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Injury prevention and safety promotion in rural communities

Contribution of community health workers and an injury data registry
system in Iran

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ABSTRACT

Injuries affecting people from the rural populations of middle-income countries are poorly documented and so are people health care seeking behaviour and their views and concern about injury prevention. The aim of this thesis, based on studies conducted in rural areas of the Twiserkan district (Iran) is to increase knowledge about injury epidemiology and the potential contribution of community health workers to the control and prevention of injuries.

A retrospective interview-based study including the victims of all unintentional injuries leading to hospitalization or death that had occurred within a twelve month period was first conducted (134 injuries from 117 households). Both injury circumstances and opinions about potential means of prevention were documented. A community-based household survey was also conducted on a cluster sample of 759 households so as to assess the frequency of occurrence of injuries of various severity levels, determine people injury-related healthcare seeking behaviour, and people's views about possible prevention measures. Thereafter, all community health workers (known as Behvarzes) from the district (over 100) were enrolled in a prospective six-month injury registration project during which they conducted injury analysis, proposed preventive measures, and identified their implementation barriers. These studies showed the injury incidence rates in the rural community of Twiserkan varied – and decreased with – severity level. Road traffic injuries (RTIs) were the most important injury mechanism, and motorcycle, the most common mode of transportation of the victims. Most people with severe injuries and nearly half of those with moderate ones went first to the hospital; all those with minor injuries sought care initially at the local health house. Common suggestions made by injured and non-injured people for prevention were engineering changes (under the responsibility of the authorities), safety education (responsibility of the Behvarzes), and safe behaviour/practice together with better cooperation (by citizens). Behvarzes emphasized the adoption of safe behaviour/practice as an important means for RTI prevention, with a focus on motorcycle helmet use and compliance with traffic rules. They also raised the need for engineering, law enforcement, and education. They saw their own contribution as being health and safety educators and promoters.

A complementary study on the injury data registry system in place as perceived by various stakeholders from the national, provincial, and district levels indicated the system is acceptable for Behvarzes to work with and a useful tool for them to use for educational purposes in the local community. The most important facilitator of the system agreed upon was the fact that Behvarzes come from the area. The Behvarzes' high workload is regarded as a potential barrier for them to their commitment in the system and their health services to the people.

In conclusion, injuries in general and RTIs in particular are important health problems in the rural areas. Behvarzes can play an important role in injury surveillance and in identifying context-relevant means of prevention that they or other actors may then implement.

Keywords: Road traffic injuries; Injury healthcare-seeking; Community health worker; Behvarz; Injury prevention; Data registration system; Middle-income countries; Iran

LIST OF PUBLICATIONS

This thesis is based on the following original articles:

- I. Rezapur-Shahkolai F, Naghavi M, Shokouhi M, Laflamme L Unintentional injuries in the rural population of Twiserkan, Iran. A cross-sectional study on their incidence, characteristics and preventability. *BMC Public Health* 2008, 8:269
- II. Rezapur-Shahkolaia F, Naghavid, M, Vaez M, Shokouhi M, Laflamme L. Injury incidence, healthcare consumption and avenues for prevention: A household survey on injury in rural Twiserkan, Iran. *Public Health* (2009), *in press*, doi:10.1016/j.puhe.2009.03.010
- III. Rezapur-Shahkolai F, Shokouhi M, Naghavi M, Laflamme L The prevention and control of road traffic injuries in rural communities: Input from community health workers in rural Twiserkan, Iran. *Submitted*
- IV. Rezapur-Shahkolai F, Naghavi M, Shokouhi M, Nikniaz A, Laflamme L. Health system contribution to injury surveillance in rural Iran. Community health workers' and health authorities' views and concerns. *Manuscript*

The articles will be referred to in the text by their Roman numerals (I-IV).

CONTENTS

BACKGROUND	1
RURAL INJURIES	1
RURAL INJURY PREVENTION.....	2
INJURY SURVEILLANCE.....	3
IRAN	4
<i>Iran in general.....</i>	<i>4</i>
<i>The primary health care system in Iran.....</i>	<i>4</i>
<i>The primary health care in rural areas</i>	<i>6</i>
<i>The inclusion of injuries in the data registry system in rural areas</i>	<i>7</i>
UNANSWERED QUESTIONS	8
MAIN AIM AND OBJECTIVES.....	9
(I) INJURY OCCURRENCE.....	9
(C) COUNTERMEASURES FOR INJURY PREVENTION	9
(S) CONTRIBUTION OF INJURY DATA REGISTRY SYSTEM TO INJURY SURVEILLANCE	9
MATERIALS AND METHODS	10
STUDY SETTING.....	10
DESCRIPTION OF THE STUDIES.....	11
<i>Study I – Injury study.....</i>	<i>13</i>
<i>Study II – Community-based household survey.....</i>	<i>14</i>
<i>Study III – Behvarzes follow-up</i>	<i>16</i>
<i>Study IV – Stakeholders interview</i>	<i>18</i>
RESULTS	21
INJURY OCCURRENCE	21
<i>Frequency and distribution of injuries</i>	<i>21</i>
<i>Main characteristics of injuries</i>	<i>22</i>
<i>Injury-related healthcare-seeking behaviours.....</i>	<i>22</i>
COUNTERMEASURES FOR INJURY PREVENTION	22
<i>Views and suggestions of people (injured or not) and Behvarzes</i>	<i>22</i>
<i>Views and suggestions of Behvarzes following the occurrence of specific road traffic injuries</i>	<i>24</i>
<i>Barriers to the implementation of preventive measures.....</i>	<i>25</i>
CONTRIBUTION OF INJURY DATA REGISTRY SYSTEM TO INJURY SURVEILLANCE.....	25
<i>Acceptability of the system for Behvarzes.....</i>	<i>25</i>
<i>Potential of the system for the achievement of different outcomes</i>	<i>26</i>
DISCUSSION	29
INJURY OCCURRENCE.....	29
<i>Main findings.....</i>	<i>29</i>
<i>Strengths and limitations.....</i>	<i>30</i>

COUNTERMEASURES FOR INJURY PREVENTION	31
<i>Summary of the injuries sustained in the district</i>	31
<i>Main findings</i>	32
<i>Strengths and limitations</i>	35
CONTRIBUTION OF DATA REGISTRY SYSTEM TO INJURY SURVEILLANCE.....	37
<i>Main findings</i>	37
<i>Strengths and limitations</i>	38
CONCLUSION	40
INJURY OCCURRENCE	40
COUNTERMEASURE FOR INJURY PREVENTION	40
RURAL HEALTH SYSTEM CONTRIBUTION IN INJURY SURVEILLANCE	41
ACKNOWLEDGEMENTS	42
REFERENCES.....	44
APPENDIX	51

LIST OF ABBREVIATIONS

CI	Confidence Interval
LICs	Low-Income Countries
LMICs	Low-and Middle-Income Countries
MICs	Middle-Income Countries
PI	Principal Investigator
PHC	Primary Health Care
RTIs	Road Traffic Injuries
WHO	World Health Organization

BACKGROUND

Rural injuries

Injuries are an important public health problem worldwide¹⁻⁴ and they constitute one of the major causes of death among people under 45 years.^{1,2} Males are typically – but not consistently – more at risk considering all causes aggregated as well as specific causes. In 2000, the World Health Organization (WHO) estimated that they accounted for 9% of the global mortality and 12% of the global burden of disease.²

The majority of all injury-related deaths occur in low- and middle-income countries (LMICs), where they most often receive little attention.¹⁻⁶ Epidemiological studies are conducted in some countries on a regional basis but focus is most often placed on road traffic injuries (RTIs) and on those occurring in urban settings.⁷⁻¹⁰ This is not surprising however as RTIs are a major – and increasing – cause of death and disability worldwide.¹⁻⁶

For LMICs, injuries affecting people in rural areas are nonetheless an important preoccupation since this where a considerable proportion of the population live. This is also reflected in studies from, for instance, Pakistan^{11,12} Bangladesh¹³⁻¹⁵, India¹⁶, Vietnam¹⁷⁻¹⁹, Kenya²⁰, Ghana²¹, Uganda²² and Tanzania²³, Nigeria²⁴ and Nicaragua.²⁵⁻²⁷ The results of a nationally representative household survey on the incidence, patterns and severity of unintentional injuries among persons five years and older in Pakistan,¹¹ showed that the estimated incidence rate of injuries was higher in urban areas rather than rural areas. Also the injuries were frequently sustained through falls and occurred most often at home or in the road traffic environment. Even in Bangladesh,¹³⁻¹⁵ falls and cutting injuries were frequent mechanisms of nonfatal injuries and children and older people experienced higher injury rates than others; injuries occurred in and outside the home and at work. All severe cases were treated at a hospital. In rural Vietnam¹⁷ it was observed that males were injured at 1.6 times the rate of females, and home and road traffic injuries were most common. In Uganda²¹ the leading causes of death were drowning in rural areas and road traffic in urban ones. In Tanzania²³ the overall incidence of injuries was higher in rural rather than urban areas. Indeed, rural residents were more likely to experience injuries due to falls and cuts but had a lower risk of transport injuries. A study in rural areas of Nigeria²⁴ showed injuries were higher among males and that falls and traffic related injuries were the two joint-leading causes of injuries. In Nicaragua²⁵ it was observed that the total incidence rates of injuries were similar in rural and urban areas, but the incidence in urban males was higher than in females, while the opposite was observed in rural areas.

In fact, whereas injuries affect not only the total population but also the urban one of both low- and middle-income countries, most studies conducted in rural areas are from low-income countries (LICs)¹¹⁻²⁴ rather than middle-income countries (MICs)²⁵⁻²⁷.

As injuries are highly preventable,^{6,28,32} data on their occurrence, distribution and characteristics are essential for context relevant counter-measures and conditions of

implementation to be determined. Also, the available data, including those gathered by healthcare services, ought to be assessed.^{6,9,10, 14,26,32-36}

Iran, a middle-income country, and the setting for this research project on rural injuries, is also a country severely afflicted by injuries. Injury-related years of life lost are higher than for the world average³⁷⁻³⁸ in particular due to RTIs^{4,36-47} their rates being among the highest in the world.^{4,38}

During the past decade, studies on the associated mortality, morbidity and epidemiology of various causes of injuries have been conducted, often on a regional basis,^{45,55} and cause specific mortality and morbidity data are available at the national level.^{38-44,56-58} Those studies are predominantly urban. Those concerned with rural injuries indicate RTIs are a threat even there.^{39,42}

The data at hand have been generated through facility- or register-based studies and population-based household surveys are uncommon. Also, neither the injury-related healthcare-seeking behaviours of the population nor its views regarding injury prevention and control have been researched, something that could help in determining targets for prevention and context-relevant counter-measures.

Rural injury prevention

Inspired by the pioneer conceptual work of Haddon,⁵⁹⁻⁶¹ the public health approach to injury epidemiology and prevention distinguishes three phases in the injury process – each paralleling one phase of the disease process. “*Pre-crash*” is the phase where relatively stable and “causative” attributes of the host, environment or vehicle interplay. Prevention at this phase deals with the reduction or control of those causative factors and includes reducing the number of risk factors and environmental exposures. “*Crash*” is the “early detection and treatment” phase where an injurious transfer of energy occurs and where prevention aims to minimize the effect on the victim of the energy transfer. “*Post-crash*” is where appropriate supportive and rehabilitation services need to be provided to minimize mortality and long-lasting morbidity and maximize quality of life.

Haddon has also proposed a Matrix which incorporates not only the three phases of the injury process but the components involved, i.e., the host, agent, and environment. On the basis of this framework, Haddon has proposed ten alternative strategies for injury prevention⁶¹: eliminate the hazard, separate the hazard, isolate the hazard, modify the hazard, equip, train and instruct, warn, supervise, rescue, repair and rehabilitate.

Additional concepts of interest are the distinction between “active” and “passive” prevention.⁶⁰ In active prevention people make an active decision to follow a safety procedure or utilize a device (e.g., seatbelt or helmet) whereas passive prevention is usually integrated or built into the vehicle, for instance, or situation.

For its part the safety promotion approach parallels the health promotion one in that it encompasses motivational efforts at the community or societal levels, aiming at

prevention as an end result^{30,32,62} In community-based health and safety interventions, the focus is expected to shift from individual responsibility (alone) to a multi-faceted and cross-sectoral and collaborative community approach^{32,62}. For health and safety to be promoted, in each community, there is a need to consider the different cultures and conditions (e.g., socio-economic and health care policy and practice) and to make use of the stakeholders' capacity and skills, including those of laypeople.^{28,32,62,63}

In a given country, interventions can be conducted not only locally but also nationally and regionally. In all instances, multi-sectoral efforts are likely to be required (WHO).⁶ Despite universal guidelines and identified "best practice" or evidence-based measures for prevention, injury control and prevention will often require contextualization.^{28,32,62}

Also the identification of barriers to prevention activities can be a prerequisite^{32,64,65}

The above was taken into account in the development of the research work conducted in rural Iran, where injury epidemiology was studied but were also the opinions and suggestions from both laypeople and community health workers were gathered in order to document what they regarded as potential avenues for prevention (see below).

Injury surveillance

The prevention and control of injuries as well as the follow-up of tailored interventions require that relevant and accurate data be continuously gathered and disseminated,^{6,9,10,14,26,32-36} which is the purpose of public health surveillance.³²⁻³⁵ A surveillance system can be very simple or highly developed, depending on the purpose of its implementation and the aims of those who need it³. Surveillance differs from epidemiological research in that it is ongoing, limiting data collection to a minimum, used for different purposes such as the identification of problems or cases for epidemiologic studies or the tailoring and follow-up of intervention-programs.³²⁻³⁵

Surveillance is the best way to monitor trends, detect emerging problems, identify interventions and determine their results in a timely manner.³²⁻³⁵ Accurate data is an essential attribute of surveillance. Qualitative criteria of importance are simplicity, flexibility, and acceptability of the system.³²⁻³⁵

Data sources can vary from one country to another, depending on, for example, the stage of development of the country, health situation, facilities and other related factors. Hospital based data may only reveal the "tip of iceberg"³² due to under-reporting. This problem can be dealt with by integrating data collection into the health network, which is the approach adopted in Iran (see below). The better the coverage of the health care system, the more representative the information gathered through it.

There are several well-known injury surveillance systems in high income countries but in LMICs there is still limited injury surveillance.

