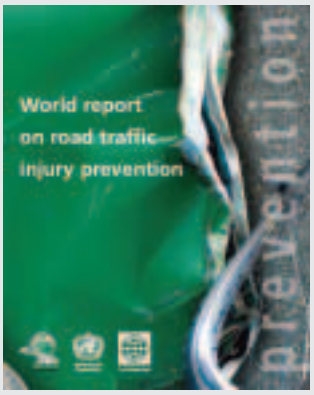
Road Traffic Injury Prevention

Training Manual

World Health Organization

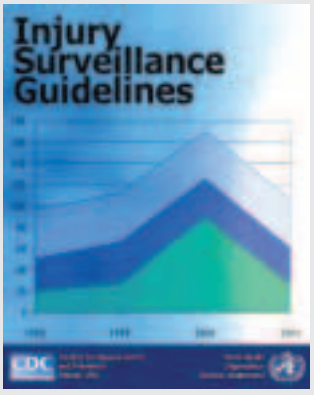
INDIAN INSTITUTE OF TECHNOLOGY DELHI

Selected WHO publications

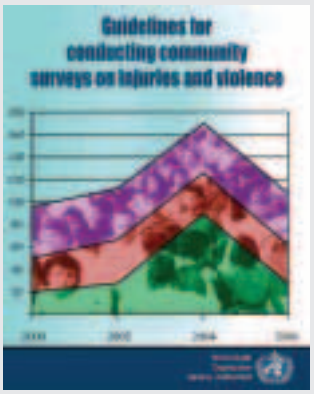


http://www.who.int/violence_injury_prevention/en/

http://www.who.int/violence_injury_prevention/capacitybuilding/teach_vip/en/index.htm



http://www.who.int/violence_injury_prevention/surveillance/en/



http://www.who.int/violence_injury_prevention/surveillance/en/

Road traffic injury prevention training manual

Dinesh Mohan, Geetam Tiwari,
Meleckidzedeck Khayesi and
Fredrick Muyia Nafukho

World Health Organization

INDIAN INSTITUTE OF TECHNOLOGY DELHI

WHO Library Cataloguing-in-Publication Data

World Health Organization.
Road traffic injury prevention : training manual.

1.Accidents, Traffic - prevention and control 2.Data collection - methods 3.Emergency medical services - organization and administration 4.Teaching materials 5.Manuals I.Title.

ISBN 92 4 154675 1 (NLM Classification: WA 275)

Printed in India

Contents

Foreword

Road traffic injuries are the leading cause of death by injury, the eleventh leading cause of all deaths and the ninth leading contributor to the burden of disease worldwide. Each year 1.2 million men, women and children around the world lose their lives as a result of road traffic collisions. Hundreds of thousands more are injured on the world's roads, some of whom become permanently disabled.

Human capacity to respond to this major public health concern is an important component of efforts to prevent road traffic injuries. Policy-makers, researchers and practitioners need information on effective prevention measures and how to develop, implement and evaluate such interventions. There is a need to train more specialists in road traffic injury prevention in order to address the growing problem of road traffic injuries at international and national levels. The *World report on road traffic injury prevention*, launched in 2004, identified the development of capacity as a key recommendation. Consequently, the World Health Organization, in collaboration with the Transport Research and Injury Prevention Programme of the Indian Institute of Technology in New Delhi, was prompted to develop this manual to provide guidance to professionals working on road traffic injury prevention.

This manual equips the user with necessary information on: the magnitude and impact of the problem of road traffic injuries; key risk factors; the need for a scientific approach to preventing road traffic injuries and how to strengthen the evidence base for prevention; how to implement promising interventions; how to deliver post-crash care; the need for multisectoral collaboration; and how to formulate and implement road safety policies.

We hope that this manual, which is designed for a multidisciplinary audience including medical doctors, nurses, transport and road engineers, vehicle safety professionals, law enforcers, policy-makers, urban planners, and social scientists, will contribute towards strengthening capacity to implement measures to prevent road traffic injuries in different settings around the world. The students of today will be the road safety specialists of tomorrow.

Dr Etienne Krug
Director
Department of Injuries and Violence Prevention
World Health Organization

Contributors and acknowledgements

The World Health Organization acknowledges with thanks all those who contributed to this document, for their support and expertise over the last four years. Particular thanks are due to a few dedicated individuals who brought this document to fruition.

The writers - Dinesh Mohan and Geetam Tiwari, from the Transportation Research and Injury Prevention Programme (TRIPP), Indian Institute of Technology Delhi, a WHO Collaborating Centre in Delhi, who shared their experiences of running international road safety courses and used this to draft the manual. Also to Fredrick Muyia Nafukho, University of Arkansas, USA, for his educational expertise during the writing phase.

The advisory group - Dinesh Mohan and Geetam Tiwari (TRIPP), Margie Peden and Meleckidzedeck Khayesi (WHO), Ian Roberts (UK), Anthony Bliss (World Bank), Frederick Muyia Nafukho (USA).

The Injury Prevention Initiative for Africa (IPIFA) who pilot tested the first draft of this document and gave valuable feedback which was incorporated into the second draft which went out for external review.

The reviewers - Martha Hijar (Mexico), Tsegazeab Kebede (Ethiopia), Adnan Hyder (Pakistan/USA), Wilson Odero (Kenya), Fred Wegman (The Netherlands), Andrew Downing (GRSP), Mark Stevenson (Australia), Maarten Amelink (The Netherlands), David Meddings (WHO).

The final draft was edited by Angela Haden with support from Caroline Allsopp.

The production team - Pascale Lanvers-Casasola (administrative support), Biplab Kundu (design and layout), Tami Toroyan (proofreading) and Marijke Bollaert (reference assistant).

Funding for this publication was kindly provided by the FIA Foundation for the Automobile and Society, and the Swedish International Development Agency (SIDA).

Guidance to users

- Why was this manual developed?
- How was this manual developed?
- Who are the intended users?
- Structure and content
- Using this manual effectively
- Suggestions for facilitators
  - Which units to offer?
  - Adapting the content to a local context
  - Making training sessions participatory and interactive
- Suggestions for trainees
- Evaluation
- References

Why was this manual developed?

Few people are trained in road traffic injury prevention. While there are growing efforts in different parts of the world to prevent road traffic injuries, capacity remains a problem. The situation is especially serious in low-income and middle-income countries. There is also an urgent need to train practitioners and policy-makers in the scientific approach to road traffic injury prevention. There needs to be a cadre of professionals working from a shared understanding of the magnitude of the problem of road traffic injuries, risk factors and the value of implementing evidence-based strategies. This underscores the need for people working in the area of road traffic injury prevention to be equipped with appropriate knowledge and skills derived from empirical evidence and professional wisdom. Intervention programmes seeking to prevent road traffic injuries need to address the problem of capacity in different sectors *(1)*.

This manual attempts to address the problem of capacity for road traffic injury prevention by providing guidance to professionals working on road safety. The manual is part of a series of training and evidence resources that have been developed by the World Health Organization (WHO) to help prevent violence and injuries. A list of complementary documents is provided on the inside back cover of this manual.

How was this manual developed?

This manual was developed jointly by WHO and the Transport Research and Injury Prevention Programme of the Indian Institute of Technology in New Delhi, India. It is based on the International Training Course on Transportation Planning and Safety offered by the Transport Research and Injury Prevention Programme *(2)*, the *World report on road traffic injury prevention (1)*, the TEACH-VIP curriculum *(3)* and other relevant documents produced by WHO (see outside and inside back covers). All the relevant information was gathered and a draft of the manual was prepared, pilot tested, peer reviewed, and revised, ultimately being published in the present form. It is envisaged that the manual will be further refined in the light of experience in its use.

Who are the intended users?

This manual is designed for a broad inter-disciplinary audience consisting of people involved in preventing road traffic injuries. This group includes medical doctors, nurses, transport and road engineers, vehicle safety professionals, law enforcers, policy-makers, urban and regional planners, administrators, private sector representatives, campaigners for road safety and researchers. Since effective implementation of road safety policies requires an interdisciplinary approach, this manual provides guidance to workers in a wide range of disciplines, who are involved in different aspects of road traffic injury prevention in different settings. Thus, this manual is aimed not only at medical professionals, but also at professionals from the public health and other sectors, who are involved in preventing road traffic injuries.

Structure and content

This manual is composed of seven complementary units. Each unit is independent and can be taught or learned separately. This structure gives facilitators and trainers flexibility to customize the content for different audiences.

The units provide users with information enabling them to respond to key road safety questions:

- What are the appropriate methods and approaches for preventing road traffic injuries?
- What policies and strategies have been shown to be successful?
- What strategies should be implemented for maximum benefits?
- What can road safety professionals do to initiate and sustain viable programmes to improve road safety?

This manual equips users with specific information on:

- magnitude and impact of road traffic injuries;
- risk factors for road traffic injuries;
- importance of evidence as a foundation for prevention;
- implementing specific interventions to prevent road traffic injuries;
- delivering post-crash care;

- multisectoral collaboration;
- formulating and implementing road safety policy.

Each unit is designed to promote interaction and action. Each unit begins with an overview of the unit's content and a list of learning objectives to help in assessing whether or not the delivery of content has achieved the expected outcomes. Each unit provides examples to illustrate concepts and questions relating to the prevention of road traffic injuries. Learning activities are provided to give the trainees practical exercises. Key points summarize the information that the facilitator should emphasize, and the main concepts are defined.

Using this manual effectively

This manual provides principles and information to meet training needs in different settings. It can be used in facilitator-guided training, as well as for self-learning. Users are expected to be creative and innovative. Some suggestions for facilitators and trainees on how they can effectively use this manual are given here.

Suggestions for facilitators

Which units to offer?

Professionals working on road safety have different levels of prior knowledge. Some may have had formal training, while others may not. Also, these professionals are likely to be working on different aspects of road safety. Trainers are advised to consider the needs of different audiences, especially their pre-existing knowledge and practical needs in their work. The modular structure of this manual allows for flexibility in customizing the content to meet different training needs. Box 1 suggests some factors to consider when selecting units on which a training session will be based.

Trainers are advised to carefully assess training needs in each setting and choose the units appropriately. It will require trainers to consult relevant institutions and interact directly with the training audience in advance of the training.

Adapting the content to a local context

This manual provides key principles and discusses universal problems, but these principles and problems

BOX 1

Some factors to consider in selecting units

- What is the pre-existing knowledge level of the audience? In particular, how sound is their grasp of the fundamentals of road traffic injury prevention?
- Are these trainees actively working in a capacity directly related to road traffic injury prevention? If so, do they need to acquire competencies for their work? If not, do they only need to be made aware of some of the concerns in this area?
- For trainees engaged in road traffic injury prevention, how can the selection of lessons be optimized so as to make the training session of direct relevance to their current activities?
- Is the knowledge level of the audience such that they can be expected to participate actively in various forms of participatory learning? If so, how might the selection of units take advantage of this?
- How much time is available for the planned training session? What is a realistic number of units to provide, taking into account any participatory exercises, discussions and group work that are also planned?

need to be made relevant to the local context. While the importance of adapting the content to local situations cannot be underestimated, trainers who are overseeing the local adaptation of the training materials must ensure that the fundamental principles are not radically changed or misrepresented. It is also important to ensure that the material, when adapted to a specific local setting, remains accurate.

There are a number of ways of adapting this manual to a local context. Trainers can do this by:

- modifying the style and level of content in view of the pre-existing knowledge base of the training audience;
- introducing local experiences into the training materials to make the course meaningful to the audience, for instance by considering the local implications of road traffic collisions, risk factors and policy development;
- substituting locally relevant examples for the illustrative examples in the manual;
- adding new topics at the request of specific audiences, and developing materials for these topics;
- asking trainees to look for examples in advance and make presentations on them during the training sessions;
- inviting local decision-makers, government officials, nongovernmental organizations, staff of transport companies and insurance companies, and victims and researchers to share their knowledge, experience and projects.

While the manual covers the main topics in road traffic injury prevention, it is possible that other specific topics, such as enforcement and programme implementation, need to be added in certain local settings. Trainers should respond adequately to requests by an audience to deal with such matters, and are urged to share information on additional topics with WHO to assist in the future revision of this manual.

Making training sessions participatory and interactive

Learning is a two-way process and it is important to enhance opportunities for learning, not only between the trainer and trainees, but also among all those involved in a learning context. One way of achieving this is through promoting active participation and interaction during learning sessions. There are a number of activities that can be used to achieve this, examples of which are given in Table 1. Judicious use of the suggested activities will greatly improve the quality of training sessions, making them extend beyond the mere authoritarian transmission of content from facilitators to trainees. Trainees will be able to discover the knowledge by themselves and think critically about how to apply it in the context of the practical needs that arise in their work. In addition, they will be able to construct knowledge from their own perspectives, making what they are learning meaningful.

Suggestions for trainees

Trainees are important players in this course. This manual is meant to develop their capacity to prevent road traffic injuries. Trainees are therefore expected to:

- read the content before the training session and prepare a set of questions on matters to be clarified during the session;
- actively participate during training sessions by voicing ideas and opinions, engaging in class discussions, asking and answering questions, sharing knowledge and experiences with others, and doing exercises given by facilitators;
- review learning activities, and where possible gather local examples and data;
- take notes during the training sessions;
- read the references and the recommended further reading;
- find practical ways of using the content of this manual to initiate and support road safety activities in the their local settings;
- read the content again after the training session.

Each unit includes a section listing questions to think about. These questions are intended to guide trainees in identifying some practical activities to work on after the training.

TABLE 1

Suggested activities for participatory learning

Activity	Description
Partner exercises	**Partner collaboration** In pairs, each person explains a topic, concept or answer to his or her partner. The partner listens and then asks questions or discusses. **Peer evaluation** Divide the class into pairs. Partners exchange written work or listen to each other's oral presentations. They give each other feedback and work together to identify what was good, what needed improvement and how it could be improved.
Group exercises	**Case studies** A study or scenario is presented to the class or provided as a hand-out. Groups discuss the study or scenario together in response to questions. **Fishbowl** One group discusses a topic. A second group observes the discussion and each person records: • a partner's contribution (and gives individual feedback afterwards); • the important parts of the discussion (for example, identifying problems, applications or generalizations). **Group discussion** Groups (up to six people) talk about a topic. A set of questions from the facilitator helps to structure the discussion and focus the group. **Syndicates** Groups of trainees work together on projects that entail researching and presenting information. This approach is useful for building group and cooperative skills while covering content.
Classroom exercises	**Panel** One or more people with technical expertise are invited to the session to answer questions from the class. These people may be government representative, other trainers, medical personnel or trainees. **Presentations** Individuals or small groups find information on a topic, then prepare and deliver a short informative session to the wider group. **Question-and-answer session** This is a useful activity to check trainees' understanding. Time is set aside to discuss and answer questions.

Evaluation

Trainers are advised to evaluate the units taught whenever they use this manual. Two kinds of evaluation have been developed for this manual. The first is the trainee's evaluation of each unit. A form is provided at the end of each unit to assist the facilitator get feedback from trainees on how well each individual unit was delivered. The facilitator should make enough copies of the forms so that every trainee can fill one in. The second is the facilitator's or trainer's evaluation of the manual. A trainer's evaluation form is included in the Annex at the end of the manual for this purpose. WHO encourages facilitators and trainers to evaluate this manual and to send their evaluations to WHO (as a hard copy or an electronic copy) at the following address:

World Health Organization
Department of Injuries and Violence Prevention
20 Avenue Appia
CH-1211 Geneva 27
Switzerland
E-mail: traffic@who.int

References

1. Peden M et al. *World report on road traffic injury prevention*. Geneva, World Health Organization, 2004.
2. Tiwari G, Mohan D, Muhlrad N, eds. *The way forward: transportation planning and road safety.* New Delhi, Macmillan Ltd., 2005.
3. TEACH-VIP curriculum *(electronic resource).* Geneva, World Health Organization, 2005.

UNIT 1

Magnitude and impact of road traffic injuries

- Overview
- Objectives
- Global estimates and pattern
- Global trends and projections
- Who is affected by road traffic injuries?
- Activity
- Socioeconomic and health effects of road traffic injuries
- Global estimates of costs of road traffic crashes
- Key points
- Definitions of key concepts
- Questions to think about
- References
- Further reading
- Notes
- Trainee's evaluation

Overview

Road traffic injuries are a growing public health and development problem. In this unit, we examine in detail the magnitude and impact of road traffic injuries using evidence at global, regional and national levels. This evidence shows how serious the problem of road traffic injuries is at present and indicates that it will become worse if no appropriate action is taken now.

Objectives

By the end of this unit, the trainee should be able to:

- describe the global magnitude and trends of road traffic fatalities;
- discuss the global socioeconomic and health burden of road traffic injuries;
- describe the magnitude and trends of road traffic injuries in his or her own country, region and city;
- discuss the socioeconomic and health burden of road traffic injuries in his or her own country, region and city.

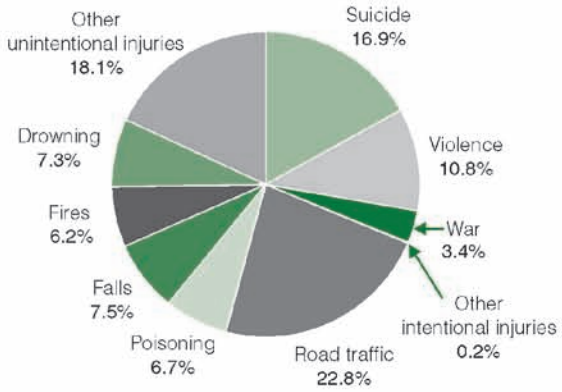
Global estimates and pattern

Data provided by the World Health Organization (WHO) and the World Bank were used for the statistical analyses that form the basis of the *World report on road traffic injury prevention (1).* In summary, these data showed that, in 2002:

- 1.2 million people died as a result of road traffic collisions. This means that on average 3242 people were killed daily on the world's roads.
- 20 million to 50 million people were injured or disabled in road collisions.
- Road traffic injuries were the 11th leading cause of death worldwide and accounted for 2.1% of all deaths globally. Furthermore, these road traffic deaths accounted for 23% of all injury deaths worldwide (Figure 1.1).
- 90% of road traffic deaths occurred in low-income and middle-income countries, where 5098 million people or 81% of the world's population live *(2)* and own about 20% of the world's vehicles.
- The WHO African Region had the highest mortality rate, with 28.3 deaths per 100 000 population. This was followed closely by the low-income and middle-income countries of the WHO Eastern Mediterranean Region, at 26.4 per 100 000 population (Table 1.1). Countries in the WHO Western Pacific Region and the WHO South-East Asia Region accounted for more than half of all road traffic deaths in the world.

FIGURE 1.1

Distribution of global injury mortality by cause



Source: reproduced from reference *1.*

Note: Unintentional (or "accidental") injuries are those attributable to road traffic crashes, falls, drowning and fires. Intentional (or deliberate) injuries are those attributable to violence, suicide and war.

TABLE 1.1

Road traffic injury mortality rates (per 100 000 population) in WHO regions, 2002

WHO region	Low-income and middle-income countries	High-income countries
African Region	28.3	—
Region of the Americas	16.2	14.8
South-East Asia Region	18.6	—
European Region	17.4	11.0
Eastern Mediterranean Region	26.4	19.0
Western Pacific Region	18.5	12.0

Source: reproduced from reference *1.*

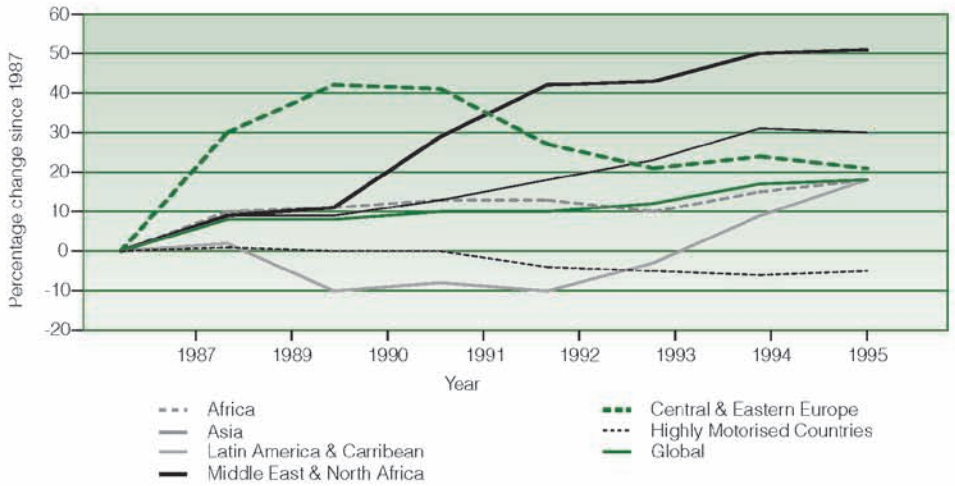
Global trends and projections

The key findings on global trends and projections presented in the *World report on road traffic injury prevention (1)* are summarized below:

- The number of road traffic injuries has continued to rise in the world as a whole, but there has been an overall downward trend in road traffic deaths in high-income countries since the 1970s, and an increase in many of the low-income and middle-income countries (Figure 1.2).
- Road traffic injuries are predicted to rise from tenth place in 2002 to eighth place by 2030 as a contributor to the global burden of diseases (Figure 1.3).
- Road traffic deaths are predicted to increase by 83% in low-income and middle-income countries (if no major action is taken), and to decrease by 27% in high-income countries. The overall global increase is predicted to be 67% by 2020 if appropriate action is not taken (Table 1.2).

FIGURE 1.2

Global and regional road fatality trends, 1987-1995[a]



[a] Data are displayed according to the regional classifications of TRL Ltd, United Kingdom.
Source: reproduced from reference *3*.

FIGURE 1.3

Change in rank order for the 10 leading causes of death, world, 2002-2030

2002		2030	
Rank	Disease or injury	Rank	Disease or injury
1.	Ischaemic heart disease	1.	Ischaemic heart disease
2.	Cerebrovascular disease	2.	Cerebrovascular disease
3.	Lower respiratory infections	3.	HIV/AIDS
4.	HIV/AIDS	4.	Chronic obstructive pulmonary disease
5.	Chronic obstructive pulmonary disease	5.	Lower respiratory infections
6.	Perinatal conditions	6.	Diabetes mellitus
7.	Diarrhoeal diseases	7.	Trachea, bronchus, lung cancers
8.	Tuberculosis	8.	***Road traffic injuries***
9.	Trachea, bronchus, lung cancers	9.	Tuberculosis
10.	***Road traffic injuries***	10.	Perinatal conditions

Source: reference *4*.

