten governments in implementing good practices in road safety, in line with their national road safety strategies.

INNOVATIVE PRACTICE EXAMPLE: VICTIMAS DE VIOLENCIA VIAL (VIVIAC) ADVOCATES FOR DRINK-DRIVING LEGISLATIVE CHANGE IN MEXICO

VIVIAC is an NGO consisting predominantly of victims of RTIs, operating in the state of Jalisco in Mexico. By facilitating opportunities for victims and their families to share their stories with influential groups, VIVIAC have been instrumental in bringing about state legislative change on drink-driving.

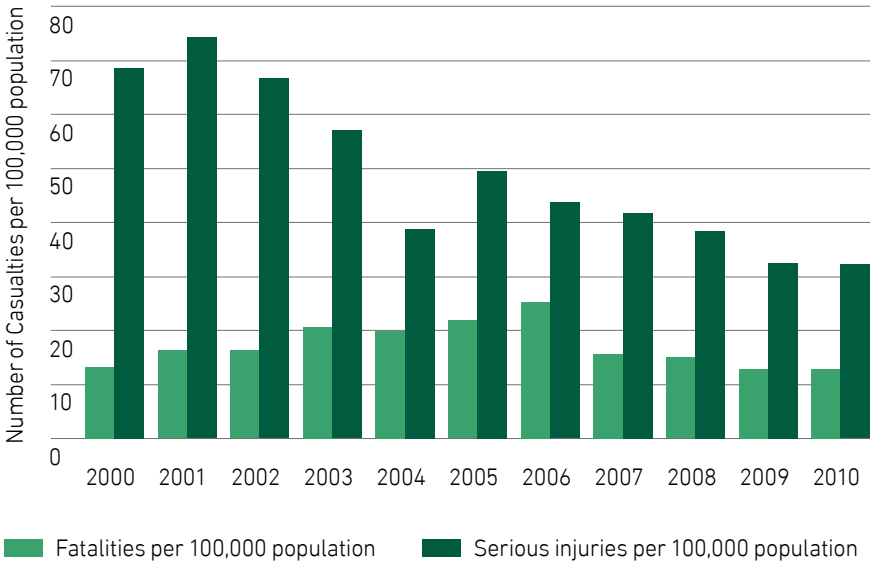
Under the banner "Legislando para la Vida" or "Legislating for Life," VIVIAC regularly organizes interviews with victims, their families, and representatives of the state's broadcast and print media. Their emotive stories reach thousands of people through TV broadcasts and radio talk shows, which helps to increase road safety awareness and educate the public about the need for stricter laws and enforcement. In September 2010, with the backing of three main political parties, the state of Jalisco revised its drink-driving legislation, setting an upper limit for BAC of 0.05 g/dl for the general public. This contrasts with the previous limit of 0.15 g/dl, which was three times higher. Additionally, a strict BAC limit of 0.00 g/dl was implemented for drivers of public transport vehicles.

Owing in part to the advocacy efforts of VIVIAC and other non-governmental organizations within the "Colectivo Ciudadano" or "Citizens' Collective," the state has seen a decline in drink-driving fatalities since the law was enacted. With support from some key government ministries, VIVIAC and its partners are currently organizing advocacy for other issues, such as seat belts, child restraints, and helmets for motorcyclists.

Source: Advocating for road safety and road traffic injury victims: a guide for nongovernmental organizations[34]

BEST PRACTICE EXAMPLE: THE QATAR NATIONAL ROAD SAFETY STRATEGY 2013-2022 – "SAFE ROAD USERS, SAFE VEHICLE, SAFE ROADS, SAFE SPEEDS"

Between 2000 and 2006, Qatar experienced a steadily increasing number of road crash fatalities as its population rapidly expanded. With the introduction of an initial series of road traffic reforms in 2007, the number of fatalities and serious injuries declined.



However, even with this reduction, road fatality rates in Qatar remain excessive when compared to other HICs. For example, in 2010 there were 13 deaths per 100,000 population in Qatar, compared with around 3 per 100,000 population in countries like the Netherlands, the UK and Sweden.

In response to this burden of RTIs, the Qatar National Road Safety Strategy has been developed. This ten-year strategy (2013-2022) sets out to reduce road crash fatalities from about 13 to 6 per 100,000 people, and serious injuries from 33 to 15 per 100,000 people. This will be accomplished by pursuing a variety of tactics, including increased police enforcement measures, mass media campaigns, concentrating on "high-risk drivers and riders" such as males aged 18-30, improved street and infrastructure design, police-backed data-collection efforts, and enhanced vehicle safety standards.