Iran

Iran in general

The Islamic Republic of Iran (see Figure 4), with a population of 73 million inhabitants (2008), covers an area of 1,648,000 square kilometres and is located in Middle East and in Asia.^{66,67} It has 30 provinces, 336 districts, 1012 cities and approximately 64 000 villages⁶⁸. Iran is a middle-income country with a GDP per capita of 10,031 US\$ (2006)⁶⁹ and an annual growth rate of 1.2%.⁶⁷

In 2006, one-third of total population lived in rural areas, the life expectancy at birth was 69 for males and 73 for female and female respectively, with a median age of 24.0 years. The mean family size was 4.0 and the literacy rate, 84%.The sex ratio (males per 100 females) was 103.9 (2005). Nearly all citizens are Muslims.^{67,69}

The primary health care system in Iran

The Iranian primary health care (PHC) system or health network (see Figure1) was established around three decades ago to improve easy access of communities to basic health care in order to reduce the gap between health outcomes in urban and rural areas. To achieve this important aim, the system has relied on three main components: (1) establishing *health houses* in remote and sparsely populated villages; (2) staffing the health houses with health workers, known as “Behvarzes” (see below), recruited from local communities; and (3) developing a simple but strong and well-integrated health information system.⁷⁰⁻⁷⁴

The primary health network is an integrated system with different levels of health care services for both urban and rural population (see Figure 2).

There is at least one university of medical sciences in each province which has an important role both in medical education and providing health services in the province. In each province there is a district health network and in each district there is one district health centre. Also there are a number of urban and rural health centers which all of them are administrated by the district health centre.⁷⁰⁻⁷⁴

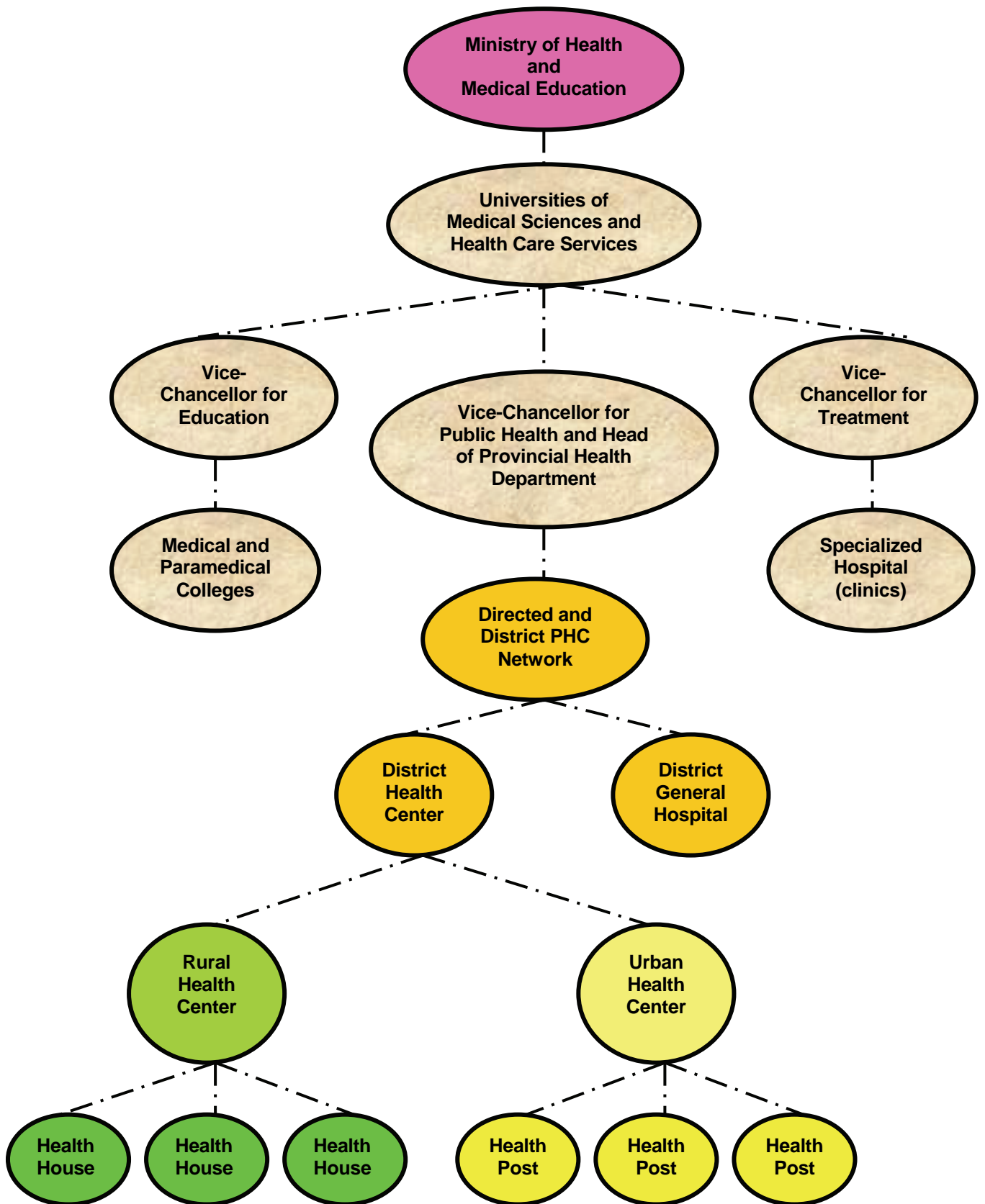


Figure 1: The Iranian primary health care (PHC) system or health network

The primary health care in rural areas

As mentioned above, rural Iran benefits from a well-established health network. More than 90% of the rural population of the country have access to primary health care (PHC) services. Rural health centres are headed by physicians and staffed by paramedical and administrative employees. They support and supervise the activities of the rural health houses they cover, accept referral cases from them and maintain proper contact with both the higher levels of the health system and the district general hospital (including referring the cases in need of special treatment or hospitalization). Referral to physicians at the health centres is dealt with by the Behvarzes and to the hospital, by the rural health centre. In emergency cases there is no need for this referral system and people can be directly admitted to the hospital.⁷⁰⁻⁷⁴

Rural health houses and community health workers

The health houses are the first level of contact between the rural community and the health network in the country, covering one or several villages. Each health house is usually the closest and only health facility available in the area, covering usually about 1500 people found in one or more satellite villages. As mentioned above, each rural health house is staffed by one or more female Behvarzes and one male Behvarz. They are recruited by the Ministry of Health and usually come from their catchment area. So they are not only well trained for their job but also highly regarded by – and have close contact with – their community.

Behvarzes provide primary health care (which is free of charge). Before starting their work in the health house, they receive a special two-year training (employing modern educational methods based on group discussions and role playing exercises and working in accordance with the specific Behvarz model). Each province has a training center for Behvarzes.

They are responsible for both in-house and external tasks. The female Behvarz is usually responsible for in-house tasks, that is, receiving clients, serving routine health care including maternal and child health care and simple curative care to their catchment population, including immunization, providing patients with simple medication. Also there are some external tasks, usually done by male Behvarzes including following up cases with communicable diseases, preparing case findings, administering immunizations, overseeing environmental health and providing routine health care for satellite villages.

Behvarzes also serve as an important component of the health information system of the PHC network. The system gathers health related data and provides health information from their catchment area which is passed on to the upper levels of the health system from rural health centres to the Ministry of Health and Medical Education. It is expected that prior knowledge of the community facilitates that accurate data are gathered. It is considered that Behvarzes have had an important role in the success of the Iran PHC network.^{70,71}

In the health house, they have family related files and logbooks where they record their daily activities regarding e.g., family planning and immunization. In order to summarize and present these data, each health house has an innovative document,

called the “vital horoscope”. It is physically a 50cm x 70cm sheet of paper kept pinned to the wall of the health house. It was originally designed to register births, deaths and family planning in the community and it also includes tables summarizing demographic information, such as that from the population census. It is regarded as a useful and practical tool for the Behvarzes^{70,71} and is expected to secure rapid quality control of data collection at health-house level.

The inclusion of injuries in the data registry system in rural areas

As mentioned above, the main function of the Behvarzes is to offer primary health care services to rural areas. Their responsibilities include educating the public about health matters, providing simple treatments and family planning services, caring for children’s growth and development, carrying out health activities and recording health information. The systematic collection of injury information and injury control and prevention programmes were added to their tasks more recently (19). They register all deaths on the horoscope, with the exception of under-5 year-olds for whom deaths caused by injury are recorded.

In 2004, the Ministry of Health and Medical Education launched the revised and extended “vital horoscope” which is renamed as “health horoscope” (see Figure 2). This has been done by adding a number of new forms/tables to fill, in order to monitor a number of health parameters/diseases, including injuries. The vital horoscope covers all village-specific injury related deaths and in-patient cases. One of the purposes of this addition was to provide local data for the injury control and prevention work in future. The program ultimately aims at the reduction of injuries in rural areas.

Before it being integrated at the country scale, the “health horoscope” was implemented by the Ministry of Health and Medical Education in five districts from five different provinces (Hamedan, Hormozgan, Golestan, Semnan, and Yazd) of the country. Twiserkan district (located in Hamadan province), where this project conducted, was one of them. The health horoscope integrated at the country scale in 2008.

According to the new system, Behvarzes are responsible for the registration of all injuries leading to hospitalization (at least 6 hours as a standard criterion) or death. This data should provide information on the frequency of occurrence and characteristics (gender, age group, mechanism and place) of severe injuries and allow for the follow-up of future national and local interventions. Injury information will even come up to a higher level in the health network, on a yearly basis, and it will be supervised by rural health-center workers weekly.

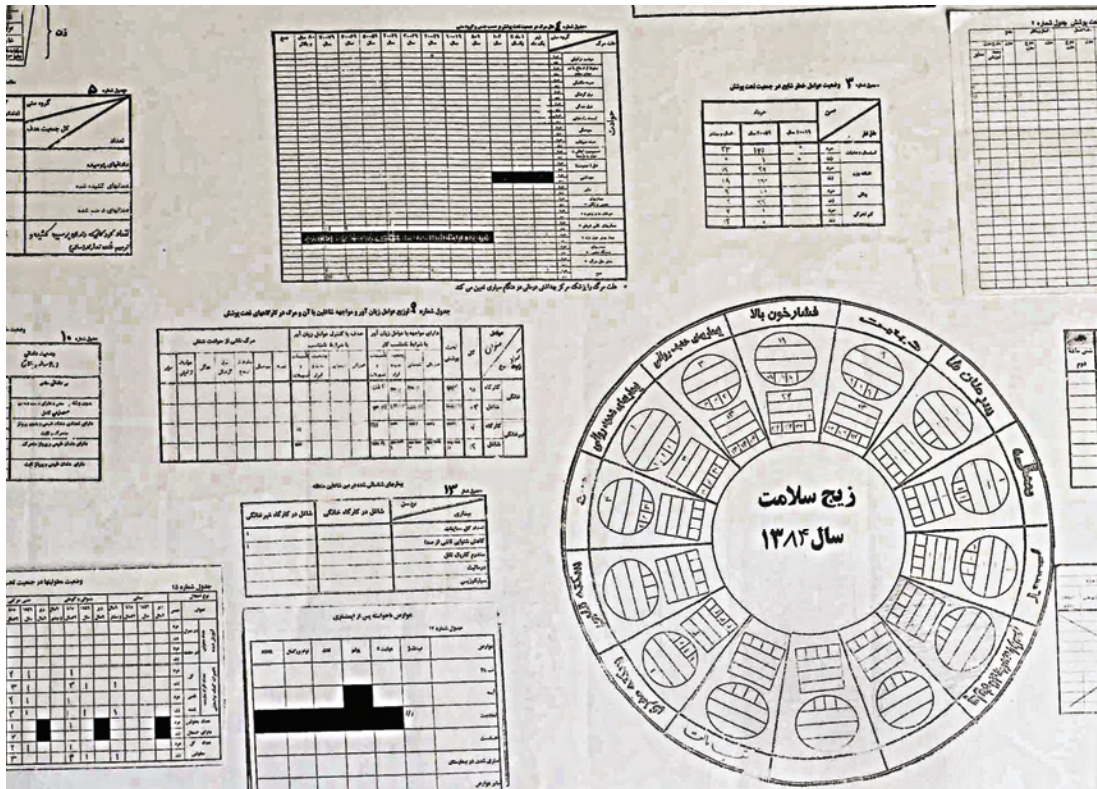


Figure 2: Health horoscope (2005)

Unanswered questions

In Iran injuries are one of the most important causes of death. For their control and prevention, increased knowledge is needed regarding their distribution and epidemiology. Injuries affecting people from the rural population are poorly documented and so is people's health care seeking behavior and their views and concern about injuries.

On other hand there is, as mentioned above, a successful health network in Iran, in particular in rural areas with a simple but strong and well-integrated health information system. Behvarzes are key actors for community-based injury control and prevention in rural areas. How they regard their role, and that of other stakeholders in that respect is largely unexplored are their views on the value of the new "health horoscope" as a tool.

MAIN AIM AND OBJECTIVES

The overall aim of this thesis is to increase knowledge about injury epidemiology and the potential contribution of community health workers to the control and prevention of injuries in rural areas.

The studies forming the thesis concern mainly the Twiserkan district, located in the Hamadan province of Iran. They have the following specific objectives, split into three main domains of research: injury occurrence, countermeasures for injury prevention and a rural health system for injury surveillance.

(I) Injury occurrence

- To assess the frequency of occurrence of injuries, considering all injuries aggregated and various injury mechanisms. (Studies I, II and III)
- To determine the main characteristics of those injuries. (Studies I, II and III)
- To identify injury-related healthcare-seeking behaviours in the rural community. (Study II)

(C) Countermeasures for injury prevention

- To document the views and suggestions of people (injured or not) and Behvarzes about how different actors/stakeholders can help enhance injury prevention and control. (Studies I, II and III)
- To identify barriers to the implementation of preventive measures. (Study III)

(S) Contribution of injury data registry system to injury surveillance

- To determine the acceptability of the system among Behvarzes. (Study IV)
- To document the potential of the system for the achievement of different outcomes. (Study IV)

MATERIALS AND METHODS

To achieve the study aim and objectives, this thesis builds on four specific studies, all of which are identified in Figure 3 in relation to the domain and objectives of research they contribute. Each study corresponds to one article, and they will be referred to in the text by the Roman numerals below.