TABLE 1.2

Predicted road traffic fatalities by region (in thousands), adjusted for underreporting, 1990-2020

World Bank Region[a]	Number of countries surveyed	1990	2000	2010	2020	Change (%) 2000–2020	Fatality rate (deaths per 100 000 persons)	
							2000	2020
East Asia and Pacific	15	112	188	278	337	79	10.9	16.8
East Europe and Central Asia	9	30	32	36	38	19	19.0	21.2
Latin America and Caribbean	31	90	122	154	180	48	26.1	31.0
Middle East and North Africa	13	41	56	73	94	68	19.2	22.3
South Asia	7	87	135	212	330	144	10.2	18.9
Sub-Saharan Africa	46	59	80	109	144	80	12.3	14.9
Sub-total	121	419	613	862	1 124	83	13.3	19.0
High-income countries	35	123	110	95	80	-27	11.8	7.8
Total	156	542	723	957	1 204	67	13.0	17.4

[a] Data are displayed according to the regional classifications of the World Bank.

Source: reference *5*.

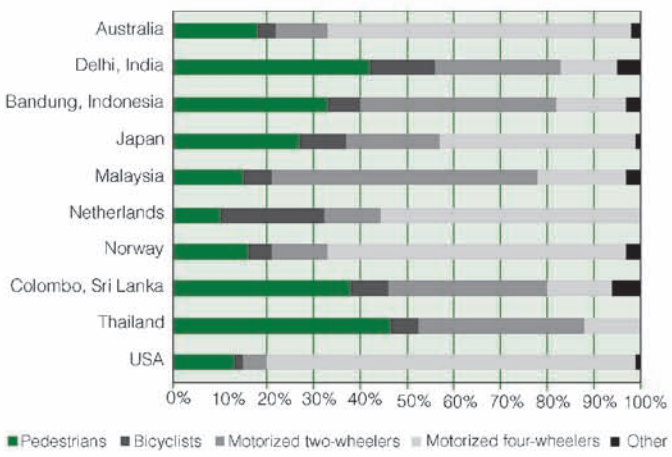
Who is affected by road traffic injuries?

The *World report on road traffic injury prevention (1)* indicates that there are notable differences in the way different road users are affected by road traffic collisions as summarized below:

- More than half of all global road traffic deaths occur among young adults between 15 and 44 years of age.
- 73% of all global road traffic fatalities are males.
- Vulnerable road users – pedestrians, cyclists and motorcyclists – account for a much greater proportion of road traffic collisions in low-income and middle-income countries than in high-income countries (Figure 1.4).

FIGURE 1.4

Road users killed in various modes of transport as a proportion of all road traffic deaths



Source: reproduced from reference *6*.

Activity

Task

Look at Table 1.3 which presents data on estimated road traffic fatalities per 100 000 population in the WHO African Region for 2002. Carefully study the table and write down key features related to the distribution of road traffic fatalities per 100 000 by sex and age.

Expected results

The purpose of this exercise is to assist trainees to identify and summarize key elements in the distribution of road traffic fatalities per 100 000 population for the WHO African Region. They are to describe variations noted in this indicator by different age groups for males and females.

TABLE 1.3

Estimated mortality[a] caused by road traffic injury[b] in WHO African region

Age[c] in years	Males	Females
0–4	18.6	11.0
5–14	42.6	25.5
15–29	27.2	10.0
30–44	53.4	15.0
45–59	65.7	22.1
60 and above	81.9	35.8
Total	39.3	17.4

[a] Mortality is measured by number of road traffic fatalities per 100 000 population.

[b] Road traffic injury = ICD10 V01–V89, V99, Y850 (ICD9 E810–E819, E826–E829, E929).

[c] Age-standardized.

Source: reproduced from reference *1*.

Socioeconomic and health effects of road traffic injuries

Road traffic injuries cause emotional, physical and economic harm. There is a moral imperative to minimize such losses. A case can also be made for reducing road crash deaths on economic grounds, as they consume massive financial resources that countries can ill afford to lose *(3)*. It is important to estimate the cost of road traffic injuries to society:

- to justify the expenditure necessary in promoting road traffic injury prevention;
- to make the best use of investments when different options are available;
- to ensure that the most cost-effective safety improvements are introduced in terms of the benefits that they will generate in relation to the cost of their implementation.

Global estimates of costs of road traffic crashes

It is estimated that road traffic crashes cost (Table 1.4):

- US$ 518 billion globally;
- US$ 65 billion in low-income and middle-income countries, exceeding the total amount received in development assistance;
- between 1% and 1.5 % of gross national product in low-income and middle-income countries; and
- 2% of gross national product in high-income countries.

Road traffic injuries put significant strain on families *(1)*. For everyone killed, injured or

TABLE 1.4

Road crash costs by region

Region[a]	GNP, 1997 (US$ billion)	Estimated annual crash costs	
		As percentage of GNP	Costs (US$ billion)
Africa	370	1	3.7
Asia	2 454	1	24.5
Latin America and Caribbean	1 890	1	18.9
Middle East	495	1.5	7.4
Central and eastern Europe	659	1.5	9.9
Subtotal	5 615		64.5
Highly motorized countries	22 665	2	453.3
Total			517.8

GNP: gross national product.

[a] Data are displayed according to regional classification of the TRL Ltd, United Kingdom.

Source: reproduced from reference *3*.

BOX 1.1

Cost of road traffic injuries to households

A case study conducted in Bangladesh found that poor families were more likely than those better off to lose their head of household and thus suffer immediate economic effects as a result of road traffic injuries. The loss of earnings, together with medical bills, funeral costs and legal bills, can have a ruinous effect on a family's finances. Among poor people, 32% of the road deaths surveyed in the Bangladesh study occurred to a head of household or that head's spouse, compared to 21% among those not defined as poor. Over 70% of households reported that their household income, food consumption and food production had decreased after a road death. Three-quarters of all poor households affected by a road death reported a decrease in their living standard, compared to 58% of other households. In addition, 61% of poor families had to borrow money as a result of a death, compared with 34% of other families.

Source: based on reference *1.*

disabled by a road traffic crash there are many others deeply affected. Many families are driven into poverty by the cost of prolonged medical care, the loss of a family breadwinner, or the extra funds needed to care for people with disabilities. Road crash survivors, their families, friends and other caregivers often suffer adverse social, physical and psychological effects. Various studies have made an effort to analyse some of these detailed aspects (Box 1.1) but further research is needed in this area. There is a need not only for more evidence but also for improvement in methods of data collection and analysis, especially concerning poor families and communities.

Key points

- Worldwide, about 1.2 million persons are killed in road traffic crashes every year.
- 20 million to 50 million more are injured or disabled in these crashes.
- Road traffic injuries account for 2.1% of global mortality and 23% of all injury deaths worldwide.
- The position of road traffic injuries as a contributor to the global burden of disease is predicted to rise from tenth place in 2002 to eighth place by 2030.
- Over the past four decades there has been an overall downward trend in road traffic deaths in high-income countries and an increase in many of the low-income and middle-income countries.
- Globally, the economic cost of road traffic injuries is about US$ 518 billion with low-income and middle-income countries accounting for US$ 65 billion.
- Road traffic injuries put significant financial strain on families. Many families are driven into poverty by the cost of prolonged medical care, the loss of a family breadwinner or the extra funds needed to care for people with disabilities.
- Road crash survivors, their families, friends and other caregivers often suffer adverse social, physical and psychological effects.

Definitions of key concepts

- Road traffic fatality: a death occurring within 30 days of the road traffic crash.
- DALY (Disability-adjusted life year): a health-gap measure that combines information on the number of years lost from premature death with the loss of health from disability.
- Willingness to pay approach: an approach used by economists to measure the value of pain and suffering by asking people what they are willing to pay or by studying what people actually pay

for small improvements in their chance of avoiding the risk of being killed or injured.

- Prevalence costs: costs that measure all injury-related expenses during one year, regardless of when the injury occurred.
- Incidence-based costs: costs that take into account the lifetime costs that are expected to result from injuries that occur during a single year.

Questions to think about

a) What challenges does your country face as a result of road traffic crashes?

b) In most countries, road traffic injury costs exceed 1% of gross national product. This figure is generally considered to be an underestimate of national road crash costs. What is the estimated cost of road traffic injuries in your country? How is this estimate derived? How frequently is this estimate updated?

c) Conduct a review of literature to establish how much research has been done on costs of road traffic injuries in your country. Look for published research on this issue in both local and international journals. This activity is meant to equip you with library research skills and the capacity to examine existing literature. You can work on your own, or with two or three colleagues. Try to summarize the results and indicate gaps in knowledge that need to be filled. Consider preparing a manuscript based on your review to submit to a journal.

d) Identify a family you know where someone has been involved in a non-fatal road crash recently. Seek permission to gather information on the economic costs of that crash for that family. Prepare a summary of the economic costs to the family and immediate society. Think of ways of using this information to enhance prevention of road traffic injuries in your local setting.

References

1. Peden M et al. *World report on road traffic injury prevention.* Geneva, World Health Organization, 2004.
2. *World population prospects: the 2002 revision.* Volume 1: Comprehensive tables. New York, United Nations, 2003.
3. Jacobs G, Aeron-Thomas A, Astrop A. *Estimating global road fatalities*. Crowthorne, Transport Research Laboratory, 2000 (TRL Report 445).
4. Mathers C, Loncar D. *Updated projections of global mortality and burden of disease, 2002-2030: data sources, methods and results.* Geneva, World Health Organization, 2005.
5. Kopits E, Cropper M. *Traffic fatalities and economic growth.* Washington, DC, World Bank, 2003 (Policy Research Working Paper No. 3035).
6. Mohan D: Traffic safety and health in Indian cities. *Journal of Transport and Infrastracture*, 2002, 9:79-94.

Further reading

Hauer E. Can one estimate the value of life or is it better to be dead than stuck in traffic? *Transportation Research Series A,* 1994, 28:109–118.

Trinca G et al. *Reducing traffic injury: the global challenge.* Melbourne, Royal Austra-lasian College of Surgeons, 1988.

Notes

Trainee's evaluation of Unit 1: Magnitude and impact of road traffic injuries

This form is to be completed by the trainee at the end of this unit to assess the content and approach used. This evaluation is helpful to the trainee, trainer and developer of this manual.

1. To what extent did you achieve the objectives set for this unit? (Please check once using "X" for each objective)

Objectives	Completely successful	Generally successful	Completely unsuccessful
Describe the global magnitude and trends of road traffic fatalities.			
Discuss the global socioeconomic and health burden of road traffic injuries.			
Describe the magnitude and trends of road traffic injuries in your own country, region and city.			
Discuss the socioeconomic and health burden of road traffic injuries in your own country, region and city.			

2. What is your overall rating of the content presented in this unit? (Please check one using "X")

Scale	Excellent	Better than expected	Satisfactory	Below average
Rating				

3. How do you rate the balance between theoretical and practical content in this unit? (Please check one using “X”)

Scale	Good balance	Too theoretical	Too practical
Rating			

4. a) Did you find the activities presented in the unit helpful? (Please check one)

Yes_____ No_____

b) If yes, in what ways were they helpful? What improvements do you suggest?

_____

_____

c) If no, what were the shortcomings? What suggestions do you have to make them helpful?

_____

_____

5. What did you like most about the unit?

6. What did you like least about the unit?

7. What did you learn most from this unit?

8. Explain how your organization, community, city and country, and other interested parties will benefit from your having read this unit.

9. What do you think should be added to this unit?

10. What do you think should be dropped from this unit?

UNIT 2

Risk factors for road traffic injuries

Overview

A road traffic crash results from a combination of factors related to the components of the system comprising roads, the environment, vehicles and road users, and the way they interact. Some factors contribute to the occurrence of a collision and are therefore part of crash causation. Other factors aggravate the effects of the collision and thus contribute to trauma severity. Some factors may not appear to be directly related to road traffic injuries. Some causes are immediate, but they may be underpinned by medium-term and long-term structural causes. Identifying the risk factors that contribute to road traffic crashes is important in identifying interventions that can reduce the risks associated with those factors.

This unit is devoted to discussing risk factors for road traffic injuries. The first part of the unit provides frameworks that can be used to identify and analyse risk factors. The second part discusses the key risk factors.

Objectives

By the end of this unit, the trainee should be able to:

- discuss the basic elements of the public health approach and Haddon matrix;
- apply the principles of a systems approach to the analysis of risk factors for road traffic injuries;
- discuss the key risk factors for road traffic injuries;
- relate these risk factors to the trainee's own country, region and city.

Analytical frameworks

Various analytical frameworks can be used to identify the risk factors involved in road traffic injuries. In this section, we present three frameworks or approaches: the public health approach; the Haddon matrix; and the systems approach.

Public health approach

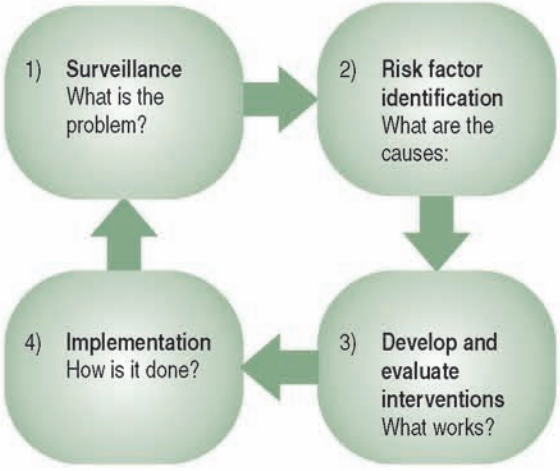
The public health approach is a generic analytical framework that has made it possible for different fields of public health to respond to a wide range of health problems and diseases, including injuries and violence *(1, 2)*. This approach is not only helpful in the analysis of risk factors, but also provides a framework that guides decision-making throughout the entire process, from identifying a problem to implementing an intervention. Analysis of risk factors is one of the components of this approach, and that is why we have included it here for application to road traffic injuries.

The public health approach involves four interrelated steps (Figure 2.1):

- The first step is to determine the magnitude, scope and characteristics of the problem. Defining the problem goes beyond simply counting cases: it includes delineating mortality, morbidity, and risk-taking behaviour. In the case of road traffic injuries, this step includes obtaining information on the demographic characteristics of the people involved, the temporal and geographical features of the incident, the circumstances under which it occurred, and the severity and cost of the injuries. Quantitative (for example, surveys) and qualitative (for example, focus group

FIGURE 2.1

The public health approach



discussions) research methods drawn from the behavioural and social sciences are increasingly being used to identify and characterize problems.

- The second step is to identify the factors that increase the risk of disease, injury or disability, and to determine which factors are potentially modifiable. Whereas the first step looks at "who, when, where, what and how", the second step looks at "why". It may also be used to define populations at high risk for injuries and violence and to suggest specific interventions.
- The third step is to assess what measures can be taken to prevent the problem by using the information about causes and risk factors to design, pilot test and evaluate interventions. This step aims at developing interventions based upon information obtained from the previous steps and testing these or other extant interventions. Methods for testing include randomized controlled trials, controlled comparisons of populations for occurrence of health outcomes, cohort studies, time series analyses of trends in multiple areas, and observational studies such as case control studies. An important component of the evaluation step is to document the processes that contribute to the success or failure of an intervention, in addition to examining the impact of interventions on health outcomes.
- The final step is the implementation of interventions that have been proven or are highly likely to be effective on a broad scale. In both instances it is important that data are collected to evaluate the programme's effectiveness in actually reducing road traffic injuries and fatalities, particularly since an intervention that has been found effective in a clinical trial or a small study may perform differently at the community level, or when expanded to target broader populations or geographical areas. Another important component is determining the cost-effectiveness of such programmes. Balancing the costs of a programme against the cases prevented by the intervention can be helpful to policy-makers in determining optimal public health practice. Implementation also implies health communication, the formation of partnerships and alliances as well as developing methods for community-based programmes.

Though each of the four steps is presented separately, it is important to remember that in reality these steps may overlap in terms of the timing in which they are implemented.

Haddon matrix

William Haddon *(3)* developed a matrix that identifies risk factors before the crash, during the crash and after the crash, in relation to the person, vehicle and environment (Table 2.1). Haddon

TABLE 2.1

The Haddon matrix

		FACTORS		
PHASE		HUMAN	VEHICLES AND EQUIPMENT	ENVIRONMENT
Pre-crash	Crash prevention	Information Attitudes Impairment Police enforcement	Roadworthiness Lighting Braking Handling Speed management	Road design and road layout Speed limits Pedestrian facilities
Crash	Injury prevention during the crash	Use of restraints Impairment	Occupant restraints Other safety devices Crash protective design	Crash-protective roadside objects
Post-crash	Life sustaining	First-aid skill Access to medics	Ease of access Fire risk	Rescue facilities Congestion

Source: reference *3.*

described road transport as an ill-designed "man-machine" system in need of comprehensive systemic treatment. Each phase – pre-crash, crash and post-crash – can be analysed systematically for human, vehicle, road and environmental factors. The Haddon matrix is an analytical tool to help in identifying all factors associated with a crash. Once the multiple factors associated with a crash are identified and analysed, countermeasures can be developed and prioritized for implementation over short-term and long-term periods. For the pre-crash phase, it is necessary to select all countermeasures that prevent the crash from occurring. The crash phase is associated with countermeasures that prevent injury from occurring or reduce its severity if it does occur. Finally, the post-crash phase involves all activities that reduce the adverse outcome of the crash after it has occured.

Systems approach

Traditionally, analysis of risk has examined the road user, vehicle and road environment separately. Furthermore, there is a tendency by researchers and practitioners to look for one or a few factors, when in actual fact they should be analysing multiple factors. Building on Haddon's insights, the systems approach (where interactions between different components are taken into account) seeks to identify and rectify the major sources of error, or design weaknesses, that contribute to fatal crashes or crashes that result in severe injury, as well as to mitigate the severity and consequences of injury. The essence of using a systems approach is to consider not only the underlying factors, but also the role of different agencies and actors in prevention efforts. Road traffic injuries are a multi-dimensional problem that require a comprehensive view when examining the determinants, consequences and solutions.

Any road traffic system is highly complex and can be hazardous to human health. Elements of the system include motor vehicles, roads, and road users along with their physical, social and economic environments. Making a road traffic system less hazardous requires a systems approach — understanding the system as a whole and the interaction between its elements, and identifying where there is potential for intervention. In particular, it requires recognition that the human body is highly vulnerable to injury, and that humans make mistakes. A safe road traffic system is one that accommodates and compensates for human vulnerability and fallibility *(4)*.

Each crash and its consequences can be represented by its system of interlinked factors (Figure 2.2). As the components of the road and transport system interact, linkages appear between crash and trauma factors. For example, some road features or vehicle characteristics may have influenced particular aspects of road users' behaviour, and the effects of some vehicle defects may have been compounded by particular road characteristics. For the purpose of planning measures to avoid collisions, it is essential to

Activity

Task

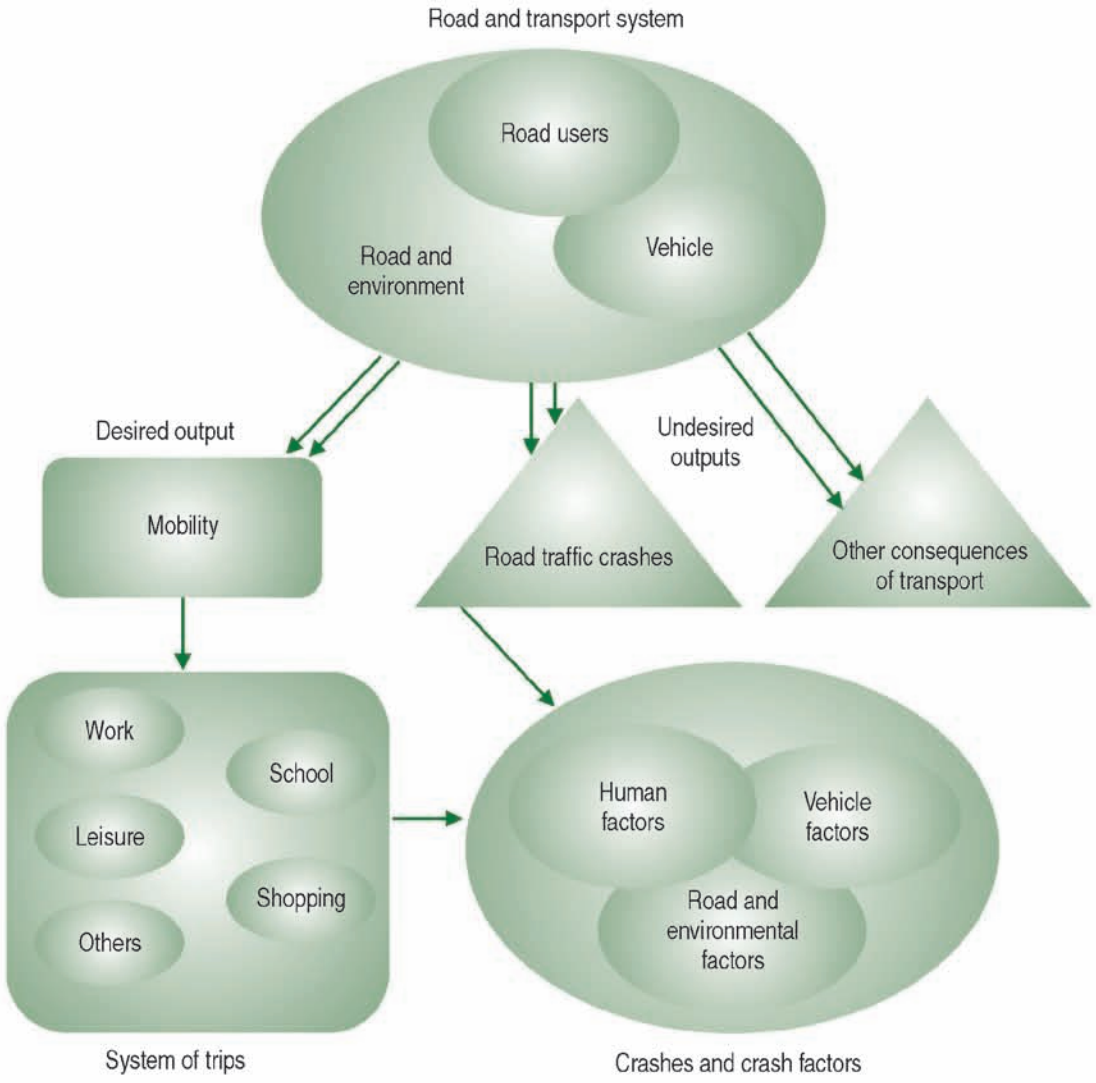
Read carefully this description of a road traffic collision scene. A speeding motorist who is late for a meeting approaches a road junction and goes through a traffic light that has just turned red. He hits a motorcyclist, for whom the lights had just turned green. The motorcyclist, who is not wearing a helmet, suffers severe head injuries. The motorist suffers facial injuries. The police find out that the motorist had not put on his seat-belt. Using the Haddon matrix shown in Table 2.1, identify the pre-crash, crash and post-crash risk factors related to the driver and the motorcyclist.