This multi-pronged strategy conforms to the five pillars designated by the Global Road Safety "Decade of Action", and illustrates the need for national road safety strategies to be comprehensive and ambitious in design. Qatar's experience will provide valuable lessons for the global community in the field of road safety.

5. INFRASTRUCTURE

Increasing attention is being directed at structural changes to the built environment. Such changes can help to protect road users from injuries, either by reducing their exposure to vehicle use or by transforming the environment into a safer one for road travel. One broad approach is to separate pedestrians from vehicles more thoroughly, by means of better sidewalks, raised crossings, or wide refuge islands. These and other approaches, used jointly or singly, can greatly improve pedestrian safety.

RUMBLE STRIPS

Rumble strips, also known as audible lanes, are low-cost road safety devices installed on roadways. Consisting of a series of raised strips, they alter the noise of a vehicle's tires on a roadway, and thereby provide an audible warning for drivers.[35] Given their low cost and effectiveness, rumble strips are a very suitable intervention for LMICs.[36]

CABLE MEDIAN BARRIERS

Cable barriers are median dividers made up of 3-4 steel cables hung along a series of central posts, and are designed to prevent lane-departure crashes with opposing traffic.[37] In contrast to solid medians, cable barriers allow for flexion during crashes, and so tend to produce less severe crash outcomes than guardrails and concrete barriers do.[38, 39]

DYNAMIC SPEED LIMITS

In contrast to permanent speed limits, dynamic speed limits are variable, changing in accordance with a variety of factors. They are based on the real-time expectations of motorists, and respond to changes in weather, traffic flow, road conditions and traffic incidents.[40] Dynamic speed limit systems are options for countries that have the technology capacity to implement them and a public that actively adheres to posted speed limits.

TRIP REDUCTION MEASURES

Trip reduction measures include a range of techniques to reduce or modify the amount of vehicle travel.[41] The measures include: telecommuting for workers; greater use of electronic communication methods; improved management for mass transportation systems; bans on freight transportation; and urban design adjustments to restrict vehicle parking and road use.[10, 42]

INNOVATIVE PRACTICE EXAMPLE: PEDESTRIAN SAFETY – ABU DHABI URBAN STREET DESIGN MANUAL

The Abu Dhabi Urban Street Design Manual (USDM) was commissioned in 2009 by the Abu Dhabi Urban Planning Council (UPC) to address the needs of the growing population, and to improve pedestrian facilities in order to create more walkable and livable communities. The USDM's main objective is to re-balance the priorities of street design to suit all road users, in particular the most vulnerable. In other words, the USDM aims to shift the system of street design to an integrated process that serves the needs of pedestrians, transit riders and cyclists, as well as motorists.

On the basis of the recommendations in the manual, a segment of a major street in Abu Dhabi, Salam Street, was redesigned in 2011. Prior to the redesign, this street was characterized by manholes, utility poles, signs, and ill-placed street furniture, which posed hazards to pedestrians. There was very limited separation between vehicles and pedestrians, with no formal sidewalks or curbs. The redesigned road now has much-improved pedestrian facilities, including refuge islands, median barriers, raised crossings and traffic control. This has resulted in improved walking conditions for pedestrians, and a reduction in vehicle speed of 4-10km/hr relative to nearby streets. Street redesign has been accompanied by increased enforcement at pedestrian crossings, raised awareness and implementation of education campaigns, and implementation of other design measures such as bollards and redirective curbs.

The manual is the first of its kind to be tailored to the local climate and culture, and aims to guide Abu Dhabi's transition from a motor-vehicle-oriented city to a multi-modal one. The manual has gained international recognition, and the Urban Planning Council was recently awarded the 2013 Institute of Transportation Engineers (ITE) Award for Best Program.

www.upc.gov.ae/template/upc/pdf/Street Design Manual English (small) FINAL.pdf

PRIVATE SECTOR

The private sector can play a key role in road safety, particularly in conjunction with the government and civil service organizations. As manufacturers, the private sector can ensure that vehicles meet safety standards, such as those relating to seat belts and other safety equipment.

CREATING A ROAD SAFETY WORK ETHIC

Promotion of effective work-related road safety policies can benefit business, in addition to alleviating some of the RTI burden. Campaigns such as 'Driving for better business' (www.drivingforbetterbusiness.com) can effectively raise awareness of the importance of work-related road safety in the business community. The private sector can also promote benchmarking of road safety, as with the global program 'Fleet safety benchmarking' (www.fleetsafetybenchmarking.net).

