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**The Impact of Safe Community Program on
safety promotion among motorcyclists in
IR Iran with focus on helmet usage**

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**Karolinska
Institutet**

Stockholm 2014

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ISBN 978-91-7549-515-6

The Impact of Safe Community Program on safety promotion among motorcyclists in IR Iran with focus on helmet usage

THESIS FOR DOCTORAL DEGREE (Ph.D.)

by

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Abstract

Background: Injuries to motorcyclists are an important public health problem. Motorcycles' riders and pillion have the highest public health burden in terms of disability adjusted life years (DALY) lost. Many countries are facing the problem of a rapidly growing motorcyclists' death. This is important for us because the motorcycle fleet in Iran is rising quickly. These series of studies conducted to assess and evaluate the impact of safe community program on motorcyclist's safety in Islamic Republic of Iran.

Methods: Two cross sectional observations were conducted in 14 cities (5 safe community practicing and 9 safe community non practicing cities) independently on 2005 and 2007. 10% of registered motorcycles were observed and interviewed (n=1114 in each observation).

Results: results revealed that 87.9% used motorcycle for the commercial purposes. All motorcyclists were male, mostly aged 18-29 years old. Death rate significantly rose from 122 to 254 per 100000 motorcyclists in Fars province since first observation ($p < 0.0001$). Helmet usage rate was constant (13%). Recorded crashes increased from 16.4% to 23.1% in safe community setting ($p < 0.0001$). 11% carried more than one pillion. Heat disturbances, embarrassment, hearing blockage, and neglecting were the most mentioned excuses for not using helmet. Law enforcement, public education, accessible to helmet on discount rate, new legislation and finally access to new designed helmet were the most suggestions made by motorcyclists to promote helmet usage. No significant effect was noticed between two settings. Interventions were not constant in safe community cities. Community involvement into the safe program could ensure sustainability of initiatives.

Conclusion: Motorcyclists' death rate is high among the young adult male of 19-39 in both communities in Iran. A positive outcome was detected at the beginning of safe community program on knowledge, attitude and behaviour of motorcyclists' riders and preventive effect on death rate. As the time passes, this effect drops and no significant effect was noticed between the two settings. This suggests that the process of interventions must be constant

Keywords: Safe community, Motorcyclists' safety, Helmet usage

LIST OF PUBLICATIONS AND MANUSCRIPTS

- I. Alireza Moghisi, Reza Mohammadi, Leif Svanstrom, Hussein Kazemainy. Epidemiological study of deaths among motorcyclists due to road traffic injury in IR Iran. Accepted for publication in Open Journal of Preventive Medicine
- II. Alireza Moghisi, Reza Mohammadi, Leif Svanstrom,; To study knowledge, attitude and behavior among the motorcyclists in 14 cities of Iran. Accepted for publication in Iranian Red Crescent Medical Journal
- III. Alireza Moghisi, Reza Mohammadi, Leif Svanstrom, Design specific interventions based on the first study using Focus Group Discussion. Submitted to the Archives des Science journal
- IV. Alireza Moghisi, Reza Mohammadi, Leif Svanstrom ; Impact of safe community program on motorcyclists' safety with focus on helmet usage in 14 cities of Iran. Published in International Journal of Injury Control and Safety Promotion
- V. Alireza Moghisi, Reza Mohammadi, Leif Svanstrom; Motorcyclists' Safety in Iran; implication of Haddon Matrix in Safe Community setting: Accepted for publication in Iranian Medical Journal of Medicine

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LIST OF ABBREVIATIONS

DALY	Disability Adjusted Year
SC	Safe Community
NSC	None Practicing Safe Community
OECD	Organization for Economic Co-operation and Development
IRTAD	International Road Traffic and Accident Database
WHO	World Health Organization
GBD	Global Burden of Disease
RTI	Road Traffic Injury
MOHME	Ministry of Health and Medical Education
DRS	Death Registry System
ANOVA	Analysis of Variance
SPSS	Statistical Package for the Social Sciences
VR	Vital Registration
CBI	Community Based Initiatives
CDC	Center for Disease Control
KAP	Knowledge, Attitude and Practice
OR	Odds Ratio
EMRO	Eastern Mediterranean Region Office
MI	Myocardial Infarction
CVA	Cerebro Vascular Accident
STATA	Data Analysis and Statistical Software

1. CHAPTER 1

1.1 BACKGROUND OF THE STUDY AREA:

1.1.1 Geography:

The Islamic Republic of Iran is located in the Eastern Mediterranean Region (EMR) of WHO. It is the 18th largest country in the globe. There is major climatic and seasonal variation among different regions and cities. Often temperature variations reach to 40 degree Celsius between two neighboring cities at the same time.

1.1.2 Demography and Health:

Iran is currently undergoing an epidemiologic and demographic change. Increasing in population especially in urban area is a characteristic phenomenon for the time being. This is due to rapidly declining death rates and increasing in life expectancy. In 2011, the population of Iran was over 75 million people of which approximately two-thirds lived in urban areas, and over two-thirds were aged younger than 30 years old.^{1,25}

1.1.3 Transportation:

Iran is located at the strategic crossroads. Goods transportation has an ancient background in Iran because Silky road which was a connection route between Asia and Europe passed through it. Now goods transportation continually plays a vital role in Iranian national economy and makes one of the most important building blocks of Iranian economic system. The transport sector comprises 10% of GDP, which is very high compare to other countries. 95 % of goods and passenger transportation is carried out by roads.¹²² Thus, making roads safe remains important not only for economy but also for health sector of the country.^{25,121}

1.1.4 Road Traffic Injuries:

Usually qualified, reliable and exact estimation of the incidence and prevalence of road traffic injuries and deaths are accessible in high income countries. There are many ways to collect data. For those countries that are belonging to the Organization for Economic Co-operation and Development (OECD), results are collected and reported by the International Road Traffic and Accident Database (IRTAD). For the rest of the countries in the world, road traffic crashes data are available from the WHO reporting which is also based on individual countries reporting and the Global Burden of Disease (GBD) project, which is a crude and general assessment of death and disability for 107 diseases including injuries with focus on the road traffic injuries. In general, death rates in developing countries are higher than developed countries.^{2,4,21} The general health of Iranian has improved over the last decades. This is due to the public health prevention

services within Primary Health Care network (PHC), which caused some declines in child and maternal mortality rates, communicable and parasitic diseases and rise in life expectancy. In spite, mortality and morbidity caused by non-communicable diseases and accidents have been raised in recent years meanwhile death rate over the next few years due to Road Traffic Injuries (RTI) is expected to rise. Like other low and middle income countries in the world.^{19,20,21,22} (Fig1.1)

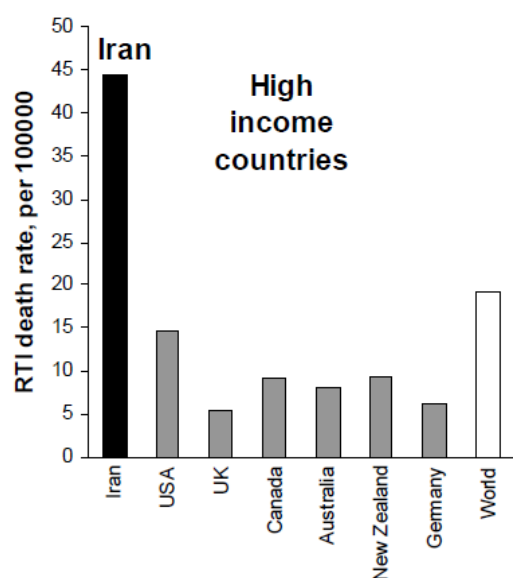


Figure 1.1: RTI death rate in Iran compared with other countries and world

Table 1.1: Leading causes of death in Iran 2004

Rank	Cause of Death	# of deaths	% total deaths
	All causes	299338	100%
1	Myocardial infarction	68892	23%
2	Cerebral vascular diseases	33922	11.3%
3	Road traffic injuries	30721	10.3%
4	Other cardiac diseases	11459	3.8%
5	Stomach cancer	7799	2.6%
6	Chronic lung and bronchus disease	5297	1.8%
7	Cancer of trachea, bronchus and lung	4596	1.5%
8	Disorders related to short gestation and low birth weight	4443	1.5%
9	Pneumonia	4413	1.5%
10	Intentional self- harm	4344	1.5%

Road traffic death rate in Iran is 44 deaths per 100,000 people, slightly higher than any other country in the world, 7th rank in the world regarding road traffic deaths.¹²⁶ Road traffic injuries are among the leading cause of death and disability in the country. Deaths from road traffic crashes are the third rank among top ten causes of death after MI and CVA at the country level.¹²⁶ (Table 1.1)

In Iran RTI deaths account for 10.3% of all deaths, the world average for RTI death is 2.1%. In addition to deaths, road traffic crashes result in a large number of morbidity and disability. Almost 0.8 million people (1.1% of population) are hospitalized for road traffic injuries annually, resulting in a significant burden on health.^{3,5,17,18,109,126}

Road traffic deaths occur most commonly among young adult males nationwide. The rates of hospital admissions and outpatient visits are the highest among this group, suggesting that the highest risk to crash among them. Death due to RTI is high among elderly pedestrians, despite the lower rate of involvement of the elderly in crashes in general.^{6,10,11} (Fig1.2)