Expected results

This exercise is meant to assist trainees in identifying the chain of events involved in road traffic injury causation. The exercise seeks to identify a few risk factors in this scene and classify them under the three phases of the Haddon matrix (pre-crash, crash, and post-crash) and by group (human, vehicle and equipment, and environment). In addition to identifying the risk factors, this exercise should lead trainees to look at the interaction among different elements of the broader system of road, road user, vehicle and environment, in the case presented.

FIGURE 2.2

The systems approach



Source: reference 5.

understand the full complex causation process, as it provides vital information, and usually leads to a wide scope of possible areas of preventive action. There is an opportunity for intervention in all aspects of the transport system, and related systems indicated in Figure 2.2, to reduce the risk of road traffic injuries and deaths. The key message to take from Figure 2.2 is that a road traffic crash or collision is the outcome of interaction among a number of factors and subsystems.

If road traffic crashes are reduced to one "cause" only, it is obvious that the components of the system – human, infrastructure and vehicle factors – are necessarily considered as independent. Measures addressing any one component can thus be implemented separately, which makes things easier as the decision-makers responsible for each area of intervention do not have to coordinate with the others. However, opportunities to influence one type of

factor through another (for example, to obtain more appropriate driver behaviour through changes in road design) are entirely ignored. Moving away from the simplified model for road safety action to a systems approach requires that considerable effort be put into acquisition of knowledge of the nature of crashes. This effort is rewarded by the larger range of opportunities opened up for preventive action and by the more appropriate design of measures. Getting sufficient knowledge of the factors generating hazards in the road and transport system implies analysing the chain of events leading to crashes and injuries. As crash factors relate to human as well as to physical and technical components of the road and transport system, detailed analysis of road crashes may require a multidisciplinary approach.

What are the main risk factors?

Research has identified a number of risk factors for road traffic injuries and these are discussed in the recently published *World report on road traffic injury prevention (4)*. Box 2.1 provides a summary of these factors.

Factors influencing exposure to risk

Movement of people and goods on the road is necessary for social, economic and political reasons, but this need to travel leads to a risk of road traffic injuries. A range of factors determine who uses different parts of the transport system, how they use them and why, and at what times. It may not be possible in practice to completely eliminate all risk, but it is possible to reduce

BOX 2.1

The main risk factors for road traffic injuries

Factors influencing exposure to risk

— economic factors such as level of economic development and social deprivation;
— demographic factors such as age and sex;
— land-use planning practices which influence length of trip and mode of travel;
— mixture of high-speed motorized traffic with vulnerable road users;
— insufficient attention to integration of road function with decisions about speed limits, road layout and design.

Risk factors influencing crash involvement

— inappropriate and excessive speed;
— presence of alcohol, medicinal or recreational drugs;
— fatigue;
— being a young male;
— having youths driving in the same car;
— being a vulnerable road user in urban and residential areas;
— travelling in darkness;
— vehicle factors – such as braking, handling and maintenance;
— defects in road design, layout and maintenance, which can also lead to unsafe behaviour by road users;
— inadequate visibility because of environmental factors (making it hard to detect vehicles and other road users);
— poor eyesight of road users.

BOX 2.1 (continued)

Risk factors influencing crash severity

— human tolerance factors;
— inappropriate or excessive speed;
— seat-belts and child restraints not used;
— crash-helmets not worn by users of two-wheeled vehicles;
— roadside objects not crash-protective;
— insufficient vehicle crash protection for occupants and for those hit by vehicles;
— presence of alcohol and other drugs.

Risk factors influencing post-crash outcome of injuries

— delay in detecting crash and in transport of those injured to a health facility;
— presence of fire resulting from collision;
— leakage of hazardous materials;
— presence of alcohol and other drugs;
— difficulty in rescuing and extracting people from vehicles;
— difficulty in evacuating people from buses and coaches involved in crash;
— lack of appropriate pre-hospital care;
— lack of appropriate care in hospital emergency rooms.

Source: reference *4.*

exposure to the risk of severe injury and to minimize its intensity and consequences. The specific modes and issues of importance when examining exposure to risk are fully discussed in the *World report on road traffic injury prevention (4)*. A brief summary is given here.

Growth in number of motor vehicles

One of the main factors contributing to the increase in global road crash injuries is the growing number of motor vehicles. The problem is not just the growth in numbers and increase in exposure to the risk but also ensuring that appropriate road safety measures accompany this growth. The motor vehicle, along with the subsequent growth in the number of motor vehicles and in road infrastructure, has brought societal benefit but it has also led to societal cost, to which road traffic injury contributes significantly. Without proper planning, growth in the number of motor vehicles can lead to problems for pedestrians and cyclists. In fact, where there are no facilities for pedestrians and cyclists, increasing numbers of motor vehicles generally lead to reductions in walking and cycling.

At present, motor vehicle growth in low-income and middle-income countries is taking place against a background of associated problems. Only a small number of people in these countries can afford cars, while the costs of roads, parking spaces, air pollution and road traffic injuries are borne by the whole society. Despite the rapid growth in motorized traffic, most families in low-income and middle- income countries are unlikely to own a car within the next 25 years.

In terms of exposure to risk, the main modes of travel in these countries in the foreseeable future are likely to remain walking, cycling and public transport. This emphasizes the importance of planning for the needs of these road users, who, as was seen in Unit 1, bear a high proportion of the burden of road traffic injuries. Buses and trucks are a major mode of travel in low-income and middle-income countries. High volumes of passengers being transported have an impact on the safety, not only of the passengers themselves, but also of vulnerable road users.

Motorized two-wheeled and three-wheeled vehicles

The substantial growth in the use of motorized two-wheelers, particularly in low-income and middle-income countries, is being accompanied by an increase in the number of head and traumatic brain injuries. This is of particular concern in Asia where, for many commuters, the motorized two-wheeler is used as a family vehicle. Use of such vehicles increases exposure to the risk of road traffic injuries. Like other motor vehicles, motorized two-wheelers and three-wheelers also cause injuries to other road users as noted in their collisions with buses, cars and pedestrians.

Non-motorized traffic

Non-motorized vehicles predominate in both rural and urban areas in low-income and middle- income countries. Overall in developing countries, pedestrian and cyclist traffic has grown without accompanying improvements in facilities for these road users. The high number of pedestrian and cyclist casualties in these countries reflects not only the inherent vulnerability of these road users, but also insufficient attention to their needs in policy-making.

Demographic factors

Different groups of people have different exposures to risk. As populations change over time, so their overall exposure will change. Fluctuations in the relative sizes of different population groups will have a strong effect on the road traffic toll. For instance, in high-income countries, young drivers and riders – at increased risk of involvement in road crashes – are currently overrepresented in casualty figures. Demographic changes in these countries over the next 20–30 years, however, will result in road users over 65 years of age becoming the largest group of road users. The physical vulnerability of older people places them at high risk for fatal and serious injuries. Despite the rising number of older people holding driving licences in high-income countries, their declining driving ability as well as possible financial constraints will mean that many of them will have to give up driving. This may differ from many low-income countries where older people may never have driven in the first place. In low-income countries in general, the expected demographic evolution suggests that younger road users will continue to be the predominant group involved in road traffic crashes. Worldwide, a large proportion of older people will be dependent on public transport or will walk. This illustrates the importance of providing safe and short pedestrian routes, and safe and convenient public transport.

Transport, land use and road network planning

Planning decisions regarding transport, land use and road networks have significant effects on public health – as they affect the amount of air pollution by vehicles, the degree of physical exercise undertaken by individuals, and the volume of road traffic crashes and injuries. The development of a network of roads – or indeed of other forms of transport, such as railways – has a profound effect on communities and individuals. It influences such things as economic activity, property prices, air and noise pollution, social deprivation and crime – in addition to health. Long commuting times degrade the quality of life and therefore health. Sedentary travel directly and adversely affects health. In the absence of proper land use planning, residential, commercial and industrial activity will evolve in a haphazard pattern, and road traffic will evolve similarly to meet the needs of these various activities. This is likely to produce heavy flows of traffic through residential areas, vehicles capable of high speed sharing space with pedestrians, and heavy, long-distance commercial traffic using routes not designed for such vehicles. The consequent exposure to road traffic injury may be high for car occupants, and even more so for vulnerable road users, such as pedestrians, cyclists and motorized two-wheeler users.

Choice and use of less safe forms of travel

Of the four main modes of travel, road travel presents the highest risk in most countries – using almost any measure of exposure – compared with rail, air and marine travel. Within this mode of road

travel, major variations exist between pedestrians, cyclists, riders of motorized two-wheelers, car occupants, and bus and truck passengers. The risks for these road users also vary greatly according to the traffic mix and hence vary greatly from country to country. In general, in high-income countries, riders of motorized two-wheelers have the highest levels of risk.

Factors influencing crash involvement

This section provides a summary of selected factors presented in the *World report on road traffic injury prevention (4).*

Speed

The speed of motor vehicles is at the core of the road traffic injury problem. Speed influences both crash risk and crash consequence (Box 2.2). The physical layout of the road and its surroundings can both encourage and discourage speed. Crash risk increases as speed increases, especially at road junctions and while overtaking – as road users underestimate the speed and overestimate the distance of an approaching vehicle.

Drivers' speed choice is influenced by a number of factors that can be considered as:

- driver-related factors (age, sex, alcohol level, number of people in the vehicle);
- factors relating to the road and the vehicle (road layout, surface quality, vehicle power, maximum speed);
- traffic-related and environment-related factors (traffic density and composition, prevailing speed, weather conditions).

Alcohol

Impairment by alcohol is an important factor influencing both the risk of a road crash as well as the severity of the injuries that result from crashes

BOX 2.2

Effects of speed on crashes and crash severity

- The higher the speed of a vehicle, the shorter the time a driver has to stop and avoid a crash. A car travelling at 50 km/h will typically require 13 metres in which to stop, while a car travelling at 40 km/h will stop in less than 8.5 metres.
- An average increase in speed of 1 km/h is associated with a 3% higher risk of a crash involving an injury.
- In severe crashes, the increased risk is even greater. In such cases, an average increase in speed of 1 km/h leads to a 5% higher risk of serious or fatal injury.
- Travelling at 5 km/h above a road speed limit of 65 km/h results in an increase in the relative risk of being involved in a casualty crash that is comparable with having a blood alcohol concentration of 0.05 g/dl.
- For car occupants in a crash with an impact speed of 80 km/h, the likelihood of death is 20 times what it would have been at an impact speed of 30 km/h.
- Pedestrians have a 90% chance of surviving car crashes at 30 km/h or below, but less than a 50% chance of surviving impacts at 45 km/h or above.
- The probability of a pedestrian being killed rises by a factor of 8 as the impact speed of the car increases from 30 km/h to 50 km/h.

Source: reference *4.*

(Boxes 2.3 and 2.4). The frequency of drinking and driving varies between countries but it is almost universally a major risk factor for road traffic crashes. The extent to which alcohol contributes to road traffic crashes varies between countries, and direct comparisons are difficult to make. In many high-income countries, about 20% of fatally injured drivers have excess alcohol in their blood (i.e. above the legal limit). Studies in low-income countries have shown alcohol to be present in between 33% and 69% of fatally injured drivers.

Driver fatigue

Fatigue or sleepiness is associated with a range of factors. Some of these factors with relevance to road traffic are long-distance driving, sleep deprivation and the disruption of circadian rhythms. Three high-risk groups have been identified:

— young people, particularly males, aged 16–29 years;

— shift workers whose sleep is disrupted by working at night or working long, irregular hours;

BOX 2.3

Effects of alcohol on risk of crashes and of crash injury

- Drivers and motorcyclists with any blood alcohol content greater than zero are at higher risk of a crash than those whose blood alcohol content is zero.
- For the general driving population, as the blood alcohol content increases from zero, the risk of being involved in a crash starts to rise significantly at a blood alcohol content of 0.04 g/dl.
- Inexperienced young adults driving with a blood alcohol content of 0.05 g/dl have 2.5 times the risk of a crash compared with more experienced drivers.
- If a blood alcohol content limit is fixed at 0.10 g/dl, this will result in three times the risk of a crash than that at 0.05 g/dl, which is the most common limit in high-income countires. If the legal limit stands at 0.08 g/dl, there will still be twice the risk than at 0.05 g/dl.
- Alcohol consumption by drivers puts pedestrians and riders of motorized two-wheelers at risk.

Source: reference *4.*

BOX 2.4

What factors affect alcohol-related road crashes?

- The risk of a road crash when a driver is alcohol-impaired varies with age. Teenagers are significantly more likely to be involved in a fatal crash than older drivers. At almost every blood alcohol level, the risk of crash fatality decreases with increasing driver age and experience.
- Teenage drivers who are alcohol-impaired are at increased risk of having a road crash if they have passengers in the vehicle, as compared with those driving alone.
- A low expectation of getting caught with a blood alcohol content above the legal limit has been shown to lead to an increased risk of a crash.

Source: reference *4.*

— people with untreated sleep apnoea syndrome or narcolepsy.

Factors that substantially increase the risk of a fatal crash or a crash with serious injuries are:

— driving while feeling sleepy;

— driving after five hours of sleep;

— driving between 02:00 and 05:00.

Commercial transport

Surveys of commercial and public road transport have revealed that owners of public transport vehicles, in pursuit of increased profits, frequently force their drivers to drive at excessive speeds, to work unduly long hours and to work when exhausted.

Hand-held mobile telephones

The use of hand-held mobile telephones can adversely affect driver behaviour – as regards physical tasks as well as perception and decision-making. The process of dialling influences a driver's ability to keep to the course on the road. Results of studies on distraction and mental load show that driver reaction times are increased by 0.5–1.5 seconds when talking into a mobile telephone. Studies have shown that driver performance is particularly affected in maintaining the correct lane position and the headway between two vehicles travelling one behind the other, in keeping to an appropriate speed, and in judging and accepting safe gaps in the traffic. There is some evidence from studies that drivers who use mobile telephones while driving face a risk of a crash four times higher than the risk for drivers who do not use mobile telephones.

Inadequate visibility

In motorized countries, inadequate visibility plays a key role in three types of crashes:

— a moving vehicle running into the rear or side of a slowly moving or stationary vehicle located ahead on the roadway, at night-time;

— angled collisions or head-on collisions in daytime;

— rear-end collisions in fog, in daytime and at night.

In low-income and middle-income countries, the phenomenon of pedestrians and vehicles not being properly visible is frequently a serious problem. In many places, there are fewer roads with adequate illumination and some may not be lit at all. In addition, it is more common for large numbers of bicycles and other vehicles to have no lights or reflectors and for road space to be shared by fast-moving and slow-moving road users.

Road-related factors

Road crashes are not evenly distributed throughout the network. They may occur in clusters at single sites, along particular sections of road, or scattered across whole residential neighbourhoods, especially in areas of social deprivation. While road engineering can greatly help in reducing the frequency and severity of road traffic crashes, it can also contribute to crashes. The road network has an effect on crash risk because it determines how road users perceive their environment, and it provides instructions for road users, through signs and traffic controls, on what they should be doing. Many traffic management and road safety engineering measures work through their influence on human behaviour.

Road engineering factors include those where a road defect directly triggers a crash, where some element of the road environment misleads a road user and thereby creates error, or where some feasible physical alteration to the road would have made the crash less likely. In the planning, design and maintenance of the road network, the following four particular elements affecting road safety have been identified:

- safety-awareness in the planning of new road networks;
- the incorporation of safety features in the design of new roads;
- safety improvements to existing roads;
- remedial action at high-risk crash sites.

Factors influencing crash severity

Factors influencing crash severity are presented in this section.

Lack of in-vehicle crash protection

In the past decade, the crashworthiness of private cars for their occupants has improved considerably in many high-income countries, though there is still considerable room for further improvement. In low-income and middle-income countries, regulation of motor vehicle safety standards is not as systematic as in high-income countries. Many engineering advances to be found in vehicles available in high-income countries are not standard fittings in vehicles in low-income and middle-income countries. In addition, the majority of road casualties in low-income and middle-income countries occur outside the car, affecting pedestrians, cyclists, motorized two-wheeled vehicle riders, or passengers in buses and trucks. As yet, there are no requirements to protect vulnerable road users by means of crashworthy designs of the fronts of trucks or buses.

The main injury risks for car occupants arise from the way vehicles interact with each other and with the roadside in frontal and side-impact crashes. In fatal and serious crashes, head, chest and abdominal injuries are predominant. Among injuries that cause disability, those to the legs and neck are important. Determinants of the degree of severity of injuries include:

— contact by occupant with the car's interior, exacerbated by intrusion into the passenger compartment of the colliding vehicle or object;

— mismatch in terms of size and weight between vehicles involved in a crash;

— ejection from the vehicle;

— inadequate vehicle safety standards.

Bus and truck occupants

Buses with passengers, minibuses and trucks are frequently involved in crashes in low-income countries. The use of open-backed vehicles for transporting passengers, particularly widespread in rural areas, presents a risk of ejecting passengers. In many low-income and middle-income countries, second-hand trucks and buses are imported without the crash-protective features – such as occupant restraints – that are present in high-income countries. Such vehicles have low crashworthiness. They also have poor stability when fully laden or over-loaded, as they frequently are.

The urban centres of low-income and middle-income countries typically contain a great mix of vehicles. Incompatibility of size between different types of road vehicles is a major risk factor, especially in impacts between cars and large trucks. The power of the larger vehicle – its mass, geometry and structural properties – increases rates of injury and death many times compared with an equivalent car-to-car collision.

Non-use of crash helmets by two-wheeled vehicle users

The main risk factor for motorized two-wheeler users is the non-use of crash helmets (Box 2.5). The lack or inappropriate use of helmets has been shown to increase the risk of fatalities and injuries resulting from road crashes involving motorized two-wheelers. Head injuries are a major cause of death, injury and disability among users of motorized two-wheel vehicles. Many of these head injuries could have been prevented or their severity reduced through the use of simple and inexpensive helmets.

Non-use of seat-belts and child restraints in motor vehicles

The lack or inappropriate use of seat-belts and other safety restraints (child seats and booster seats) are risk factors for the fatalities and injuries that result from road crashes (Box 2.6). The most frequent and most serious injuries occurring in frontal impacts to occupants unrestrained by seat-belts are to the head (Box 2.6).

Roadside objects

Impacts between vehicles leaving the road and solid roadside objects such as trees, poles and road signs are a major road safety problem worldwide. These collisions are usually single-vehicle crashes and frequently involve young drivers, excess or inappropriate speed, the use of alcohol or driver fatigue. Another problem related to impacts with objects off the road is the occurrence of crashes caused by restricted visibility, resulting from the poor siting of these objects.

BOX 2.5

Helmet wearing

- Non-helmeted users of motorized two-wheelers are three times more likely to sustain head injuries in a crash compared to those wearing helmets.
- Helmet-wearing rates vary from slightly over zero in some low-income countries to almost 100% in places where laws on helmet use are effectively enforced.
- Although helmets have generally been widely worn in most high-income countries, there is evidence of a decline in usage in some countries.
- More than half of adult riders of motorized two-wheelers in some low-income countries do not wear their helmets properly secured.
- Child passengers rarely wear helmets, or wear adult helmets that do not adequately protect them.
- Helmet use does not have adverse effects on neck injuries, visibility or the ability to drive safely in traffic.

Source: reference *4.*

BOX 2.6

Safety restraints

Seat-belt wearing

- Rates of seat-belt use vary greatly among different countries, depending upon the existence of laws mandating their fitting and use and the degree to which those laws are enforced. In low-income and middle-income countries, usage rates are generally much lower.
- Seat-belt usage is substantially lower in fatal crashes than in normal traffic.
- Young male drivers use their seat-belts less often than other groups and are also more likely to be involved in crashes.
- The effectiveness of seat-belts depends upon the type and severity of the crash and the seating position of the passenger.
- Seat-belts are most effective in roll-over crashes and frontal collisions, and in lower speed crashes.
- Correctly used seat-belts reduce the risk of death in a crash by approximately 60%.

Child restraint use

- The use of child restraints (child seats and booster seats) in motor vehicles varies considerably between countries and is mainly confined to high-income countries.
- The use of child restraints can reduce infant death in car crashes by 71% and toddler deaths by 54%.
- Child restraints work in the same way as adult seat-belts.
- The use of appropriate restraint depends on the age and weight of the child: rear-facing seats are particularly effective for young infants, forward-facing restraints are appropriate for younger children, and booster seats used with seat-belts are effective for older children.
- The potential hazard of combining air bags with rear-facing seats in the front seat of a vehicle is well documented.
- There is a substantial amount of incorrect use of both adult seat-belts and child restraints, which markedly reduces their injury-reducing potential.

Source: reference *4.*

The linkage between vehicle crash protection and roadside crash protection needs to be strengthened. The road environment needs to be designed so as to eliminate head-on collisions – into trees, poles and other rigid objects – at high speeds, where the car itself cannot offer sufficient protection.

Factors influencing post-crash injury outcomes

Death is potentially preventable in a proportion of cases of people who die as a result of road crashes before they reach hospital. The potential help towards recovery that victims can receive may be viewed as a chain with several links:

- actions, or self-help, at the scene of the crash, by the victims themselves, or more frequently by bystanders;
- access to the emergency medical system;
- help provided by rescuers of the emergency services;
- delivery of medical care before arrival at the hospital;
- hospital trauma care;
- rehabilitative psychosocial care.

There are risk factors in both pre-hospital and hospital settings. Post-crash care is covered in detail in Unit 5.

Key points

- A road traffic collision is the outcome of interaction among a number of factors, some of which may not appear to be directly related to road traffic injuries.
- The public health approach is not only helpful in the analysis of risk factors, but also provides a framework that guides decision-making for the entire process, from identifying a problem to implementing interventions.
- Main risk factors can be categorized into four groups:
  - factors influencing exposure to risk, such as demographic and economic factors, level of motorization, and land use planning practices;
  - factors influencing crash involvement, such as inappropriate and excessive speed, drinking and driving, unsafe road design, and lack of effective law enforcement and safety regulations;
  - factors influencing crash and injury severity, such as the non-use of seat belts, child restraints or crash helmets, insufficient vehicle crash protection for occupants and for those hit by vehicles, and presence of alcohol;
  - factors influencing post-crash injury outcomes, such as delay in detecting the crash and providing life-saving measures and psychological support.

Definitions of key concepts

- Public health approach: a generic analytical framework that has made it possible for different fields of public health to respond to a wide range of health problems and diseases, including injuries and violence.
- Risk: probability of an adverse health outcome, or a factor that raises this probability.
- Determinant: a factor which contributes to or explains the occurrence and prevalence of a phenomenon.
- Systems approach: a perspective that takes into account the various parts and their relationships as they contribute to the totality of a phenomenon. In the case of road traffic injury prevention, this calls for a comprehensive understanding of the risk factors, determinants, impacts and interventions, as well as consideration of the role of different agencies and stakeholders in prevention.