The Private Sector Road Safety Collaboration (PSRSC) is an established road safety network that aims to promote and strengthen international collaborations among private-sector companies in matters of road safety, in order to reduce RTIs and deaths among staff, the fleet workers they contract, and the communities in which they operate. Groups such as the Network of Employers for Road Safety (NETS) is a non-profit organization dedicated to improving the health and safety of employers, their families, and the community, by preventing traffic crashes at work and elsewhere.

THE PRIVATE SECTOR AS DONORS

By making road safety outcomes a development priority, and by investing in road safety grants for health, transport, environment, and education, the private sector can significantly improve the research and development (R&D) relating to interventions in road safety globally.

PUBLIC-PRIVATE PARTNERSHIPS

Collaborative mechanisms such as the Global Road Safety Partnership (GRSP), which bring together business, civil society, and governmental organizations to address road safety worldwide, can exert considerable leverage in the field. Companies work closely with GRSP in HICs and LMICs to promote road safety through activities such as: supplying reflective material for integrating into clothing and safety devices; improving road signs and markings; creating road safety zones, particularly outside schools; and improving fleet safety standards.

6. POST-CRASH CARE

However much RTIs might decrease as a result of preventive road safety efforts, the reality is that crashes are going to occur, and emergency care is going to be needed. The WHO has not only called on member states to improve existing systems for trauma care, but also developed guidelines for the creation of essential trauma care systems.[43,44] These systems should be universal, well-designed, and locally appropriate, and call for innovative thinking, planning, and adaptation, particularly in LMICs. This section will not cover strategies for basic trauma management, pre-hospital clinical care, or basic rehabilitation techniques (such as breathing management and bleeding control), which are obviously essential for any post-crash care initiative. What this section will focus on is the issue of innovations in the field of trauma care.

QUALITY IMPROVEMENT PROGRAMS FOR TRAUMA CARE SYSTEMS

Efforts to improve trauma care systems – measures such as streamlining patient flows and enhancing the care of injured patients – have been shown to reduce the mortality of trauma patients by 15-20 percent.[45,46] Among medically preventable deaths, such improvements could even reduce mortality by 50 percent.[45,46] Not only do these quality-improvement programs decrease deaths, but they also decrease overall costs through improving the process of care.[47,48] Such programs have the advantage of being applicable in a variety of settings, including low-income ones.

FIRST RESPONDERS

Where no pre-hospital trauma care system exists, one potential approach is to teach community members basic first aid techniques. Such "first responders," as they are known, would then be able to recognize emergencies, call for help, and provide basic treatment until formally trained health personnel arrive, or until the victim can be transported to hospital by whatever means available.

AUTOMATIC CRASH NOTIFICATION

Recent research has highlighted the potential of Automatic Crash Notification (ACN) systems in cars to reduce transit times to trauma centers.[49] An Australian study estimated that such a notification system could reduce crash-to-hospital times by 3-6 minutes, and would result in 104 fewer fatalities in Australia every year.[49]

mHEALTH: eCall 112

This system has been installed in some EU countries. The in-vehicle eCall is an emergency call generated either manually by vehicle occupants or automatically via activation of in-vehicle sensors. When activated, the in-vehicle system will establish a voice connection directly with the 112 emergency services provider. This system has the potential to change communication protocols for trauma care.

AMBULANCE REDESIGN

Improved mobile healthcare systems permit ambulance services to give definitive treatment for urgent conditions at the scene of a road crash, thereby improving their quality, efficiency and cost-effectiveness. Redesign features include: 360-degree access to the patient, which not only increases clinical efficiency but also enhances patient safety; an easy-to clean-interior; special equipment packs; and new digital diagnostics and communications systems.[50]

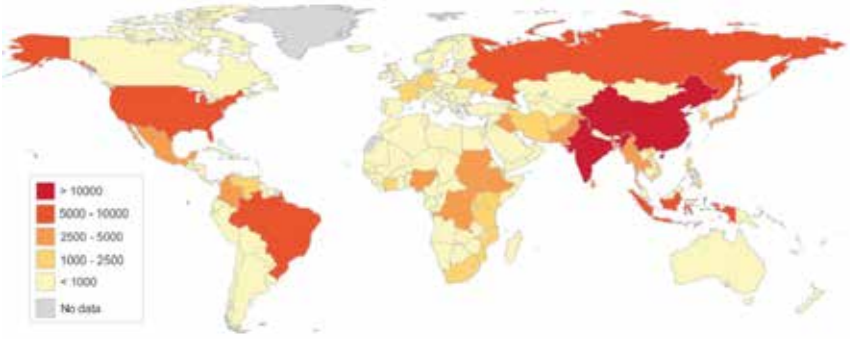
INNOVATIVE SOLUTIONS IN POST-CRASH CARE – TRANEXAMIC ACID: FROM RESEARCH TO PRACTICE