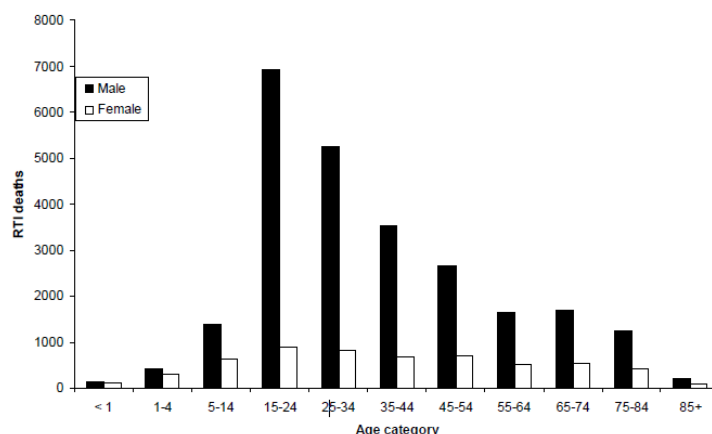


Figure 1.2. RTI deaths in Iran by age and sex groups

Motorcyclists' accidents are the first cause of hospital visits in compare with other road users, even though there are fewer motorcyclists' deaths than car occupants. So motorcyclists' mortality and morbidity are at the first in DALYs due to road traffic accidents.^{17,21,26,34,66} (Fig 1.3.).

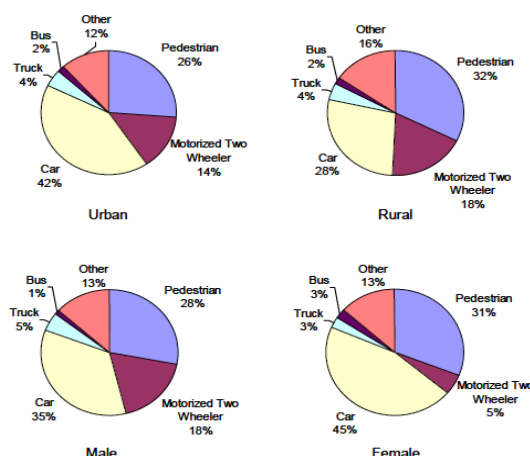


Figure 1.3. Victim's mode of transport for urban and rural residents, and for Males and Females

It is shown that crash helmet usage can prevent fatal and serious head injuries and deaths from resulted from motorcycle crashes in many countries.⁴⁴ Many studies have shown that proper use of helmet would prevent death from motorcycle crashes by 60% - 75%.^{115,118}

Many countries have adopted legislation for mandatory use of crash helmet by motorcycle's riders and pillions.⁴⁴ Still there is a long way to go. In the Eastern Mediterranean Region only 20% of the member states have adopted mandatory helmet law and standards for the type of helmet to be used.^{47,50,60} In Iran motorcyclists are considered as the most vulnerable group among all road users.^{9,14,26} Mortality rate among this group of road users is high and the consequences of the crashes to the riders, pillions and families are tremendous. Most of the victims are young adult and the only breadwinner. Data shows that 25% of total deaths from road traffic accidents are related to motorcyclists' crashes.^{17,32,54,97} Three hundred to four hundred thousand lives are lost every year due to motorcycle death and disabilities.²⁶ It is shown that Community Based Initiatives may be helpful for promotion of helmet usage by motorcyclists at national level. A safe community movement has been initiated for ensuring participation of society in public health programs since last two decades. Actually, safe community movement has its roots in health-policy developments like new public health, World Health Organization (WHO), health for all strategy, and the Ottawa charter.^{106,107,123,124} A safe community is defined as a concrete multi disciplinary model including private, governmental, social, educational and economic authorities and their organizations commit to work on injury prevention and safety promotion at the local and population level.^{19,35}

1.2. SAFE COMMUNITY:

1.2.1. International Safe community:

The concept of a safe community movement originated from the first world conference on Injury Prevention and Safety Promotion held in Stockholm in 1989.¹²⁴ The manifesto for Safe communities was developed later which has been defined the resolution of the conference and still stands as the key foundation document for the international safe communities movement. Many people and organizations in communities all over the world are dedicated to the goals and objectives of safe community and invest energy and resources to accomplish these goals. Manifesto inspired from the concept of systematic collaboration of all organizations and people within a community for changing towards safety. No single approach can be as effective as collaboration of community for injury prevention and safety promotion issues. In this respect the safe community is unique and has ability to fulfil individual expectation. It is said that the leading role should be played by the member of the community, an entity which is more highlighted than any of its components. These communities are expected to achieve the following tasks:

- 1) To document a systematic approach to define and prioritizing injury prevention and safety promotion
- 2) To develop a program to address these above issues in a collaborative process.
- 3) A strong commitment to evaluate the effectiveness of the program on regular basis.

This community is formally eligible to be designated as a safe community by means of World Health Organization's Collaborating Centre on Community Safety Promotion. So far, from all over the world, 336 communities have been designated as a safe community.^{19,35,106,107,125}

1.2.2. A Safe community Model:

A Safe Community reflects the passion of people who committed the community to be free from injury and become safe. They are keen to accomplish tangible goals. By involving people, they make sure that a community will have a significant impact on injuries and disabilities for all age groups, both sexes and all situations. A safe community has to create the capacity to address its injury problems in a most practical way.^{19,35} To be an international designated community fulfillment of 7 indicators of Safe Communities must be demonstrated by nominees.^{19, 35,106,107,125}

1.2.3 Safe community Indicators:

There are seven international indicators have to be fulfilled by a community in order to be designated as an International safe community.^{19,35,106,107,125}

1. An infrastructure based on partnership and collaborations, governed by a cross-sector group that is responsible for safety promotion in their community;
2. Long-term, sustainable programs covering genders and all ages, environments, and situations;
3. Programs that target high-risk groups and environments, and programs that promote safety for vulnerable groups;
4. Programs that are based on the available evidence;
5. Programs that document the frequency and causes of injuries;
6. Evaluation measures to assess their programs, processes and the effects of change;
7. Ongoing participation in national and international Safe Communities networks.

1.2.4. Safe community in Iran:

In Iran the thought of safe community program began on 1997 at the Ministry of Health and Medical Education; implementation was started on 5 piloting cities. The first city that could fulfill the criteria of becoming a safe community was Kashmar city in Khorasan Razavi province. The designation ceremony coincided with the 16th International Conference on Safe Community was held in Tehran on June, 2007. Safe community waves reached to Arsanjan city in Fars province one year later. (Fig 5) At present 25 communities have been designated as an international safe community nationwide.¹²⁵

Although many studies have clearly contributed to a better understanding of the relation between social differences and injury risks and have also demonstrated how crucial some aspects of social stratification are, in this scenario motorcyclists' injury is a neglected category, specifically when concerning the helmet usage by them. A greater attention has been kept on understanding everything about the “output” but almost nothing about the “input”, both at an individual and at a societal level. Although some studies conducted in Iran have documented the rate of helmet use, these series of observational studies are unique in its kind. The main aim was to determine the impact of safe community program on death rate and also on knowledge, attitude and behavior of motorcyclists with focus on crash helmet usages among riders and pillions in safe community practicing cities comparison to safe community non practicing cities in IR

Iran in order to reduce the burden of injuries from motorcycles' crashes.^{19,35,106,107}
Haddon matrix was used as a tool to document potential interventions for promoting helmet usage among motorcyclists in safe community practicing cities

1.2.5. What is Haddon's Matrix?

In 1950 Dr. William Haddon developed a framework for injury analysis based on 3 component including the host (i.e. the person injured), the agent (i.e. what caused the injury) and the environment (i.e. the physical and social). In this type of analysis 3 approaches to injury preventions are considered, including behavioral, environmental and policy changes. From this work he developed a tool called Haddon's Matrix, which can be used to assess injury and identify methods of prevention.^{19,35,47,70,79,80,85,91,92,93,107}

Haddon's Matrix consists of the following four columns and three rows:

Column:

- The host refers to the person at risk of injury.
- The agent of injury is energy which is transmitted to the host through a vehicle like mechanical, thermal, and electrical.
- Environment is subdivided in to two types including
 - I. The physical Environment includes roadway, building, playground, or sports arena.
 - II. The social environment refers to the norms in social, cultural and behavioral e.g. norms about child discipline usage of child restraints, alcohol consumption, policies about licensing drivers, and talking to cell phone while driving.

Rows:

Haddon approached to injury prevention by considering time event of injury occurrence. The following items are placed in the rows of Haddon matrix:

- Pre-injury event phase or Primary prevention, This phase is to prevent injury from occurrence
- Injury event phase or Secondary prevention, This is to reduce the seriousness of an injury or prevent to die
- Post injury phase or tertiary prevention that refers to treatment and rehabilitation phase.

1.3. APPROACH TO THIS STUDY:

Interventions which had been setup and conducted by the expert groups in safe community settings were implemented by the relevant organizations according to the

type of interventions. The interventions included environmental renovation or reform, the law re-enforcement, public education and road engineering

Mean while the Safe community non practicing cities were excluded from all types of interventions and remained as a reference community in this aspect. The same questionnaire was used by the same interviewers as in before and after intervention data collection. Comparison was made between two groups of cities and effectiveness of interventions was measured. This study was performed in five sub studies.