Questions to think about

- Why is the public health approach a useful framework in dealing with road safety issues?
- What are the most important risk factors for road traffic injuries in your local setting?

References

1. Krug EG, Sharma GK, Lozano R. The global burden of injuries. *American Journal of Public Health*, 2000, 90:523–526.
2. Mercy JA et al. Public health policy for preventing violence. *Health Affairs*, 1993:7–29.
3. Haddon Jr W. Advances in the epidemiology of injuries as a basis for public policy. *Public Health Report*, 1980, 95:411–421.
4. Peden M et al. *World report on road traffic injury prevention*. Geneva, World Health Organization, 2004.
5. Muhlrad N, Lassarre S. Systems approach to injury control. In: Tiwari G, Mohan D, Muhlrad N, eds. *The way forward: transportation planning and road safety.* New Delhi, Macmillan India Ltd., 2005:52–73.

Further reading

Haddon W, Baker SP. Injury control. In: Clark DW, MacMahon B, eds. *Preventive and community medicine*. Boston, Little-Brown and Company, 1981:109–140.

Haddon W Jr. A logical framework for categorizing highway safety phenomena and activity. *Journal of Trauma*, 1972, 12:193–207.

Tiwari G. Transport and land-use policies in Delhi. *Bulletin of the World Health Organization*, 2003, 81(6):444–450.

Trinca G et al. *Reducing traffic injury: the global challenge*. Melbourne, Royal Australasian College of Surgeons, 1988.

Notes

Trainee's evaluation of Unit 2: Risk factors for road traffic injuries

This form is to be completed by the trainee at the end of this unit to assess the content and approach used. This evaluation is helpful to the trainee, trainer and developer of this manual.

1. To what extent did you achieve the objectives set for this unit? (Please check once using "X" for each objective)

Objectives	Completely successful	Generally successful	Completely unsuccessful
Discuss the basic elements of the public health approach and Haddon matrix.			
Apply the principles of a systems approach to the analysis of risk factors for road traffic injuries.			
Discuss the key risk factors for road traffic injuries.			
Relate these risk factors to your country, region and city.			

2. What is your overall rating of the content presented in this unit? (Please check one using "X")

Scale	Excellent	Better than expected	Satisfactory	Below average
Rating				

3. How do you rate the balance between theoretical and practical content in this unit? (Please check one using "X")

Scale	Good balance	Too theoretical	Too practical
Rating			

4. a) Did you find the activities presented in the unit helpful? (Please check one)

   Yes_____ No_____

b) If yes, in what ways were they helpful? What improvements do you suggest?

_____

_____

c) If no, what were the shortcomings? What suggestions do you have to make them helpful?

_____

_____

5. What did you like most about the unit?

_____

_____

6. What did you like least about the unit?

7. What did you learn most from this unit?

8. Explain how your organization, community, city and country, and other interested parties will benefit from your having read this unit.

9. What do you think should be added to this unit?

10. What do you think should be dropped from this unit?

UNIT 3

Importance of evidence as a foundation for prevention

Overview

To be effective, decision-making and planning interventions for road traffic injury prevention should be based on evidence, not on guesswork. This unit discusses the importance of evidence for planning and developing strategies to prevent road traffic injuries. It justifies the need for evidence, as well as discussing aspects of collecting and analysing data, research capacity and other issues.

Objectives

By the end of this unit, the trainee should be able to:

- state at least three reasons why evidence is important in efforts to prevent road traffic injuries;
- describe the main sources of data and evidence on road traffic injuries;
- discuss the different methods used to collect and analyse data on road traffic injuries;
- explain the importance of research and research capacity in road traffic injury prevention;
- explain ethical issues in research on road traffic injury prevention;
- evaluate the quality of data and evidence on road traffic injury prevention in the trainee's own country.

Why collect data and build evidence on road traffic injuries?

Rational decision-making in public policy, including road safety issues, should be dependent on evidence. Road traffic injury prevention is of concern to many individuals, groups and organizations, all of whom require data and evidence. Different people have their own opinions on what could make the roads safer, but policy decisions for effective road traffic injury prevention need to be based on reliable data and evidence of what works. We put emphasis on sound evidence, because limited resources will be wasted if they are spent on measures that are not effective or have very limited impact. Road safety policies and programmes should therefore be based on reliable and valid evidence. This is not just about collecting data on road traffic injuries; it is also about using the best validated evidence on intervention measures. In fact, there is a need to ensure the reliability not only of the data collected, but also of the methods and instruments used to collect and analyse information to generate evidence.

Reliable data and evidence are essential for:

- describing the burden of road traffic injuries;
- assessing risk factors;
- establishing priorities and allocating resources for prevention of road traffic injuries;
- developing and evaluating interventions;
- providing information for policy-makers and decision-makers;
- raising awareness.

Sources and types of data

Police departments and hospitals provide most of the data used in road traffic injury prevention. In addition to the sources indicated in Table 3.1, data are also available from published documents, such as journals, books and research reports, as well as on the Internet. As a professional in road traffic injury prevention, you can draw on data and evidence from many published sources and from the "grey literature".

A growing source of information are the systematic and comprehensive reviews of road traffic injuries. These reviews synthesize and summarize evidence from research on specific topics. Some are global and others are specific to selected regions and issues. Examples of such reviews are:

- Odero, Garner and Zwi who conducted a review of road safety research in developing countries *(2)*;
- Nordberg who reviewed the status of knowledge on injuries (including road traffic injuries) in Sub-Saharan Africa *(3)*;
- Reviews on such topics as alcohol ignition interlock programmes, helmets and pedestrian education that have been conducted by the Cochrane Injuries Group *(4, 5, 6)*;

TABLE 3.1

Key sources of data on road traffic injuries

Source	Type of data	Observations
Police	Number of road traffic incidents, fatalities and injuries Type of road users involved Age and sex of casualties Type of vehicles involved Police assessment of causes of crashes Location and sites of crashes Prosecutions	Level of detail varies from one country to another. Police records can be inaccessible. Underreporting of injuries is a common problem in all countries, particularly in low-income and middle-income countries.
Health facility settings (hospital inpatient records, emergency room records, trauma registries, ambulance or emergency technician records, health clinic records, family doctor records)	Fatal and non-fatal injuries Age and sex of casualties Costs of treatment	Level of detail varies from one health care facility to another. Injury data may be recorded under "other causes", making it difficult to extract for analysis.
Insurance firms	Fatal and non-fatal injuries Damage to vehicles Costs of claims	Access to these data may be difficult.
Other private and public institutions, including transport companies	Number of fatal and non-fatal injuries occurring among employees Damage and losses Insurance claims Legal issues Operational data	These data may be specific to the planning and operation of the firms.
Government departments and specialized agencies collecting data for national planning and development	Population denominators Income and expenditure data Health indicators Exposure data Pollution data Energy consumption Literacy levels	These data are complementary and important for analysis of road traffic injuries. The data are collected by different ministries and organizations, though there may be one central agency that compiles and produces reports, such as statistical abstracts, economic surveys and development plans.
Special interest groups (research institutes, advocacy nongovernmental organizations, victim support organizations, transport unions, consulting firms, institutions involved in road safety activities, and others)	Number of road traffic incidents, fatal and non-fatal injuries Type of road users involved Age and sex of casualties Type of vehicles involved Interaction of victims with vehicles Causes Location and sites of crashes Social and psychological impacts Interventions	The various organizations have different interests.

Source: reproduced from reference *1.*

- Elvik and Vaa who assembled information from more than 1700 studies on the effects of road safety measures, covering land use planning, road safety audits, provision of medical services, road design, road maintenance, traffic control, vehicle design, vehicle inspection, requirements for drivers, road user education and enforcement *(7)*.

Activity

Task

Based on Table 3.1, describe the status of at least two of the sources of data on road traffic injuries available in your country.

Expected results

The purpose of this exercise is to help trainees review the kind of data collected and kept by different agencies in their countries. Trainees are expected to comment on how adequate the data are and if this information is made readily available to users.

Injury surveillance systems

Injury surveillance is ongoing systematic collection, analysis and interpretation of health data essential to the planning, implementation and evaluation of health practice, closely integrated with the timely dissemination of these data to those who need to know. The final aspect of the surveillance chain is in the application of these data to prevention and control *(8)*. A surveillance system includes capacity for collecting data, analysing them and disseminating them for public health interventions. There are several types of surveillance systems. These can be universal (whole population), based on sampling (e.g. one week of each month), based on registries, or based on settings or jurisdictions. An injury surveillance system is a subset of surveillance that is specific to different types of injuries. It is a useful source of injury data routinely collected in the health-care setting and by other agencies or institutions. It therefore presents the first approach to obtaining data on road traffic injuries. Several steps are needed to create a successful injury surveillance system (Box 3.1).

BOX 3.1

Designing and building a surveillance system

Key steps, in order, include:

- *Identification of stakeholders*. Identify agencies that need information on injuries to set prevention priorities and to evaluate their work. Agencies should not only be within the health sector, as much injury information is actually collected within other sectors such as transport or police.
- *Definition of the objectives of the system.* These objectives should address why studying a particular injury problem or group of injury problems is necessary; the type of surveillance to be used should be defined.
- *Definition of a case.* This definition determines whether or not events will be counted or classified in one way or another: different sectors and disciplines frequently define cases differently. Arriving at a common definition of a case is thus essential.
- *Identification of data sources.* Quality and reliability of sources need to be considered.
- *Assessment or evaluation of the existing resources to be used by the system.* Evaluate the expertise of the personnel, the existence of adequate technological and logistic resources, as well as the actual functioning of the agencies involved. The environment where data are gathered is also important, not only to ensure completeness and reliability, but also for providing injured people or their relatives with the best possible environment in which to address their needs.

BOX 3.1 (continued)

- *Inclusion and participation of stakeholders all along the process.* Agency involvement in decision-making processes can improve the functioning of the system by addressing and responding to agency-specific concerns.
- *Definition of data needs.* Define what types of variables will or will not be collected. There are some basic or core minimum data that need to be collected for an injury surveillance system to be effective.
- *Collection of data.* Data collection needs to start once the preceding steps have been taken. A good strategy to save time and resources is to build surveillance systems on already existing sources of information. If the use of multiple independent systems is involved, then interagency agreements will be necessary, and adequate conceptual and technical knowledge on linkage of information will be needed.
- *Establishment of a data processing system.* This includes the creation of written protocols for data collection and transmission, and defines whether these operations will be done manually or electronically. Data processing is best done electronically, and can use software that is readily and freely available. Analysis of the data implies that technical expertise for this purpose already exists among the surveillance system personnel.
- *Design and distribution of reports based on the analysed data.* Frequent reporting can keep stakeholders up to date on injury issues relevant to them. These reports are the means by which results are conveyed to stakeholders. In general, they should be produced and distributed regularly, at least quarterly.
- *Training of staff and activation of the system.* Training should occur at three levels, with everyone taking the first level and selected individuals taking the other two. The first level of training should include basic concepts of epidemiology and surveillance, and an overview of the system. The second level should include detailed review of forms, with emphasis on the categories of data and coding, and knowledge on required procedures to obtain the data, including confidentiality guarantees. The third level should include hands-on practice in extracting information, coding it and transmitting it. The activation of the system can actually be conducted as part of an exercise, thus allowing people to get acquainted with all the procedures and work routines.
- *Monitoring and evaluation of the system.* This should be continuous and should address any gathering, reporting or analysis problems. A feedback process is required to inform those responsible for data collection of the strengths of the data collected and any deficiencies that require attention.

All steps indicated above are directed towards using the results to plan interventions. This is the ultimate purpose of a surveillance system. Having a surveillance system for the sake of having information is a waste of resources. This information must be shared and must be provided as a basis for key persons to make informed decisions on what are the best health options for the population.

Source: references *8, 9.*

Most countries have some form of national system for aggregating data on road traffic crashes using police records or hospital records, or both. However, the quality and reliability of data vary between surveillance systems in different countries. For road traffic injuries, certain key variables need to be collected. WHO's guidelines for developing and implementing injury surveillance systems in hospital settings contain recommendations on the core minimum data set and supplementary data that should be collected on all injury patients, including road traffic casualties *(8)*. These include age, sex, place of injury, activity at time of injury, mode of transport, road user, alcohol use, and nature of injury.

Community-based surveys

A second approach to gathering data on road traffic injuries is to conduct community-based surveys (sometimes called household surveys). Some injured patients fail to reach hospitals for a variety of reasons, in which case they will not be registered in hospital-based injury surveillance systems. Community-based surveys offer useful information on injuries. WHO has developed guidelines for conducting community surveys on injuries and violence, which provide a standardized methodology for carrying out such studies *(10)*. Community surveys have the advantage that they can be designed for local needs and adapted to resources available. Such surveys provide more comprehensive data on injuries in a defined population or setting, and can help in prioritizing problems at hand and getting the attention of local stakeholders.

Studies on selected themes

A third approach is to conduct studies on particular themes related to road traffic injuries and transport. Examples are road user surveys, roadside surveys, origin-destination surveys, pedestrian surveys, cyclist surveys and speed surveys – as well as studies on such issues as alcohol use and the cost of crashes. Different designs can be used (Box 3.2). These studies may arise from the need for specific information that is not available from surveillance systems or

BOX 3.2

Examples of epidemiological studies

Two examples of epidemiological studies are case-control and cohort studies.

Case-control studies

A case-control study is an analytic study in which the researcher identifies persons with a specific injury or condition (the outcome) and selects a comparison group consisting of persons without the injury. The proportion of each group with evidence of a particular exposure (for example, motorcyclists wearing helmets) is then compared.

Cohort studies

The cohort is made up of two groups: the target individuals who have a particular exposure and the comparison individuals who do not have that particular exposure. The study follows the cohort over a defined period of time. Cohort studies are generally not used when the outcomes are rare or if they occur long after exposure. Another difficulty of cohort studies is that individuals are likely to drop out before the study is completed for reasons such as changing jobs or moving to another town.

Source: references *11*.

BOX 3.3

In-depth crash analysis

While primary level data are useful, such data are generally not adequate for evaluating the effectiveness of changes in road or vehicle design or enforcement methods. For such evaluations, it is necessary to conduct special studies and collect data in much greater detail than available from primary sources. These in-depth studies require people specially trained for the task.

After a particular problem or safety target has been identified (in terms of a geographical area, a road location, a type of incident, or a group of road-users involved), a representative sample of crash reports is drawn from the police or court records, covering one or two recent years. The sample size required is based on the prevalence of the risk factors to be considered, along with features such as the ability to make comparisons between different road types, regions, and road users. Advice of a statistician is necessary to determine how large the sample needs to be.

Each crash process is reconstructed separately, by one to three people, using a multidisciplinary approach. Objective data are used as a framework against which to assess and interpret the verbal accounts provided by the road users involved and the witnesses. The more incomplete the crash record, the more interpretation will be necessary. Often, field visits to typical crash locations may be necessary to check some factors related to infrastructure or current behaviour. In order to obtain reliable results, practical training of the multidisciplinary team is important.

Because the data used are not intended for diagnostic purposes, some uncertainty remains in most reconstructions of crash processes: in some cases, several possible scenarios could explain how a crash occurred, and the various factors identified in these scenarios are considered as probable rather than definite. After the crash-generating processes have been reconstructed for the whole sample and the main probable factors identified, these are aggregated to identify the most prominent ones that corrective measures should primarily seek to address.

Source: reference *11*.

community surveys. Questionnaires are the most common survey instruments. Other approaches include direct observations, physical examinations, laboratory tests, and environmental measurements. In-depth crash analysis and complementary investigation can also be undertaken (Boxes 3.3 and 3.4).

Linking and sharing data

Road traffic injury data and evidence are collected and stored by a range of agencies. This is in itself a positive feature, as it reflects the multisectoral nature of the problem. However, it also raises important issues to do with access, harmonization and linkages between different data sources and users. Ideally, where there are a number of data sources available, it is important that the data should be linked, to obtain maximum value from the information. However, for many countries, especially those with a number of systems at the local level, this is not always the case. A major problem is coordination and sharing of information among different users. While there are usually issues of confidentiality and other legal restrictions involved, ways should be found of summarizing the relevant information and making it available, without violating any legal prohibitions.

BOX 3.4

Complementary investigations

Complementary investigations are needed to further explain or verify the conclusions of road crash analysis. The investigations should focus on:

- road surveys of hazardous crash locations, aimed at verifying that items of road design or of behaviour, identified from crash analyses as probable causal or risk factors, are real and relevant;
- road inventories, aimed at identifying the most current defects in road design and maintenance that may be dangerous and, more specifically, at identifying the items in the road environment that may be causal or risk factors, and checking their location and frequency;
- on-the-road vehicle surveys, aimed at assessing the quality of safety-oriented components of vehicle fleets.
- behavioural observations, aimed at assessing the frequency of dangerous behaviours identified from in-depth crash analyses, and at understanding their determinants;
- general road-user surveys, aimed at describing public opinions and attitudes towards traffic, safety conditions and safety rules, and at relating them to crash characteristics and factors, in order to be able to improve road-user information and education;
- specific road-user surveys, aimed at clarifying particular risk factors by quantifying exposure;
- specific road-user surveys, aimed at assessing the public acceptance of specific measures.

Source: reference *11*.

Data processing, analysis and dissemination

Data collected from primary and secondary sources need to be analysed to answer such questions as:

- What are the most common causes and types of road traffic injuries in different age groups?
- What are the characteristics of persons who are injured?
- What are the circumstances under which road traffic injuries are most likely to occur?
- What policies and programmes can reduce the likelihood and severity of road traffic injuries?

Analysing data, producing regular outputs and disseminating information on road traffic injuries are all vital activities. For the purposes of data analysis, there are various software packages available, for example Epi Info and Statistical Package for Social Scientists (SPSS). These packages can build automatic validity checks and quality control into the data management process. Software packages also provide powerful analysis features for diagnosing problems, enabling rational decisions to be made on priorities for intervention.

It is necessary to share and disseminate data and evidence on road traffic injuries with colleagues, other researchers, policy-makers, victims, and the community at the local, national and international levels. Though writing reports and articles is central to research, this should not be an end in itself. Information systems on road traffic injuries need to allow all appropriate outside bodies access and ensure that the information is effectively distributed. The design of databases should therefore take account of the principal needs of their users, providing high quality data without overburdening those collecting the data. Databases

also require sufficient resources to ensure their sustainability. Countries should collaborate and help support regional and global systems, so that the monitoring and evaluation of road safety can be improved and sustained.

Data issues and concerns

There are a number of issues and concerns about road traffic injury data. These are summarized below.

Indicators

Indicators are important not just for measuring the magnitude of a problem but also for setting targets and assessing performance. The most frequently used absolute and relative indicators for measuring the magnitude of the road traffic injury problem are presented in Table 3.2. There is still a need for these measures to be refined and for new ones to be explored. Road traffic injury measures need to take into account other changes taking place that can

TABLE 3.2

Examples of commonly used indicators of the road traffic injury problem

Index	Description	Use and limitations
Number of injuries	Absolute figure indicating the number of people injured in road traffic crashes Injuries sustained may be serious or slight	Useful for planning at the local level for emergency medical services Useful for calculating the cost of medical care Not very useful for making comparisons A large proportion of slight injuries are not reported
Number of deaths	Absolute figure indicating the number of people who die as a result of a road traffic crash	Gives a partial estimate of the magnitude of the road traffic injury problem, in terms of deaths Useful for planning at the local level for emergency medical services Not very useful for making comparisons
Fatalities per 10 000 vehicles	Relative figure showing ratio of fatalities to motor vehicles	Shows the probability vehicle involvement in fatal crashes A limited measure for assessing safety in a society because it omits non-motorized transport and other indicators of exposure. Usually declines with motorization
Fatalities per 100 000 population	Relative figure showing ratio of fatalities to population	Shows the impact of road traffic crashes on human population as a public health problem Useful for comparing road traffic injuries as a health problem in different communities Useful for estimating severity of crashes
Fatalities per vehicle-kilometre travelled	Number of road deaths per billion kilometres travelled	Useful for some international comparisons, decreases with motorization Does not take into account non-motorized travel
Disability-adjusted life years (DALYs)	Measures healthy life years lost to disability and mortality One disability-adjusted life year (DALY) lost is equal to one year of healthy life lost, either due to premature death or disability	DALYs combine both mortality and disability DALYs do not include all the health consequences associated with injury, such as mental health consequences

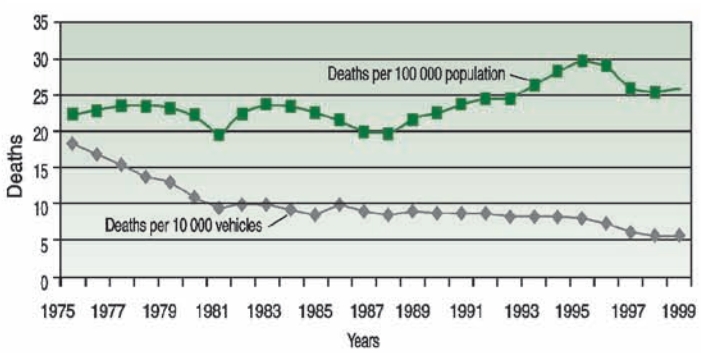
Source: reproduced from reference *1*.

indirectly affect road traffic injury, such as increases in population and in transport. When monitoring safety, changes in transport, movement patterns and motorization are important.

Two very common indicators are the number of deaths per 100 000 population, and the number of deaths per 10 000 vehicles. However, both of these indicators, have limitations regarding their reliability and validity that place restrictions on how they can be used and interpreted. The number of deaths per 100 000 population is widely used with reasonable confidence to monitor changes over time in "personal risk" levels and to make comparisons between countries. Errors in population statistics are assumed to have little impact on the observed changes or comparisons. The number of deaths per 10 000 vehicles relies on vehicle registerations as an estimate of motorization. However, it is more problematic as there can be errors in country databases because of delays in adding or removing records of vehicles. Furthermore, changes in vehicle numbers do not generally provide a good estimate of changes in exposure to risk on the road network, especially when making comparisons between countries. An example from Malaysia in the use of these two indicators is presented in Figure 3.1. The figure shows that since 1975 Malaysia has experienced a continuous decline in deaths per 10 000 vehicles, whereas the rate of deaths per 100 000 population has shown a slight increase. Over the same period, there has been a rapid growth in motorization and increased movement among Malaysia's population. The opposing trends in the two indicators reflect the fact that road traffic fatalities have increased more slowly in Malaysia than the growth in the vehicle fleet, but that they have increased a little faster in recent years than the growth in the population.

FIGURE 3.1

Road traffic deaths in Malaysia



Source: reproduced from reference *1*.