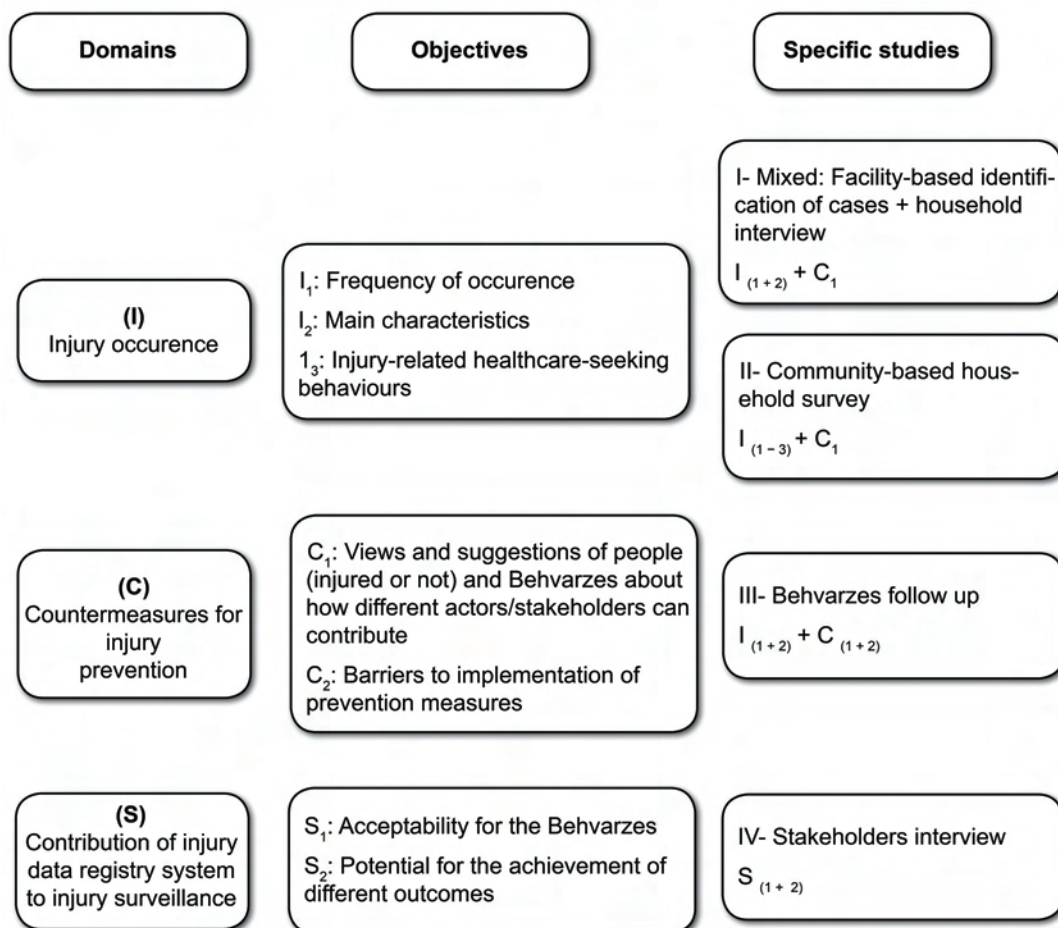


Figure 3: Research domains, objectives and specific studies forming the thesis

Study setting

The Twiserkan district, covering a mountainous area of 1 480 km², is located in the Hamadan province (capital city: Hamadan), which has a surface area of over 19 000 km² and is situated in the western part of Iran. Twiserkan district includes Twiserkan (or Toyserkan) city, located about 100 km south of Hamadan city, and has over 100 villages. Twiserkan is one of the most important producers of walnuts in the country and this crop is one of the most important sources of individual income in the district where the location and mild weather are highly appropriate for farming.⁷⁵⁻⁷⁷

At the time this project was conducted (2006-2008), Hamadan province had over 1.7 million inhabitants, of whom over 40% lived in rural areas (while the Twiserkan district had a population of about 110,000 inhabitants, about 58% of whom were rural dwellers. In 2006 the district contained 14,789 rural households (62,857 inhabitants)

and had a male/female ratio of 1.06 and a child/adult (<15/15+ years) ratio of 0.66 (verbal communication with the statistics unit of Twiserkan district health centre).

As is the case with the other rural areas of Iran, rural people from Twiserkan have access to primary health care services free of charge. When this project took place, the district had one public hospital, situated in the middle of the city, 16 rural health centres and 62 health houses with around 115 Behvarzes.

Twiserkan is one of the first rural districts in the country to start using an injury data register in its health houses. The system/procedure at that time was paper-based.

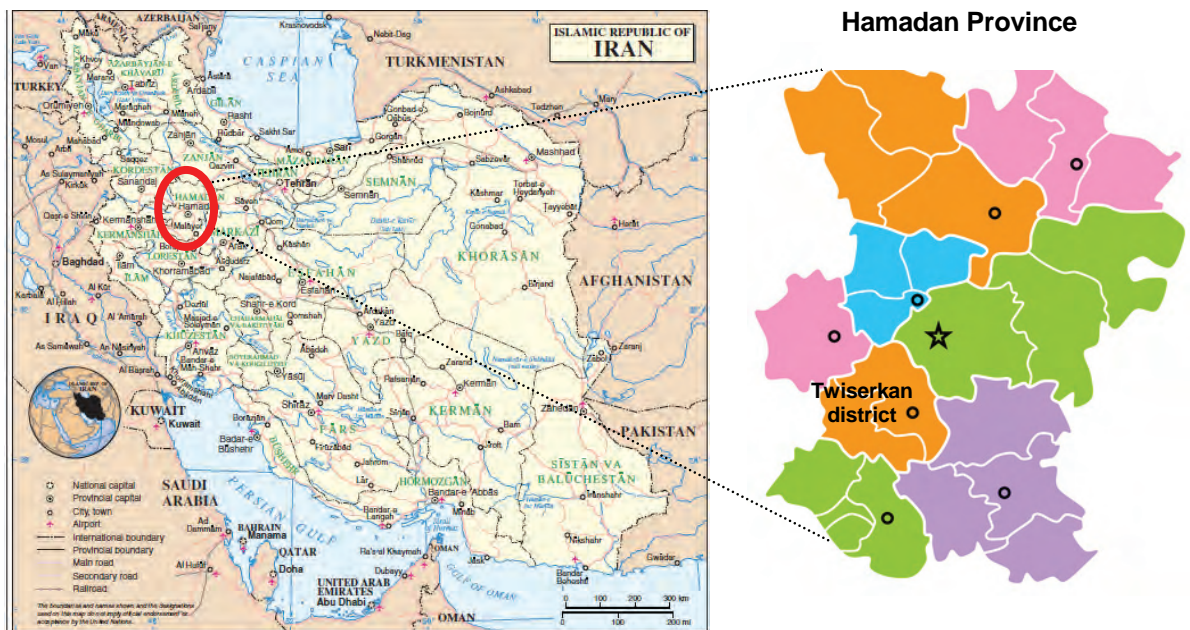


Figure 4: Map of Iran⁷⁸ and Hamadan Province⁷⁹, with Twiserkan district indicated

Description of the studies

Table 1 presents the general features of the studies conducted, each of which is presented in greater detail thereafter. From the four studies forming this thesis, three took place completely in the rural areas of Twiserkan district (study I, II and III) and the fourth and last one (study IV) was conducted not only in rural Twiserkan but also in Tehran, Hamadan city, and Twiserkan city.

Table 1: Summary of the materials and methods of the four studies forming the thesis

Study	Method	Study population	Data collection instrument/ strategy
I	Interview-based study during June 1, 2005 – May 31, 2006 (facility-based identification of injured people, interview in household)	All victims of injuries leading to hospitalization or death during 12 months, identified in the files of the 62 “health houses” of the Twiserkan district (n=134 injuries in 117 households)	Structured questionnaire including both closed and open questions / face-to-face interview
II	Community-based household survey in June 2006	Representative sample of rural households (cluster sampling): n=759 households, 75 households had injury occurrence for first time during the reference periods	
III	Prospective/ six-month follow-up: from July 15 2007 until January 15 2008 with	Behvarzes of all health houses of Twiserkan district (n=62 with around 115 Behvarzes)	Logbooks, including both closed and open questions
	Question session at the end of follow up	Behvarzes of all health houses of Twiserkan district for question session (n=87 out of 115)	Self administrated questionnaire, including both closed and open questions
IV	Interview-based study during September to November 2006	Stakeholders in different level: (1) high-level key informants: at national, provincial and district level: (n=8) All heads of all rural health centers (n=16) All Behvarzes of 28 health houses, out of 62 health houses, randomly selected and the heads of these villages. (A total of 114 stakeholders)	Structured questionnaire, including closed, Likert answers and open questions / face-to-face interview

Study I – Injury study

- *To assess the frequency of occurrence of **severe injuries**, considering all injuries aggregated and various injury mechanisms.*
- *To determine the main characteristics of those injuries.*
- *To document the views and suggestions of **injured people** about how different actors/stakeholders can help enhance injury prevention and control.*

Study design and data collection

In this study, which was a retrospective interview-based study, all unintentional severe injuries leading to hospitalization (more than 6 hours) or death and occurring over a one-year period (June 1, 2005 – May 31, 2006) were considered. As the Behvarzes of Twiserkan district registered all severe injuries occurring in the district during the study period, the cases were first identified at the local health houses (n=62) and the Behvarzes were asked to report only unintentional injuries. Thereafter, the household of each injured person was visited by a trained interviewer and a face-to-face interview was conducted with the family member identified as responsible of caring for the household (response rate 100%). To ensure as complete answers as possible, the injured family member took part in the interview any time she or he was present at the time of visit.

A total of 134 injuries sustained by members of 117 households were identified.

The interview was based on a (pre-tested) structured questionnaire, including closed and open questions. It covered information about the injured person (and his/her household) and the injury sustained (place, mechanism, nature and circumstances of occurrence). Open-ended questions were included so as to identify how people regarded the role of the community, the Behvarzes, and the authorities (health and others) with regard to injury control and prevention. In households where more than one injury had occurred during the reference period, all injuries sustained were considered at once when addressing the questions about household opinions concerning the roles of different actors in injury prevention and control.

Data treatment and analysis

Data were entered, processed and analyzed in Excel (version 2003). The data treatment took place as follows.

- (1) The incidence rates were estimated globally and for fatal and non-fatal injuries, respectively. Injury characteristics were coded and categorized according to the WHO guidelines for injury survey and surveillance.^{33, 80}
- (2) Using descriptive statistics, the characteristics of the injured people (e.g. sex, age group, education and occupation) and of the injury events (place of injury and injury mechanism) were highlighted.
- (3) People's views and suggestions about injury prevention, with regard to different actors in this field (authorities, Behvarzes and people themselves), were first entered as free text. Thereafter, answers were read by two members of the research team and key

ideas/phrases were identified and discussed at different sessions. Meaningful categories were identified that represented specific and homogeneous domains of potential intervention or action. Since some people had several suggestions and as they were not asked to prioritize or rank them, all opinions expressed by each respondent were taken into account.

Study II – Community-based household survey

- *To assess the frequency of occurrence of **injuries at different level of severity**, considering all injuries aggregated and various injury mechanisms.*
 - *To determine the main characteristics of those injuries.*
 - *To identify injury-related healthcare-seeking behaviours in the rural community.*
 - *To document the views and suggestions of **people (injured or not)** about how different actors/stakeholders can help enhance injury prevention and control.*
-

Study design and data collection

This study was a community-based household survey on injury occurrence, injury-related health-care seeking behaviour, and views and suggestions of people (both injured and non-injured) about how different actors/stakeholders can help enhance injury prevention and control. For data collection purposes, an injury was defined as “an injurious event usually occurring whilst travelling, at the workplace, domicile, place of education or place of leisure and causing harm/injury e.g. traffic injury, fall, burn, poisoning, drowning, or animal attack”. No mention was made of the injury “intent” as this can be a delicate matter in a household survey. Also, three severity levels were considered: (1) injuries leading to hospitalization or death (during past 12 months), (2) injuries treated by a physician (past six months), and (3) injuries dealt with by the healthcare services at a health house (past month).

A sample of 770 households was selected by means of cluster sampling, with a proportion of injury set at 0.50, in order to optimize the sample size⁸¹ and precision considered at ± 0.05 , with a confidence interval of 95%. The design effect was set at 1.8, with an estimated non-response rate of 10%.⁸⁰ The cluster size was set at 5 neighbouring households (n=154 clusters).

For each cluster, the first household selected for interview was the one whose identification number was obtained by systematic random sampling, using rural households’ numbers as identified in the files of the health house (address provided thereafter by the responsible Behvarz). For each interview, the family member responsible for caring for other household members was requested as the interviewee. Whenever an injury was reported, if the injured person was not the interviewee him/herself, the injured person could take part in the related section of the interview.

Once the interview was completed, the interviewer went to the four neighbouring households on the right-hand side of the first one. It was planned that if an interview could not be conducted at the time of the first visit, the household would be re-visited a

maximum of three times. During the period 6-27 June 2006 a total of 759 households consisting of 3 054 inhabitants participated in the study (response rate 98.5%).

Face-to-face interviews using a structured questionnaire were carried out by ten interviewers (8 males and 2 females). The questionnaire was pre-tested in 10 randomly selected rural households from 10 different villages. In its final version, it included background information on the household and information about the injury occurrence and injury-related healthcare-seeking behaviours.

The interview ended with a series of open questions concerning people's suggestions about how the authorities (health and others), Behvarzes, and citizens themselves could contribute to the control and prevention of rural injuries.

The data collection was monitored by the principal investigator and two trained field supervisors. The completed questionnaires were checked for completeness and accuracy each day.

Data treatment and analysis

Data were entered, processed and analyzed in Excel (version 2003). The data treatment took place as follows.

Injury incidence was compiled using two severity levels: 1. hospitalization (more than 6 hours) and 2. non-hospitalization, including those injury cases which led to care by physician (in health centre, hospital or by private physician) and receiving any care in the health house. The time intervals for moderate (physician) and minor injuries (health house) were multiplied by 2 and 12 months respectively, to compile annual incidences.^{19,80,82}

A total of 7 households had more than one injury during the reference period (4 with 2 injuries and 3 with 3 injuries). In all the analyses, the first reported injury by a household was used in order to avoid the dependency-effect of repeated events.^{19,82}

Injury mechanisms were considered, using six mechanisms defined by the WHO guidelines for injury survey and surveillance^{33,80} i.e., traffic; fall; burn; inanimate mechanical injury (cut and hit by object); poisoning and animal attack.