CRASH2
Clinical Randomisation of an Antifibrinolytic in Significant Haemorrhage

An estimated 5.8 million people die each year as a result of trauma of all kinds, many after reaching hospital.[51] One of the most common causes of death is bleeding, accounting for 40 percent of in-hospital trauma deaths.[52]

Tranexamic acid (TXA) has been used to control bleeding during elective surgeries. Researchers investigated whether this drug could be used to treat uncontrolled bleeding in trauma patients. The CRASH-2 trial, a large international randomized control trial carried out in 40 countries, showed that administration of Tranexamic acid (TXA) – if completed within three hours of injury – could indeed lead to a statistically significant reduction in mortality of trauma patients with bleeding.[53] From these studies, it has been estimated that more than 100,000 lives could be saved globally each year if TXA were in widespread use.[54]

Global distribution of deaths likely averted by means of TXA administration within three hours of injury[54]



At less than US$10 per treatment, TXA administration has been shown to be highly cost-effective in LMICs or HICs.[55] It is more cost-effective than antiretroviral treatment for HIV, and nearly as cost-effective as bed nets for malaria prevention. On the basis of the evidence of TXA's effectiveness, the drug has been incorporated by the British Army into combat care treatment protocols, and is now included in the WHO list of essential medicines.

7. TECHNOLOGY

A wide variety of e-Safety technologies are in use today, some of which are fitted to vehicles as standard equipment.

ALCOLOCKS

"Alcolocks" are emerging as an innovative mechanism for separating drinking and driving without relying on human behavior. The alcolock is an alcohol ignition lock, an electronic device that prevents the vehicle from being started if the driver has drunk too much. The driver has to breathe into the apparatus before starting the engine, and also at random times while driving.

INTELLIGENT SPEED ADAPTATION (ISA)

ISA is a system that prevents or discourages the driver from exceeding the statutory local speed limit. The in-vehicle speed limit is set automatically as a function of the speed limits indicated on a road. GPS allows ISA technology to continuously update and adjust the vehicle speed limit to the road speed limit.

SUMMARY

The innovations described above are summarized and classified in Table 5, according to the type of innovation and intervention they represent. Table 6 indicates their applicability at the individual, institutional and systems levels, and in relation to the time of injury event (pre, intra, post). These matrices allow a comprehensive analysis of innovation types and their operational characteristics.

Bear in mind that these innovations are the product of a process – the process of inquiry and discovery that leads to a solution. The process often begins by identifying challenges (such as the high burden of RTIs), and then moves on to identifying specific needs (such as those in LMICs), then to research that suggests several potential solutions, then to pilot testing to identify which ones work, and then to large-scale testing and quality-assurance studies to check for both effectiveness and safety, and finally to implementation and continuous monitoring and evaluation. That is a generic, and perhaps somewhat simplistic, definition of an innovation cycle or process, but it does give some indication of the amount and complexity of the work that has to be done in order to realize innovations that will actually bring about change in the real world.

Note too that this report has not concerned itself with the specific sources of innovations. Innovations may emerge from any part of the world – high-, middle- or low-income – as the innovations in road safety and trauma care clearly show. While the lessons passed from HICs to LMICs are well-known, the "reverse innovation" from LMICs to the world is less widely discussed.[56] WISH 2013 offers an opportunity to celebrate all creativity irrespective of location.

To highlight some of the innovations, we have compiled a mixed selection of case studies illustrating innovative and best practices from around the world. The innovations and approaches described have been successfully employed in a variety of settings. A reminder of some examples: in South Africa, the insurance company Discovery developed an incentive program for drivers that has significantly increased the proportion of "good" and "excellent" drivers on the road. In Mexico, the NGO VIVIAC used a grassroots advocacy approach to revise regional drink-driving legislation. And in the United Arab Emirates, Abu Dhabi's Urban Planning Council commissioned a street design manual and successfully used its recommendations to redesign a major roadway, making it safer for pedestrians. These heartening real-world successes fit perfectly with WISH 2013's emphasis on innovative practices that have emerged from around the globe.