Activity

Task

Using the example presented in Figure 3.1, draw graphs showing the trend in fatalities per 10 000 vehicles and fatalities per 100 000 persons for any country of your choice. The trainer is expected to provide data on motor vehicles, population and road traffic fatalities for a period of at least 10 years for selected countries. Where possible, the trainer should ask trainees to look for the data before the training session. This may be possible in situations where trainers have contact with trainees several days before the training session.

Expected results

This exercise seeks to give trainees a practical exercise to compute the two indicators, draw graphs and describe the trends that emerge.

Definitions and standardization of data

There are a number of potential problems with the definitions of a road traffic death or injury, arising from:

- variations in the interpretation of the specified time period;
- the actual interpretation of the definition in different countries and by different people recording the information;
- differing levels of enforcement;
- differing techniques for assessing the severity of injuries.

The most commonly cited definition of a road traffic fatality is: "any person killed immediately or dying within 30 days as a result of an injury accident"*(12)*. However, a recent study has revealed considerable variations in working definitions of the period used to define a road traffic

fatality. For example, in the European Union, Greece, Portugal and Spain use 24 hours, France uses 6 days, Italy uses 7 days, and the other countries use 30 days *(13)*. To adjust for this variation, correction factors are applied to arrive at a 30-day equivalent. However, such factors introduce uncertainty as to what the real numbers would be at 30 days.

There are a number of other problems of definition relating to the classification of injury, including:

- the method of assessment;
- the location of a fatal crash – whether on a public or private road;
- the mode of transport – with some classifications emphasizing the presence of at least one moving vehicle;
- the source reporting the data – whether police or a self-report;
- whether or not to include confirmed suicides;
- whether or not postmortem examinations are routinely conducted on road traffic deaths.

Problems of definition also arise with regard to survivors of road traffic crashes, including:

- the actual definition and interpretation of a serious injury in different countries;
- whether the police, who record most of the information, are sufficiently trained to ascertain and correctly assign injury severity.

Road traffic injury and death data can be missed by the data collection system because of different definitions used in different countries and contexts. This highlights the need for definitions to be standardized and applied across different countries and settings.

Underreporting

Underreporting of both deaths and injuries is a major global problem affecting not only low-income and middle-income countries but also high-income ones. Underreporting can arise from:

- a failure on the part of the public to report;
- the police not recording cases reported to them;
- hospitals not reporting cases presenting to them;
- an exemption for certain institutions, such as the military, from reporting directly to the police;
- victims sometimes being unable to afford to attend hospital, especially in some low-income and middle-income countries.

The problem of underreporting highlights a number of other structural, methodological and practical issues affecting the quality of data collected on road traffic injuries, including:

- the coordination and reconciliation of data between sources;
- the harmonization and application of agreed definitions – especially the definition of a road crash fatality;
- the actual process of classification and the completion of data forms.

These problems make it difficult to obtain reliable estimates of road traffic fatalities and injuries worldwide, and also for certain countries. Harmonization of data at the national and international levels can be facilitated by adopting international definitions. The International Classification of Diseases (ICD-10) *(14)* and the Abbreviated Injury Scale can be used for non-fatal road crash injuries *(15)*. Agreements to adhere to regional systems such as the International Road Traffic Accident Database and the Asia–Pacific Road Accident Database will encourage uniformity of definitions.

Other issues

Studies have uncovered a number of other problems related to road traffic injury data and evidence. These include:

- missing information within individual records;
- the unavailability of certain specific data – for example, the crash location, type of injury, and identification of the vehicle in which the casualty occurred;
- the scientific soundness of the methods used;
- inadequate quality control;
- lack of data collection on cycling and walking in transport information systems;
- lack of data on exposure;
- the accuracy and completeness of police assessment of cause of crash;
- lack of rigorous evaluation of interventions, particularly in low-income and middle-income countries.

Research and research capacity

Research forms the basis for generating data and evidence for informed and effective decision-making. Developing research capacity nationally is important for road traffic injury prevention (Boxes 3.5, 3.6, 3.7). Without research capacity, there exist few means to overcome misconceptions and prejudices about road traffic injuries *(1)*. National and community research – as opposed to solely relying on international research – is important for identifying local problems and localized groups who are at increased risk of road traffic injuries. It also helps to ensure a cadre of national and local professionals who can use research findings to assess the implications for policy and programmes. The national evaluation effort needs to be led by research professionals, since it is only through implementation and thorough evaluation that effective programmes evolve. The independence of research and its separation from the executive function in developing public policy is necessary for ensuring quality, and it protects the research body against political pressures.

Ethical issues in road traffic injury research

Research into road traffic injuries must take into consideration ethical issues. Research ethics deals with questions concerning the professional and moral responsibility of the researcher in relation to the subjects of study, the research sponsors, the general public, and his or her own beliefs. A conflict of interest can easily arise because of the values and interests of different groups involved in research. It must be noted that each of the stages of the entire

BOX 3.5

What are some of the research needs in the area of road traffic injury prevention?

There are many research-related needs for road injury prevention but there is a pressing need for better collection and analysis of data to enable more reliable estimates to be made of:

- the burden of road traffic injuries on different road users;
- the economic and social impacts of road traffic injuries;
- the effectiveness of specific interventions for road traffic injuries;
- the adequacy of design standards and guidelines for intercity roads carrying mixed traffic.

The following specific areas require research:

- how best to assess the effectiveness of packages of road safety measures combining different actions — such as area-wide traffic calming and urban design;
- the interaction between transport planning and urban planning, and how these affect road safety;
- the design of roads and traffic management, taking into account traffic environments and traffic mixes encountered in specific locations;
- how various types of successful preventive measures can be transferred between countries with differing socioeconomic conditions and differing rates of motorization and traffic mixes;
- how improvements in post-impact care can be made at an affordable cost;
- mechanisms causing head injury and whiplash injury in road crashes, and treatments for these injuries;
- how to harmonize to incompatibility between vehicles of different sizes involved in crashes
- how to manage exposure to risk — the least-used strategy.

Source: reference *1*.

BOX 3.6

Research capacity development

The development of national research capacity is urgently needed in many parts of the world. Experience from many countries that have been successful in reducing the incidence of traffic injuries shows the importance of having at least one — preferably independent — adequately funded national organization that deals with road safety research. Countries that have encouraged the development of professional expertise across a range of disciplines at national level, and regional cooperation and exchange of information, have reaped much benefit. Developing these mechanisms should be a priority where they do not exist.

In the field of road traffic injury prevention, several types of initiatives can provide models for capacity development:

- Network development at the institutional level allows for exchange of information, the sharing of experiences, and the fostering of collaborative projects and research studies. WHO's Collaborating Centres for Violence and Injury Prevention are one global example of this model. A regional example is the Injury Prevention Initiative for Africa.
- Another model is to support schemes that allow scientists and professionals to exchange research ideas and findings, develop proposals, mentor less experienced researchers, and carry out research directed at policy-making. The Road Traffic Injuries Research Network is an example of such a framework that focuses on assisting researchers from low-income and middle-income countries.
- A third model for capacity development is to strengthen university departments and research institutes so as to generate a critical mass of appropriately trained professionals. The Indian Institute of Technology (New Delhi) and University Putra Malaysia are examples of centres with regular training programmes on road safety.
- A fourth model is to strengthen the career development pathways of trained professionals. This is important both for attracting and retaining valuable human resources. Part of such a strategy includes establishing positions for road traffic injury prevention in appropriate ministries – such as those of health and transport, and finding incentives to encourage professionals in such posts to perform at a high level.

Source: reference *1.*

research process may involve ethical considerations, in addition to scientific issues. There are guidelines to assist researchers in approaching ethical issues in a professional manner. These guidelines focus on relations between researchers and subjects of study, confidentiality, anonymity, accountability, responsibility and privacy. Researchers need to follow national guidelines on research ethics. These are published and available in different countries.

Key points

- Effective decision-making and planning should be based on evidence, and should not promote strategies that have no evidence supporting their effectiveness.
- Reliable data and evidence are essential for describing the burden of road traffic injuries, assessing risk factors, establishing priorities for prevention, developing and evaluating interventions, providing information for policy-makers and decision-makers, and raising awareness.
- Police departments and hospitals provide most of the data used in road traffic injury prevention. In addition, data are also available from published documents and research reports, as well as on the Internet.

BOX 3.7

Technology and evidence transfer from high-income countries

Transport system priorities developed in high-income countries may not always fit well with the safety needs of low-income and middle-income countries for a variety of reasons, including the differences in traffic mix. In low-income countries, walking, cycling, motorcycling and use of public transport are the dominant transport modes. In North America and Europe, car ownership is high, there are between two and three people per car, whereas in China and India car ownership is much lower, about 280 and 220 people per car, respectively. While it is predicted that car ownership will increase in China and India, it will still remain low in terms of cars per capita for another 20–30 years. With a low rate of car ownership, there is a much wider mix of road users — pedestrians, riders of bicycles, motorcycles and three-wheeled vehicles, and drivers and passengers of cars, trucks, buses, and vehicles pulled by humans and animals. These modes of transport operate at different speeds. Technology transfer, therefore, needs to be appropriate for the mix of different vehicle types and the patterns of road use in a particular place.

Road safety in countries that are in the process of becoming motorized is further hindered by the perception that current levels of walking, cycling and motorcycling are temporary. Such a view may have arisen through imported expertise from developed countries as much as from domestic sources. This tends to lead to models of infrastructure from developed countries being adopted to cater to the longer-term transport needs. However, in most low-income countries, safety should be promoted within existing conditions, and these include: low per-capita incomes, the presence of mixed traffic, a low capacity for capital intensive infrastructure, and a different situation as regards law enforcement.

In high-income settings, strategies and programmes for traffic injury prevention generally require considerable analysis and planning beforehand. Priority should be given to importing and adapting proven and promising methods from all nations, and to pooling information among low-income countries as to their effectiveness in the imported settings.

Source: reference *1*.

- Since road traffic injury data and evidence are collected and stored by a range of agencies, there is a need to ensure access, harmonization and linkages between different data sources and users. Ideally, where there are a number of data sources available, it is important that the data should be linked, to obtain maximum value from the information.
- There are a number of areas where road traffic injury data are often problematic. These include: integration of sources of data – from police or the health system; the types of data collected; inappropriate use of indicators; non-standardization of data; definitional issues related to traffic deaths and injuries; underreporting; and poor harmonization and linkages between different sources of data.
- National and community research – as opposed to relying solely on international research – is important for identifying local problems and localized groups at increased risk of road traffic injuries.
- Research on road traffic injuries, like any other research activity, must take into consideration ethical issues.

Definitions of key concepts

- Evidence: proof or the grounds for demonstrating the validity of a knowledge claim.

- Research design: a set of concise, clear instructions or procedures indicating how to conduct research.
- Ethics: principles of morality, particularly those dealing with the rights and wrongs of an action, such as the rules of conduct for members of a particular profession.

Questions to think about

a) Based on your experience, identify any two major decisions you have made in the past regarding road traffic injury prevention. Explain what was the basis for making these decisions. Did you consider the body of evidence around this issue when making the two decisions?

b) Discuss the prevailing situation with regard to coordination and sharing of data among agencies that collect information on road traffic injuries in your country. If you identify limited coordination and linkage, indicate steps that can be taken to improve this situation.

c) There is a general concern about the gap between evidence and policy implementation. Does this situation exist in your country with respect to road traffic injury prevention? If so, what leads to this? What steps can be taken to address this situation?

d) Underreporting of both deaths and injuries is a major global problem affecting not only low-income and middle-income countries but also high-income countries. What is the situation in your country? What efforts have been made to address this problem?

References

1. Peden M et al. *World report on road traffic injury prevention.* Geneva, World Health Organization, 2004.
2. Odero W, Garner P, Zwi A. Road traffic injuries in developing countries: a comprehensive review of epidemiological studies. *Tropical Medicine and International Health*, 1997: 445–460.
3. Nordberg E. Injuries as a public health problem in Sub-Saharan Africa: epidemiology and prospects for control. *East African Medical Journal*, 2000 (Suppl.), 77: S1-S43.
4. Willis C, Lybrand S, Bellany N. Alcohol ignition interlock programmes for reducing drink driving recidivism. Cochrane Injuries Group, (http://www.cochrane.org/reviews/en/ab004168.html, accessed 31 January 2006).
5. Liu B, Ivers R, Norton R, Blows S, Lo SK. Helmets for preventing injury in motorcycle riders. Cochrane Injuries Group (http://www.cochrane.org/reviews/en/ab004333.html, accessed 31 January 2006).
6. Duperrex O, Roberts I, Bunn F. Safety education of pedestrians for injury prevention. Cochrane Injuries Group, (http://www.cochrane.org/reviews/en/ab001531.html, accessed 31 January 2006).
7. Elvik R. and Vaa T, eds. *The handbook of road safety measures*. Amsterdam, Elsevier, 2004.
8. Holder Y et al., eds. *Injury surveillance guidelines*. Geneva, World Health Organization, 2001.
9. *TEACH-VIP: user's manual*. Geneva, World Health Organization, 2005.
10. Sethi D et al., eds. *Guidelines for conducting community surveys on injuries and violence*. Geneva, World Health Organization, 2004.
11. Tiwari G, Mohan D, Muhlrad N, eds. *The way forward: transportation planning and road safety.* New Delhi, Macmillan India Ltd., 2005.
12. United Nations Economic and Social Council. Economic Commission for Europe. *Working Party on Transport Statistics (Fifty-fourth session, 11–13 June 2003).* Intersecretariat working group on transport statistics (IWG). Report TRANS/WP.6/2003/6, 4 April 2003.
13. Mackay M. National differences in European mass accident data bases. In: Gennarelli TA, Wodzin W, eds. *Proceedings: Contemporary Injury Severity and Outcome Issues, RCOBI Annual Conference, Lisbon, Portugal, 24 September 2003: 51-55.*

14. *International statistical classification of diseases and related health problems. Tenth revision*. Geneva, World Health Organization, 1994.

15. Joint Committee on Injury Scaling. *The Abbreviated Injury Scale: 1990 revision*. Chicago, IL, Association for the Advancement of Automotive Medicine, 1990.

Further reading

Rosman DL, Knuiman MW. A comparison of hospital and police road injury data. *Accident Analysis & Prevention*, 1994, 26:215-222.

Sabey EB. Accident analysis methodology. *Journal of International Association of Traffic and Safety Sciences*, 1990, 14:35-42.

Notes

Trainee's evaluation of Unit 3: Importance of evidence as a foundation for prevention

This form is to be completed by the trainee at the end of this unit to assess the content and approach used. This evaluation is helpful to the trainee, trainer and developer of this manual.

1. To what extent did you achieve the objectives set for this unit? (Please check once using "X" for each objective)

Objectives	Completely successful	Generally successful	Completely unsuccessful
State at least three reasons why evidence is important in efforts to prevent road traffic injuries.			
Describe the main sources of data and evidence on road traffic injuries.			
Discuss the different methods used to collect and analyse data on road traffic injuries.			
Explain the importance of research and research capacity in road traffic injury prevention.			
Explain ethical issues in research on road traffic injury prevention.			
Evaluate the quality of data and evidence on road traffic injury prevention in the trainee's own country.			

2. What is your overall rating of the content presented in this unit? (Please check one using "X")

Scale	Excellent	Better than expected	Satisfactory	Below average
Rating				

3. How do you rate the balance between theoretical and practical content in this unit? (Please check one using "X")

Scale	Good balance	Too theoretical	Too practical
Rating			

4. a) Did you find the activities presented in the unit helpful? (Please check one)

   Yes_____ No_____

b) If yes, in what ways were they helpful? What improvements do you suggest?

c) If no, what were the shortcomings? What suggestions do you have to make them helpful?

5. What did you like most about the unit?

6. What did you like least about the unit?

7. What did you learn most from this unit?

8. Explain how your organization, community, city and country, and other interested parties will benefit from your having read this unit.

9. What do you think should be added to this unit?

10. What do you think should be dropped from this unit?

UNIT 4

Implementing specific interventions to prevent road traffic injuries

Overview

Interventions are required to solve the road traffic injury problems discussed in the earlier units. This unit examines the basic principles for road traffic injury control. It goes on to identify and discuss examples of specific interventions that can be implemented in different settings around the world.

Objectives

By the end of this unit, the trainee should be able to:

- describe the basic principles of road traffic injury control;
- describe specific interventions that can be implemented in different settings to prevent road traffic injuries;
- describe a specific road traffic injury problem for which the trainee can design and implement an intervention in the trainee's own setting.

Basic principles of road traffic injury control

Injuries are caused by a transfer of energy between the human body and the environment. The amount of damage and the severity of injuries are directly related to the amount of energy that is available and exchanged during a crash. Reducing or managing the excess energy that may contribute to the occurrence of a crash and the severity of injuries during the crash is therefore one of the main basic principles of road traffic injury control. This approach was first formalized by Haddon in 1973 *(1)* and is referred to as ten strategies (Box 4.1). The emphasis of Haddon's "ten strategies" is on technological modifications to reduce injuries.

What specific interventions can be implemented?

There is no standard package of interventions suitable for all contexts and countries. Interventions proven in one setting may not easily be transferable elsewhere, and will require careful adaptation and evaluation. Where effective interventions are altogether lacking, scientific research is needed to develop and test new measures. Whether in high-income, or low-income and middle-income countries, there are several good practices that can be followed *(2):*

- reducing exposure to risk through transport and land-use policies;
- shaping the road network for road injury prevention;
- improving visibility of road users;
- promoting crash-protective vehicle design;
- setting and securing compliance with road safety rules;
- delivering post-crash care.

BOX 4.1

Haddon's ten strategies for road traffic injury prevention

a) *Prevent the initial aggregation of the particular energy form*. This is usually done by discouraging the use of vehicles and designs that are particularly hazardous and by encouraging alternative travel modes.

b) *Reduce the amount of energy aggregated.* Examples are the setting of speed limits on roads, making engines which are not very powerful, and installing speed limiters on existing vehicles.

c) *Prevent the inappropriate release of energy.* This can be achieved by designing vehicles and the environment such that road users do not make mistakes easily, for example, through the use of better brakes, safer intersections and roundabouts, and skid resistant roads.

BOX 4.1 (continued)

d) *Alter the rate or spatial distribution of release of the energy from its source*. Making pointed and sharp surfaces rounded and flatter distributes the forces over a larger area during an impact and thus reduces stresses on the body. Vehicles with appropriate crashworthiness criteria will transfer less energy to occupants.

e) *Separate susceptible structures from the energy being released by means of space or time*. Separate lanes for bicycles and pedestrians reduce the probability of the riders or walkers being hit by motor vehicles. Daytime curfews for trucks in cities reduce the number of crashes involving pedestrians.

f) *Interpose a material barrier to separate the released energy from susceptible structures*. Examples are physical road dividers on highways, and bollards and fences between pedestrian paths and roads.

g) *Modify contact surfaces or basic structures that can be impacted.* Padded interiors and absence of sharp objects prevent injury. Examples include softer car and bus fronts, breakaway poles on highways, and use of helmets by two-wheeler riders.

h) *Strengthen human beings who are susceptible to damage by the energy transfer.* An example is treatment for osteoporosis of older road users.

i) *Quickly detect and evaluate damage, and prevent its continuation or extension.* Damage can be limited by efficient systems for extraction of victims from vehicles, emergency care, and management of crash sites.

j) *Carry out all necessary measures between the emergency period immediately following damage and ultimate stabilization of the process*. Such measures include intermediate and long-term repair and rehabilitation.

Source: reference *1.*

Apart from the delivery of post-crash care, which is dealt with in Unit 5, examples of the wide range of interventions that are available are presented below.

Managing exposure to risk through transport and land-use policies

Safety-conscious planning and design of the road network and of land use is necessary to minimize the risk of road traffic injuries. Exposure to risk of road traffic injury can be decreased by strategies that include:

- reducing the volume of motor vehicle traffic by means of better land use;
- providing efficient networks where the shortest or quickest routes coincide with the safest routes;
- encouraging people to switch from higher-risk to lower-risk modes of transport;
- placing restrictions on motor vehicle users, on vehicles, or on the road infrastructure;
- promoting safety-centred planning, design and operation of the road network.

Efficient land use

Land-use planning practices and "smart growth" land-use policies – development of high-density, compact buildings with easily-accessible services and amenities – can serve to lessen the risk exposure of road users. The creation of clustered, mixed-use community services, for example, can cut the distances between commonly-used destinations, curtailing the need to travel and reducing dependence on private motor vehicles. The main aspects of land use that influence road safety include:

- the spatial distribution of origins and

destinations of road journeys;
- urban population density and patterns of urban growth;
- the configuration of the road network;
- the size of residential areas;
- alternatives to private motorized transport.

Trip reduction measures

Measures that may reduce the distance travelled include:

- better management of commuter transport, and of transport to and from schools and colleges;
- better management of tourist transport;
- bans on freight transport;
- restrictions on vehicle parking and road use;
- making greater use of electronic means of communication as a substitute for delivering communications by road.

Encouraging use of safer modes of transport

Travel by bus and train is many times safer than any other mode of road travel. Policies that stimulate the use of public transport, and its combination with safe walking and cycling, are thus to be encouraged.

Strategies that may increase the use of public transport include:

- improved mass transit systems (including improvements to routes covered and ticketing procedures, shorter distances between stops, and greater comfort and safety of both the vehicle and the waiting areas);
- providing safe walking and bicycling facilities;
- better coordination between different modes of travel (including the coordination of schedules and the harmonization of tariff schemes);
- secure shelters for bicycles;
- allowing bicycles to be carried on board trains, ferries and buses;
- "park and ride" facilities, where users can park their cars near public transport stops;
- improvements to taxi services;
- higher fuel taxes and other pricing reforms that discourage private car use in favour of public transport.

Shaping the road network for road traffic injury prevention

Examples of road design considerations and strategies that can make a major contribution to road traffic injury prevention are presented below.

Classifying roads and setting speed limits by their function

Many roads have a range of functions, and are used by different types of vehicles and by pedestrians – with large differences in speed, mass of vehicle and degree of protection. In residential areas and on urban roads this often leads to conflicts between the mobility of motor vehicle users on the one hand and the safety of pedestrians and cyclists on the other. Classifying roads functionally – in the form of a "road hierarchy", as it is known in highway engineering – is important for providing safer routes and safer designs. Such a classification takes account of land use, location of crash sites, vehicle and pedestrian flows, and objectives such as speed control.

Improving safety of single-lane carriageways

A range of engineering measures is needed to encourage appropriate speed and make hazards easily perceptible. These measures include:

- provision for slow-moving traffic and for vulnerable road users;
- lanes for overtaking, as well as lanes for vehicles waiting to turn across the path of oncoming traffic;
- median barriers to prevent overtaking and to eliminate head-on crashes;
- better highlighting of hazards through road lighting at junctions and roundabouts;
- improved vertical alignment;
- advisory speed limits at sharp bends;
- regular speed-limit signs;

- rumble strips;
- the systematic removal of roadside hazards – such as trees, utility poles and other solid objects.