The first contact with the healthcare services due to the injury was determined and the number and proportion of injured persons according to the level of severity was calculated based on where the treatment/care was initially sought, and thereafter split into three categories: severe injury, leading to hospitalization; moderate injury, leading to treatment by the physician; minor injury, leading to care at the health house.

People's suggestions for injury prevention and control were also captured in this study from three different actors: Behvarzes, authorities (health and other) and the citizens themselves. To analyze these suggestions, the free text of a random sample of 50 out of 759 questionnaires was entered and read by two members of the research group. Key themes were identified, discussed and categorized. Thereafter, all questionnaires were read and answers were coded according to the categories determined using the sample. For the households with more than one suggestion, all of them were considered.

Study III – Behvarzes follow-up

- *To assess the frequency of occurrence of severe injuries, considering all injuries aggregated and various injury mechanisms.*
 - *To determine the main characteristics of those injuries (traffic-related injuries).*
 - *To document the views and suggestions of Behvarzes about how different actors/stakeholders can help enhance injury prevention and control.*
 - *To document the views and suggestions of Behvarzes following the occurrence of specific injury*
 - *To identify barriers to the implementation of preventive measures.*
-

Study design and data collection

This study was designed as a special six-month follow-up assignment for all Behvarzes in the district, involving prospective data collection on severe injuries (July 15th 2007 to January 15th 2008) which was concluded with a group questionnaire session in February 2008. A special training course took place prior to data collection.

The data collection focused on injuries occurring in the catchment area and which were classified as severe following the definition used in the data registration system in place, i.e., all injuries leading to hospitalization (more than 6 hours) or death. For data collection purpose for this study, Behvarzes didn't need to specify the intent of the reported injuries.

During the follow up, Behvarzes used a logbook in which, when a severe injury occurred (hospitalization more than 6 hours and death), they were expected to answer a series of questions related to the victim(s), the injury sustained, the manner in which it could be prevented and what could impede the adoption or implementation of the countermeasure proposed.

All Behvarzes prior to the follow up were trained (n=97) in a series of six group sessions each with about 16 participants. The training took place in regular monthly educational classes offered by the district health centre of Twiserkan. It was delivered by the principal investigator during the first hour (or 1.5 hour) period of the training. One training session targeted those people expected to assist and better supervise the Behvarzes during the follow-up, i.e. health technicians from the rural health centres and staff from the district health centre (n=31).

The logbook was split into different sections, starting with a general part followed by five cause-specific parts (traffic, fall, burn, injury due to inanimate mechanical force, injury of any other type). Those sections included a definition of the injury cause and a set of questions to be answered in case of injury (one detachable form for each injury). On the form, data were gathered concerning the injured person, the injury circumstances, risk factors identified and related suggestions for countermeasures. The risk factors were split into three categories: individual, product and environment. Space was also reserved to enter information about the activities carried out by the Behvarz to either reduce the severity of the injury and/or to prevent further injury.

The field visits took place in the context of the regular weekly visits made by the health centres to their affiliated health houses. A trained health technician was then involved and could also answer any queries. One district supervisor served as a contact person between these technicians and the principal investigator.

At the end of the follow-up, all Behvarzes were asked to fill in a brief self-administered questionnaire and were then gathered together in two sessions. The questionnaire included mainly open questions and addressed their views and asked for suggestions for injury control and prevention in the district. This took place in the main health centre of Twiserkan district in February 2008. A total of 87 Behvarzes (76% of all those in the district) answered the questionnaire. To guarantee anonymity, the questionnaire had no identifier allowing a link between a logbook and a questionnaire. However, the respondents were asked whether they had reported injuries of various kinds during the follow-up. It was possible – but not compulsory – to mention the name of the health house where one worked.

As in the logbook, each injury mechanism covered was taken one at a time. Mirroring the logbook structure, the questions dealt with what the Behvarzes thought different actors could do to prevent injuries of various kinds, including the Behvarzes themselves and other people (e.g., authorities, people, and police). Here they were also asked what they considered to be the main barriers in their community relating to the control and prevention of injuries. But the question was formulated in general terms rather than divided up according to individual, environmental and product-related factors.

Data treatment and analysis

Table 2 shows the distribution of the 110 injuries reported by the Behvarzes during the follow-up by mechanism. As the traffic-related injuries (RTIs) were, by far, the most common reported injuries (59%), they were considered separately and all data related to this specific injury mechanism were analyzed for the third article (Article III).

Table 2: Injuries reported by Behvarzes in six-month follow-up classified by mechanism (July 15th 2007 to January 15th 2008), Twiserkan, Iran

Mechanism	N	%
Traffic	59	54
Fall	23	21
Inanimate mechanical (cut and hit by object)	15	14
Burn	6	5
Other	7	6
Total	110	100

All suggestions made in the logbook (in injury-case specific) during the follow-up; those made in the self-administered questionnaire at the end of follow-up (in general) as well as the barriers identified at both stages were first entered in Excel (version

2003) as free text, one question at a time. The data were then analyzed by means of summative content analysis.⁸³ As tools for classification, Haddon’s ten strategies for prevention and his matrix were used.^{32,59-61}

For each specific question, once the list of codes, categories and some sub-categories were finalized, the numbers of respondents referring to them were compiled. Compilations were based on total number of suggestions made by all respondents. A preliminary question-specific list of codes and categories was discussed in one panel session gathering a number of injury research experts and students.

Study IV – Stakeholders interview

- *To determine the acceptability of the system for Behvarzes.*
- *To determine the potential of the system for the achievement of different outcomes.*

Study design and data collection

This study concentrates on the original stakeholders’ views about the injury information system focusing on Behvarzes’ involvement in this system. For this purpose, a structured questionnaire was developed and pre-tested by the research team that included questions addressed to all stakeholders and others more “level or group-specific”. Questions were asked regarding the original determinants, the conception and the management of the injury information system in Iran – with special focus on rural areas. It consisted of four parts including: 1) background information of the interviewees, 2) the management of the injury information system in general, 3) role of the system in injury control and prevention, and 4) the integration of the system within the activities of the health house and of the Behvarzes and its potential for injury information management.

Table 3: Questions extracted for consideration in Study IV

Part of questionnaire	Number and kind of questions
1. Background information of the interviewees	2 open questions about the respondents’ occupation and professional position
2. The management of the injury information system in general	10 close questions with Likert-scales about function of the system, 2 open questions about facilitators and barriers to the work of the Behvarzes
3. Role of the system in injury control and prevention	2 open questions about strengths and weaknesses
4. The integration of the system within the activities of the health house and of the Behvarzes and its potential for injury information management	1 closed question with Likert-scales about acceptability of the system by the Behvarzes

As Table 3 shows, the questions retained were mainly from part 2 and were about potential of the system to reach different outcomes. For the questions from part 3, which were about strengths and weaknesses of the system in relation to injury control

and prevention, the answers gave broader information about all potential strengths and weaknesses of the system (including injury control and prevention).

For all close questions, the interviewees were given the possibility to comment and those comments were also entered by hand by the interviewer.

All stakeholders were interviewed at their workplace, implying that the national stakeholders were interviewed in the capital city Tehran; those at the provincial-level in Hamadan city; and those at the district-level in both Twiserkan city and the villages. All interviews took place during the three months between September and November 2006.

It was estimated that, all three levels considered, there would be a total of about 150 people to interview. Based on a sampling criteria approach for small populations (EPI Info), it was determined that 108 could be interviewed, including (1) “high level key informants”; (2) “physician/heads of all rural health centres”; “Behvarzes” and “head of villages” in a sample of villages of Twiserkan district. Table 4 shows the estimation of sample size for this study.

Table 4: The estimation of sample size for Study IV

Level/place	Sampling/selection procedure	Number
High level key informants/ Tehran, Hamadan, Twiserkan city	National level: Convenient sample n=4	Total=8
	Provincial level: Convenient sample in Deputy of Health n=2	
	District level: Convenient sample in district health network and district health centre n=2	
Heads of all rural health centres/ villages of Twiserkan	Census	16
Behvarzes/ villages of Twiserkan	28 villages/health houses (out of 62 health houses), randomly selected.	
Heads of villages/ villages of Twiserkan		$[108-(8+16)]/3^*=28$
	Two Behvarzes and one head of village on average	28 villages

*Regarding that, usually, each village/health house has two Behvarzes and also each village has one head

Finally, a total of 114 people were interviewed, given that some health houses had more or fewer Behvarzes (some health houses also had Behvarzes who worked in two neighbouring health houses, partially/share) and a few villages had no head of village and a few health centres had more than one physician. Only one interview was not conducted as the person to interview could not be reached due to the long journey (response rate: 99%).

Each high level stakeholder was interviewed in his workplace at a preset time. For the other stakeholders, a letter was sent by the director of the district health centre to all rural health centres and health houses, describing the aim of the study and specifying the timetable for data collection. Each interview lasted an average of about 40-45 minutes.

Data treatment and analysis

The answers provided by all interviewees except the heads of villages were taken into consideration. Those are key administrative persons in the villages but, at the time of data collection, they were not yet familiar with the details of the health system and could not adopt a position on most questions. The other interviewees were grouped in two categories: Behvarzes (n=64) and other stakeholders (n=27).

Data from those interviewed people were entered in Excel (version 2003), including answers to all open questions (in free text). Thereafter, for the open questions selected, key ideas were identified, discussed and coded during different sessions.

RESULTS

Injury occurrence

Frequency and distribution of injuries

In Study I (injury study), a total of 134 unintentional severe injuries were reported by the Behvarzes. These were identified among 117 households (of 14,789 in total). The corresponding injury incidence rate were 21.4 per 10 000 person-years (95% CI 13.9-20.4).

In Study II (household survey), a total of 75 households (about 10%) reported injuries that met the inclusion criteria. The estimated annual incidence rate was 91 per 1 000 person-years. The incidence of injuries leading to treatment/care by physician or at a health house (81/1000; 95% CI: 72-91) was substantially higher than the estimated incidence of injuries leading to hospitalization (10/1000; 95% CI: 8-15).

In both studies, men were more affected than women, both all injuries aggregated and for RTIs in particular. The latter was also observed in Study III (Behvarz follow up).

Whereas falls were more common among men in Study I (28 out of 35), they were more common among females in the household survey (11 out of 19). But both of them show that fall is most common among adults. Study II also shows that two falls in three were sustained by people over the age of 65. Also, as many as 11 out of 15 burns were among males and 6 cases were paediatric burns (0-15).

Table 5 shows the distribution of the injuries by injury mechanism, and by age and sex of the injured people as revealed by Study II (community-based household survey).

Table 5. Injury distribution by mechanism and age group and sex of the injured people (n=75). Twiserkan district, Iran, 2006

Injury mechanism	Age group		Sex	
	0-15 year	≥16	Female	Male
	n	n	n	n
Traffic	4	18	9	13
Fall	5	14	11	8
Burn	3	4	4	3
Inanimate mechanical (cut and hit by object)	3	14	7	10
Poisoning	2	1	2	1
Animal attack	4	3	4	3
All	21	54	37	38

Main characteristics of injuries

All studies documenting injuries (I-III) show that RTIs are, by far, the most common injury mechanism (60 out of 134 in injury study, 22 out of 75 in community household survey and 59 out of 110 in follow-up study). The second most common mechanism in all studies was falls. In Study I, burn was the third mechanism but the second cause of injury death after RTIs.

Additional characteristics identified throughout the studies are:

- Traffic injuries were as common as home-related injuries (31.3%, each one) but they were far more fatal (Injury study)
- The most common mode of transportation among RTI victims was motorcycle (43.3% in injury study and 53% in Behvarz/follow-up study)
- The most common place of RTIs was road/street outside the village (68.3% in injury study and 88% in Behvarz/follow-up study)
- Fall at the same level and from a roof were the most common kinds of falls reported (8 cases each), followed fall from tree (n=7) and down stairs (n=5). (Injury study).
- Falls from tree occurred among adults and at work, this is common in rural Twiserkan, especially during the walnut harvest. (Injury study)
- Fracture was the most frequent injury, in about half of the cases. (Injury study).
- For all injuries aggregated, the most commonly injured part of the body was the lower limbs (20.1%), followed by head/face (14.2%) and upper limbs (13.4%). (Injury study)
- The most commonly injured part of the body in RTIs was head/face followed by lower limbs and for falls was upper limbs followed by lower limbs and pelvis/hip equally. (Injury study)

Injury-related healthcare-seeking behaviours

The household survey shows the healthcare initially sought following injuries of various levels of severity. The majority of severely injured people reported that they went to the “hospital” as their first point of contact with the healthcare services (78.1%). This occurred in four out of ten of the moderate injuries treated by a physician. All of those with minor injuries went first to a health house.

Countermeasures for injury prevention

Views and suggestions of people (injured or not) and Behvarzes

Suggestions of people

Table 6 shows the suggestions made by the people in the injury study (I) (injured) and in the community household survey (II) (injured or not), about how different actors/stakeholders can help enhance injury prevention and control. People in both studies had quite a lot of suggestions. Among the most frequent ones were:

For authorities

- Design and infrastructure-related matters in the village (e.g. building roads, traffic-calming measures and bridges, better housing, waste water outlets, a fire station, some public facilities such as a bakery in the village)
- Provision of equipment and services (e.g., piped gas, piped water, and other services e.g. telephone, outdoor lighting and traffic signs.

Other suggestions included maintenance and repair of infrastructure, financial support and law enforcement.

For Behvarzes

- Safety education both in general, injury-specific (e.g. fall, burn, traffic, electricity) and first aid

For people, themselves

- Behaving in safer manner and increased cooperation with each other in particular in injury occurrences (e.g., helping to transfer the victims as soon as possible to the health facilities) and also with authorities

Table 6: Suggestions of people (injured or not) about how different actors/stakeholders can help enhance injury prevention and control

Suggestions	Study I	Study II
	117 households %	759 households %
Authorities		
Infrastructure/engineering/building/signage/product	49	72
Provision of services	20	43
Repair/maintenance	12	32
Financial support	19	22
Law enforcement	16	7
Provision of emergency services	14	—
Education	13	—
Behvarzes		
Instruction/ education/ information	58	62
Post trauma care (health house/home visit)	15	—
People		
Behave in safe manner	38	30
Cooperation with each other	21	30
Cooperation with authorities	20	12
Compliance	14	8

Identifying those groups of suggestions made by $\geq 10\%$ or more of the households at least in one of two studies. Twiserkan district, Iran, 2006

Suggestions of Behvarzes

In Study III the Behvarzes were asked what they themselves and other actors could do for road traffic injury control and prevention in general.