1.4. AIMS AND OBJECTIVES:

1.4.1. Main aim:

-To evaluate the impact of Safe Community Program on safety promotion among motorcyclists in Iran with focus on helmet usage.

1.4.2. Specific objectives:

1. To study epidemiological pattern of motorcyclists' death in case and control cities. (sub study 1)
2. To understand the knowledge, attitude and behaviour of the motorists in case and control cities. (sub study 2)
3. To recognize certain interventions needed to be implemented for promoting helmet usage among the motorcyclists in two different settings.(Sub study 3)
4. To study the role of the safe community program on knowledge, attitude and behaviour of the motorists in case and control cities. (Sub study 4)
5. To measure effects of the specific interventions on helmet usage among the motorcyclists. (Sub study 4)
6. To study the existing rules and regulations' effect on helmet usage among the motorcyclists. (Sub study 3,4)
7. To study possibilities of a new traffic rules and regulations on helmet usage among the motorcyclists in Iran. (Sub study .3,4,5)

1.4.3. Study Area:

The Islamic republic of Iran is located in the Eastern Mediterranean and North Africa Region of WHO. The total area is 1.648 million sq km with thirty one provinces. Iran's population was over 75 million on 2011 census. In terms of health, a major change has occurred during the last couple of decades. The annual population growth

rate has declined from 3% to 1.4% during the above-mentioned period. Crude death rate has declined from 14 to 5 between 1970 and 2009.^{94,101,121} (Fig5)

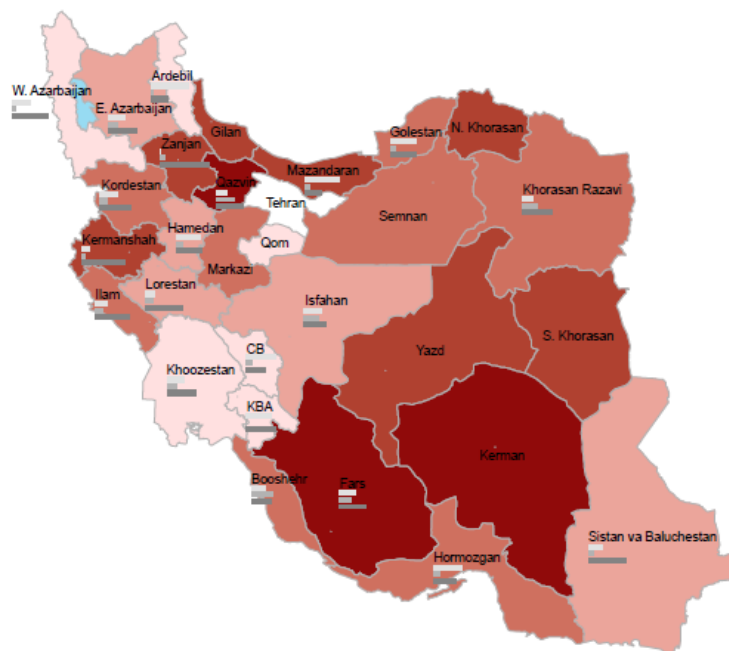


Figure 5; Province level of Iran

1.4.4. Sub Studies:

1.4.4.1. Sub Study One:

"Epidemiological study of deaths among motorcyclists due to road traffic injury in IR Iran"

This study is intended to measure and report injury and death rate among motorcyclists in safe community practicing cities compared to a non-practicing safe community cities as control community (WHO safe communities are those that have either undergone or preparing to under-go the formal WHO accreditation process on the basis of meeting the seven eligibility criteria outlined above).^{19,35,106,107,125} Potential sources of information which was being shown motorcyclist' fatalities were used for investigating any statistical relationships between fatality rate and type of cities (safe community practicing and non-practicing cities).

14.4.1.1. Statistical Method:

1.4.4.1.1.1 SOURCE OF DATA :

-Vital Registration System

In this study, vital registration (VR) refers to the Death Registration System (DRS) in the ministry of health and medical education (MOHME). MOHME collects mortality data from districts' health centers. Data are registered from the most periphery areas including 18000 health houses and is reported to the district health centers. At the district level, vital data are obtained from five sources, they are: all public and private hospitals, district cemeteries, the district office of the forensic medicine organization, and household surveys and information from community health volunteers.¹⁷

Different form of data sources such as death record, hospital admissions, forensic medicine and burden of disease study reports were utilized and merged. All fatality data due to motorcycle accidents were extracted from the above sources existing in 14 cities (5cities known as a WHO safe community and 9 cities are not safe community practicing cities) during 2006-2007.^{16,33,48}

Comparison of the data in these two groups was performed.³⁸ Descriptive statistics for each group was produced as initial analysis. One way analysis of variance (ANOVA) test was used to analyze the relationship between outcome variables of each group. A Kruskal-Wallis one-way ANOVA test was used wherever applicable. All statistical analyses were performed using STATA IQ T1.0.0 version 11 soft ware.^{37,38}

1.4.4.2. Sub Study Two:

"To study knowledge, attitude and behavior among the motorcyclists in 14 cities of Iran"

This is a cross sectional study. It is partly based on questionnaire and partly based on observation which was performed on population. Major streets, junctions and crossing roads in each city were proposed in day timing of day. All motorcyclists who were passing through the study sites in each city were considered by interviewers. Motorcyclists were halted and explained about the goals and the objectives of the study. There were asked for consent and if the consent was obtained, they were proceeded for the next step. This was going on until the total number of participants reached to 5% of registered motorcycles in each city area. The total number of registered motorcyclist was taken from traffic police department.^{87,88,90,91,93}

1.4.4.2.1. Statistical Method:

A standard data collection form was designed and used to obtain data from participants. Data was collected by interviewers in fourteen cities independently and then compared to the neighboring city.

1.4.4.2.2. Data Sources

The source of data mainly was the motorcyclist's statements and observations of the interviewers themselves. All put together in a checklist. Any discrepancies were identified and resolved at a meeting of the reviewers.^{16,30}

1.4.4.2.3. Design of the Study and analysis

Initial analysis produced descriptive statistics for each group. For continuous exposure data of normal distribution, a one way analysis of variance (ANOVA) test was used to analyze the relationship between outcome variables of each group. A Kruskal-Wallis one-way ANOVA test was used for continuous exposure data not normally distributed. Linear (in the case of continuous outcome variables) and logistic (in the case of binary outcome variables) regression methods were used to explore differences between the groups, with adjustment for confounding variables. All statistical analyses were performed using STATA IQT1.0.0 version 11 soft ware.^{37,38}

1.4.4.3. Sub Study three:

"To design specific interventions based on the first study using Focus Group Discussion"

A qualitative research on knowledge, attitude and practice of motorcyclists was performed in 14 cities of Iran on 2006. Meanwhile in another study the rates of motorcyclists' fatality rate were extracted from the vital registry in the same cities on same period. A retrospective chart review of Motorcyclists' injury and death with the result from the KAP study of motorcyclists were obtained. A range of variables relevant to motorcyclists' injury research and prevention was developed and organized according to the Haddon matrix. A series of potential interventions were listed. Representatives from the responsible organizations who are members of the safe community committee were agreed upon to imply interventions relevant to their organization missions in safe community practicing cities.^{83,85,86,91,92,95}

Experience from some high income countries shows that this integrated approach to road safety will result in declining in road deaths and serious injuries and disability. But the systematic approach remains the most important challenge for professionals. The development of traffic safety policy involves many participants from cross sectional group of organizations; like governments (police, justice, health, planning and education), community, industry, NGO's, professionals and media. Classically, responsibilities for traffic safety fall within the transport ministry. Other sectors

cooperate with the ministry of transportation. At the local level the same rule applies. The representatives from transport sector, traffic police department and municipality has joined together for motorcyclists' safety. As fact road safety is best achieved when all the key stake holders work together and share the tasks. When there is a culture of road safety, the providers and enforcers of road traffic systems (vehicle manufacturers, road traffic planners, road safety engineers, police, educators, health professionals and insurers) take responsibility to meet the highest possible standards for road safety. Road users take responsibility by obeying the laws and regulations. To make roads safer, three "E" have to be considered by the local community.

They are explains as follows:

1.4.4.3.1. What is 3E?

This is one of the tools which were used to identify intervention strategies. The other tool is Haddon's matrix.

Three categories are referred to the 3 Es.

- Environment approaches to make the environment safer.
- Educational approaches to provide information to individuals and family and community.
- Enforcement approaches rely on change through laws.⁹

Many studies have investigated motorcyclists' characteristics such as attitudes, knowledge, behaviors, riding frequency, traffic experience, and age of licensure. As motorcycles represent a vehicle easy to use and inexpensive means of transportation, both in the heavy traffic of large cities and in the countryside, the majority of



Motorcycle riders involved in road accidents are young males, especially under 20 years, who generally tend to adopt risky attitudes and behaviors having an increased risk of injury compared with older drivers. Focus Group Discussion is a useful

approach to use “3E” but Haddon matrix tools for operational planning towards road safety.⁸

1.4.4.3.2. What is a Focus Group Discussion or FGD?

Focus Group Discussion is a form of qualitative research method in which the interviewer (also called the moderator) asks research participants specific questions about a topic or an issue in a group discussion. Focus groups, unlike individual interviews, provide the multi dimension answers to the specific questions. Interaction among group members encouraging communication with one another and exchanging ideas should be focused by moderator.¹⁴

1.4.4.3.3. Aims and Objectives:

Design specific interventions based on the existing literature using Focus Group Discussion.