Traffic-calming measures

Traffic-calming consists of techniques such as those discouraging traffic from entering certain areas and installing physical speed-reducing measures, that include:

- narrowing of streets;
- giving priority to pedestrians and bicyclists;
- link closure;
- partial street closure;
- speed breakers (road humps);
- raised pedestrian crossings;
- roundabouts;
- rumble devices;
- chicanes ('build outs' or 'kerb extensions');
- speed bumps (Box 4.2).

These measures are often backed up by speed limits of 30 km/h, but they can be designed to achieve various levels of appropriate speed. At speeds below 30 km/h pedestrians can coexist with motor vehicles in relative safety.

Improving visibility of road users

Seeing and being seen are fundamental prerequisites for the safety of all road users. There are various ways of improving the visibility of particular groups of road users. Some commonly used methods are listed below.

For motorized two-wheelers:

- use of daytime running lights on the front of motorized vehicles, which improves visibility while travelling during daylight hours. Some countries have made the use of daytime running lights mandatory (Box 4.3).
- use of reflective and protective clothing (jackets and vests), which increases the visibility of riders during the night and thus reduces the probability of a crash. When these jackets are made with protective padded material, they can also serve to reduce the severity of injuries. However, some of these jackets and vests may be uncomfortable in warmer climates or prohibitively expensive. Brightly coloured clothing, extra reflectors on

BOX 4.2

Speed bumps in Ghana: a low-cost road safety intervention

The use of speed bumps, in the form of rumble strips and speed humps, has been found to be effective on Ghanaian roads. For instance, rumble strips on the main Accra-Kumasi highway at the crash hot spot of Suhum Junction reduced the number of traffic crashes by around 35%. Fatalities fell by some 55% and serious injuries by 76%, between January 2000 and April 2001. This speed-reducing measure succeeded in reducing or even eliminating certain kinds of crashes, as well as improving the safety of pedestrians. Speed control bumps and humps have become increasingly common on Ghanaian roads, particularly in built-up areas where excessive vehicle speeds threaten other road users. A wide range of materials – including vulcanized rubber, hot thermoplastic materials, bituminous mixes, concrete and bricks – have been used in the construction of the speed control areas. Rumble strips are cheap and easy to install. They have been constructed at potentially dangerous places on the Cape Coast-Takoradi highway, the Bunso-Koforidua highway and the Tema-Akosombo highway. Speed humps, in contrast, have been laid to slow down vehicles and improve the safety of pedestrians in the towns of Ejisu and Besease on the Accra-Kumasi highway.

Source: based on reference *2*.

BOX 4.3

Use of daytime running lights by motorcyclists in Malaysia and Singapore

In Malaysia, analysis conducted in 1992 revealed that motorcyclists constituted a majority of the road traffic injuries and fatalities. A nationwide intervention was introduced to encourage the use of daytime running headlights. This consisted of a three-month educational and publicity campaign, followed by a compulsory law introduced in September 1992. The intervention did not have many supporters in the community, and it was thought necessary to evaluate its effect. A preliminary study showed that the number of visibility-related crashes involving motorcycles in the six months after legislation was significantly less than the number of such crashes in the six months before the introduction of the legislation. A subsequent, more extensive study of the long-term effects found that the use of daytime headlights by motorcyclists reduced visibility-related crashes by 29%.

Singapore also has a high rate of motorcycle crashes, and their riders constitute 40%–50% of traffic-related injuries and fatalities. In recognition of this problem, as of November 1995, the Singapore Traffic Police made it compulsory for all motorcyclists to switch on their motorcycle headlights during the daytime. The legislation was accompanied by a publicity campaign and a study of the effectiveness of the programme. All the cases of road collisions reported to the Singapore Traffic Police in the years 1992–1996 were analysed. The results showed that the legislation was effective in reducing the number of fatal and serious injuries.

Source: based on references *3* and *4*.

the vehicle or light reflective vests of thin plastic material may be an alternative.

For four-wheelers:

- adoption and enforcement of laws requiring daytime running lights.
- use of high-mounted brake lights, positioned on the back windscreen of cars, giving greater visibility from the rear.

For cyclists and pedestrians:

- equipping bicycles with lights, and with front, rear, and wheel reflectors.
- using brightly coloured clothing, accessories and vehicles, which can make pedestrians, riders and non-motorized vehicles more visible to all road users. Orange and yellow colours are conspicuous both at night and in the daytime. Bright colours for wheels and rear ends of non-motorized vehicles (e.g. rickshaws) may also have the potential to increase visibility. However, the effectiveness of such measures has yet to be determined.
- illuminating crosswalks, including the floodlighting of pedestrian crossings and increased illumination at crosswalks.

Promoting crash-protective vehicle design

The following design features can make cars more crashworthy:

- a strong passenger compartment with crash-absorbing front and back;
- head-rests to prevent whiplash injury;
- collapsible steering column;
- laminated windscreens fastened to the car to prevent ejection;
- padded instrument panels;
- door locks that prevent doors from opening during a crash;

- crash-resistant roofs;
- side protection bars on doors;
- front end design to prevent injury to pedestrians in crashes, removal of sharp and pointed objects.

Setting and securing compliance with road safety rules

Setting road safety rules is an important aspect of road traffic injury prevention. Attention should be paid to the following:

- Setting rules should not be an end in itself. It is important to ensure compliance through enforcement, information and education.
- Attempts at enforcing road traffic legislation will not have any lasting effect, either on road-user behaviour or on road traffic crashes unless the enforcement is continued for a long time, and is perceived to be so by road users.
- Enforcement levels need to be high, and high levels need to be maintained, so as to ensure that the perceived risk of being caught remains high.
- Imposing very strict penalties (in the form of higher fines or longer prison sentences) does not affect road-user behaviour and tends to reduce the level of enforcement.
- Once offenders are caught, their penalties should be dealt with swiftly and efficiently.
- Using selective enforcement strategies to target particular risk behaviours and choosing specific locations both improve the effectiveness of enforcement.
- Automated means – such as cameras – are cost-effective.
- Publicity supporting enforcement measures increases their effectiveness; but used on its own, publicity has a negligible effect on road user behaviour. It is essential that road users can observe the actual increase in level of enforcement activity.

There are risk factors such as speed and alcohol, discussed in Unit 2, which require enforcement of road safety rules. These are briefly summarized here.

Setting and enforcing speed limits

As indicated in Unit 2, speed is a key risk factor in road traffic injuries, influencing both the risk of a road crash as well as the severity of the injuries that result from crashes. High speeds and large speed differences makes driving situations difficult to predict and control. The greater the speed, the less time available for preventing collisions, and the greater the severity of the consequences when a collision takes place. Controlling vehicle speed can prevent crashes from occurring and can reduce the impact when they do occur, lessening the severity of injuries sustained by the victims (Box 4.4).

Enacting and enforcing laws on alcohol impairment

As indicated in Unit 2, impairment by alcohol is an important factor influencing both the risk of a road crash, as well as the severity of the injuries that result from crashes. The frequency of drinking and driving varies between countries but it is almost universally a major risk factor for road traffic crashes. The scientific literature and national road safety programmes concur that a package of effective measures is necessary to reduce alcohol-related crashes and injuries (Box 4.5).

Enacting and enforcing laws on the use of seat-belts and child restraints

The following can be done to improve seat-belt and child restraint use:

- Make the use of seat-belts and child restraints mandatory by law.
- Strictly enforce these laws, and support enforcement by public information and awareness campaigns.
- Encourage primary enforcement (where a driver is stopped solely for not wearing a seat-belt), which is more effective than secondary enforcement (where a driver can only be stopped if another offence has been committed).
- Set rules requiring use of technological solutions to encourage belt use, for example, seat-belt reminders.
- Use incentive programmes to enhance police enforcement. In these programmes, seat-belt use is monitored and seat-belt wearers are eligible for a reward. The rewards may range from a meal voucher or lottery ticket to

BOX 4.4

Effective management and control of vehicle speed

The following can be done for effective management and control of vehicle speed:

- Set and enforce speed limits;
- Post speed limits so that motorists know what speeds are expected on different roads or sections of roads.

Bear in mind that:

- Introduction of speed limits should be accompanied by sustained, visible enforcement of these limits;
- Speed cameras are a highly cost-effective means of reducing road crashes;
- Speed levels can also be affected by developing a safer infrastructure. This can involve modifying the road environment to reduce traffic flow and vehicle speed, thereby providing protection from crashes and reducing injury rates. Such measures include segregating high-speed and low-speed road users, or discouraging vehicles from entering certain areas;
- Traffic-calming measures can be used;
- The transition from high-speed to low-speed roads can create areas of high risk for crashes – for example, where vehicles exit motorways. Design features can be used to mark transition zones on busy roads approaching towns and villages that can influence drivers' speed. Slower-speed zones are examples of features that are useful in reducing the speed of vehicles;
- Appropriate speed can be imposed on traffic through design features that limit the speed of the vehicle itself.

Source: based on results summarized in reference *2*.

BOX 4.5

What can be done to prevent alcohol-impaired driving?

Below is a summary of things that can be done to prevent alcohol-impaired driving:

- Set blood alcohol limits. The limits should be consistent with current epidemiological information concerning the relationship between alcohol and crash involvement. Upper limits of 0.05 g/dl for the general driving population and 0.02 g/dl for young drivers are generally considered to be the best practice at present;
- Enact laws that establish a lower legal limit for blood alcohol content for younger or inexperienced drivers than for older, more experienced drivers;
- Enforce drink-driving laws;
- Use breath-testing devices that provide objective evidence of blood alcohol content;
- Enact laws that specify minimum legal drinking-age laws, an age below which the purchase or public consumption of alcoholic beverages is illegal;
- Enact laws that require installation of “alcohol ignition interlocks” that require a driver to take a breath test before starting a car;
- Implement a graduated driver-licensing system for new drivers that sets a period during which restrictions are placed on any unsupervised driving. These restrictions should include a prohibition against driving after drinking any alcohol.

Source: based on results summarized in reference *2*.

sizeable prizes such as video recorders or free holidays.

- Encourage the use of the appropriate type of child restraint. Good protection requires that the type of restraint used is appropriate for the age and weight of the child.
- Place child restraints correctly. Child seats should not be placed in front of air bags.

Enacting and enforcing laws making the use of crash-helmets mandatory

There are various strategies that effectively address the problem of head injuries in motorcyclists. They include:

- legislation making helmet wearing compulsory, accompanied by targeted information and enforcement campaigns – with penalties for non-use of crash helmets;
- introduction of standards for motorcycle safety helmets.

In many parts of the world, there are standards setting out performance requirements for crash helmets. These standards are most effective when based on research findings on crash injuries. In low-income and middle-income countries, it would be highly desirable for effective, comfortable and low-cost helmets to be developed, and local manufacturing capacity increased.

Activity

Task

Study the picture below. Explain the steps you would take to promote the use of helmets by two-wheeler riders in such a setting.

Expected results

The purpose of this exercise is to assist the trainees in identifying and discussing some of the practical issues that have to be examined when developing an intervention such as promoting helmet use. This exercise can be done in groups. Trainees can be put into groups of three to four people and asked to discuss what can be done. Each group should then present the main points and outcome of their discussion to the class. Among the key topics that should emerge from the discussions are the need for:

- an assessment to determine helmet-wearing rates, reasons for low use of helmets, numbers of fatalities and injuries occurring to motorcyclists;
- development of a strategy to promote wearing of helmets, including campaigns, making helmets available, distribution of helmets to targeted groups, and enforcement of laws requiring helmets to be worn;
- monitoring and evaluation of helmet use.

The role of education and publicity

Public health sector campaigns in the field of road traffic injury prevention have encompassed a wide range of measures, but education has always featured as one of the key activities of prevention. Ongoing research (Box 4.6) and experience have led to re-examination of the role that education plays in road traffic injury prevention. The following are the key conclusions from research on this issue:

- Informing and educating road users can improve knowledge about the rules of the road and about such matters as purchasing safer vehicles and equipment.
- Basic skills on how to control vehicles can be

BOX 4.6

Re-examination of road safety education and training: conclusions from studies

Concerns regarding the effectiveness (or lack of it) of education in promoting road safety have prompted researchers to do systematic literature reviews on the subject in the past few years. A summary of the conclusions of these reviews is presented below:

- *Education and skill training for children and pedestrians*

  Education and skill training programmes on bicycle handling for children, and on car handling and drunken driving for adolescents, for the most part showed no effects, or even negative effects, on attitude, behaviour, and incidence of injuries. Such training might create unrealistic beliefs in one's own abilities, and parents might overestimate their children's abilities, so that they may be exposed to more dangerous situations *(5)*.

  Pedestrian safety education can result in improvement in children's knowledge and can change observed road crossing behaviour but whether this reduces the risk of pedestrian motor vehicle collision and injury occurrence remains unknown. Changes in safety knowledge and observed behaviour decline with time, suggesting that safety education must be repeated at regular intervals *(6)*.

- *Driver education*

  Driver education (school based) leads to early licensing. Results of systematic literature review provide no evidence that driver education reduces road crash involvement, and suggest that it may lead to a modest but potentially important increase in the proportion of teenagers involved in traffic crashes *(7)*.

  A systematic review that examined the effects of post-licence driver education found no evidence of effect on prevention of road traffic injuries or crashes *(8)*. Although the results are compatible with a small reduction in the occurrence of traffic offences, this may be due to selection biases or bias in the included trials. Because of the large number of participants included in the meta-analysis (close to 300 000 for some outcomes) we can exclude, with reasonable precision, the possibility of even modest benefits.

  Drivers who take a theory test have similar crash rates as drivers who do not undergo a theory test, optional training for motorcycle and moped riders or use of simulators during training *(9)*.

- *Graduated driver licensing systems*

  Young and inexperienced drivers have higher crash rates *(10)*. Over the past decade experiments have been done to provide gradual access to driving privileges to new licensees. These programmes are called graduated driver-licensing systems. Restrictions can include curfews over driving at night, limits on carrying passengers especially at night. Results from studies have shown great promise with reductions in crash rates from 5% to 60% *(11)*.

taught.

- Education can help to bring about a culture of concern and develop sympathetic attitudes towards effective interventions.
- Most programmes providing highway safety education do not work in isolation – they need to be linked or used in combination with other measures.
- There is a need for a balanced approach to the role

of education and publicity, taking into account evidence from research on behaviour change, the interventions that may be promising, those to avoid, and those to encourage, as well as the need to implement proven measures.

- General non-specific road safety campaigns should be avoided. Campaigns should rather be used to put important questions on the agenda, and should preferably support other measures such as new legislation or police enforcement.

The ongoing re-examination of road safety education is an essential aspect of research, and the emerging conclusions need to be considered and examined by researchers and practitioners in the field of road traffic injury prevention. The conclusions draw attention to the need to be cautious and avoid focusing on only road safety education.

Key points

- Injuries are caused by a transfer of energy between the human body and the environment. Therefore reducing or managing the excess energy that may contribute to the occurrence of a crash and the severity of injuries during the crash is one of the main basic principles of road traffic injury control.
- There is no standard package of interventions suitable for all contexts and countries.
- Whether in high-income, or low-income and middle-income countries, there are several good practices that can be followed:
  - reducing exposure to risk through transport and land-use policies;
  - shaping the road network for road traffic injury prevention;
  - improving visibility of road users;
  - promoting crash-protective vehicle design;
  - setting and securing compliance with key road safety rules;
  - delivering post-crash care.

Definitions of key concepts

- Excess speed: exceeding the speed limit set for a specific country, city, town, region or road.
- Inappropriate speed: driving at a speed unsuitable for the prevailing road and traffic conditions.
- Smart growth land-use policies: the development of high-density, compact buildings with easily accessible services and amenities.

Questions to think about

- Choose one of the interventions presented in this unit that has been implemented in the country or city where you live. Discuss the results that have been obtained.
- The local authority of your city is planning interventions to respond to increasing collisions involving children who live on one side of the road but have to cross this road to reach a school on the other side. What interventions would you recommend? What are the reasons for your recommendations?
- The majority of people in a certain community do not wear seat-belts despite the existence of a law requiring the use of seat-belts. Discuss what you would do to address this problem.

References

1. Haddon Jr W. Energy damage and the ten countermeasure strategies. *Human Factors* 1973, 15: 355–366.
2. Peden M et al. *World report on road traffic injury prevention*. Geneva, World Health Organization, 2004.
3. Umar RS, Mackay MG, Hills BL. Modelling of conspicuity-related motorcycle accidents in Seremban and Shah Alam, Malaysia. *Accident Analysis & Prevention*, 1996, 28: 325–332.
4. Yuan W. The effectiveness of the 'ride-bright' legislation for motorcycles in Singapore. *Accident Analysis & Prevention*, 2000, 32: 559–563.
5. Lund J, Aaro LE. Accident prevention: presentation of a model placing emphasis on human, structural and cultural factors. *Safety Science*, 2004, 42: 271–324.
6. Duperrex O, Roberts I, Bunn F. Safety education of pedestrians for injury prevention: a systematic review of randomised controlled

trials. *British Medical Journal,* 2002, 324: 1129–1131.

7. Roberts I et al. 2003. Preventing child pedestrian injury: pedestrian education or traffic calming? *Australian Journal of Public Health,* 1994, 18: 209–212.
8. Ker K et al. Post-licence driver education for the prevention of road traffic crashes: a systematic review of randomised controlled trials. *Accident Analysis & Prevention,* 2005, 37: 305–313.
9. Elvik R, Vaa T, eds. *The handbook of road safety measures.* Amsterdam, Elsevier, 2004.
10. Evans L. *Traffic safety and the driver.* New York, Van Nostrand Reinhold, 1991.
11. Hedlund J, Compton R. Graduated driver licensing research in 2003 and beyond. *Journal of Safety Research,* 2004, 35: 5–11.

Further reading

Mohan D, Tiwari G. Road safety in low-income countries: issues and concerns regarding technology transfer from high-income countries. In: *Reflections on the transfer of traffic safety knowledge to motorising nations*, Global Traffic Safety Trust, Vermont South, Australia, 1998: 27–56.

O'Neill B. Role of advocacy, education, and training in reducing motor vehicle crash losses. In: *Proceedings of WHO meeting to develop a 5-year strategy on road traffic injury prevention*, World Health Organization, Geneva, 2001: 32–40.

Robertson LS. *Injuries: causes, control strategies and public policy*. Lexington Books, Lexington, MA, 1983.

Notes

Trainee's evaluation of Unit 4: Implementing specific interventions to prevent road traffic injuries

This form is to be filled by the trainee at the end of this unit to assess the content and approach used. This evaluation is helpful to the trainee, trainer and developer of this manual.

1. To what extent did you achieve the objectives set for this unit? (Please check once using "X" for each objective)

Objectives	Completely successful	Generally successful	Completely unsuccessful
Describe the basic principles of road traffic injury control.			
Describe specific interventions that can be implemented in different settings to prevent road traffic injuries.			
Describe a specific road traffic injury problem for which the trainee can design and implement an intervention in the trainee's own setting.			

2. What is your overall rating of the content presented in this unit? (Please check one using "X")

Scale	Excellent	Better than expected	Satisfactory	Below average
Rating				

3. How do you rate the balance between theoretical and practical content in this unit? (Please check one using "X")

Scale	Good balance	Too theoretical	Too practical
Rating			

4. a) Did you find the activities presented in the unit helpful? (Please check one)

   Yes_____ No_____

b) If yes, in what ways were they helpful? What improvements do you suggest?

_____

_____

c) If no, what were the shortcomings? What suggestions do you have to make them helpful?

_____

_____

5. What did you like most about the unit?

6. What did you like least about the unit?

7. What did you learn most from this unit?

8. Explain how your organization, community, city and country, and other interested parties will benefit from your having read this unit.

9. What do you think should be added to this unit?

10. What do you think should be dropped from this unit?

UNIT 5

Delivering post-crash care

- Overview
- Objectives
- Pre-hospital care
  - Core components
  - First responder care
  - Taking an injured person to hospital
  - Basic pre-hospital trauma care
  - Advanced pre-hospital trauma care
  - Core administrative elements
  - Legal and ethical considerations
- The hospital setting
  - Human resources
  - Physical resources
  - Organization of trauma care
- Rehabilitation
- Activity
- Key points
- Questions to think about
- References
- Further reading
- Trainee's evaluation

Overview

Preventing road traffic injuries from occurring should be the main goal to be pursued, but the reality is that crashes continue to occur. Society therefore has to be prepared to mitigate the consequences of crashes and enhance the quality of life of people who are injured. The aim of post-crash care is to avoid preventable death and disability, limit the severity of the injury and the suffering caused by it, and ensure the crash survivor's best possible recovery and reintegration into society. The way in which persons injured in road traffic crashes are dealt with following a crash determines their chances and the quality of survival. In this unit, we discuss the chain of help for people injured in road traffic collisions. The unit discusses three components of post-crash care: pre-hospital, hospital and rehabilitation.

Objectives

By the end of this unit, the trainee should be able to:

- describe the main actions that need to be taken soon after a road traffic collision has occurred;
- discuss the key resources and organization needed for hospital care;
- discuss ways of providing rehabilitation services to injured persons;
- examine the quality of post-crash care in the trainee's own setting.

Pre-hospital care

Core components

An effective pre-hospital care system must have certain core administrative and programmatic elements (Box 5.1). When available, the existing emergency medical services of the country or region should be used and strengthened, with input from community leaders and members of the population that they serve. Various structural models of pre-hospital care systems exist. The one chosen for a particular setting should take into account local factors and resources. At the national level, a lead agency should be designated to promote pre-hospital trauma care. In some countries, this role may be played by the ministry of health, while in others it may rest with the ministry of the interior, the ministry of transport or elsewhere. Because pre-hospital trauma care involves public safety as well as public health, intersectoral cooperation is essential.

Regardless of how simple or sophisticated a given pre-hospital trauma care system might be, certain elements are essential in order to decrease preventable morbidity and mortality *(1)*. These elements include, at a minimum, prompt communication and activation of the system, the prompt response of the system, and the assessment, treatment and transport of injured people to formal health-care facilities when necessary. Whenever and wherever possible, existing clinics, hospitals and health services should be used to ensure efficient mobilization of health-care resources. This is true for both rural and urban areas.

First responders

The first and most basic tier of a system can be established by teaching interested community members basic first aid techniques. These first responders can be taught to recognize an emergency, call for help and provide treatment until formally trained health-care personnel arrive to give additional care (Box 5.2). There are many publications that provide information on good practices to be followed by lay persons when providing first responder care *(1–3)*.

It may be possible to identify particularly motivated or well-placed workers, such as public servants, taxi drivers, or community leaders, and train them to provide a more comprehensive level of pre-hospital care. In addition to learning a more extensive range of first-aid skills, this group could be taught the basic principles of safe rescue and transport. With this level of training, a kit of simple equipment and supplies (Box 5.3) and access to a suitable vehicle, these individuals can provide an acceptable level of trauma care.