- 1) Regarding themselves, they focused on their community educating role, as could be expected (79% of respondents).

A number of examples:

- Specific topics (e.g., traffic rules, crossing the road, safety issues, use of motorcycle helmets and car seatbelts);
- Specific target groups (e.g., families and people, motorcyclists and other vehicle drivers, parents, students)
- Various manners of educating (e.g., face-to-face, continuous)

Further, 18% mentioned that they also could advocate for RTI control and prevention.

- 2) For other actors, most Behvarzes (regarding Haddon's ten strategies for prevention) proposed human-related efforts like:

- Training and instruction (45%)
- Strategies related to environmental modification or maintenance or repair (33%).

In addition, falling outside Haddon's strategies, three additional categories emerged including:

- Law enforcement (34%)
- Public cooperation with other actors (e.g., police, authorities and Behvarzes)
- Compliance.

In sum, the Behvarzes addressed all of the 3 "Es" of injury prevention and control (i.e., education, enforcement and engineering³⁰), but emphasized "Education".

Views and suggestions of Behvarzes following the occurrence of specific road traffic injuries

The most common suggestion formulated by the Behvarzes was by far the adoption of safe behaviour/practice by people (90%), with a focus on:

- The use of motorcycle helmets (36%)
- Compliance to traffic rules by motor vehicle drivers (29%)

In addition, Behvarzes emphasized the importance of "law/regulation/restriction" which was divided into three sub-categories including:

- Driving practice (for instance not driving without a driving license) (37%)
- Sale restrictions (e.g., not buying motorcycles for the young, and even banning the sale of cheap motorcycles by the authorities) (14%)
- Law enforcement (e.g. making the use of helmets compulsory for motorcyclists) (8%)

Further, the elimination of risk factors (e.g., modern and safe cars instead of old ones, restricting availability of motorcycles for the young and removing inappropriate bends in roads) was a rather frequent sub-category (20%).

Barriers to the implementation of preventive measures

Figure 5 illustrates the barriers to traffic injury prevention which were presented in different categories with regard to Haddon’s matrix. Individual-related barriers/factors were the most commonly proposed type of barriers mentioned by the Behvarzes (98%) and included speeding, not using individual protection (in particular helmet use by motorcyclist), lack of caution, driving without a license and lack of compliance with traffic rules.

Behvarzes also focused on the barriers related to physical environmental factors (88%). These included: single carriageways without a dividing fence or central reservation and/or inappropriate bends on the roads; inadequate traffic signs and lack of traffic calming measures; roads that are too narrow, uneven and rough and have a steep incline; increase in motorcycles and other vehicles and inadequate lighting on the roads.

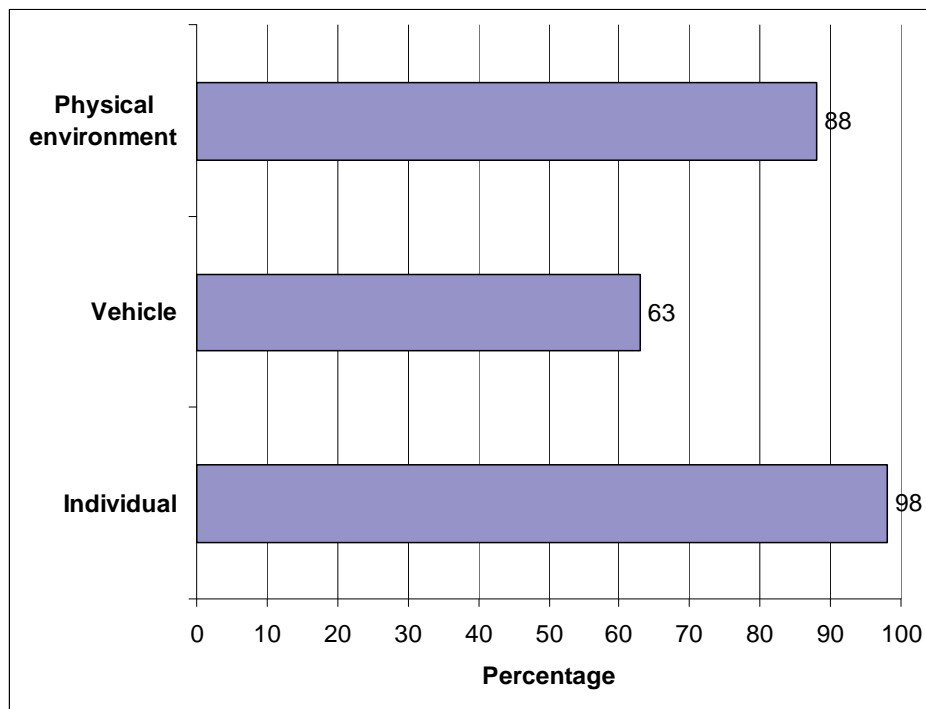


Figure 5: Barriers to specific-traffic-injury prevention, identified by Behvarz during follow-up period (number of injury cases=59).

Contribution of injury data registry system to injury surveillance

In Study IV, the interviewees were split in two groups: 1) Behvarzes 2) other stakeholders.

Acceptability of the system for Behvarzes

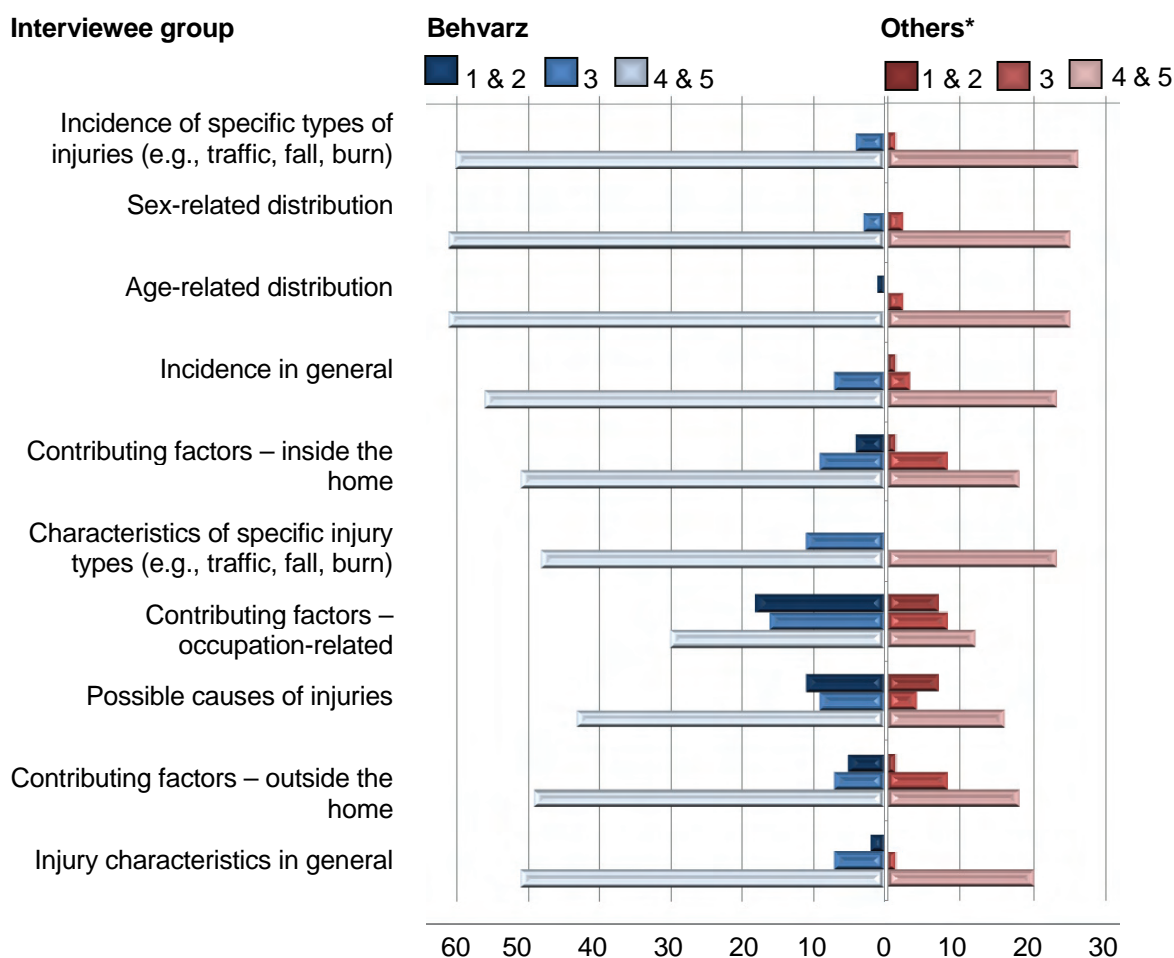
All Behvarzes and other stakeholders, but two, answered the question on how acceptable the system is for the Behvarzes. Most Behvarzes (53 out of 64) and about half of the other stakeholders (13 out of 27) answered favourably (score 4 or 5 on the

Likert scale). The comments provided on this question (by 72 interviewees) came mainly from those with a less favourable view. These answers show the injury information system is quite acceptable to most Behvarzes. They think it raises awareness about the injury situation in the catchment population; helps to plan and give more appropriate education to the community by Behvarzes, and is a good tool for planning and decision-making by the authorities. On the other hand, there are concerns about the work load that the new task may imply in the health house and they would also like to see action from higher level authorities, planned with regard to the data gathered and reported by Behvarzes.

Potential of the system for the achievement of different outcomes

Both “Behvarzes” and “other stakeholders” agreed strongly regarding the potential of the system to determine the incidence of specific type of injuries (e.g., traffic, fall and burn-related injuries) as well as their sex- and age-related distribution of injuries. There was lower consensus between two groups and even within each group about the system’s potential to determine occupation-based data on injuries and cause of injuries.

Figure 6 shows the Likert scale scores of two groups of interviewees on the potential of the system to determine/highlight different outcomes.



**Others/ other stakeholders consist of high/top level key informants at the national, provincial and district level (n = 8) and the head/physician of all rural health centres in Twiserkan district (n = 19).*

Figure 6: Scores on how reachable different system outcomes can be in the population area (64 Behvarzes and 27 other stakeholders), (scale 1=not at all; 5=very much).

Facilitators and barriers to Behvarzes to work with the system

Table 7 shows the facilitators and barriers for Behvarzes to work with the data registration system which identified by interviewees.

These are presented in decreasing order (frequency of answers) in each group. As can be seen, there were far more answers pointing out possible facilitators (52/64 Behvarzes and 25/27 stakeholders) than barriers (18/64 Behvarzes and 21/27 stakeholders).

Table 7: Facilitators and barriers for Behvarzes to work with the data registration system as identified by the Behvarzes and other stakeholders interviewed

Facilitators	Barriers
Coming from the area	High workload / multiplicity of tasks
Design of related form and system	Data completeness requirements
Usefulness of the data/trust in the system	Poor incentive/ preparation
Local cooperation/compliance	Case identification/ registration delay
Familiarity with the task	Identification of the injury intent/ misclassification
Referral system	-
Regular quality control	-

Not surprisingly, the fact that the Behvarzes live and come from the catchment area was regarded as a considerable facilitator – and mentioned far more often than any other item. Comments in that regard concerned e.g., the close relation between the Behvarz and people in the community, the fact that they would know an injured person – and if someone was injured. This, in turn, would ensure higher data accuracy. An additional point raised was the “usefulness of the data/trust in the system”, implying that the interviewees expressed confidence in what the system was for.

Among the barriers identified, although by far less interviewees, “high workload/multiplicity of tasks” ranked first, followed by the lack of “incentive/preparation” or “data completeness requirement”, that can be jeopardized when for instance an injured person seeks care from a traditional healer or directly to the city (e.g., a private physician) and doesn’t go to a health house. An additional aspect raised is the difficulty to capture the injury intent and thereby the risk for “misclassification” in some instances.

Potential strengths and weaknesses of the system

Table 8 highlights the strengths and weaknesses of the data registration system identified. They are also presented in decreasing order of frequency of answers. As for the questions above, there are more answers on the “positive” aspects (61/64 Behvarzes

and 26/27 stakeholders) than on the negative ones (21/64 Behvarzes and 14/27 stakeholders).

Table 8: Strengths and weaknesses for the data registration system as identified by Behvarzes and other stakeholders interviewed

Strengths	Weaknesses
Variety of information made available	Data completeness/exhaustively requirements
Prevention and control	Flow of information
Data stratification rendered more easy	Quality assurance
Raise the priority of the injury problem	-
Simplicity	-
Data accuracy	-
Clarity of visible support	-

The most common strength mentioned by both Behvarzes and other stakeholders was the “variety of information made available” through the system and how it provided useful data for “injury prevention and control”. The simplicity of the system was mention by Behvarzes and different aspects of data accuracy in this system were mentioned by other stakeholders.

Those weaknesses mentioned concerned mainly the “data exhaustivity” demands (e.g., inclusion criteria – outpatients’ information are not registered in this system) and even sometimes “data completeness demands”. It was also mentioned that the Behvarzes need more training and practice in order to become expert in the new Health horoscope/ extended data registry system, and that more quality assurance ought to be implemented by means of regular controls.

DISCUSSION

Injury occurrence

Main findings

The injury incidence rates in the rural community of Twiserkan varied across severity levels and, as could be expected, increased with decreasing severity levels. The incidence also varied across the studies' similar severity levels. For injuries leading to hospitalization or death, it was 21/ 10 000 in Study 1 (injury study) compared to 10/1000 in Study II (community-based household survey). It is very likely that those differences are due to the fact that the first study considered the entire population of the area rather than the members of a number of households, as in the second one.