Table 5: Matrix of Road Safety Innovations

	INNOVATIVE SOLUTIONS	INNOVATIVE USE/UTILITY OF EXISTING NON-RTI SOLUTIONS	INNOVATIVE IMPLEMENTATION OF EXISTING RTI INTERVENTIONS
1. Legislative/enforcement	• Lowered BAC limit for novice drivers • Use of automatic speed enforcement to improve compliance • Training new and existing MPs and policy-makers in road safety issues • Developing appropriate legislation to deal with emerging road safety issues, eg, E-Bikes • Company policies that fully ban the use of cell phones during driving • Levies on licenses and insurance • Implementation of NCAP in all countries • "Booze buses"	• Promoting policies on corporate social responsibility and road safety	• Improved speed-enforcement technology along with training and mentoring • Increased use of speed cameras/radars to improve enforcement • Fines for non-use of seat belts, eg, Click-it or Ticket • Random breath tests for all drivers (not just suspects) and in more areas • Bans on cell phone use while driving for young/novice/fleet-car/school bus drivers • Implementation of helmet laws
2. Behavioral	• Graduated driver licensing programs • Car insurance incentive schemes	• Improved marketing/branding of road safety	• Promoting a change of culture in road safety – unacceptable to drink-drive or use cell phones while driving • Use of hard-hitting graphic campaigns to create a theater of policing • Training media on road safety interventions
3. Community Empowerment	• Empowering NGOs to be enforcement officers where police are under-resourced • Encouraging social accountability, eg, matatu passengers	• Encouraging CSO engagement in lobbying, eg, HIV/AIDS	• Training of NGOs and volunteers in first aid
4. Road Safety Management	• Legislation to ensure that there is a lead agency for road safety • Shift towards local/city-level management of road safety	• Lobbying to make road safety a part of the SDGs	• Promotion of national/city-level Road Safety Councils • Encouraging multi-sectoral collaboration across all Decade of Action pillars

Table 5: Matrix of Road Safety Innovations (continued)

	INNOVATIVE SOLUTIONS	INNOVATIVE USE/UTILITY OF EXISTING NON-RTI SOLUTIONS	INNOVATIVE IMPLEMENTATION OF EXISTING RTI INTERVENTIONS
5. Infrastructure	• Dynamic speed limits • Steel cables in highway medians • Reducing demand for car use through urban design • Linking traffic calming measures with well-funded programs, eg, street resurfacing • Rumble strips • Separation of vulnerable road users and vehicles		• Speed limits • Speed restriction zones • Traffic calming measures, eg, roundabouts • Separation of bikes from other vehicles
6. Post-crash Care	• Use of tranexamic acid in post-crash treatment • Promoting a systems approach to trauma care • eCall systems • Building emergency lanes to provide rapid care in congestion • Automatic notification to emergency services • Psychological support for road crash victims • Trauma registries • Quality improvement programs for trauma care systems	• Mobile-phone emergency reporting systems • Identification and reporting of high-risk drivers by emergency departments • Emergency department brief interventions	• Engaging Red Cross or Red Crescent societies in post–crash care, eg, Kenya
7. Technology	• Alcohol Interlocks • Seat belt reminders • Gearshift delay to promote seat belt use • Intelligent Speed Adaptation • Autonomous cars		• Speed governors • Cell phone-blocking technology in cars
8. Other	• Employing road safety information systems (linked databases: vehicles/drivers/ crashes/violations) • Hospitals to claim back treatment costs from health insurance	• Lowering import duties in LMICs on safety-related spare parts for vehicles, such as brake components and tires	• Improved research on intervention effectiveness • Cost-effectiveness studies • Improved mass transport systems, eg, rapid bus system • Involving more private companies in global road safety