BOX 5.1

Key elements in administering a pre-hospital trauma care system

- *Lead national agency.* Designate a lead national agency to govern the system. This agency's responsibilities should include legislative development, regulatory supervision, and organization and financing of the system.
- *Support.* Ensure that there is regional and local support, and involvement that includes members of the local community.
- *Local administration.* Develop local administration and supervision, taking into account the local context and resources.
- *Medical direction.* Ensure that the medical director is providing the essential coordination of care, training and education, and quality improvement initiatives.
- *Political support.* Develop political and legislative support. These are essential for ensuring the operational and financial viability of the system.

Source: reference *1.*

BOX 5.2

Role of lay bystanders

Those who are present or who arrive first at the scene of a crash can play an important role in various ways, including by:

- contacting the emergency services, and calling for help;
- taking action to secure the scene — such as preventing further crashes, preventing harm to rescuers and bystanders, and controlling the crowd gathered at the scene;
- organizing people and resources, keeping bystanders away from the injured so that helpers can get on with rescue operations, and organizing people into groups (one group for comforting the victims, their friends and their relatives, another group for transporting the patients, and another group for actually administering the first aid);
- helping to put out any fire;
- applying first aid;
- transporting the injured persons to a hospital if no ambulance is available.

Source: reference *1.*

Taking an injured person to hospital

If you have to take injured patients to hospitals you have to make sure that during shifting the patients are not hurt more. You have to move the patients from where they are lying to carry boards or stretchers and then to vehicles in which they are going to be carried to hospitals. Any firm board can be used for this. If a ready-made stretcher is available, it should be used, but it is not essential. What is important is a rigid flat surface which keeps the spine stable and which allows resuscitation to be carried out. A stretcher can be improvised from:

- any wooden board or ladder;
- two or three boards tied together;
- bus, van or other flat seats that are long enough.

BOX 5.3

First aid and first aid kit

Conventionally, first aid to an injured person includes resuscitation, dressing of wounds and splintage. In principle, resuscitation at the crash site is similar to what takes place at the hospital. The "ABC" of resuscitation includes:

- maintenance of a clear *airway;*
- establishment of *breathing;*
- establishment or assessment of *circulation.*

Experience has shown that most of the medicines, antiseptics, bandages and implements usually found in first aid kits are not necessary for first aid. In fact, if you do not use bandages and dressings promptly, they usually gather dust containing all kinds of bacterial spores and, if the air is damp, they will even grow fungi. Some bandages and dressings are sold in sterile bags. These, too, may grow harmful organisms if they are not checked regularly for damage and for expiry dates. A clean cloth would be safer and better. The following items could be useful while you are administering first aid:

- a set of large safety pins to make slings and splints;
- a pair of tweezers to take out splinters and thorns;
- a pair of scissors to cut cloth bandages and dressings;
- soap to wash wounds, to remove grease and dirt, and to wash your hands after you have administered first aid.

While shifting, the patient's back, neck and airway have to be protected from further injury. If the patient is unconscious, gently place a large folded cloth or towel under the neck so that the neck does not sag against the ground.

Ambulances are specifically designed for carrying patients to hospital. However, the type of vehicle is not as important as whether it can carry a patient comfortably and safely. The vehicle should have enough space to keep the patient's back straight, and the person accompanying the patient should be able to care for and resuscitate the patient if necessary. Though rapid transport is important, it is not possible to go above a certain speed in towns and cities without endangering the lives of patients and those outside the vehicle. Speeding could even cause yet another collision.

At all times during transport, it is important to keep watch to ensure that the patient's airway is clear, the patient is breathing (a clear airway does not necessarily mean that the patient is breathing), and that the patient's pulse can be felt. Being able to feel the pulse means that the heart is beating. A crash victim may look fine and appear to be uninjured and it may take some time before signs and symptoms of injury become obvious.

When the patient is fully conscious and you are sure that he or she has only a limb injury, then he or she can be safely taken to hospital in a sitting position. Take care to splint or protect limb injuries or stop bleeding. While in the vehicle, try to keep the injured limb from touching the floor of the vehicle. Vehicle bumps are easily transmitted from the floor, and this hurts the patient more. If the patient has to be carried down a flight of stairs then the chair-lift can be used.

Basic pre-hospital trauma care

The second tier of care can be provided at the community level by those who have been trained in the principles of basic pre-hospital trauma care, also known as basic life support. These providers should have formal training in pre-hospital care, scene management, rescue, stabilization and the transport of injured people. Those who provide this basic care form the backbone of formal pre-hospital trauma care systems.

Advanced pre-hospital trauma care

The third-tier care interventions include the establishment of complex regional call management centres and highly integrated communication networks. On a system level, advanced pre-hospital interventions include call management centres, the development of integrated wireless communication networks, and the purchase and maintenance of a fleet of ground ambulances or air ambulances. Broadly termed "advanced life support", clinical services like these generally require the skills of a professional pre-hospital care provider – either a physician or a non-physician paramedic with professional training.

Recent scientific reviews have questioned the effectiveness of many medical techniques at the crash site such as intravenous fluid administration and endotracheal intubation *(4)*. Even the efficacy of advanced trauma life support training in the pre-hospital setting for ambulance crews has been questioned by researchers *(5)*. If adopted without regard for cost, advanced life support programme techniques can inadvertently harm pre-hospital systems by diverting precious resources from less glamorous but clearly effective interventions that benefit far more people. For this reason, planners should exercise caution when considering whether or not to adopt advanced life support options and to base their decisions on a clear understanding of the costs of implementation versus the anticipated benefits. WHO has recently published a document on pre-hospital trauma care systems that provides guidance on these issues *(1)*.

Core administrative elements

In addition to implementing basic systems of care, certain administrative elements must be in place to ensure that a pre-hospital care system is both effective and sustainable. For example, each episode of care should be documented, not only because it is important to monitor the processes and outcomes of care, but also because incident records provide important insights into the nature and location of community hazards and how injuries might be prevented.

Legal and ethical considerations

Finally, for pre-hospital trauma care systems to function effectively, certain ethical and legal principles must be established and followed. Bystanders must feel both protected to act and confident that they will not suffer adverse consequences, such as through legal liability, as a result of aiding someone who has been injured. Most of the legal and ethical concepts that underlie the provision of pre-hospital care are universally respected, regardless of a country's religious, ethical and cultural traditions.

The hospital setting

The key components of the hospital setting are outlined below.

Human resources

Not all hospitals have the same level of expertise for managing trauma patients. Unnecessary shifting from one hospital to another hospital can be avoided if proper triaging is carried out. Fortunately, most bystanders make their own assessment of the injury depending on bleeding and other subjective judgements, and may decide to transport patients to hospitals.

There are three categories for triaging trauma patients:

- Category 1: most seriously injured, based on physiological or anatomical criteria;
- Category 2: less injured, including the patient at risk of significant injury based on the mechanism of injury;
- Other: those not meeting the criteria for Categories 1 or 2; these patients are handled as consultations without a trauma alert.

For hospital care to be effective, police officers and primary care providers must have a good knowledge of the locations and levels of expertise of different hospitals in their regions. The link between primary, secondary and tertiary centres is essential. The most appropriate communication technology should be developed for this purpose, and its availability publicized.

With regard to training, the following needs to be kept in mind:

- Training for teams managing trauma care is vital (Box 5.4);
- Short in-service training should be conducted to strengthen the available human resources;
- There should also be more formal, in-depth training. This includes improving the trauma-related training received by doctors, nurses and other professionals, both in their basic education and in postgraduate training.

Physical resources

In addition to human resources, physical resources are necessary. Many hospitals in low-income and middle-income countries lack important trauma-related equipment, vital for treating life-threatening chest injuries and airway obstruction — major preventable causes of death in trauma patients. Part of the problem, in some countries, is lack of organization and planning, rather than restricted resources. There is a need to address this problem, including by conducting research on the matter.

Organization of trauma care

A prerequisite for high quality trauma care in hospital emergency departments is the existence of a strategy for the planning, organization and provision of a national trauma system. There is considerable potential worldwide to upgrade arrangements for trauma care and improve training in trauma care at the primary health care level, in district hospitals, and in tertiary care hospitals.

The Essential Trauma Care Project, a collaborative effort between WHO and the International Society of Surgery, aims to improve the planning and organization of trauma care worldwide *(6)*. The project seeks to help individual counties in developing their own trauma services, to:

- define a core of essential injury treatment services;
- define the human and physical resources necessary to assure such services in the best possible way, given the particular economic and geographic settings;
- develop administrative mechanisms to promote these and related resources on a national and international basis, such mechanisms to include specific training programmes, programmes to improve quality, and hospital inspections.

While the goals of the Essential Trauma Care Project extend beyond the field of road safety, the success of the project can only be beneficial for crash-related trauma care.

BOX 5.4

Trauma team training for rural needs in Uganda

The trauma team training course in Uganda was jointly developed by the Injury Control Center in Kampala, and the Canadian Network for International Surgery, in response to the needs of rural hospitals in Uganda. The course is designed to create trauma teams that can function with personnel found in under-resourced health centres in Africa. The team normally consists of a clinical officer, an anaesthetic officer, an orthopaedic technician, a registered nurse and an aid. The course lasts three days and is delivered through lectures, skill stations and team exercises. The purpose of the lectures is to ensure that all team members have a common understanding of key issues in clinical trauma care, and of the importance of working together as a team. The skill stations assure that all participants can proficiently perform their role in the skills necessary for the initial care of the injured patient and the preparation of the patient for definitive care. At the end of the course, the institution gains a cohesive team. Since its inception in 1998, the trauma team training course has trained over 200 people from rural hospitals in Uganda, and plans are in place for its translation into Portuguese and Arabic for wider use in Africa.

Source: reference *1*.

Rehabilitation

For every person who dies in a road traffic crash, many more are left with permanent disabilities *(7)*. Rehabilitation services are an essential component of the comprehensive package of initial and post-hospital care of the injured. They help to minimize future functional disabilities and to restore the injured person to an active life within society. Most countries need to increase the capacity of their health-care systems to provide adequate rehabilitation to survivors of road traffic crashes.

High-quality treatment and interventions for rehabilitation in the period of hospitalization immediately following an injury are of utmost importance, in order to prevent life-threatening complications related to immobilization. However, despite the best management, many people still become disabled as a consequence of road traffic crashes. In low-income and middle-income countries, efforts should focus on capacity building and personnel training so as to improve the management of survivors of road traffic crashes in the acute phase, and thus minimise the development of permanent disability.

Medical rehabilitation services involve professionals from a range of disciplines. These include specialists in physical medicine and rehabilitation, as well as in other medical or paramedical fields, such as orthopaedics, neurosurgery and general surgery, physical and occupational therapy, prosthetics and orthotics, psychology, neuropsychology, speech therapy and nursing. In every case, the recovery of the patient's physical and mental health is paramount, as well as the patient's ability to become independent again and reintegrate into daily life.

Medical rehabilitation services also play a vital part in the independence and quality of life of people living with disabilities. Among other things, these services can provide mechanical aids that greatly assist affected individuals to be reintegrated into and participate in ordinary daily activities, including their work. Such aids, delivered through outpatient departments or outreach services to the home, are often essential in preventing further deterioration. In many countries, once acute management has been accomplished and mechanical aids provided, community-based rehabilitation remains the only realistic means of reintegrating the individual into society.

Activity

Task

Based on the information provided in this unit, prepare a brief summary on the status of the post-crash care system in your setting.

Expected results

This exercise is meant to help trainees conduct a rapid assessment of the post-crash care system in their settings. They can do this for the entire system or selected components.

Key points

- Society has to be prepared not only to prevent road traffic injuries but also to mitigate their consequences and enhance the quality of life of people who are injured.
- Essential elements in pre-hospital care include prompt communication, treatment and transport of injured people to formal health-care facilities.
- Existing clinics, hospitals and health services should be used to ensure efficient mobilization of health-care resources.
- Human resources, physical resources and organization are essential aspects in hospital settings.
- Rehabilitation services are an essential component of the comprehensive package of initial and post-hospital care of the injured.
- The three components of care – pre-hospital, hospital and rehabilitation – are interrelated and form a continuum of care.

Questions to think about

a) How adequately is your country or city prepared to respond to post-crash needs of persons injured in road traffic collisions?

b) How can you improve post-crash care in your country?

References

1. Sasser S et al. *Prehospital trauma care systems*. Geneva, World Health Organization, 2005.
2. Varghese M, Mohan P. *When someone is hurt ... a first aid guide for laypersons and community workers*. New Delhi, Transportation Research and Injury Prevention Programme, Indian Institute of Technology, Delhi, 1998.
3. Werner D. *Where there is no doctor*. Palo Alto, Hesperian Foundation, 1977.
4. Bunn F et al. *Effectiveness of pre-hospital trauma care*. On behalf of the WHO Pre-hospital Trauma Care Steering Committee. Cochrane Reviews, Chichester, UK: John Wiley & Sons, Ltd., 2001.
5. Sethi D et al. *Advanced trauma life support traing for ambulance crews*. On behalf of the WHO Pre-Hospital Trauma Care Steering Committee. The Cochrane Database of Systematic Reviews 2006, Issue 1. Chichester, UK, John Wiley & Sons, Ltd., 2006.
6. Mock C et al. *Guidelines for essential trauma care*. Geneva, World Health Organization, 2004.

Further reading

Peden M et al. *World report on road traffic injury prevention*. Geneva, World Health Organization, 2004.

Pan American Health Organization. *Establishing a mass casualty management system*. Washington, D.C., Pan American Health Organization and World Health Organization, 2001.

Notes

Trainee's evaluation of Unit 5: Delivering post-crash care

This form is to be completed by the trainee at the end of this unit to assess the content and approach used. This evaluation is helpful to the trainee, trainer and developer of this manual.

1. To what extent did you achieve the objectives set for this unit? (Please check once using "X" for each objective)

Objectives	Completely successful	Generally successful	Completely unsuccessful
Describe the main actions that need to be taken soon after a road traffic collision has occurred.			
Discuss the key resources and organization needed for hospital care.			
Discuss ways of providing rehabilitation services to injured persons.			
Examine the quality of post-crash care in your setting.			

2. What is your overall rating of the content presented in this unit? (Please check one using "X")

Scale	Excellent	Better than expected	Satisfactory	Below average
Rating				

3. How do you rate the balance between theoretical and practical content in this unit? (Please check one using "X")

Scale	Good balance	Too theoretical	Too practical
Rating			

4. a) Did you find the activities presented in the unit helpful? (Please check one)

Yes_____ No_____

b) If yes, in what ways were they helpful? What improvements do you suggest?

_____

_____

c) If no, what were the shortcomings? What suggestions do you have to make them helpful?

_____

_____

5. What did you like most about the unit?

6. What did you like least about the unit?

7. What did you learn most from this unit?

8. Explain how your organization, community, city and country, and other interested parties will benefit from your having read this unit.

9. What do you think should be added to this unit?

10. What do you think should be dropped from this unit?

UNIT 6

Multisectoral collaboration

Overview

The *World report on road traffic injury prevention* observes that the world faces a road safety crisis that has not been fully recognized *(1)*. It points out that international organizations, donor countries, governments and nongovernmental organizations have important roles to play in addressing this crisis and strengthening road safety around the world. The report strongly emphasizes the use of a systems approach to the global road safety crisis. This refers not only to academic analysis of the elements or systems that contribute to road traffic injuries, but also to the need for different sectors to work together. The report notes that road safety is a shared responsibility, and calls for multisectoral collaboration. The need for collaboration was further stressed in the World Health Assembly resolution WHA57.10 on road safety and health *(2)*, which recommends that WHO Member States should facilitate multisectoral collaboration between different ministries and sectors. This unit examines the role of multisectoral collaboration in road traffic injury prevention. It discusses the rationale for collaboration and outlines different forms and levels of collaboration for road traffic injury prevention.

Objectives

By the end of this unit, the trainee should be able to:

- explain why there is a need for multisectoral collaboration to prevent road traffic injuries;
- describe different forms of collaboration for road traffic injury prevention at international, national and local levels;
- discuss the roles that different institutions involved in road traffic injury prevention can play;
- discuss how to effectively use collaboration to strengthen efforts to prevent road traffic injuries in his or her own city, region and country.

Why collaborate?

The need for collaboration arises from the diverse nature of the problem of road traffic injuries. The problem has multiple determinants, affects many people and sectors, and requires action by different sectors. Many sectors are involved in road safety (Figure 6.1) and it is important for them to collaborate to try and influence the likely success of road safety initiatives that are undertaken at national, regional and international levels. The benefits of multisectoral collaboration are summarized in Box 6.1.

FIGURE 6.1

The key organizations and players influencing road safety policy

What kind of collaboration can be developed?

Different forms of collaboration can be developed. Collaboration can, for example, be organized around complementary issues at international, regional, national and local levels. The issues might be research, information sharing, implementation of interventions, policy development, advocacy, support to victims and their families, fund-raising and capacity development. Collaboration can also be formal or informal. We provide examples of these forms on the next pages.

BOX 6.1

What can collaboration in road safety deliver?

- increased access to resources
- more efficient use of resources
- enhancement of accountability
- development of innovations
- broadened awareness
- lasting relationships
- sustainable development of activities
- broad sharing of responsibility for different activities
- stronger ownership by stakeholders
- use of strengths of different partners
- sharing of knowledge and technology
- better balanced design of projects

Source: reference *3*.

International collaboration

The *World report on road traffic injury prevention* observes that although joint international road safety efforts had taken place in the past, there had been little coordinated planning between the agencies involved on a large scale *(1)*. No international lead agency took responsibility for ensuring that such coordinated planning was in place. The report calls for a change in this situation so that responsibility is clearly assigned, specific roles are allocated to specific agencies, duplication is avoided and a firm commitment is made to produce and implement a global plan for road safety. The United Nations General Assembly and World Health Assembly have responded to this challenge and there is now a growing United Nations Road Safety Collaboration (Box 6.2).

BOX 6.2

United Nations Road Safety Collaboration

Since the adoption in 2004 of United Nations General Assembly resolution 58/289 on Improving global road safety *(4)*, WHO has been actively involved in coordinating road safety within the United Nations system. The United Nations resolution invited WHO, in collaboration with the United Nations regional commissions, to coordinate road safety efforts among the United Nations agencies. Having accepted this mandate, WHO has facilitated the development of a group of United Nations and other international road safety organizations – now referred to as the "United Nations Road Safety Collaboration". As at February 2006, this group comprised over 40 agencies, including 11 United Nations entities. The number and range of participating organizations (governmental and nongovernmental organizations, donors, research agencies, and the private sector) from the transport, health, and safety sectors attest to the broad support for this collaborative effort. The group has articulated common objectives for its work, which include addressing the main risk factors identified in the *World report on road traffic injury prevention (1)*.

There are other kinds of international collaboration. For example, the Global Road Safety Partnership is a global partnership between business, civil society and governmental organizations collaborating to improve road safety conditions around the world. The Global Road Safety Partnership is one of four Business Partners for Development programmes initiated by the World Bank. Business Partners for Development is a project-based initiative that studies, supports and promotes strategic examples of partnerships for the development of communities around the world.

National multi-agency coordination

In many countries, responsibilities for road safety are spread over different levels of government. In most countries, road safety programmes have the following arrangements:

- Ministries of public works and associated agencies are responsible for provision and maintenance of roads.
- Ministries of transport are responsible for traffic laws and regulations, and for certification of vehicles and drivers. In some countries, some of these activities may be the responsibility of the police department.
- Ministries of the interior are responsible for the enactment of laws and their enforcement in traffic, and the education of drivers and the other road users.
- Ministries of education are responsible for road safety education.
- Ministries of health are responsible for emergency medical services, hospital treatment and rehabilitation of disabled people.
- Ministries of finance are responsible for the allocation of sufficient resources to the relevant agencies.

Though the government sector has a responsibility for promoting and ensuring road safety, it is essential that all the other players also be involved as partners in this activity, in order to increase the potential for better results. The development of multisectoral institutional capacity, both in the governmental and nongovernmental spheres, is key to developing road safety, and can only be delivered by a national political commitment. To get all organizations and individuals together, it is important to have mechanisms that make it possible for this to happen. A lead agency in government should be identified to guide the national road safety effort. This is discussed in Unit 7.

Activity

Task

Prepare a two-page summary on any form of multisectoral collaboration on road traffic injury prevention you know of in your country. In your summary, indicate the aim, objectives, activities, achievements and challenges faced.

Expected results

This exercise is intended to assist the trainees with assessing the role of collaboration on road traffic injury prevention. This should make them appreciate both the benefits and challenges of collaboration on road traffic injury prevention. They can describe collaboration on research, advocacy, an intervention and capacity building. The trainees can also work in groups of three to four persons so that they complement each other's knowledge.

Local community-based collaboration

People's potential for improving their own situation is enormous. The concept of community involvement in health and development has been promoted to counter strategies that fail to involve people in creatively thinking and contributing to finding solutions to problems that society faces. An avenue for community participation can be through the primary care programmes and training of community health workers, nongovernmental organizations, community-based organizations and other grassroots groups.

Road safety projects need to be supported and initiated by communities that live in different parts of a nation. The government and municipal bodies of a city or province can form an active association with all stakeholders, including nongovernmental organizations, researchers in universities, hospitals and policy-makers, to work on programmes for the

prevention of road traffic injuries. An example of an effort at securing the involvement of different sectors of the local community in injury prevention, including road traffic injuries, is the Safe Community Movement (Box 6.3). Another effort at collaboration that has mobilized members of the community for advocacy is provided by Mothers Against Drunk Drivers (Box 6.4).

BOX 6.3

Safe Community Movement

The Safe Community movement started in Sweden at the end of the 1980s, following the first World Conference on Accident and Injury Prevention, held in Stockholm, Sweden, in 1989. More than 500 delegates from 50 countries participated. A major premise of the meeting was that community-level programmes for injury prevention are key to reducing injuries. At the conclusion of the conference, a "Manifesto for Safe Communities" was issued, summarizing important principles for injury control. The Safe Community movement has been developed by the WHO Collaborating Centre on Community Safety Promotion at the Karolinska Institute in Sweden. A safe community can be a municipality, a county, a city, or a district of a city, working with safety promotion, and injury, violence and suicide prevention. The programme can cover all age groups, genders and areas. The movement recognizes that it is the people who live and work in a community who have a good understanding of their community's needs, problems, assets and capacities. The involvement and commitment of community members are important in identifying and mobilizing resources for effective, comprehensive and coordinated community-based action on injuries. To date, 83 communities have been designated as members of the Safe Community Network.