As there are not many published injury-related studies in rural areas of middle-income countries (MICs) it is hard to determine whether the incidences observed are high or low. But they are higher than those reported in other middle income countries such as for example, rural Nicaragua.²⁵ They are also higher than the incidence rates reported in some studies from LICs like Pakistan¹¹ and rural Vietnam.¹⁷

There are reasons to believe that the higher rates observed in rural Twiserkan are likely to be explained, at least in part, by the rapid and widespread motorisation taking place in Iran. A clear indication of this can be found in the high representation of road traffic injuries among the injuries sustained by rural community members. In Study I, road traffic injuries were indeed as numerous as injuries in the home (see even results from Vietnam¹⁷ and Nicaragua²⁵. Traffic-related injuries are a serious threat to life and health in Iran.^{4,37-41,44,46,48,50,51} Even Studies II and III revealed a high proportion of injuries sustained on the road. Among road users, motorcyclists seem to be a group of particular concern – as is the case in many Asian countries.⁸⁵

As motorized commuting is on the increase even in rural Iran, people get injured in and around their village or residence or when travelling longer distances. As is the case with injuries of other types, men are more affected than women by RTIs. It is important to pay attention to road safety.^{6,84}

Injuries at home also deserve attention in rural areas as is the case, for instance, in Pakistan, a neighboring country, where they form the majority of injuries.¹¹ In the Twiserkan district, burns may require special attention, if not because of their frequency, because of their severity (see also earlier Iranian studies.^{52-56,58} Injury study showed severe burns also affect children to a greater extent, which is consistent with an earlier study from Bangladesh that showed that the incidence of burns among rural children was more than four times higher than among urban children.⁸⁶

In the Twiserkan district – and perhaps even in Iran as a whole – gas equipment used for cooking or heating may warrant special attention. Some villages still do not have gas mains and people use gas capsules and/or other heating equipment that is poorly adapted to in-house use. At present, fire stations are far from most villages and people did mention this as a matter of concern.

Even falls may deserve attention. They were most common among adults in both Study I and Study II, but severe falls were more common among men in Study I and falls in general were more common among females in the household survey. For its part, the prevention of falls is undermined by the vast number of different situations leading up to them, which is a challenge for community-based education programs. Potentially more severe falls from a height, e.g. from a roof and falls from a tree may constitute important targets. The latter occur during work activities, mainly during the walnut harvest. This work is done in a traditional, non-technical manner and every year some people fall from large trees and are injured or killed. The results of one study on safety assessment of agricultural machinery in Iran showed that 60% of agricultural injuries were severe. As falls affect people in the higher age group, fall injury prevention may require not only environmental improvements in and around the house but also, in the long run, changes in health behaviours (e.g. eating, smoking, and exercising) so as to reduce individual susceptibility to falls and also to aid recovery after a fall.

Injuries due to inanimate mechanical forces (e.g., cuts, hit by object) were also frequent in this setting. Several were work-related as wood-working is a common occupation in some villages.

An additional finding is that people seek care where they are expected to from the care delivery point of view: in their local area for minor injuries and at the hospital for moderate and severe ones. This, in turn, indicates that the health house fulfils its care and referral function in case of injury, thus contributing to more rapid care and a decrease in the load for hospital physicians. For severe injuries, Behvarzes come more into play after hospital discharge (e.g. primary care and referring them to physician if necessary). The observation that many moderately injured people go initially to the hospital to seek treatment (this is in addition to severely injured people) stresses the importance of hospital-based emergency services for injury control. This in turn, can form part of any upcoming improvement program.

Strengths and limitations

Because of the routines in place,⁷⁰⁻⁷⁴ the existence of a referral system and the relatively small size of the catchment areas, there are good reasons to believe that the injury study (Study I) offers an accurate coverage of the severe injuries incurred in the population under study during the study period. It is indeed very likely that health houses do have a complete coverage of injuries leading to hospitalization and death in their community. In spite of the fact that collecting injury data was a relatively new procedure when the cases were identified, the likelihood of missing cases can be regarded as very unlikely given that the injuries covered are relatively severe; that the Behvarzes are well anchored in their community; and that those communities are relatively small. One of the strengths of Study I was its response rate which was 100%. This could be due to the persistence of the interviewer who made every effort to conduct each interview and revisited the household if people could not be reached at the first visit. An additional important reason could be the willingness of the people, who had severe injury experience, to contribute to the project which was relevant to their interests and could be important for future injury control and prevention.

One strength of the community-based household survey lies in the large and representative number of households covered and the very high response rate achieved (98.5%).

It ought to be underlined that, for ethical reasons the “intent” of injury was not asked, when the interviewer went to a household to interview, both in the injury study and in the household survey (and even in the Behvarz follow-up) as this can be a delicate matter and also it might be of a source of misclassification of our results. It is indeed possible that a proportion of the injuries reported were sustained intentionally, either self-inflicted or through interpersonal violence. This, in turn, would call for different types of interventions and counter-measures.

To minimize recall biases in the household survey three reference periods were used for different injury severity levels.^{19,80,82} Further, in order to avoid a dependency-effect of repeated events, all analyses were based on the first reported injury by the household. By doing so, the rates presented are an underestimation of the true injury burden in the district.

In the community-based household survey, the places where the injured patients sought their first medical care/treatment, but not the flow of the healthcare, were investigated.¹⁵ The reason was that in healthcare-seeking behaviour in rural areas, considering the different severity levels of injuries, to determine the places where the people go directly after an injury event to seek treatment is the prime issue.¹⁵ In particular when there is lack of this kind of information in the setting. The knowledge can help authorities to be aware of and prioritise these places when working on improving healthcare services.

As the data gathered from the health houses concerned exclusively severe and fatal injuries, only the “tip of the iceberg” is revealed.³² The community-based household survey for its part included even data on minor and moderate injuries. Altogether, the combination of various data and information sources as well as injury severity levels enriches the information made available and allows for triangulation regarding the relative importance of various injury causes and mechanisms as well as their circumstances of occurrence. This could serve as a foundation for the determination of a safety agenda and help with general and specific countermeasures, which is the object of the coming section.

Countermeasures for injury prevention

Summary of the injuries sustained in the district

The injury studies conducted in the Twiserkan district reveal that in the rural community, traffic was the most common injury mechanism and that motorcyclists were highly affected, in number and severity. The majority of RTIs occurred in the road/streets outside the villages. Further, men were more affected than women by injuries in general and by road traffic injuries in particular. RTIs were more common among young men.

Other injuries of numerical importance were home-related injuries: falls and injuries due to inanimate forces. Burns were far less frequent but they were often severe or fatal.

Most people with severe injuries and nearly half of those with moderate ones seek care initially in the hospital, while all those with minor injuries first seek care at the local health house.

Main findings

People's views and suggestions

Study I and Study II dealt with people's views regarding the prevention of injuries of various causes. Severe injuries were covered in Study I and injuries of various severity levels, in Study II. Some of the interviewees had never themselves suffered an injury or reported an injury sustained by a family member. Almost all of them came up with suggestions regarding things that can be done in order to prevent and control injuries in rural areas. The suggestions covered a diversity of aspects of safety promotion, including human related factors or environmental ones and involving different potential actors in the safety promotion field.

Authorities. People had many suggestions relative to improvement in the physical environmental, on the road or at home. Important examples of counter-measures include the improvement of the local infrastructure (e.g. roads, traffic calming, bridges, better housing); the provision of more services, including piped gas (which is currently in progress), a fire station (burn prevention), outdoor lighting (fall prevention) and telephone (emergency); and the build up of public facilities (e.g., a bakery within the village) that can reduce transport needs and thereby reduce traffic exposure.

People even raised the need for financial subsidies to enable them to build safer and better-equipped houses, for instance with railings or balcony and stairs. Some people even mentioned the difficulty and safety threats of living in one single room.⁸⁷ For instance, in the winter they put the food on the cooker at the same time as children are playing which implies higher risk for burns to happen.

Altogether, those suggestions and concerns highlight people's expectations for engineering measures that can help reduce the level of risk and number of hazards to which they are exposed, which constitutes an acknowledgement of the need for measures of primary prevention in the field of safety promotion.³² People also underlined this importance and the need for greater accessibility of daily (like bakery) and emergency services and even maintenance of the roads for instance.

Not only engineering but also enforcement was regarded as an important contributory factor to injury prevention and control. People referred to both laws and regulation enforcement in general and in the traffic environment in particular. In that sense, rural areas have similar needs to urban ones.

People also suggested that more attention be paid to public education by the authorities (e.g., through the mass media). Currently, there are different safety related campaigns on television, for instance, which are mainly about road traffic injuries.

Behvarzes. People put great focus on the important role of Behvarzes in injury prevention, mainly as an educator in the local community. It ought to be mentioned that Behvarzes already have face-to-face meetings and education for the community members as part of their traditional duties. They use educational packages provided by the Ministry of Health and Medical Education, including some specific home safety issues.⁵⁸ Those packages could be further developed and locally adapted, based on the results of the studies conducted in the district.

Those people who had experienced severe injury also pointed out the need for post trauma care by the Behvarz, both at the health house and by means of home visits. Of course, if necessary, the Behvarzes visit people but this is not done systemically. This is due to the Behvarzes's high-workload which they, themselves, focused on in both Study III and IV and this deficiency seems to be a concern.

People themselves. Members of the community adopting safe behaviours was the most important factor likely to contribute to injury prevention and control mentioned by the laypeople interviewed. They thought that in this way not only can they reduce the probability of injuries among themselves, but also they can be a good role model for their children and for injury prevention in future. Whether this is an indication of readiness to adopt safe behaviour remains to be investigated.

Laypeople also focused on cooperation with each other specially for transporting injured people rapidly to the health facilities. This suggestion shows the importance of the issue of pre-hospital care and accident victim transport among the rural population.⁵⁰

There are a certain number of ambulances in the rural areas of the district, mainly in rural health centers, which are used in emergency cases. Whether the number is sufficient or if the post-trauma care facilities are adequate is uncertain.

People also mentioned compliance as a means of injury prevention. Maybe this can be a matter for further, more in-depth research as can people's attitudes about safety rules and law enforcement.

Altogether, laypeople's suggestions provide good indications of their understanding of the potential causes of injuries and context-relevant prevention measures for any further planning and intervention of any population based or community- oriented injury prevention and safety promotion programmes.

Behvarzes' views and suggestions on RTI prevention

As the description below will show, there was considerable consensus between laypeople and Behvarzes regarding what can be done for injury prevention and control.

In Study III, Behvarzes suggested many counter-measures regarding RTIs either during the follow up, when investigating specific injury events, or at the questionnaire session, when summarizing their experience and views. The injuries reported during the follow up confirmed a factor that had already been discovered about the district during Study I and II, namely that young male motorcyclists are a concern. Therefore, it was not surprising that Behvarzes, like the laypeople, raised motorcycle helmet use as a suggestion for prevention. But the Behvarzes raised even other context-relevant measures targeting products and environment.

During the follow up, their most common suggestions were “victim-related” and addressed the need for “protection” rather than “prevention” – i.e. the adoption of safe behaviour/practice like helmet and seat belt use and compliance with traffic rules.

Just like the laypeople (see above), Behvarzes raised additional aspects like the need for more effective law enforcement.

At the end of the follow-up, education emerged as the most common suggestion, which could be expected given that health education is one of their responsibilities, in the context of primary health care.³² Behvarzes specified areas of concern that could form part of a local intervention aimed at raising awareness and competence as regards the control and prevention of RTIs (e.g., education targeting families, parents, students or motorcyclists; education about traffic rules, behaviour at intersections, individual protection including motorcycle helmet and seatbelt use; education provided face to face and continuously).

Behvarzes in this part also showed their concern about young motorcyclists through different suggestions. Motorcycles are the favorite means of transport in particular in rural areas but as motorcyclists are very vulnerable road users they need to be given more attention in injury prevention and safety promotion programs among rural communities.^{46, 85, 88, 89}

For other actors in the injury prevention field Behvarzes had also various important suggestions, including training and instruction, law enforcement, modification and maintenance, warning, cooperation and consultation and also elimination of risk factors and modernization. Some examples of suggestions relative to the physical environment were repairing/improving roads and bridges to bring them up to standard; constructing a fence down the middle of single-carriageway roads; building standard roads and bridges for villages; building traffic-calming measures; repairing streets and alleys and asphaltting; lighting of roads, streets and alleys. It is interesting to note that most of these ideas were also raised by laypeople.

Behvarzes' suggestions for other actors also showed they encompass the three “Es” of injury control and prevention: Education (by training and instruction), Enforcement (by law and enforcement) and Engineering (by environmental modification but even through road repair and maintenance).³⁰ In the latter case, they even mentioned the need for warning signals (e.g., repair/install traffic signs and also traffic lights especially on bends).

Behvarzes also mentioned their advocacy role as they are key health persons in the village and among the rural community. They can liaise with local and regional authorities, in terms of RTI prevention in the rural area.

Interestingly, many of above mentioned suggestions from both laypeople and Behvarzes form part of the WHO recommendations.⁶

As for the design and implementation of each individual injury prevention and safety promotion program, it is important to know the barriers and risk factors. Behvarzes were also asked about these in Study III, to explore the knowledge that they have of their community. They identified barriers to RTI prevention as being mainly individual and physical environmental factors. High speed, failure to use individual protection including motorcycle helmets and safety belts and even driving without a license were mentioned during and at the end of the follow-up. These risk factors have also been raised in earlier publications and reports.^{6,46,90-96} When asked specifically about barriers related to “products” – at the time of the follow up – Behvarzes rightfully identified more problematic areas, above all relative to vehicle safety, including those of motorcycles.^{6,46,96-101}

One Iranian study, about public health providers’ views on barriers to high-quality primary reproductive health services, also discussed the fact that different tasks including registering different information in different forms, files and logbooks can lead to an increase in the work load thus leaving too little time for clients in health facilities.⁶⁵ However current governmental attempts are ongoing to computerize the data registry in health houses which perhaps can help to decrease Behvarzes’ work load.

Strengths and limitations

According to the published literature, there is a dearth of research on the population’s views and attitudes on community level regarding injury prevention and control, something that could help in determining targets and context-relevant counter-measures. This applies to both urban and rural areas. On other hand it is difficult to compare the results.

During the first three studies, the views and suggestions of people with and without injury experience and Behvarzes as the key health worker/provider were collected. Response rates of the studies were high and people came up with quite a lot of suggestions in both the injury study (Study I) and the community-based household survey (Study II). Several peoples even had more than one suggestion in this study.

In this project an attempt was to identify what is regarded as counter measures for prevention in the local community – laypeople themselves or their community health workers. Also this study shows what the people and Behvarzes thought could work – sources of consensus and differences.