1.4.4.3.4. Procedure

The process involved formulating research questions, protocols were developed, venue was arranged, and finally data analyzing and reporting was achieved.²⁵

1.4.4.3.5. Formulate research questions

A clear and specific purpose statement is needed in order to develop the right questions and elicit the best information from Focus Group Discussions. For example, “To find out how people define a healthy interpersonal relationship”.

1.4.4.3.6. Recruiting participants

Participants were recruited on the basis of their experience or involvement to the motorcyclists' safety. Participants were selected from police department, health sector, hospitals and community centers.

1.4.4.3.7. Participants:

The followings are the structure of the safe community committee for safety of motorcyclists:

Representatives from the following ministry/organization at the local level:

- 1- Traffic Police
- 2- Emergency Medical Services
- 3- Ministry of Road and Transportation
- 4- Ministry of Health and Medical education
- 5- Ministry of Education

- 6- Family Welfare Organization
- 7- Municipality
- 8- Media
- 9- NGOs

1.4.4.4. Sub Study Four:

"The impact of safe community program on motorcyclists' safety with focus on helmet usage in 14 cities of Iran"

Two sets of observational study were conducted in 14 cities (5 practicing safe community cities and 9 were none practicing safe community cities) in 5 provinces of Iran on 2006 and 2007 independently. Permission to questioning motorcyclists for the selected main cross roads in each city was obtained from the municipality authorities and traffic police department. Research assistant and trained investigators were assigned to each observatory site. Over one week period, 10% of the total number of registered motorcycles were observed and interviewed after obtaining oral consent from motorcyclists. Information including motorcycle number plate, rider and pillion demography data and wearing helmet, history of any previous crash and the outcome, knowledge, attitude and behavior of rider and pillion based on standardized questioner were recorded. Observational data sheets were checked for consistency. Data was analyzed by Statistical Package for the Social Sciences (SPSS) soft ware version 11.0. Frequencies were generated, chi-square test for testing significances between before and after test was carried out and two sets of data in each category were compared at the P level of 0.05.^{110,111,113,119,120}

Objective is to evaluate the effectiveness of interventions made for motorcyclists' safety in cities both practicing safe community and non practicing safe community programs. Knowledge, attitude and behavior of motorcyclists with focus on helmet wearing rate among them were considered as criteria of study.

1.4.4.4.1. Methods :

Two sets of observational study was conducted in 14 cities (5 practicing safe community cities and 9 were none practicing safe community cities) in 5 provinces of Iran on 2005 and 2007 independently. Permission to question motorcyclists for the selected main cross roads in each city was obtained from the municipality authorities and traffic police department. A research assistant and trained investigator were assigned to each observatory site. Over one week period 10% of the total number of registered motorcycles were observed and interviewed after obtaining oral consent

from motorcyclists. Information including motorcycle number plate, rider and pillion demography data and wearing helmet, history of any previous crash and the outcome, knowledge, attitude and behavior of rider and pillion based on standardized questioner were recorded. Observational data sheets were checked for consistency. Data was analyzed by Statistical Package for the Social Sciences (SPSS) software version 11.0. Frequencies were generated, chi-square test for testing significances between before and after test was carried out and two sets of data in each category were compared at the P level of 0.05.

1.4.4.4.2. Biostatistics' Methodology for using ANOVA

When we deal with comparison of means of two independent normal populations, three methods: t-test, ANOVA and regression could be used. They are equivalent to each other and give the same p-values. For instance in this study we compared the mean of death due to motorcycle accident in two independent populations: Safe community practicing city and none practicing safe community. In other words we dealt with hypothesis test as follows:

$$\begin{cases} H_0: \mu_1 = \mu_2 \\ H_1: \mu_1 \neq \mu_2 \end{cases}$$

Suppose that X and Y are two independent random variables indicate safe community and non safe community's motorcyclist's death respectively. Also we assume that the variances of two populations are equal. So we have two independent random samples of sizes n_1 and n_2 :

$$X_1 X_2 X_3 \dots X_{n_1} \sim N(\mu_1, \sigma^2)$$

$$Y_1 Y_2 Y_3 \dots Y_{n_2} \sim N(\mu_2, \sigma^2)$$

The simplest way to test H_0 against H_1 , So the H_0 if $|T| > t_{n_1+n_2-2, \alpha}$ is rejected.

Also we can simply prove that the regression analysis gives the same results. Suppose that Y is the motorcyclist's death variable of total population and X is a dummy variable that take 0 if individual be safe community and take 1 when one is Non safe community:

$$X = \begin{cases} 0 & \text{if an individual is SC} \\ 1 & \text{if an individual is NSC} \end{cases}$$

In linear regression we assume the model as below:

$$Y = \beta_0 + \beta_1 X + \varepsilon; \quad \varepsilon \sim N(0, \sigma^2)$$

In this situation the test statistic for $H_0: \beta_1 = 0$ vs $H_1: \beta_1 \neq 0$, H_0 rejected if $|T| > t_{n_1+n_2-2, \alpha}$

Critical region: $F > f_{1, n-2, \alpha} \leftrightarrow$ Reject of H_0

At below we demonstrate that the T and F statistics are equivalent

$F > f_{1, n-2, \alpha} \leftrightarrow T^2 > (t_{n-2, \alpha})^2 \leftrightarrow |T| > t_{n_1+n_2-2, \alpha}$

Therefore both methods give the same p-values.

1.4.4.5.Sub study 5

Motorcyclists' Safety in Iran; implication of Haddon Matrix

Three studies were conducted aiming to design specific interventions with aiming motorcyclist's safety by using Haddon matrix in 14 cities of Iran.

1.4.4.5.1.Methods:

Motorcyclists' fatality data was extracted in 14 cities (5 safe community practicing and 9 safe community non practicing cities) during 2006-2007. As the next step a cross sectional study on KAP (Knowledge, Attitude and Practice) of motorcyclists about helmet was performed. A range of variables relevant to motorcyclists' injury research and prevention were developed and organized according to the Haddon matrix. The risky Behaviors, including over speeding, acrobatic movement, no helmet or not properly wearing helmet were considered. Data were analyzed with chi-square and ANOVA method by Using STATA soft ware.

2. CHAPTER 2

2.1. RESULT:

2.1.1. Sub Study one:

"Epidemiological study of deaths among motorcyclists due to road traffic injury in IR Iran"

This study revealed that the main age group of participants was aged between 18-29 years old (45%). (Table2.1.1.)

Table2.1.1: Number and proportion of registered motorcycles existing in 14 cities in Iran by owner's age group, in practicing safe community cities verses Non practicing safe community cities, 2007

Characteristic	Safe community groups		
	Safe community practicing	Safe community no practicing	all
Participants, no. (%)	116520(51.3%)	110540(48.7%)	227060(100%)
Owners age in years			
0-17	0(0)	0(0)	0(0)
18-29	52434(45%)	48195(43.6%)	100629(44.3%)
30-44	33790(29%)	37804(34.2%)	71594(31.5%)
45-59	15963(13.7%)	12380(11.2%)	28343(12.5%)
60 and above	14333(12.3%)	12161(11%)	26494(11.6%)

Khorasan province with more than 65% of the registered motorcycles has the highest rate of motorcyclists among the three provinces in this study. Bushehr province which is located at the north side of the Persian Gulf has 21% of the motorcyclists and Fars province in south west of Iran has the least number of motorcyclists in each province, there are two groups of cities. Group one case cities where the WHO safe community model for injury prevention and safety promotion activities is being practiced. Except Bushehr where the effect of safe community to the motorcyclists' death rate could not be demonstrated, in Fars and Khorasan, safe community approaches have had positive effects on the motorcyclists' death rate.

In Khorasan province the numbers of motorcycles are the highest among safe communities practicing cities (55.4%) compare with non practicing safe communities (44.6%). The death rate of motorcyclists are less in safe communities of Khorasan province includes Kashmar and Bardscan which both are internationally designated as a WHO safe community since 2007, 2008 respectively(47%). In Ferdos and Torbat-e-

heydarieh cities where are located in Khorassan province as non-practicing safe community death rate of motorcyclists is high (53%).

The same picture was detected in Fars province. Arsanjan and Eglid are two cities that the WHO safe community model is practicing; the Arsanjan was designated as an international safe community on 2008. Effect of the WHO safe community to the motorcyclists' death is positive in these two cities compare with the other cities of the Province, Kazeron and Niriz (44.5% vs. 55.5%).