NCAP: New Car Assessment Program

Table 6: Levels of Application for Innovations

	LEVELS OF APPLICATION				
	INDIVIDUAL			INSTITUTIONAL	SYSTEM
TIME HORIZON	GENERAL POPULATION	VULNERABLE GROUPS	YOUNG DEPENDENTS/ ADOLESCENTS		
PRE-EVENT	• "Booze buses" • Alcohol Interlocks • Seat belt reminder • Gearshift delay • Intelligent Speed Adaptation • Cell phone blocking technology in cars • Incentive programs • Encouraging social accountability, eg, matatu drivers	• Separation of bikes from other vehicles • Separation of vulnerable road users and vehicles • Infrared detectors on cars to detect vulnerable road users • Pedestrian Behavior Programs • Improved Pedestrian/Cyclist Visibility • Pedestrian safety measures	• Graduated driver licensing programs • Lowered BAC limit for novice drivers • Bans on cell phone use while driving for young/novice/fleet-car/school bus drivers • Booster seat programs • Speed governors • Vehicle Data Recorders	• Training new and existing MPs and policy-makers in road safety issues • Developing appropriate legislation to deal with emerging road safety issues, eg, E-Bikes • Company policies that fully ban the use of cell phones during driving • Implementation of NCAP in all countries • Promoting policies on corporate social responsibility and road safety • Legislation to ensure that there is a lead agency for road safety councils • Shift towards local/city-level management of road safety • Lobbying to make road safety a part of the SDGs • Promotion of national/ city-level Road Safety Councils • Encouraging multi-sectoral collaboration across all Decade of Action pillars • Involving more private companies in UNRSC • Political advocacy approaches • Encouraging CSO engagement in lobbying, eg, HIV/AIDS	• Improved marketing/branding of road safety • Promoting a change of culture in road safety – unacceptable to drink-drive or use cell phones while driving • Use of hard-hitting graphic campaigns to create a theater of policing • Training media on road safety interventions • Levies on licenses and insurance • Improved speed enforcement technology along with training and mentoring • Increased use of speed cameras/ radars to improve enforcement • Fines for non-use of seat belts, eg, Click-it or Ticket • Implementing random breath tests on all drivers (not just suspects) and in more areas • Implementing helmet laws • Employing road safety information systems (linked databases: vehicles/drivers/crashes/ violations) • Lowering import duties in LMICs on safety-related spare parts for vehicles, such as brake components and tires • Improved mass transport systems, eg, rapid bus system • Police patrols

Table 6: Levels of Application for Innovations (continued)

	LEVELS OF APPLICATION				
	INDIVIDUAL			INSTITUTIONAL	SYSTEM
TIME HORIZON	GENERAL POPULATION	VULNERABLE GROUPS	YOUNG DEPENDANTS / ADOLESCENTS		
PRE-EVENT					• Road safety campaigns • Improved lighting for roadways and vehicles • Red-light cameras • Speeding cameras • Traffic-calming measures • Geographic Information Systems (GIS) • Non-vehicle-dependent travel
EVENT					• Dynamic speed limits • Rumble strips • Reducing demand for car use through urban design • Linking traffic calming measures with well-funded programs, eg, street resurfacing • Steel cables in highway medians
POST-EVENT SUB-ACUTE	• Use of tranexamic acid in post-crash treatment			• Trauma registries • Continuing Education Courses, such as ATLS, PTC, NTMC • Quality improvement programs for trauma care systems	• Promoting a systems approach to trauma care • eCall systems • Emergency lanes built to provide rapid care in congestion • Automatic emergency services notification • Cell phone emergency reporting systems
POST-EVENT LONG TERM MANAGE MENT				• Engaging Red Cross or Red Crescent societies in post–crash care, eg, Kenya • Emergency department brief interventions	• Psychological support for road crash victims

THE DEVELOPMENT CHALLENGE

The desire to reduce road traffic deaths and injuries amidst rapid economic growth and urbanization necessitates a new way of thinking in the field of road safety. The worldwide boom in road networks and the soaring number of vehicles on them will require innovative measures to move road safety forward, and to ensure that RTIs are taken into account during this time of rapid economic development and urbanization.

The consequences of this economic development and urbanization include:

- Massive investments in road building, and the need to refine road safety, both for immediate and for long-term benefits. This is critical, given the path dependency of transport systems.
- Expansion of the global car industry and the shift of production to rapidly growing middle-income countries, and the need to build safety measures into these new cars. In addition, questions over how a surge in low-cost cars can be consistent with safety concerns.
- Incorporation of large populations into the road transport networks, whether as drivers or pedestrians, and the need for rapid changes in road safety culture. These changes took a long time in the HICs, but we need accelerated strategies for change in LMICs.
- Rapid growth in the road transport industry, and the need for measures to reduce risk around the world.
- Major changes in the pattern of health problems, including a soaring incidence of RTIs, and the inability of many health systems to deliver adequate acute and trauma care.

These consequences raise several challenges:

- Are mechanisms available to help incorporate road safety rapidly into the management of these new road transport systems?
- Are there examples of road-system expansion schemes that consciously included road safety in their planning?
- Can new technologies, especially the newly available low-cost technologies, help to make driving safer, even where cultural change has lagged behind the change in road transport systems? In HICs, such possibilities include the use of driverless cars, as currently being developed by Google in the US. In LMICs, the challenge remains more pronounced.
- What kinds of coalitions could emerge to drive forward reforms in safe transport? What contributions could be made by city governments, health systems, health insurance schemes, highway authorities, and the automobile industry? Could new types of insurance play a role?
- As more countries set universal health coverage as a political aim, will the coverage include low-cost and effective trauma care? How can best-practice models be spread rapidly? Who should pay for this trauma care – government or health insurance schemes; or perhaps drivers, through taxes or insurance; or perhaps the people who are injured?