However there is no clear reflection of them giving a priority to safety or being ready to behave differently – can be as a source of further deeply researches.

In the field of road traffic safety, quite a number of safety measures have been identified thus far, most of them are summarized in reports made available in recent years.⁶ But the know-do gap that seems to impede the uptake or implementation of

those measures is not well understood. In both Study I and II people identified various prevention measures for different mechanisms, particularly for road traffic injuries which were seen as the most important mechanism in the community.

Also Behvarzes were asked to introduce of potential barriers to prevention of injuries.

To assess such barriers to injury prevention and safety promotion is one of important issues which was examined in this project.

So in Study III, those measures that health workers responsible for the health and safety of people in rural areas consider as viable for prevention were highlighted. Indeed in this study Behvarzes in addition to collecting injury data, were encouraged give their own thoughts about potential or actual activities for prevention and explain them to the research team. At the end of the study, they were asked to provide proposals for prevention measures. Their views varied slightly however the emphasis was clearly on protection, and when they explained their views about injury prevention in general, various means of prevention were mentioned.

It is possible that these health workers constitute a select group of people in possession of knowledge that many other people would not have. They have a key role to play in their community as they have a close relation with the community and are very well regarded. So there are good reasons to believe that their judgment of what can be done locally is sound and they can be a good source in order to carry out a social diagnosis in their catchment population. According to the literature, studies of this kind are few. It is quite striking that the participants are both aware of their potential contribution and quite clear about what else can be done by others.

It can be underlined that the research team included members with long experience and members with considerable local knowledge, which greatly facilitated the coding process. Also for Study III, the Behvarzes' suggestions were discussed by a number of experts in the injury field.

The combination of the above mentioned points could secure the trustworthiness of the findings.

Regarding the multi factorial nature of the safety promotion field and the necessity for collaboration among different sectors for the promotion the safety of each community in this project, this issue was also considered. To identify potential prevention countermeasures which could be carried out by different actors for safety promotion in the rural community, both Behvarzes and the people themselves, during different studies, were asked about activities for authorities (health and others); Behvarzes or community heal workers; and even rural people. This was indeed a sort of triangulation approach in safety research and could increase the validity of the measures emerging.

In this project it was considered to be of importance to not only make use of existing local knowledge, but also to assess the specific situation and assess the viability of prevention measures in that context.

It is not possible to import the prevention program as a ready-made package, as the adaptation of those programmes within each context is necessary for success.

Contribution of data registry system to injury surveillance

Main findings

Acceptability is one of most important criteria for evaluating injury surveillance systems.³²⁻³⁵ The system study (Study IV) indicates that the new injury registration system based in the health houses is quite acceptable for the Behvarzes to work with, according to both the Behvarzes and the other stakeholders. They consider the system can raise Behvarzes' awareness about injury occurrence and the circumstances in their local community and that the information gathered may help Behvarzes to adapt their planned public education initiatives. An additional positive aspect is that the system can provide information for different authorities (from the health sector and others) that can be used for planning community-based safety promotion programs.

There was a consensus on the variety of data the system was expected to inform about, among which was the determination of the incidence of the specific type of injuries as well as their sex and age distribution. The interviewees also agreed that it was more doubtful that the system could help in determining the occupation-based data of injuries, causes of injuries and characteristics of injuries in general.

In this system and according to the format of the injury related form/table in the "health horoscope" at the time of this study, Behvarzes were expected to register the sex, age group and place of injury, the last of which was divided into two groups: "inside home" and "outside home". The latter also had three subgroups: "educational place", "work place" and "others".

The agreement regarding how the system can achieve some expected outcomes indicates that the people involved trust the potential capability of the system and see it in a favorite light.

Not surprisingly, the most important facilitator of the system commented upon was the fact that the Behvarzes come from the area. Even the simplicity of the system was raised as an asset, ensured by written guidelines with clear definitions of the categories and the various mechanisms of injuries, by the design of the forms to be filled in. Even other stakeholders mentioned that there is advice available for the Behvarzes from physicians and other health professionals in the health centre, if the injured person doesn't go to health house directly. Its simplicity is one of important quality criteria for the surveillance system which is also focused on here.³²⁻³⁵ In addition, the study revealed elements of community cohesion, in terms of local cooperation and good communication between the Behvarz and people.

Other stakeholders (apart from Behvarzes) were concerned about the data completeness requirements in the system (e.g. routine/standard form to analyze injury cases are lacking; case reports can be missed if injured people do not go to the Behvarz and go, rather to traditional treatment or directly to a private physician in the city).

The results of this study show that both Behvarzes and authority representatives believe the system has many facilitators. In particular, as mentioned above, it seems the community health workers were the right choice for the collection of data in this community based surveillance system. On the other hand Behvarzes' high workload and multiple tasks were regarded as likely barriers to their commitment to the system as

it might hinder their health services to the people. This aspect was raised earlier by the Behvarzes during the follow up study (Study III) and also observed even among other group of health providers in an urban area of Iran. Both groups, in particular the Behvarzes, pointed out that many programs need to be dealt with and followed up; the amount of information to be registered and the paper work limit the time available to focus on other health services.

It ought to be mentioned that, during the study period, the data registry for the Health horoscope was paper-based but that it is currently becoming computerized. It can be expected from this that the Behvarzes' work load will decrease.

More Behvarzes, rather than other stakeholders, commented that an attempt should be made to increase incentives (monetary or occupational) among Behvarzes.

Also Behvarzes (and not other stakeholders) mentioned about the case identification/ registration delay (e.g, in satellite villages). However as Behvarzes don't need to report data immediately after the injury event, this can not be in conflict with the time criteria of the system, as this is another evaluation criteria for each surveillance.³²⁻³⁵

The likely misclassification of injury intent was also raised in this regard but it was a less mentioned barrier. Not to disclose intent might be due to the fact that people know each other and even the Behvarzes in the village and don't like to inform them about the intent of their injuries.

As the strengths of the system, most interviewees considered that the system could provide an array of data of interest for future injury control and prevention. It seems the system has core data needed at the starting phase of forming injury surveillance in the field of rural areas which there were not yet.³²⁻³⁵

One of issues that interviewees raised as a weakness of the system was that as the system is just for injuries leading to hospitalization or death, information on outpatient cases, which could be helpful for any prevention program for the future, is missing. As the system is new, maybe it is more focused on severe and more urgent kinds of injuries. Also to identify severe injury cases is easier. To put this in perspective, most other injury surveillance systems also focus on hospitalization or death.^{32,33}

Behvarzes in this study would appreciate feedback about the information they gather, in the form of, for example reports from upper level authorities, in particular about how that information affects injury control and prevention at community level. It can also increase the incentive among Behvarzes when they can see the effects of their activities.

Strengths and limitations

This project studied one of important reforms in the health system of the country in the area of injury prevention and it was conducted at an early stage in the implementation of the system.

A variety of stakeholders involved in different manners and points in time in the development and implementation of the system were interviewed and offered their views and reflections on the system. This gave a unique opportunity to understand how

the system is perceived and how key informants regard its potential. Different perspectives were captured.

The result of the study can give the policy makers some useful knowledge for improvements to the system in future. It can also provide some information of interest regarding how Behvarzes, as the key involved persons in this system, regard the system and the data collected and their potential to act as pivotal actors for injury control and prevention among rural population.

CONCLUSION

The studies forming this thesis address three important domains for injury control and prevention: injury occurrence; countermeasure for injury prevention; and an injury registry system.

Injury occurrence

The injury incidence is relatively high in the rural population covered and injuries affecting children and males are more severe, many of these being traffic and fall related.

Injuries in and around the home – work-related injuries and also traffic-related injuries, in particular those among motorcyclists, are an important cause of severe and fatal injury among people from rural areas.

The rural healthcare system is accessible to people for trauma care: hospitals for moderate and severe injuries and health houses in their local area for minor ones. It seems therefore that the rural health house fulfils its care and referral function in the case of injury, thereby contributing to injury control locally and decreasing the hospital load.

Behvarzes are aware of the variety of factors that can play a role in injury occurrence and know about the injuries that occur in their community.

Countermeasure for injury prevention

When turning to the community – either injured people or the public as a whole – the prevention of injuries in general and of RTIs in particular appears to rest on a variety of measures whose implementation is under the responsibility of different actors. Injured people stressed that authorities could work on the design, engineering and infrastructure in and around the village; that the rural health workers (Behvarz) could contribute more with local information and education; and that the people themselves could behave in a safer manner.

Not only did injured and non injured people share similar views regarding what different actors can do to enhance safety but they also proposed a wide range of counter-measures that can constitute a basis for an action plan.

Behvarzes may play an important role in both injury surveillance and in identifying context-relevant means of prevention. For their part, they emphasized the adoption of safe behaviour/practice as an important means for RTI prevention, with a focus on motorcycle helmet use and compliance with traffic rules. But they also proposed counter-measures in the fields of engineering and enforcement. They saw their own contribution as health and safety education and promotion.

The barriers to prevention they identified dealt with both individual and environmental factors. Because of their central position in the community, they can help to bridge the know-do gap and provide a basis for authorities and different actors to act in the safety promotion field among the rural community.

Rural health system contribution in injury surveillance

The injury registration system based in the health houses, which focused on severe and fatal injuries, has been accepted by the Behvarzes as an appropriate tool. It is considered that the data thus gathered can help Behvarzes to be aware about injury occurrence and the circumstances in their local community and that the information may also help them to adapt their community education.

Not surprisingly, the most commonly agreed upon facilitator of the system was the fact that Behvarzes come from the area. However, their high workload is regarded as a potential barrier to their commitment to the registration system as there are concerns that increased paperwork may have a negative effect on their health services to the people.

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REFERENCES

1. Peden M, McGee K, Sharma G. The Injury Chart Book: A Graphical Overview of the Global Burden of Injuries. Geneva: World Health Organization; 2002.
2. Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJL. Global Burden of Disease and Risk Factors. A co-publication of Oxford University Press and The World Bank; 2006.
3. Krug EG, Sharma GK, Lozano R. The global burden of injuries. *Am J Public Health* 2000;90:523-6.
4. Mortality and burden of disease estimates for WHO Member States in 2002. World Health Organization; December 2004. Retrieved on 5 June 2008 from: <http://www.who.int/entity/healthinfo/statistics/bodgbddeathdalyestimates.xls>
5. Hafman K, Primack A, Keusch G, Hrynkow S. Global health concerns: addressing the growing burden of trauma and injury in low and middle-income countries. *Am J Public Health* 2005;95:13-7.
6. Peden M, Scurfield R, Sleet D, Mohan D, Hyder AA, Jarawan E, Mathers C. World Report on Road Traffic Injury Prevention. Geneva: World Health Organization; 2004.
7. Razzak JA, Luby SP. Estimating deaths and injuries due to road traffic accidents in Karachi, Pakistan, through the capture-recapture method. *Int J Epidemiol* 1998, 27:866-70.
8. Razzak JA, Luby SP, Laflamme L, Chotani. Injuries among children in Karachi, Pakistan-what, where and how. *Public Health* 2004;118:114-20
9. Razzak JA, Laflamme L: Limitations of secondary data sets for road traffic injury epidemiology: a study from Karachi, Pakistan. *Prehosp Emerg Care* 2005, 9:355-60.
10. Razzak JA: The Potential of Ambulance Records for a Road Traffic Safety Agenda in Low-Income Cities. Studies from Kachi, Pakistan. PhD thesis, Karolinska Institutet, Sweden. 2005
11. Fatmi Z, Hadden WC, Razzak JA, Qureshi HI, Hyder AA, Pappas G: Incidence, pattern and severity of reported unintentional injuries in Pakistan for persons five years and older: results of the National Health Survey of Pakistan 1990-94. *BMC Public Health* 2007, 7:152.
12. Ghaffar A, Hyder AA, Masud TI. The burden of road traffic injuries in developing countries: the 1st national injury survey of Pakistan. *Public Health* 2004;118:211-7.
13. Rahman F, Andersson R, Svanström L: Health impact of injuries: a population-based epidemiology investigation in a local community Bangladesh. *Journal of Safety Research* 1998,29:213-222.

14. Rahman F, Andersson R, Svanström L: Potential of using existing injury information for injury surveillance at the local level in developing countries: experiences from Bangladesh. *Public Health* 2000, 114:133-6.
15. Rahman F, Andersson R, Svanström L: Medical help seeking behaviour of injury patients in a community in Bangladesh. *Public Health* 1998, 112:31-5.
16. Bose A, Konradsen F, John J, Suganthy P, Muliyl J, Abraham S: Mortality rate and years of life lost from unintentional injury and suicide in South India. *Trop Med Int Health* 2006, 11:1553-6.
17. Hang HM, Ekman R, Bach TT, Byass P, Svanström L: Community-based assessment of unintentional injuries: a pilot study in rural Vietnam. *Scand J Public Health* 2003, Suppl 62:38-44.
18. Hang HM, Byass P, Svanström L: Incidence and seasonal variation of injury in rural Vietnam: a community-based survey. *Saf Sci* 2004, 42:691-701.
19. Hang HM. Epidemiology of unintentional injuries in rural Vietnam. PhD thesis, Umeå University and Hanoi University. 2004
20. Odero W, Polsky S, Urbane D, Carel R, Tierney WM: Characteristics of injuries presenting to a rural health centre in western Kenya. *East Afr Med J* 2007, 84:367-73.
21. Mock CN, Abantanga F, Cummings P, Koepsell TD: Incidence and outcome of injury in Ghana: a community-based survey. *Bull World Health Organ* 1999, 77:955-64.
22. Kobusingye O, Guwatudde D, Lett R: Injury patterns in rural and urban Uganda. *Inj Prev* 2001, 7:46-50.
23. Moshiri C, Heuch I, Aström AN, Setel P, Hemed Y, Kvåle G: Injury morbidity in an urban and a rural area in Tanzania: an epidemiological survey. *BMC Public Health* 2005, 28:11.
24. Olawale OA, Owoaje ET. Incidence and pattern of injuries among residents of a rural area in South-Western Nigeria: a community-based study. *BMC Public Health* 2007;7:246.
25. Tercero F, Andersson R, Pena R, Rocha J, Castro N: The epidemiology of moderate and severe injuries in a Nicaraguan community: a household-based survey. *Public Health* 2006, 120:106-14.
26. Tercero F, Andersson R, Julio Rocha J, Castro N, Svanström L. On the epidemiology of injury in developing countries: A one-year emergency room-based surveillance experience from León, Nicaragua. *Int J Inj Contr Saf Promot* 1999;6:33-42.
27. Tercero F. Measuring injury magnitude and patterns in a Low-income country. Experiences from Nicaragua. Doctoral thesis Karolinska Institutet.
28. Mohan D. Tiwari G. *Injury Prevention and Control*. London, Taylor&Francis, 2000