Source: reference *5.*

BOX 6.4

Mothers Against Drunk Drivers

The mission of Mothers Against Drunk Drivers is to stop drunk driving, support the victims of this violent crime, and prevent under-age drinking. The organization was founded in May 1980, in California, United Sates of America, by Candy Lightner after her 13 year old daughter was hit by a drunk driver, who happened to be a repeat offender. Chapters were quickly started across the United States in the early 1980s. Mothers Against Drunk Drivers is today one of the key road safety advocacy groups in the United States, as well as in other countries such as Australia, Canada, New Zealand, and the United Kingdom.

In the 1980s, Mothers Against Drunk Drivers popularized the concept of "designated drivers." Today, it is a household term, and bars and restaurants nationwide ask patrons to "designate a driver". Grassroots activism by Mothers Against Drunk Drivers has resulted in the passage of a number of federal and state anti-drunk driving laws in the United States. The organization's most well-known legislative campaign accomplishment came in 1984 when a United States federal law required all states to increase the legal drinking age to 21 or else lose highway funding. In the mid-1980s, Mothers Against Drunk Drivers launched an anti-impaired driving campaign and also undertook a legislative agenda that focused on administrative licence revocation, open container laws, a maximum blood alcohol content of 0.08%, a victim's bill of rights, compensation for victims of crime, and several other measures.

Source: reference *6.*

Research collaboration

There are gaps in knowledge on road traffic injuries that need to be addressed through research. Research collaboration can take a number of forms, for example:

- providing a mechanism of sharing knowledge and experience among researchers and institutes in a country;
- establishing a form of sharing information on the funding of research projects by donors;
- bringing together researchers and institutions in different countries in a networking arrangement.

Research collaboration can play an important role in sharing knowledge, experience, expertise and resources. It can reduce unnecessary duplication of efforts. Two examples of research collaboration in road traffic injuries are the Injury Prevention Initiative for Africa (Box 6.5) and the Road Traffic Injuries Research Network (Box 6.6).

Key points

- The need for collaboration arises from the diverse nature of the problem of road traffic injuries. The problem has multiple determinants, affects many people and sectors, and requires action by different sectors.
- Multisectoral collaboration has benefits such as increasing access to resources, sharing responsibilities and strengthening ownership of activities by stakeholders.
- Collaboration on road safety needs to be organized around complementary issues at international, regional, national and local levels.

Definitions of key concepts

- Partnership: collaboration between two or more persons and groups who agree to pool talent and resources, and share benefits. The partnership may be formal or informal. In some cases, a contract or agreement is signed.
- Network: an interconnected system of people and groups collaborating on an issue. Like partnership, the network may be formal or informal, and may involve signing a contract or an agreement.

BOX 6.5

Injury Prevention Initiative for Africa

The Injury Prevention Initiative for Africa is a nongovernmental organization that was established in 1997 to promote safety and injury research in Africa. It does this by:

- conducting research on epidemiology and control of all types of injuries;
- developing and conducting training programmes in injury epidemiology, surveillance, prevention and acute care;
- promoting advocacy for the prevention and control of injury;
- facilitating the exchange of knowledge on injuries in Africa;
- providing liaison between African and international stakeholders in injury control.

The current membership of this Initiative comprises individuals from 14 African countries: Egypt, Eritrea, Ethiopia, Ghana, Kenya, Mauritius, Mozambique, Nigeria, Rwanda, South Africa, Uganda, United Republic of Tanzania, Zambia, and Zimbabwe. The Injury Prevention Initiative for Africa is supported mainly by funding from WHO and the Canadian Network of Surgeons International.

Source: reference 7.

BOX 6.6

Road Traffic Injuries Research Network

The Road Traffic Injuries Research Network is a partnership of individuals and institutions – government, academic, and nongovernmental – that collaborate to further research on the impact, causes and strategies for the prevention of road traffic injuries in low-income and middle-income countries. The Road Traffic Injuries Research Network evolved from work done to address the "10/90 disequilibrium" (that is, of the estimated 100 billion US dollars spent on health research annually, less than 10% is spent on addressing the health problems relevant to 90% of the world's population), and from the recognition that the neglect of research on road traffic injuries in low-income and middle-income countries significantly contributes to this disequilibrium. Collaborating partners meet to exchange ideas and develop a research agenda on road traffic injuries. This network is contributing to developing capacity for road traffic injury research in low-income and middle-income countries by providing mentorship, information, research grants and guidance to researchers in these countries. The Road Traffic Injuries Research Network is supported by the Global Forum for Health Research, the World Bank, the George Institute for International Health, Australia, and WHO.

Source: reference *8*.

Questions to think about

a) Based on your work experience, describe a collaboration project that you have participated in. What were the main objectives of the project? How many people were involved, and what were their work and training backgrounds? Were the project objectives achieved? If they were, explain the role played by each member of the project.

b) Discuss the roles of the different sectors involved in road traffic injury prevention in your country. How well do these sectors collaborate in your country? What areas of collaboration need to be improved? What improvements do you recommend?

c) Identify and discuss the challenges that professionals with an interest in international collaboration on preventing road traffic injuries face. How can these challenges be addressed?

References

1. Peden M. et al. *World report on road traffic injury prevention*. Geneva, World Health Organization, 2004.
2. Resolution WHA57.10. Road safety and health. In: Fifty-seventh World Health Assembly, Geneva, 22 May 2004.
3. Silcock D. Strategies for action. In: FIA Foundation for the Automobile and Society. Sharing Responsibility for Safer Roads: Conference Proceedings, 2003:56–61.
4. *United Nations General Assembly resolution A/58/289 on Improving global road safety* (11 May 2004). New York, NY, United Nations (http://www.who.int/violence_injury_prevention/media/news/en/unga_58_289_en.pdf, accessed 1 February 2006).
5. Rahim Y. Safe community in different settings. *International Journal of Injury and Safety Promotion*, 2005, 12(2):105–112.
6. Mothers Against Drunk Drivers, *MADD history, Mothers Against Drunk Drivers* (http://www.madd.org/aboutus/1122, accessed 1 February 2006).
7. Injury Prevention Initiative for Africa (http://www.iccu.or.ug/partners/ipifa.php, accessed 1 February 2006).
8. Road Traffic Injuries Research Network (http://www.rtirn.net/, accessed 1 February 2006).

Further reading

Costello A, Zumla A. Moving to research partnerships in developing countries. *British Medical Journal*, 2002, 321:827-829.

Drager N, McClintock E, Moffitt M. *Negotiating health development: a guide for practitioners*. Cambridge, MA, and Geneva, Conflict Management Group and World Health Organization, 2000.

Notes

Trainee's evaluation of Unit 6: Multisectoral collaboration to prevent road traffic injuries

This form is to be completed by the trainee at the end of this unit to assess the content and approach used. This evaluation is helpful to the trainee, trainer and developer of this manual.

1. To what extent did you achieve the objectives set for this unit? (Please check once using "X" for each objective)

Objectives	Completely successful	Generally successful	Completely unsuccessful
Explain why there is a need for multisectoral collaboration to prevent road traffic injuries.			
Describe different forms of collaboration for road traffic injury prevention at international, national and local levels.			
Discuss the roles that different institutions involved in road traffic injury prevention can play.			
Discuss how to effectively use collaboration to strengthen efforts to prevent road traffic injuries in his or her own city, region and country.			

2. What is your overall rating of the content presented in this unit? (Please check one using "X")

Scale	Excellent	Better than expected	Satisfactory	Below average
Rating				

3. How do you rate the balance between theoretical and practical content in this unit? (Please check one using "X")

Scale	Good balance	Too theoretical	Too practical
Rating			

4. a) Did you find the activities presented in the unit helpful? (Please check one)

   Yes_____ No_____

b) If yes, in what ways were they helpful? What improvements do you suggest?

_____

_____

c) If no, what were the shortcomings? What suggestions do you have to make them helpful?

5. What did you like most about the unit?

6. What did you like least about the unit?

7. What did you learn most from this unit?

8. Explain how your organization, community, city and country, and other interested parties will benefit from your having read this unit.

9. What do you think should be added to this unit?

10. What do you think should be dropped from this unit?

UNIT 7

Formulating and implementing road safety policy

Overview

Formulating and implementing policies is necessary for improving road safety. Policies will have no effect on road safety unless they are implemented. This unit examines the importance of road safety policy, and then describes the basic steps and issues to consider in formulating and implementing road safety policy.

Objectives

By the end of this unit, the trainee should able to:

- explain the importance of developing policies for road traffic injury prevention;
- describe the process of developing a policy for road traffic injury prevention;
- discuss the role of a national lead agency in developing and implementing policies for road traffic injury prevention.

Importance of policy in preventing road traffic injuries

The term policy can be interpreted in a variety of ways. Here we consider a national policy on road safety to be a written document that provides the basis for action to be taken jointly by the government and its nongovernmental partners *(1)*.

A policy is necessary to *(1, 2)* :

- raise awareness and create mutual understanding about a situation;
- articulate ethical and other principles that should justify and guide action;
- generate a consensus vision on the actions to be undertaken;
- provide a framework for action;
- define institutional responsibilities and mechanisms of coordination;
- secure or raise political commitment;
- engage a variety of partners;
- identify measures which are likely to produce good results;
- monitor progress and effectiveness of strategies.

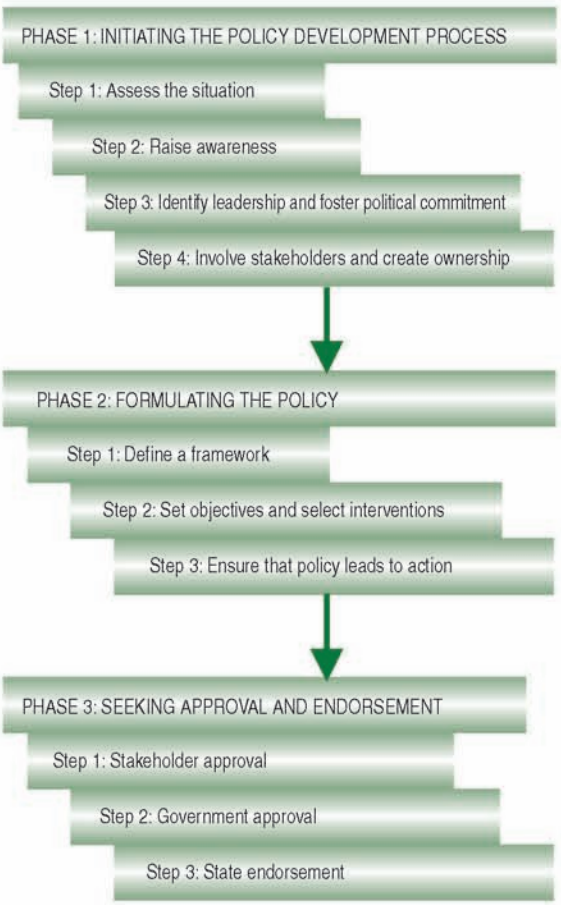
Policy formulation process

Policy formulation and implementation is a continuous process. This process is often presented as taking place in phases or stages, in order to make it easier to identify key elements. However, it should be noted that this process is complex and it does not necessarily move in a smooth manner from one step to another.

For the sake of systematic presentation and clarification of key issues, we present the process of developing a national policy as taking place in three phases (Figure 7.1). In Phase 1 the policy development process is being initiated. In Phase 2 the policy document itself is being formulated.

FIGURE 7.1

The three phases of the policy development process



Source: reference *1*.

Finally, in Phase 3 official approval and endorsement of the policy is being sought. Each of the three phases is composed of a number of steps.

Important points to note about the process presented in Figure 7.1 are as follows:

- In real life, a policy development process can be much more chaotic than the best-case scenario portrayed here. It may be necessary to jump ahead and come back to a step that ideally should have happened earlier on in the process.
- This process is influenced by social, economic and political factors.
- Political will and commitment are necessary for effective policy formulation and implementation.
- The process takes time, consultation, negotiation and effort.
- Ensure that key stakeholders are involved in the entire process.
- Consultation should be conducted with all stakeholders in an open, fair and transparent manner.
- Ensure that all the stakeholders approve and endorse the policy document.
- The very act of developing a policy document can bring about significant changes in attitudes and perceptions that can go a long way towards tackling a problem.
- Implementation of policy is essential once a policy has been formulated.
- Implementation of road safety measures requires coordinated action. Responsibilities at different levels need to be clearly spelled out.
- Financial and human resources need to be provided for implementation.
- Evaluating policy implementation is necessary. Evaluation provides feedback on how well the policy is working and can lead to improvement of the policy itself.

Institutional framework

Road safety work is a complex process involving different sectors. There is thus a need for a functional and effective institutional framework for the development and implementation of policies and programmes to prevent road traffic injuries.

Activity

Task

Is there a national road safety policy and action plan in your country? If your answer is yes, prepare a one-page summary of the aims, targets and activities that have been implemented. What are the strengths in the policy and plan? What are the weaknesses in the policy and plan? If there is no policy, what steps do you plan to take to initiate the process of developing a national road safety policy or action plan?

Expected results

This exercise is meant to assist trainees with reviewing their national road safety policy and action plan. If possible, the trainees should be given this question in advance of the training session so that they have time to gather the relevant information. If this is not possible, allow them answer based on their previous knowledge and experience. This exercise is meant to get trainees to think much more deeply about the road safety policies and action plans in their countries, and especially about whether or not these policies and plans are being implemented.

The need for a lead agency

Though different institutional frameworks are possible, there is a need to identify a lead agency in government to guide the national road safety effort. The lead agency should have authority and responsibility to make decisions, control resources and coordinate efforts by all sectors of government – including those of health, transport, education and the police. This agency should have adequate finances to use for road safety, and should be publicly accountable for its actions.

Different models can be effective in road safety and each country needs to create a lead agency appropriate to its own circumstances. Specific efforts should be taken by the agency to engage all significant groups concerned with road safety. The national road safety agency should be an

independent statutory organization attached to, or functioning in parallel with the ministry dealing with road transport, and it should be independent of the road building agency. The road safety agency should have a chairman of the rank of a minister or principal secretary to the government of the country. Awareness, communication and collaboration are key to establishing and sustaining national road safety efforts. National efforts will be boosted if one or more well-known political leaders can actively champion the cause of road safety.

The specific tasks of a national lead agency are to *(1)*:

- manage, coordinate and commission all activities regarding road safety in the country;
- advise all arms of the government on all matters relating to road safety;
- formulate policy, set goals and elaborate strategies for road safety in the country, including the targeting of particular areas and the setting of priorities;
- coordinate between different agencies of the government, research and academic institutions, and nongovernmental organizations;
- compile and analyse national statistics, and ensure that comprehensive data exist for road safety planning;
- set road safety research priorities and fund projects in those priority areas;
- assemble and disseminate information and good practice, including sharing research findings, good practice models and experiences with various agencies involved in road transport and safety planning;
- establish and fund research and teaching institutions and centres specifically for work on road safety or transport and related issues;
- establish safety standards for roads, road infrastructure and vehicles;
- monitor and evaluate the effectiveness of the road safety strategies at the central and local levels;
- encourage and enable local governments to set up relevant institutional structures;
- organize regular national conferences on road safety;
- procure sufficient finance for road safety work;
- coordinate the planning and implementation of road safety work, taking into consideration the interests of society, user groups, trade and industry, and individuals, as well as environmental aspects.

Sub-national and local institutions

While the national lead agency coordinates the road safety effort for the entire country, it may also be necessary to have sub-national institutional structures to translate and implement policy at the local level. Formal systems need to be set up in each state or province, and in each city to coordinate local efforts. Operational intersectoral programmes can be designed and implemented every year. These plans and interventions take into account national priorities as well as the local needs identified through the involvement of local actors.

There could be a road safety agency in every state or province. The form and structure of such agencies would vary from country to country because of wide differences in administrative and financial structures at the sub-national level. The provincial agency, which sets policy for road safety in the province, can involve officials from concerned departments, as well as representatives of nongovernmental organizations and businesses concerned with the road transport sector. The actors involved could include departments of roads, transport, police, education and health, along with experts from academic and other research institutions.

The provincial agency would take a leading role in coordinating the road safety effort of all relevant agencies and community groups within its particular administrative area. These activities should be consistent with the national road safety plan, and the provincial agency should coordinate activities across all relevant agencies in that administrative area.

Key points

- Policy formulation and implementation is a continuous process.
- This process is often presented as taking place in phases or stages, to make it easier to identify key elements, but the process is complex and does not necessarily move in a smooth manner from one step to another.
- There is a need for a functional and effective institutional framework for development and implementation of policies and programmes to prevent road traffic injuries.
- There is a need to identify a lead agency in government to guide the national road safety effort. The national lead agency coordinates the road safety effort for the entire country.
- It is necessary to have sub-national institutional structures to translate and implement policy, and coordinate activities across all relevant agencies at the local level.

Definitions of key concepts

- Policy: a set of principles guiding decision-making, providing a framework against which proposals or activities can be tested or measured *(1)*.
- Strategy: addresses the "how" of a national policy by defining the main directions and actions to achieve policy objectives.
- Action plan: defines (more precisely than a strategy) the specific activities, resources and time frame needed to achieve policy objectives, and provides guidance on how to implement, monitor and evaluate activities.
- Institution: formal or informal system of rules, structures and constraints that guide and shape human interaction *(3)*.

Questions to think about

a) What is the relationship between policy and legislation?

b) Is there a functional institutional framework for road traffic injury prevention in the sub-national administrative units in your country? What do you identify as the strengths and weaknesses in the existing framework? What practical steps do you propose to take to address the weaknesses you have identified?

References

1. Schopper D, Lormand JD, Waxweiler R. *Developing policies to prevent injuries and violence: guidelines for policy-makers and planners*. Geneva, World Health Organization, 2006.
2. Foster M et al. Making policy. In: McClure R, Stevenson M, McEvoy S, eds. *The scientific basis of injury prevention and control*. Melbourne, IP Communications, 2004: 267–282.
3. North D. *Institutions, institutional change and economic performance*. Cambridge, Cambridge University Press, 1990.

Further reading

Drager N, McClintock E, Moffitt M. *Negotiating health development: a guide for practitioners*. Cambridge, MA, and Geneva, Conflict Management Group and World Health Organization, 2000.

Peden M et al. *World report on road traffic injury prevention*. Geneva, World Health Organization, 2004.

Notes

Trainee's evaluation of Unit 7: Formulating and implementing road safety policy

This form is to be completed by the trainee at the end of this unit to assess the content and approach used. This evaluation is helpful to the trainee, trainer and developer of this manual.

1. To what extent did you achieve the objectives set for this unit? (Please check once using "X" for each objective)

Objectives	Completely successful	Generally successful	Completely unsuccessful
Explain the importance of developing policies for road traffic injury prevention.			
Describe the process of developing a policy for road traffic injury prevention.			
Discuss the role of a national lead agency in developing and implementing policies for road traffic injury prevention.			

2. What is your overall rating of the content presented in this unit? (Please check one using "X")

Scale	Excellent	Better than expected	Satisfactory	Below average
Rating				

3. How do you rate the balance between theoretical and practical content in this unit? (Please check one using "X")

Scale	Good balance	Too theoretical	Too practical
Rating			

4. a) Did you find the activities presented in the unit helpful? (Please check one)

   Yes_____ No_____

b) If yes, in what ways were they helpful? What improvements do you suggest?

_____

_____

c) If no, what were the shortcomings? What suggestions do you have to make them helpful?

_____

_____

5. What did you like most about the unit?

6. What did you like least about the unit?

7. What did you learn most from this unit?

8. Explain how your organization, community, city and country, and other interested parties will benefit from your having read this unit.

9. What do you think should be added to this unit?

10. What do you think should be dropped from this unit?

Appendix

Trainer's evaluation of the manual

Trainer's name:

Training location (district, town, city, country):

Trainer's experience in road safety training (in years):

---

1. Please tick the appropriate box regarding the units that you have taught.

Unit taught	Number of trainees
Magnitude and impact of road traffic injuries	
Risk factors for road traffic injuries	
Importance of evidence as a foundation for prevention	
Implementing specific interventions to prevent road traffic injuries	
Delivering post-crash care	
Multisectoral collaboration	
Formulating and implementing road safety policy	

2. Please assess each of the units you have taught as regards their relevance to the needs of trainees, using a scale from 1 to 3, with 1 being the most relevant and 3 the least relevant. Please briefly explain why you have given each score.

Please tick the appropriate box regarding the units that you have taught.

Unit taught	Score	Explanation
Magnitude and impact of road traffic injuries		
Risk factors for road traffic injuries		
Importance of evidence as a foundation for prevention		
Implementing specific interventions to prevent road traffic injuries		
Delivering post-crash care		
Multisectoral collaboration		
Formulating and implementing road safety policy		

3. Please help WHO to improve the manual by answering the following questions, indicating any comments or suggestions that you might have regarding the course. Please be as specific as you can.

a) Are there any additional topics that you would suggest?

Tick as appropriate: Yes No

If you answered yes, please specify:

b) Are there any topics or entire units that you would recommend to be merged?

Tick as appropriate: Yes No

If you answered yes, please specify:

c) Do you think any units need to be split into more than one?

Tick as appropriate: Yes No

If you answered yes, please specify which units.

d) Are there any topics or entire units that you would recommend to be excluded?

Tick as appropriate: Yes No

If you answered yes, please specify:

4. a) Which of the suggested participatory learning activities did you use most? Please specify:

b) What additional participatory learning activities would you like to see included? Please specify:

c) In what ways did you make the content relevant to the local context. Please specify, if possible by giving examples:

5. In general, which aspects of the units do you believe are most in need of improvement (overview, objectives, content, learning activities, definitions of key concepts, questions to think about, references and further reading). Please suggest specific improvements.

Selected WHO publications

http://www.who.int/violence_injury_prevention/services/en/

http://www.who.int/violence_injury_prevention/services/en/

http://www.who.int/violence_injury_prevention/policy/project/en/index.html

Road traffic collisions kill about 1.2 million people around the world every year but they are largely neglected as a health and development issue, perhaps because they are still viewed by many as being beyond human control. Efforts to prevent road traffic injuries are hampered by a lack of human capacity. Policy-makers, researchers and practitioners need information on effective prevention measures, and on how to develop, implement and evaluate such interventions. There is a need to train more specialists in road traffic injury prevention, in order to address the growing problem of road traffic injuries at international and national levels.

This manual provides guidance to professionals working on road traffic injury prevention. It is designed for a multidisciplinary audience, including medical doctors, nurses, transport and road engineers, vehicle safety professionals, law enforcers, policy-makers, trainers, and social scientists, who will contribute towards strengthening capacity to implement measures to prevent road traffic injuries in different settings around the world. The manual covers the fundamental aspects of road traffic injury prevention:

- magnitude and impact of road traffic injuries;
- risk factors for road traffic injuries;
- importance of evidence as a foundation for prevention;
- implementing specific interventions to prevent road traffic injuries;
- delivering post-crash care;
- multisectoral collaboration;
- formulating and implementing road safety policy.

ISBN 92 4 154675 1