- How can ministries of health take the lead here? One key role might be to generate and publicize statistics; another would be to promote the development of a trauma care system.
- Is road safety really amenable to technological innovations, particularly in rapidly growing LMICs? Assuming that people will largely use low-cost vehicles, how can these be made safer for drivers and also for pedestrians? What role might ICT innovations play?

These questions reflect a fundamental feature of road safety and trauma care: their complexity. To deal with such complexity, the global health community will have to be innovative and bold – and it is in that spirit that we offer our set of suggestions in the following section.

POLICY RECOMMENDATIONS

The fields of RTI prevention and trauma care are ripe for a breakthrough – a movement that drives and sustains innovations to reduce the heavy burden of RTIs and deaths. We believe that all stakeholders in road safety and trauma care across the health sector and allied sectors – governments, NGOs, researchers, academics, victim groups, the private sector, donors – have a key role to play in developing and diffusing innovative solutions and implementation. That role will involve taking up at least some of the following policy and action recommendations:

1. ADVOCATE FOR A GLOBAL UNDERSTANDING OF THE BURDEN OF RTIs

More effective communication and advocacy on road safety is needed, to elucidate the true burden of RTIs in all its dimensions (age, gender, inequities, and so on). If the current neglect of road safety continues, the price is the continued loss of more than a million lives each year. With many millions disabled, and that is a price that we cannot afford.

We urge policy-makers and non-governmental organizations to understand and use road safety data and disseminate it to their populations.

2. STIMULATE A PIPELINE OF DISCOVERY

R&D relating to RTIs should be promoted from a multi-disciplinary perspective, with collaboration from health professionals, engineers, the police, the private sector, and others. Particular emphasis should be placed on translational research and cost-effectiveness data on new solutions, especially solutions for LMICs. A solid evidence base is the cornerstone of any public health action against disease and injury.

We urge donors, governments, and the private sector to invest in R&D in road safety and trauma care.

3. ENSURE THAT POLICY-MAKERS IMPLEMENT THE RECOMMENDATIONS OF THE 2004 WORLD REPORT ON ROAD TRAFFIC INJURY PREVENTION:

1. Identify a lead agency in government to guide the national road traffic safety effort.
2. Assess the problem, policies, and institutional settings relating to road traffic injury and the capacity for road traffic injury prevention in each country.
3. Prepare a national road safety strategy and plan of action.
4. Allocate financial and human resources to address the problem.
5. Implement specific actions to prevent road traffic crashes, minimize injuries and their consequences, and evaluate the impact of these actions.
6. Support the development of national capacity and international co-operation.

We urge governments to ensure that they adopt and implement the recommendations of the 2004 World Report on Road Traffic Injuries Prevention.

4. ENABLE REAL-WORLD TESTING OF INNOVATIONS

New road safety measures and interventions developed by the private sector or academic institutions should not only reach the people they are designed for but should also be effective and safe. Systematic assessments of efficacy and effectiveness should be encouraged and funded within the field of road safety.

We urge all stakeholders to adopt the principle of promoting and using evidence-based innovations for road safety and trauma care systems.

5. PROMOTE THE DIFFUSION OF EVIDENCE-BASED INNOVATIONS

As discussed above, there are numerous interventions known to be effective, yet they have not been taken up on a larger scale, and remain confined to few locations. Legislation and enforcement revolving around the major risk factors (speed, seat belt and child restraint use, helmet use, and drink-driving) are still not present in many countries. To remedy this shortcoming, effective interactions between researchers, governments, policy-makers, and health workers need to be strengthened. The use of trusted communication channels and new social media will enhance the dissemination of evidence-based innovations in road safety.

We urge all sectors, especially NGOs, academia, and civil society, to promote global diffusion of road-safety and trauma-care innovations using traditional and new technologies.

6. USE THE DECADE OF ACTION ON GLOBAL ROAD SAFETY 2011-2020 TO PUSH FOR EFFECTIVE ACTION

We have seven years remaining in the decade – an opportunity to create global momentum for road safety and trauma care. Decision-makers should take up the challenge, and make it their decade, to create a platform for change. Innovative actions of the kind in the table below and as discussed in this report can make a real difference.