29. Mohan, D. (2002). Road safety in less-motorized environments: future concerns. *International Journal of Epidemiology*, 31(3), 527-532.
30. Wilde, G. J.S. (1994). *Target risk*. Toronto: PDE Publications.
31. Lindqvist K, a, Timpka T, Schelp L, Ahlgren M. The WHO safe community program for injury prevention evaluation of the impact on injury severity. *Public Health* 1998; 112:385-91.
32. Laflamme L, Svanström L, Schelp L. *Safety Promotion Research. A Public Health Approach to Accident and Injury Prevention*. Stockholm: Karolinska Institutet. Department of Public Health Services, Division of Social Medicine; 1999.
33. Holder Y, Peden M, Krug E, Lund J, Gururaj G, Kobusingye O. *Injury Surveillance Guidelines*. Geneva: World Health Organization; 2001.
34. Halperin W, Baker E L, Monson R. R. *Public Health Surveillance*. New York: Van Nostrand Reinhol; 1992.
35. Teutsch S M, Churchill R E. *Principles and Practice of Public Health Surveillance*. New York: Oxford University press; 1994.
36. Zavala DE, Bokongo S, John IA, Mpanga SI, Mtonga RE, Aminu ZM, Odhiambo W, Olupot-Olupot P. Special section: a multinational injury surveillance system pilot project in Africa. *Journal of public health policy* 2008, 29:148.
37. WHO Country Office in Islamic Republic of Iran: Programme areas. Accidents and injuries prevention. Retrieved on 12 March 2009 from: http://www.emro.who.int/iran/ProgrammeAreas-Accidents_Injuries.htm
38. Akbari ME, Naghavi M, Soori H: Epidemiology of deaths from injuries in the Islamic Republic of Iran. *East Mediterr Health J* 2006, 12:382-90.
39. Soori H, Naghavi M. Death from unintentional injuries in rural area of the Islamic Republic of Iran. *East Mediterr Health J* 1999;5:55-60.
40. Naghavi, M, Jafari N, Alaeddin F, Akbari M E. Epidemiology of injuries caused by external cause of injury in the Islamic Republic of Iran (2002-3) [Farsi]. Iranian Ministry of Health and Medical Education: Deputy of Health; 2005.
41. Naghavi M. Mortality profile in 23 provinces of Iran (2003) [Farsi]. Iranian Ministry of Health and Medical Education: Deputy of Health; 2005.
42. Soori H, Naghavi M. Childhood deaths from unintentional injuries in rural areas of Iran. *Inj Prev* 1998;4:222-4.
43. Roudsari BS, Shadman M, Ghodsi M. Childhood trauma fatality and resource allocation in injury control programs in a developing country. *BMC Public Health* 2006;6:117.
44. Karkhaneh M, Naghavi M, Rowe BH, Hagel BE, Jafari N, Saunders LD. Epidemiology of bicycle injuries in 13 health divisions, Islamic Republic of Iran 2003. *Accid Anal Prev* 2008;40:1, 192-199.

45. Soroush AR, Ghahri-Saremi S, Rambod M, Malek-Hosseini SA, Nick-Eghbal S, Khaji A. Pattern of injury in Shiraz. *Chin J Traumatol* 2008;11:8-12.
46. Zargar M, Khaji A, Karbakhsh M. Pattern of motorcycle-related injuries in Tehran, 1999 to 2000: a study in 6 hospitals. 2006: *East Mediterr Health J Health Journal*,12(1-2), 81-7.
47. Zavareh DK, Mohammadi R, Laflamme L, Naghavi M, Zarei A, Haglund BJ. Estimating road traffic mortality more accurately: use of the capture-recapture method in the West Azarbaijan province of Iran. *Int J Inj Contr Saf Promo* 2008;15:9-17.
48. Zargar M, Sayyar Roudsari B, Shadman M, Kaviani A, Tarighi P. Pediatric transport related injuries in Tehran: the necessity of implementation of injury prevention protocols. *Injury*,34:820-4.
49. Zargar M, Modaghegh MH, Rezaishiraz H: Urban injuries in Tehran: demography of trauma patients and evaluation of trauma care. *Injury* 2001;32:613-7.
50. Khorasani-Zavareh D, Haglund, B J A, Mohammadi R, Naghavi M,Laflamme L. Traffic injury death in West Azarbaijan province of Iran. A cross-sectional interview-based study on victim's characteristics and pre-hospital care. Accepted for publication. 2009
51. Majdzadeh R, Khalagi K, Naraghi K, Motevalian A, Eshraghian MR: Determinants of traffic injuries in drivers and motorcyclists involved in an accident. *Accid Anal Prev* 2008, 40:17-23.
52. Neghab M, Rajaei Fard A, Habibi M, Choobineh A: Home accidents in rural and urban areas of Shiraz, 2000-02. *East Mediterr Health Journal* 2006, 12:824-33.
53. Soltani K, Zand R, Mirghasemi A: Epidemiology and mortality of burns in Tehran, Iran. *Burns* 1998, 24:325-8.
54. Ahmadi A, Ytterstad B: Prevention of self-immolation by community-based intervention. *Burns* 2007, 33:1032-40.
55. Arshi S, Sadeghi-Bazargani H, Mohammadi R, Ekman R, Hudson D, Djafarzadeh H, Delavari A, Sezavar H: Prevention oriented epidemiologic study of accidental burns in rural areas of Ardebil, Iran. *Burns* 2006, 32:366-71.
56. Abdolhassani F, Moayyeri A, Naghavi M, Soltani A, Larijani B, Shalmani H: Incidence and characteristics of falls leading to hip fracture in Iranian population. *Bone* 2006, 39:408-13.
57. Mohammadi R, Ekman R, Svanström L, Gooya MM. Unintentional home-related injuries in the Islamic Republic of Iran: findings from the first year of a national programme. *Public Health* 2005;119:919-24.
58. Mohammadi R, Ekman R, Svanström L, Gooya MM: Rationales for home safety promotion in the Iranian primary healthcare system: results from a pilot study. *Public Health*, 2006, 120:58-64.

59. Haddon W, 1970. On the escape of tigers: an ecologic note. *Am J Public Health*, 60:2229-34
60. Haddon W, 1974. Strategy in preventive Medicine: passive vs. active approach to reducing human wastage. *J. Trauma*, 14: 353-54.
61. Haddon WJ. 1980. The basic strategies for preventing damage from hazards of all kinds. *Hazard Prevention*, 16:8-11.
62. Bracht N. *Health Promotion at the Community Level*. United Kingdom, Sage Publication. 1990.
63. Farley C, Haddad S, Brown B. The effect of a 4-year program promoting bicycle helmet use among children in Quebec, *Ame J Public Health* 1996;86:46-51.
64. Khorasani-Zavereh D, Khankeh HR, Mohammadi R, Laflamme L, Bikmoradi A, Hagalund BJA, Post-crash management of road traffic injury victims in Iran. Stakeholders' views on current barriers and potential facilitators. Accepted for publication. 2009.
65. Mohammad-Alizadeh, CS, Wahlström R., Vahidi R, Nikniaz A., Marions L, Johansson, A. Barriers to high-quality primary reproductive health services in an urban area of Iran: views of public health providers. *Midwifery*, 2008 [Epub ahead of print].
66. United Nations-Department of economic & social affair-population division. *World population prospects: The 2006 revision, population data base* 20 Sep 2007. Retrieved on 23 April 2009 from: <http://esa.un.org/unpp/index.asp?panel=2>
67. Vice-Presidency for Strategic Planning and Supervision: Statistical centre of Iran. *The results of population & housing census 2006, No 1: the whole country*. 2007. Retrieved on 23 April 2009 from: http://www.sci.org.ir/portal/faces/public/sci_en/sci_en.selecteddata/sci_en.yearbookdata
68. World Health Organization. Regional Office for the Eastern Mediterranean. *Country Profile: about Islamic Republic of Iran*. Retrieved on 20 April 2009, from: <http://www.emro.who.int/Iran/countryprofile.htm>
69. United Nations Development Programme. 2008 Statistical Update, Iran (Islamic Republic of). Retrieved on 25 April 2009 from: http://hdrstats.undp.org/2008/countries/country_fact_sheets/cty_fs_IRN.html
70. Shadpour K: Primary health care network in the Islamic Republic of Iran. *East Mediterr Health J* 2000, 6:822-5.
71. Mehryar AH, Naghavi M, Ahmad-Nia S, Kazemipour S. Vital horoscope: Longitudinal data collection in the Iranian primary health care system. *Asia-Pacific Population Journal*, 2008 23:55-74.
72. WHO, *Primary health care in action*. Retrieved on 19 March 2009 from: http://www.who.int/whr/2008/media_centre/country_profiles/en/index6.html

73. UNICEF Iran (Islamic Republic of)-Media center-Iran's Excellent Primary Health Care System. Retrieved on 20 March 2009 from:
http://www.unicef.org/iran/media_4427.html
74. Tavassoli M. Iranian health houses open the door to primary care. Report in Bulletin of the World Health Organization 2008, 86:8.
75. Twiserkan district: geography; 2005 [in Farsi]. Retrieved on 8 Dec 2008 from:
<http://toyserkan.com/?cat=6>
76. Statistical Center of Iran: Population Data Sheet for Islamic Republic of Iran by Province; 2001. Retrieved on 5 June 2008 from:
<http://www.unescap.org/esid/psis/population/popin/profiles/iran/Download/2.jpg>.
77. Bu-Ali Sina University: Hamadan city. Retrieved on 5 Dec 2008 from:
http://www.basu.ac.ir/english/hamadancity/e_hamadancity.htm
78. World health Organization. Iran (Islamic Republic of) Retrieved on 28 April 2009 from: <http://www.un.org/Depts/Cartographic/mapprofile/iran.pdf>
79. Hamadan Province. Wikipedia. Retrieved on 10 April 2009 from:
http://en.wikipedia.org/wiki/Hamadan_Province
80. Sethi D, Habibula S, McGee K, Peden M, Bennett S, Hyder AA, Klevens J, Odero W, Suriyawongpaisal P: Guidelines for Conducting Community Surveys on Injuries and Violence. Geneva, World Health Organization; 2004.
81. Bartlett JE, Kotrlik JW, Higgins CC. Organizational research: determining appropriate sample size in survey research. Information Technology, Learning, and Performance Journal 2001;19: 43-50.
82. Moshiro C, Heuch I, Astrom A, Setel P, Kvale G. Effect of recall on estimation of non-fatal injury rates: a community based study in Tanzania. Inj Prev 2005;11:48-52.
83. Hsieh HF, Shannon SE. Three approaches to qualitative content analysis. Qualitative Health Research 2005;15: 1277-88.
84. Khorasani D. Toward safety promotion among road user. Epidemiology and prevention of road traffic injury in Iran. Doctoral Thesis, Karolinska Institutet, Sweden 2009.
85. Chang HL, Yeh TH: Motorcyclist accident involvement by age, gender, and risky behaviors in Taipei, Taiwan. Transp Res F Traffic Psychol Behav 2007, 10:109-22.
86. Mashreky SR, Rahman A, Chowdhury SM, Giashuddin S, Svanström L, Linnan M, Shafinaz S, Uhaa IJ, Rahman F: Epidemiology of childhood burns: Yield of largest community based injury survey in Bangladesh. Burns 2008; ePub: ePub.
87. Van Niekert A, Seedat M, Manckel E, Laflamme L. Caregiver experiences, contextualisations and undrestadings of burn injury to their child. Accounts from low-income setting in South Africa. Child: care, Health and Development; 33:236-45.

88. Green LW, Kreuter, MW. Health Promotion Planning: An Educational and Ecological Approach. New York: McGraw-Hill.1999.
89. National Institutes of Health. (2005). Theory at a glance. A guide for health promotion practice. U.S: Department of Health and Human Services.
90. Bendak S. Seat belt utilization in Saudi Arabia and its impact on road accident injuries. *Accid Anal Prev*;2005; 37:367-371.
91. Farley C. The promotion of safe behaviours at the community level: Evaluation of a bicycle helmet-wearing campaign among 5- to 12-year-old children. (Doctoral thesis, Karolinska Institutet). Sweden.2002.
92. Farley C, Laflamme L, Vaez, M. Bicycle helmet campaigns and head injuries among children. Does poverty matter? *J Epidemiol Community Health* 2003;57:668-72.
93. Hanna CL, Taylor DM, Sheppard MA, Laflamme L. Fatal crashes involving young unlicensed drivers in the U.S, *Journal of Safety Research*, 2006;37, 385-93.
94. Javouhey E, Guérin AC, Chiron M. Incidence and risk factors of severe traumatic brain injury resulting from road accidents: a population-based study. *Accid Anal Prev*;2006;38:225-233.
95. Yau KK. Risk factors affecting the severity of single vehicle traffic accidents in Hong Kong 2004;36:333-40.
96. Pham KH, Le Thi QX, Petrie DJ, Adams J, Doran CM Households' willingness to pay for a motorcycle helmet in Hanoi, Vietnam. *Appl Health Econ Health Policy*. 2008;6:137-44.
97. Oluwadiya K, Olasinde AA, Odu OO, Olakulehin OA, Olatoke SA. Management of motorcycle limb trauma in a teaching hospital in south-western Nigeria. *Niger J Med*. 2008;17:53-6.
98. Afukaar FK. Speed control in developing countries: issues, challenges and opportunities in reducing road traffic injuries. *Inj Control Saf Promot*. 2003;101-2:77-81.
99. Sirathranont J, Kasantikul VMortality and injury from motorcycle collisions in Phetchaburi Province. *J Med Assoc Thai*. 2003;86:97-102
100. Oluwadiya KS, Oginni LM, Olasinde AA, Fadiora SO. Motorcycle limb injuries in a developing country. *West Afr J Med*. 2004;23:42-7.
101. Banthia P, Koirala B, Rauniyar A, Chaudhary D, Kharel T, Khadka SB. An epidemiological study of road traffic accident cases attending emergency department of teaching hospital. *JNMA J Nepal Med Assoc*. 2006;45:238-43.

APPENDIX