The story is slightly different in Bushehr province. Statistically no differences were detected in Safe community practicing cities and non- practicing safe community in Bushehr province in terms of fatality from motorcycle's accident. In Fars province number of death from motorcycle accident is slightly more in practicing safe community compare with non- practicing safe communities. This may be because of better data collecting system in the former than the later. But statistically this finding was not significant. (Table 2.1.1.2., 2.1.1.3.)

Table2.1.1.2: Number and proportion of existing registered motorcycles in 14 Iranian cities in safe community practicing Verses safe community non practicing cities, 2007

province	Number of Motorcyclists					
	SC	%	NSC	%	Total	%
Busher	Busher city	44	Genaveh & Tangestan cities	56	49060	21.6
	21520	18.5	27540	25		
Khorasan	Kashmar & Bardscan cities	55.4	Ferdos & Torbat e Hydarieh cities	44.6	148000	65.2
	82000	70.3	66000	59.7		
Fars	Arsanjan & Eghlid cities	43.4	Kazeron & Niriz cities	56.7	30000	13.2
	13000	11.2	17000	15.6		
Total	116520	51.3	110540	48.7	227060	100

Table2.1.1.3: Death rate among the motorcyclists by 100,000 motorcycles in 14 cities in Iran, in practicing safe community cities verses non practicing safe community cities, 2007

Province	Safe community practicing cities		Safe community none practicing cities		P.Value
	City	Death Rate	City	Death Rate	
Busher	Busher	41.7	Genaveh	41.8	0.0763
Khorasan	Kashmar	34.2	Ferdos	75	0.0369
	Bardscan	16	Torbat-e-heydarieh	200	
Fars	Arsanjan	225	Nairiz	254	0.0492
	Eghlid	122	Kazeron	95.7	

The situation is slightly deviated in Khorasan province. The safe community practicing cities are safer than the non practicing safe community in terms of motorcyclists' safety. After testing we did not find any statistically significant differences between these two set up. (Table 2.1.1.4.)

Table 2.1.1.4.: Number and proportion of motorcyclists' fatality in 14 cities in Iran in practicing safe community cities verses non practicing safe community cities, 2007

province	Safe community Groups	No.(%)	ANOVA or K-W test P-value
Busher	NSC	8(11.8)	0.1489
	SC	9(14.8)	
Khorasan	NSC	36(52.1)	0.1546
	SC	32(52.4)	
Fars	NSC	20(36.1)	0.1373
	SC	25(32.8)	

2.1.2. Sub Study two:

"To study knowledge, attitude and behavior among the motorcyclists in 14 cities of Iran"

Data shows that younger age groups use motorcycle more frequently; most of the participants were between 15-29 years of age. The most dominant occupation was farmers. (Table 2.1.2.1)

Table 2.1.2.1: Demographic characteristics of participants in study, by safe community group, in 14 locations in Iran, 2006

Characteristic	Safe community groups		
	Safe community practicing	Safe community no practicing	all
Participants, no. (percent)	5287 (48.3)	5639 (51.2)	10926
Age in years			
0-14	23(0.4)	28(0.5)	51(0.5)
15-29	2596(49.1)	2771(49.1)	5367(49.1)
30-44	1789(33.8)	1986(35.2)	3775(34.6)
45-59	621(11.7)	630(11.2)	1251(11.4)
60 and above	258(5.8)	224(3.9)	482(4.4)
Work status, no. (percent)			
Governmental/Non-governmental employee	951 (18.9)	1094(19.7)	2045 (19.3)
Self-employed/Free job	447(8.9)	750 (13.5)	1197(11.3)
farmer	1680 (33.3)	1496(26.9)	3176(30)

73.2 percent of motorcyclists supposed that wearing helmet is looking funny, 44.4 percent disturbing, 30 percent mentioned about the hotness generated in helmet, 36.4

percent said it blocks the hearing, and finally more than 70 percent expressed that the helmet usage is an embarrassing to the riders in both case and control cities. (Table 2.1.2.2. & 2.1.2.3.).

Table 2.1.2.2.: Reasons expressed by the motorcyclists for not wearing helmet in both groups

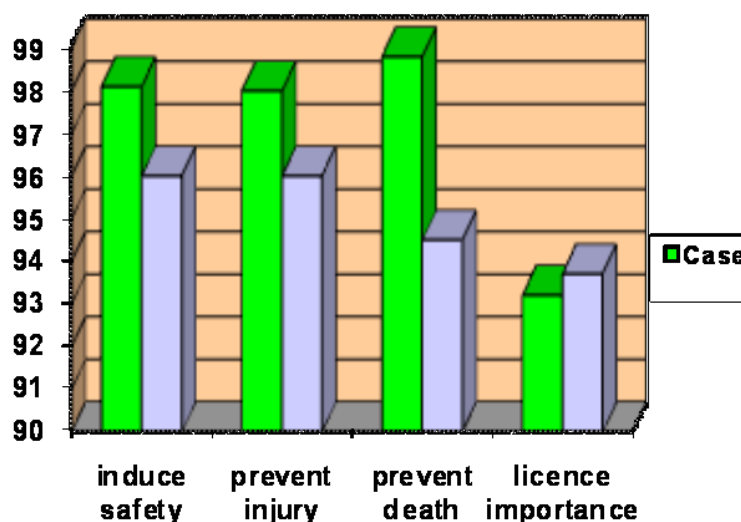
Excuses made by motorcyclists	ALL			Safe community practicing			Safe community no practicing		
	No.	percent	95percent CI	No.	percent	95percent CI	No.	percent	95percent CI
disturbing	1034	38.4	36.3-40.5	664	64.2	61.8-68.4	370	35.8	33.9-38.1
Embarrassing	253	9.4	7.7-11.6	130	51.4	49.0-53.4	123	48.6	36.1-53.9
Forgetfulness	833	30.9	28.4-33.0	544	54.5	51.7-58.3	379	45.5	40.9-64.7
Block Hearing	183	6.8	4.1-12.9	83	45.4	38.4-52.5	100	54.6	50.8-59.2

Table 2.1.2.3.: Motorcyclists' accident and its consequences in 14 cities of IR Iran by safe community group, 2006

Outcome	Safe community Group	No.	ANOVA or K-W test ^b P-value
Motorcyclists faced with accident	NSC	2500	< 0.0001*
	SC	3501	
Sustaining multiple injuries when accident happened	NSC	3512	< 0.0001*
	SC	3256	
Wearing helmet when accident happened	NSC	2	0.1373
	SC	0	

Our finding confirms that almost half of the motorcyclists have faced with at least one time accident since riding motorcycle (55 percent), most of them had got some kind of major injuries during the same crash (71 percent), but surprisingly only two motorcycle riders were wearing crash helmet at the time of crash.

For assessment of the knowledge of participants we found that most of the motorcyclists have good knowledge about the safety of helmet usage. More than 98 percent of motorcyclists knew that helmet can induce safety, can prevent injury to the head and prevent death. Statistically no differences were found between two groups of cities. $P < 0.05$ (Graph 2.1.2.1.)



GRAPH 2.1.2.1.: Knowledge of motorcyclists in 14 location of Iran by safe community group, 2006

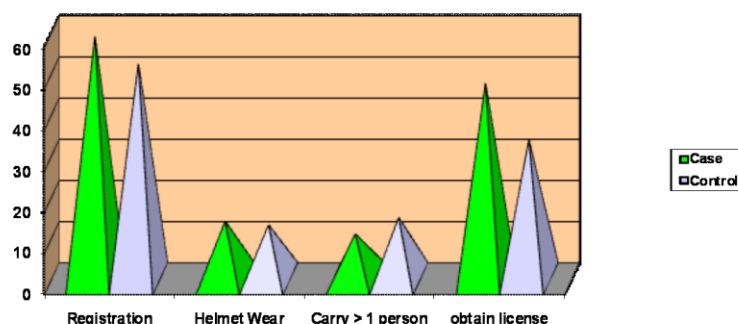
In the part of attitude assessment, this study revealed that wearing a helmet could be looked funny to some of the motorcyclists, could be disturbing, and induces hotness especially in humid and tropical cities and blocks hearing too. Embarrassing while wearing a helmet was mentioned by some participants. Odds ratio (OR) was calculated for both the groups independently, the odds of the criteria in safe community group vs. other group were considered. In two items namely generating hotness and hearing blockage while using helmet, the odds ratio was significant between two groups. Data show that the odds for generating hotness in the safe community practicing cities was 7.1 but for hearing blockage in safe community non practicing cities was 0.65 after age adjustment. (table 2.1.2.4.)

Table 2.1.2.4.: Crude odds ratio and age-adjusted odds ratio in 14 cities in Iran, 2006

Attitude of motorcyclists for helmet usage	Crude OR			Age-adjusted OR		
	OR ^a	95percent CI	P- value	OR	95percent CI	P for model
Safe community practicing						
Looking funny	1.23	0.8-1.9	-	1.17	0.7-1.9	-
Disturbing	0.47	0.3-0.8	*	0.46	0.3-0.7	-
Generate hotness	7.10	1.7-29.9	*	7.11	1.7-29.9	*
Hearing Blockage	0.69	0.4-1.1	-	0.65	0.4-1.0	*
Embarrassing	0.78	0.4-1.3	-	0.75	0.4-1.3	-

About one half of the motorcyclists had a registration number fixed on their motorcycle, about 13percent had worn helmet, about 6 percent were using the motorcycle as a vehicle to carry a load and 4.5percent had used other safety devices on the motor cycle rather than helmet, such as crash guard, and half of the motorcyclists had held the driving license in both group of the cities. About 13percent were carrying more than one passenger at the time. (Graph 2.1.2.2.).