Pillar 1 **ROAD SAFETY MANAGEMENT**	Pillar 2 **ROAD INFRASTRUCTURE**	Pillar 3 **VEHICLE SAFETY**	Pillar 4 **SAFER ROAD USERS**	Pillar 5 **POST-CRASH CARE**
Legislation to assign lead agency for Road Safety Councils	Decreased demand for car use through urban design	Implementing of NCAP in all countries	Graduated driver licensing	Tranexamic acid
Lobbying to make road safety a part of the SDGs	Speed restriction zones	Alcohol Interlocks	Car insurance incentive schemes	Promoting a systems approach
Multi-sectoral collaboration across Decade of Action Pillars	Separation of vulnerable road users and vehicles	Intelligent Speed Adaption	Automatic speed enforcement	eCall systems
		Speed governors	Random breath tests	Automatic emergency notification
		Cell phone blocking technology	Ban on cell phone use	Trauma registers
				Quality improvement

We urge governments to adopt and implement the strategies in the UN Decade of Action's Global Plan for 2011-2020.

7. INTEGRATE ROAD SAFETY INTO GLOBAL HEALTH AND DEVELOPMENT AGENDAS

The interconnection of road safety with other health and environmental agendas is considerable, and calls for incorporating RTI reduction into development policies and programs. Policies aimed at reducing RTIs must take into account the other health effects of road transport; and health policies in other areas have positive effects on road safety. Table 7 shows the linkages between road safety and four other health topics covered in the World Innovation Summit for Health 2013.

Table 7: Interconnection of Road Safety and other health agendas

HEALTH TOPIC	ASSOCIATION WITH ROAD SAFETY
Obesity	• Urban planning can promote healthy behavior and safety through investment in active transport, by designing areas to promote physical activity while keeping safe road design at the forefront. • There is a known link between obesity and higher rates of severe injuries sustained after a road traffic crash.
Mental Health	• Alcohol and substance abuse are major contributors to RTIs, as they are to the global mental health burden. • Dementia and other mental health issues associated with elderly populations are now recognized risk factors for car crashes and RTIs. • There is a known link between epilepsy and risk of car crashes.
Big Data	• Location tracking for cars yields Big Data, and could become increasingly valuable in RTI reduction efforts in the near future. • Projections of global traffic patterns over the next 20-30 years are possible via Big Data, and so are projections of the effects on human health.
Patient Engagement	• Engagement of victim support groups and the community can be a powerful advocacy tool for road safety.

Road safety needs to be an integral part of the post-2015 SDGs framework (which replaces the Millennium Development Goals). Such integration will help to mobilize the necessary political and financial support for the UN Decade of Action for Road Safety. The post-2015 framework provides a unique opportunity for policy-makers to put safe and sustainable transport prominently on the global health agenda.

We urge global health leaders and the UN agencies to ensure the incorporation of road safety and trauma care as a key concern for sustainable global health and development goals.

8. CREATE COMMUNITY DEMAND FOR EFFECTIVE SOLUTIONS

Community involvement can greatly strengthen the global movement for road safety. The more that a community is mobilized, through NGOs and other voluntary groups, and the more vocal it is, the likelier it is that officials will respond to valid demands. Enabling civil society to demand interventions is an important strategy for promoting road safety.

We urge civil society, victim groups, and NGOs to be effective advocates, and engender a strong demand for road safety and trauma care in populations around the world.

9. SHOWCASE REAL-WORLD EXAMPLES OF EFFECTIVE CHANGE

When countries take positive steps and adopt multiple interventions to reduce their RTI burden, their efforts should be publicized and should serve as models for other countries in the region. Governments and other road safety policy-makers often respond to comparative examples and neighboring models, thus documenting successes is important for local and national action on road safety.

We urge all stakeholders, especially academia and researchers, to widely share evidence-based successes and models for best practices in road safety and trauma care.

10. ENSURE CAPACITY DEVELOPMENT AS A CORE STRATEGY

A critical gap in road safety in many countries is the lack of human technical capacity. Accordingly, countries and especially LMICs should invest in the training and capacity development of their road safety professionals. As the countries adopt innovative programs, they will depend on advanced knowledge and skills to design, implement, evaluate, and sustain such programs over the course of time. Continuous investments in individual and institutional capacity development are important for sustainability.

We urge all stakeholders, especially governments and donors, to ensure that capacity development is integrated in all road-safety and trauma-care efforts.

We hope that decision-makers will take the set of ten recommendations and strive to implement them. We urge the development of model plans and programs, and hope that these solutions can be applied at scale. This paper urges several high-level actors (countries, states, cities) to volunteer to develop a model road-safety and trauma-care program, and report its effectiveness at another WISH in five years' time.

Our list of suggestions indicates key roles for all sections – government, NGOs, the private sector, academia, civil society – and each section can find a mission among the various strategies. It is time for a global movement to lighten the burden of RTIs and to promote trauma care. We hope that WISH 2013 can renew the strength and momentum of the endeavor.

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