So finally participants were asked about the ways that could improve safety among the motorcyclists with emphasize on helmet usage. They expressed on public education and necessity of mandatory helmet law enforcement as the two first options. Re-designing of helmet that suits for the use in local were mentioned by many of the motorcyclists. This action can overcome the hotness which is generated by the helmet while wearing it. Access to the less expensive helmets with affordable price was the least suggestions which were made by 46 percent of the participants. (Table 2.1.2.5.)



GRAPH 2.1.2.2.: Behavior of motorcyclists in 14 location of Iran by safe community group2006

Table 2.1.2.5.: Recommendations were made by motorcyclists for promoting helmet usage by safe community group in 14 location of Iran 2006

Excuses made by motorcyclists	ALL			Safe community practicing			Safe community no practicing		
	No.	percent	95percent CI	No.	percent	95percent CI	No.	percent	95percent CI
New legislation	1212	11.2	-	662	12.6	-	550	9.8	-
Public Education	8041	74	-	4031	76.5	-	4010	71.6	-
Less price	2548	39	-	1340	44.1	-	12.8	46.2	-
Suitable design	183	6.8	-	83	45.4	-	100	54.6	-
Law enforcement	7820	71.8	-	3782	71.7	-	4038	72	-

2.1.3. Sub Study three:

"To design specific interventions based on the first study using Focus Group Discussion"

2.1.3.1. Participants:

With the poll of experts and stakeholders from various organizations, the followings are the structure of the Safe Community Committee for Safety of Motorcyclists:

Representatives from the following ministry/organization at the local level:

- 1- Traffic Police
- 2- Emergency Medical Services
- 3- Ministry of Road and Transportation
- 4- Ministry of Health and Medical education
- 5- Ministry of Education
- 6- Family Welfare Organization
- 7- Municipality
- 8- Media
- 9- NGOs

With the poll of experts and Stakeholders from various areas, the following were selected as working groups:

- 1-Health services (physical, social and spiritual - healthy physical environment, capacity building)
- 2-Education
- 3-Law enforcement
- 4-Family and youth
- 5-Media (radio, television, newspapers, magazines and Internet)
- 6-Safety and security and physical environment
- 7-Research and statistics
- 8-Empower the community about Road Safety

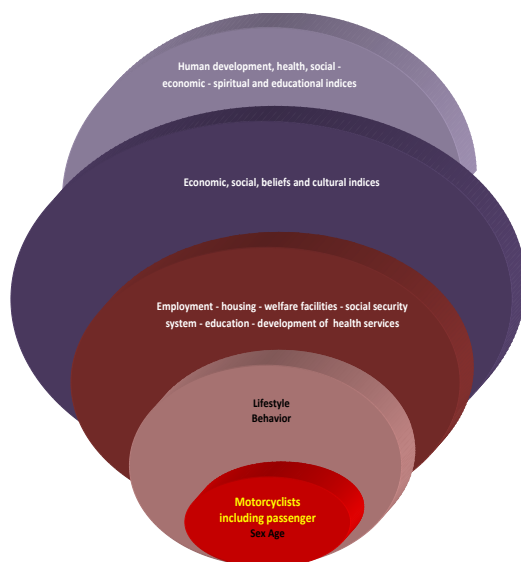
Minutes for the cross sectional meeting is shown in table2.1.3.1.

Table 2.1.3.1.: Meetings' Minutes:

<i>Date</i>	<i>General proposed meeting</i>	<i>Outcome</i>
17.june.2007	<ol style="list-style-type: none"> 1. Browse concepts 2. Expectations expression and the expected time for project completion 3. Obligation to determine and set the project team Duties 4. Need to attract support and participation of others in this area 5. Necessary to avoid parallel working 	Clear topic - create common language - to determine the project team to develop relevant proposals and determine the team functions
29.june.2007	<ol style="list-style-type: none"> 1. Discuss the differences and similarities in different areas of Road Safety 2. Talk and discuss about the proposals development 3. Talk about the age group that included. 4. Necessary measures to design multi disciplinary approach and involve other parties from the beginning. 5. Emphasis on rural groups 7. Overview of the advice from network knowledge in road safety . 8. Overview of the World Bank and World Health Organization documentation in this area 9. Need the social strata in planning 10. Necessary to reach the conceptual model to attract support. 	The initial proposals based on suggestions and comments.

17.july.2007	1. To discuss about the conceptual model 2. To discuss about the Stakeholders	To finalize proposals and to Develop basic conceptual model
27.july.2007	1. To discuss about the initial conceptual model 2. Necessary to determine the final output (s) from the beginning 3. Necessary to determine the indices that will be consequently changed throughout the program	Reform model based on the initial concept meeting and suggestions
3.Aug.2007	1. To discuss about the conceptual model 2. To discuss about the stakeholders and the need to prioritize them and they separated in to two Steering Committee members and members of working groups 3. Talk about the Steering Committee and working group members	-The final conceptual model developed -The primary table of main stakeholders developed
15.Dec.2007	Three days meeting of stakeholders to documentation	Final Text Developed

2.1.3.2. Conceptual Model:



2.1.3.3. Some of the strategies related to Motorcyclists' health

Strategy 1: direct services to victims

Strategy 2: Support and training caregivers of motorcyclists' victims

Strategy 3: Promote development education to the motorcyclists and passengers.

Strategy 4: Strengthen national and provincial resources and capabilities based on needs related to road safety

Strategy 5: Strengthen demand and awareness

Strategy 6: Developing national policies for motorcycle safety in terms of manufacturing, distributing, after sale services valid license and insurance, etc.

Strategy 7: Create/Enforce rules and regulations within the framework of support

Strategy 8: Strengthening of cooperation locally, nationally and internationally

Table 2.1.3.2.; further strategy and action plan:

Strategies	Indices
1 - Adopting policies based on national evidence of road safety	1 - 100% of policies of road safety programs related to motorcyclists' safety are developed locally based on available literatures and data 2 - 100% increase in number of policies developed with involvement of multi disciplinary centers.
2- coordination in developing comprehensive equity and health program in motorcyclists' health among all stakeholders and strengthening cooperation	1-promoting stakeholders participation by 50%
3 - adopting policies supportive motorcyclists and their family 4 - develop equitable health care programs for Road 's victims	1-Increase the number of supporting domain to 30% of basal rate 2-Increase number of health care programs to 50% compared to the basal rate 3-Increase health care coverage programs to 50% compared to the basal rate
5 –Pro moting education of motorcyclists 6-support and education for police department	1-promoting knowledge of all targeted group by 30% 2-capacity building for all targeted group by 20% annually
7-Strengthen enforcement of legislation of mandatory helmet law	Execution of 100% approvals by the end of the program

8- Changing of attitude to health and safety issues in government and non-governmental organizations and private industries to promote competent helmet manufacturing. Lowe price and better design helmets	1-50% of organizations know their duties and priorities in their areas related road safety by the end of the first year of program 3-50% operational programs of governments and non-governmental organizations to have comprehensive health related activities
9-promoting health education and information based on evidences	1 – equipment of 20% of centers delivering health education by the end of program 2 - Attracting participation of NGOs, the Forum staff at least 80% by the end of program 3 – To achieve at least 50% health education programs in partnership with program staff , NGOs, the Forum staff, the local media until the end of program. 4- 20% annual increase in the local media programs related to road safety programs
10-Expand communication and support policies to the sectors design common projects	Advocacy of 20% of stakeholders by the end of the program
11-Strengthening national resources	To use up at least 80% of financial human and equipment resources in the city until the end of potential program

Table 2.1.3.3.: Haddon Matrix for Motorcyclists' safety

Time	Host	Agent	Road environment
Pre-event	Increasing safety culture by educating this group. Providing safety environment for them, Training of traffic safety rules to the student, Training younger kids for bicycle safety and helmet use, Enforcement of traffic police for safety belt and crash helmet and over speed	-poorly designed helmet which is not suitable for the climate of Iran. -Routine Motorcycle safety inspection	Bad quality of roads particularly rural roads and tropical climate Clear road signs and signals
Event	-Wear fastened helmet - Education to the family and young individual by local media	Good quality, well-fitting helmet Leg guards on cycle Heavy boots and clothing. To look for any failure in breaking system and suspension	Energy absorbing barriers Roadsides clear of fixed obstructions Guardrail along cliff enforcement of over speeding law and checking for driving license and other document to control less than 18 years old individual driving.
Post-even	Rehabilitation	First aid kit Emergency radio	Communication network Transportation network Emergency services

2.1.3.4. Tasks achieved by the committees are:

1. Issuing official notices for the committee members and determining the duties of each member based on the instructions
2. To convene sessions with the related administrations for designing the operational plan for prevention of prioritization of injuries in the city area.
3. Agrees upon the time table to perform activities by each member with relation to the safety promotion and injury prevention among motorcyclists.
4. Following up the decisions of the committee, to coordinate with other organizations in case of needs and coordination for regular committee meetings. Every member had committed for the safe community and report back to the committee secretariat regularly.
5. Define the hot points in different places of city and correction.

Note taking with handwritten was the source of the statements mentioned by the participants. Data transcribed by two note takers independently to ensure accuracy. Although financial or staff time restraints may require that the facilitator assumes the dual responsibility of note taker, preferably the note taker does not participate in the focus group. For this project inclusion research projects, note taking is our preferred method of recording.

2.1.3.5. Data analysis:

Data analysis is the process of reviewing the information (data) gathered and finding comments. These groups of similar comments are called themes. From the themes and the differences the data begins to tell you a story. This helps you to make meaning out of the information gathered and will help you determine what kinds of actions are required and what the recommendations will be. These results form the basis of the report to be written. Make sure that the voices of the participants in the focus groups are heard by using quotes to highlight the main points and recommendations of the report. Data analysis was done in following steps;

1. Selecting statement as unit of analysis
2. Coding each statement
3. Formulating all statements
4. Clustering statements into categories
5. Assessing reliability by systematic checking until agreements achieved
6. Assessing validity through confirmation by returning to the original text to find example and resolution through discussion
7. Reassessing validity and finalizing the results

2.1.4. Sub Study Four:

"The impact of safe community program on motorcyclists' safety with focus on helmet usage in 14 cities of Iran"

At this stage a total number of 11146 observations were analyzed in each group of cities. The majority of the motorcycles were used for commercial purposes (87.9%). All observed motorcyclists were male aged 18-29 years old. The dominant literature status was diploma (12 years standard) and below. 40 percent of motorcyclists were from the rural areas. (table 2.1.4.1.)

Table 2.1.4.1.: Number and age of participants by two settings

Factors	SC		NSC	
	No	percent	No	percent
Numbers	11146	100	11652	100
0-17 years of age	0	0	37	0.13
18-29 years of age	5243	47.03	4819	41.35
30-44 years of age	3379	30.31	3378	28.99
45-59 years of age	1596	14.31	1238	10.62
60 years old and above	828	7.42	1216	10.43
Missing	100	0.89	964	8.27

The death rate from the motorcycle crashes were analyzed in two settings at two time lines. Previous studies the safe communities of Busher, Khorasan and Fars provinces showed that the death rate was 41.8, 34.2 and 122 per 100000 motorcyclists respectively. After two years the death rate from motorcyclists' crashes raised to 43.9, 43.7 and 254 respectively. Only in Fars province the raised was significant at the level of 0.05. ($P < 0.0001$) Values in safe community Non practicing cities remained statistically unchanged throughout the study. (Table 2.1.4.2.)

Table 2.1.4.2.: Death rate by 100000 motorcyclists

Name of Province	SC		NSC	
	Before	After	Before	After
Busher	41.8	43.9	41.7	43.2
Khorasan	34.2	43.7	75	79.4
Fars	122	254*	95.7	95.2

* p value < 0.0001

Helmet usage rate was found to be 13% among motorcyclists in both settings. With regards to crash profile, motorcyclists faced more crash in safe community practicing cities (15.4% Vs 25.3%) after implementations of safe community program. Helmet wearing rate on recorded crashes increased from 16.4% to 23.1% during the study period, but severity of crashes declined from 43.6% to 33.2% during the same period in safe community settings. Changes in all above figures were significant. (p value < 0.0001, $\chi^2 = 0.439$) (table 2.1.4.3.).

Table 2.1.4.3.: Facts related to crash

Crash	SC		NSC	
	Before	After	Before	After
Facing with a crash	15.4	25.3*	17.3	21.3
Wearing helmet during crash	16.4	23.1*	14.2	13
Sustaining multiple injuries	43.6*	33.2	42.3	35.4

* P value < 0.0001

In behavior part of the study revealed that helmet wearing rate was very low initially and also remained low during the second study period at both settings. 52% of motorcyclists had at least one pillion. Carrying more than one pillion was observed in almost 11 percent of motorcyclists in safe community practicing settings and was around 14 percent in safe community non practicing settings. None of them wore helmet. Both the changes were not statistically significant at the level of 0.05 (p value < 0.0001). About one half of the motorcyclists had a legal registration for the motorcycle. (Fixed number plate) at both the settings. It increased during the study period from 48.7% to 51.3% in safe community practicing settings and from 45.5% to 54.7% in safe community non practicing settings. Both the values were statistically significant. (p < 0.0001) (table 2.1.4.4.)

Table 2.1.4.4.: Behavioral factors related to motorcyclists by two settings

Factors	SC		NSC	
	Before	After	Before	After
Helmet wearing	8.9	13.1	10.7	13.9
Carrying more than one pillion	10.9	11.1	14.9	13.6
Having registration	48.7	51.3*	45.5	54.7*
License Obtained	48.0	50.2	44.3	42.9

* p value < 0.0001

When motorcyclists were asked about the reasons of not wearing helmet? Answers were because of heat disturbance, embarrassment of wearing helmet, hearing blockage and limitation of the field of vision and ignorance. In heat disturbance item the value remained statistically unchanged during the study period at both the settings. In embarrassment item a change from the first study to the second study (before and after) was noticed in both the settings which was statistically significant. More changes were noticed in safe community practicing cities rather than the fellow group (51.4% to 11.5%). In hearing blockage and limitation of field of vision part no significant changes was noticed in either groups. Finally more motorcyclists mentioned about neglecting as a reason for not wearing helmet in safe community non practicing cities compare to safe community practicing group. Statistically significant at the level of 0.05. (p < 0.0001) (table 2.1.4.5.)

Table 2.1.4.5.: Excuses made by motorcyclists for not wearing helmet by two settings

Items	SC		NSC	
	Before	After	Before	After
Disturbance	64.2	48.1	35.8	34.9
Embarrassment	51.4	11.5*	48.6	30.2*
Hearing Blockage	45.4	52.1	54.5	56.3
Neglect	66.9	51.6	33.1	48.4*

* p value < 0.0001

Finally when motorcyclists faced with the question that what can be done to promote helmet usage among motorcyclists and pillions, 76% said Public education, 71.8% mentioned Law enforcement and about 50% said accessibility with discounted rate. In new design the difference was significant in favors of both the setting after implementations at the level of 0.05. ($p < 0.0001$) (table 2.1.4.6.)

Table 2.1.4.6.: suggestions for promote helmet wearing rate by motorcyclists by two settings

Items	SC		NSC	
	Before	After	Before	After
Law Enforcement	71.8	68.9	71.5	70.0
Public Education	76.5	63.3	71.6	69.8
Discount rate	44.1	49.1	12.8	46.2
New Legislation	12.6	10.9	9.8	8.4
New Design	45.4	56.8*	54.6	67.3*

* p value < 0.0001

2.1.5. Sub study Five:

Motorcyclists' Safety in Iran: Implication of Haddon Matrix in Safe Community setting

The predominant group of the participants was male drivers between 15-29 years (table1). The highest death rate was detected from the Fars province (225/100,000 motorcycles) and the least from the Bushehr province (41.8/100,000 motorcycles). In the Fars province, the highest mortality rate was revealed in Niriz city (NSC)(254/100,000 motorcycles) and the least reported from Eghlid city (SC)(122/100,000 motorcycles). In Busher province, the highest death rate was detected from the Busher city (SC) (41.8/100,000 motorcycles) and the least was from the Genaveh city (NSC) (41.7/100,000 motorcycles). In Khorasan province, the highest death rate was reported from the Torbat-e-hydarieh city (NSC) (200/100,000 motorcycles) and the lowest from Bardscan city (SC). (16/100,000 motorcycles) (table2, 3, 4) About fifty percent of motorcyclists died on scene of crash, 25% died on the way to the hospital and 25% at the emergency room. 73.2% of motorcyclists

believed that wearing a helmet is looking funny, 44.4 percent said that it is disturbing, 30 percent mentioned that they feel warm when wearing a helmet and it generate heat particularly in summer time. 36.4 percent said it blocks the hearing, and finally more than 70 percent expressed that the helmet usage is an embarrassing to the riders in both case and control cities. (Table 5) Our finding confirms that 55 percent of the motorcyclists have faced with at least one time accident, 71 percent of them had got some kind of major injuries during the same crash, two motorcycle riders were wearing crash helmet at the time of accident. (Table 6)

We also found that most of the motorcyclists have good knowledge about the safety of helmet usage. More than 98 percent of motorcyclists knew that helmet can induce safety, can prevent injury to the head and prevent death. Statistically differences were found between two groups of cities. ($P < 0.05$) (Graph 1) Embarrassing while wearing a helmet was mentioned by many participants. Odds ratio (OR) was calculated for both the groups independently, the odds of the criteria in safe community group versus other group were considered. In two items namely inducing heat and hearing blockage while using helmet, the odds ratio was significant between the two groups. Data showed that the odds for inducing heat was 7.1 (CI: 1.7-29.9) in safe community practicing cities and the odds for hearing blockage was 0.65 (CI: 0.4-1.0) in safe community non practicing cities after age adjustment. (table 7)

About 50% of the motorcyclists had a registration number fixed on their motorcycle, about 13 percent had worn helmet, about 6 percent were using the motorcycle as a vehicle to carry loads and 4.5 percent had used other safety devices rather than helmet on the motor cycle, such as crash guard. About 50 percent of the motorcyclists had obtained valid driving license in both group of the cities. About 13 percent of motorcyclists were carrying more than one pillion. (Graph 2)

Finally participants were asked about the potential ways to improve safety among the motorcyclists with emphasize on helmet usage. They expressed on public education and necessity reinforcement of mandatory helmet law as the priority. Re-designing helmets suitable for local climates with better ventilation to overcome the hotness which is generated by the helmet was mentioned by many of the motorcyclists. Access to the low priced helmets affordable to the public was the last recommendation which proposed by 46 percent of the participants. (Table 8)

Following convening safe community committee in 5 safe community cities, three priority strategies related to Motorcyclists' safety were adopted (Table 9) as follows:

- 1- To enhance direct services to the victims and support and training to the caregivers
- 2- To promote a campaign aiming to public awareness and community sensitization
- 3- To enforce rules and regulations within the framework of support

The main tasks achieved by the safe community committees at the local level are:

6. Every inter disciplinary member have commitment to the safe community and report back to the committee regularly.
7. Issuing official notices for the inter disciplinary members of the committee and determining the duties of each members based on the instructions
8. Holding sessions in order to design operational plans for prevention of injuries in the city area.
9. Each inter disciplinary committee member should agreed upon the time table for planned activities regarding the safety promotion and injury prevention among motorcyclists.

3. CHAPTER 3

3.1. DISCUSSIONS

Motorcycles are considered the most economic form of urban transportation; it becomes more important in developing countries rather than developed countries. It can be afforded by most of people belonging to any economic levels. It accounts for high proportion of mortality and morbidity compare with other form of transportations especially in low and middle income countries.^{26,34,39,122} The highest death rates from the road traffic injuries have been recorded from eastern Mediterranean and African region. This rate has been raised since the last few years in this region and cause 1-3 percent decrease in gross national product of the countries with more impact on poorer individual. Data shows that in Iran, road traffic injuries and deaths affects almost 5 percent of gross national product and 1,200,000 lives lost on 2004.^{17,109} Among all the road users, motorcyclists are the most vulnerable groups and provide no protection for its rider and pillion.^{46,48}

The dominant age group of participants was 15-29 years of age (49.1percent), they are mostly the bread winner In Many studies including sixty one observational studies which were performed worldwide, and the results in terms of motorcyclists' death and injury were the same.¹⁴ In all studies motorcycle helmet found to reduce head injury in motorcyclists' crash. It is estimated that helmet reduces the risk of death by 42% .In some articles helmet show to reduce risk of head injury by 69%.^{114,115} There are no sufficient evidences for effectiveness of helmet in protecting facial and neck injuries. In traffic related accident mainly motorcycle injuries are sustained by young adults, posing a tremendous burden to individuals and society.^{116,117,118} Traffic related accidents prematurely interrupt the life of thousands of people, especially during the first decades of life in the economically active age range (adolescents and young adults aged 15 to 44 years), representing a serious socioeconomic and public health problem.^{8,13,26,69} This study revealed that the main age group of participants was 18-29 years of age (45%). Predominant age group of the motorcyclists in both case and control cities are the young individual below 40 years old. In these cities most of the motorcyclists were using the motorcycle as the source of the family income. Most of them were the breadwinner. A study emphasized that how crucial the first years of driving experience are and how wide the gap is in terms of socio-economic differences at this stage.^{77,78,97,98,105} Even if based on nation-wide data referring to a single country, these findings might be transferable to other countries where the motorcycle injuries have a

higher prevalence rate.¹⁰² In Our study we did not measure the experience of motorcyclists but most of them used the motorcycle as the only vehicle of source of income for the family. In another study which was performed in Sweden in an experimentally designed community, the effect of an organizational program on prevention of traffic related accidents was measured.^{11,40} The results showed a 50% reduction in the relative risk for moderate and mild injuries. Those who benefit most from the program were pedestrians, cyclists, and motorcyclists. This study does not measure the impact of helmet as a goal. Our study revealed slightly changes occurred in motorcyclists' death rate in safe community as a model for organizational interaction for injury prevention and safety promotion at the community level. sub study two that measured attitude, knowledge and practice of the motorcyclists, revealed that wearing a helmet could be looking funny to some of the motorcyclists, disturbing, inducing hotness especially in humid and tropical cities, and blocking hearing as well. Embarrassing by wearing a helmet was mentioned by some participants. Odds ratio was calculated for both groups independently, the odds of the criteria in safe community group vs. other group were considered. In two items namely generating hotness and hearing blockage while using helmet, the odds ratio was significant between two groups of cities. Data show that the odds for generating hotness in the safe community practicing cities was 7.1 and the odds for hearing blockage in safe community non practicing cities was 0.65 after age adjustment. A study was performed in Arsanjan about the safety of motorcycle in Fars province. 1286 motorbikes participated, 7.9% had helmet and 92.1% did not, 35 % of them had their own helmet and 6.4 % of them used it regularly. 7.5% of them said it was heavy and bothering and 78.4% of them were aware about benefit of use of helmet. Data showed that the lowest motorcycle accident recorded in Eghlid with 28 percent and the highest rate was recorded from the Niriz city with 42 percent. The difference was statistically significant.¹²

The none practicing safe communities in the khorasan province are Ferdos & Torbat-e-Hydarieh. In these cities death rate of motorcyclists (53%) were high. the same picture was detected in Fars province. Arsanjan city and Eghlid city are two cities that the safe community model is practicing since many years. The Arsanjan was designated as an international safe community on 2008. Effect of the safe communities to the motorcyclists' death was positive in these two cities in compare with other cities of the Province which the safe community model was not practicing. They were Kazeran city and Niriz city (44.5% vs. 55.5%).

The story is slightly different in Bushehr province. First of all the Bushehr port is cited at the northern side of the Persian Gulf in south of Iran, since high number of immigration, age and sex composition of population turns rapidly. The population density is high too.¹²¹ These criteria make the city unique within the province. The safe community program started very early in the city but due to many factors, the program did not run well. The positive effect of the safe community model to the death rate of motorcyclists could not be demonstrated and in some instances we could conclude a negative effect in spite. Statistically no differences were detected between Safe community practicing cities and non- practicing cities in Buser province in terms of mortality of motorcycle's accidents. In Fars province number of death from motorcycle accident is slightly more in safe community than in non- practicing safe community. This may because of better data gathering system in the former than the later. But statistically this finding was not significant. The situation is slightly deviated in Khorasan province. The safe community practicing cities are safer than the non practicing safe community for motorcyclists. After testing we did not find any statistically significant differences between these two set ups. It was shown that motorcyclists' safety was not the main priority of the community in safe community settings, but as a subsidiary outcome to the main activities of road traffic safety. Factors related to the individual level, such as alcohol consumption, remain by far the main determinants in injury severity.

When planning programs for motorcycle injury prevention, timing and groups more in need should be taken into account. Effective alliances are needed for multiple policies at local and national levels, including public and private partnerships, to link the fields of public health, health care, transportation, law enforcement, engineering, and education.^{12,13,42,43,45} Specifically, safety measures such as protective clothing for leg and forearm, reflectors, and structural modifications of the motorcycle like side air bags are just some of the aspects that should be considered and made available at a price affordable by all the motorcyclists, without a further increase of socio-economic differences in health outcomes.^{30,43,67} Our study revealed that law re enforcement was the main item mentioned by motorcyclists to promote helmet usage. Since most of the motorcyclists were the bread winner, motorcycles' accessory safety devices such as air bag and etc could not be considered in this study.

Almost in all studies dealing with motorcyclists' characteristics including attitudes, knowledge and behaviors, the similar findings were detected. The majority of motorcycle riders involved in road accidents are young males, particularly under 20

years, who generally tend to adopt risky attitudes and behaviours having an increased risk of injury compared with older drivers.^{39,40,49} As far as the carrier of the participants concerns, most of the participants were farmers, followed by technicians. 40percent of the motorcyclists was under 12 grade diploma. About 51.5 percent and 48.5percent of motorcyclists were from urban and rural areas respectively. This finding is against the total population distribution in the country, according to the latest report from the national census, about 75percent of the total population lives in urban settings and 25percent are living in rural areas.¹²² Wherever the motorcyclists are from, they belong to the most vulnerable economical group. This shows that using motorcycles are more attractive to the rural young adults who cannot afford to own a car. In addition easy and inexpensive usage of motorcycles and convenient usage in traffic jams can be considered as some causes of attraction.^{67,68,80,81,120}

3.1.1. Collisions involving motorcyclists

About half of the motorcyclists had faced with at least one accident in the past one year prior to this study. The number of accident cases were less in the control cities where the safe community program is not practicing, we found that this difference is statistically significant at the level of < 0.05 , the same situation exists for sustain an injury in two groups of cities, but in terms of wearing the helmet there was no differences revealed in both groups of the cities. The possible explanation is that surveillance setting is more developed in safe communities than the fellow cities. The other way to explain this finding goes back to the public educational campaign in safe community practicing cities which were conducted sometimes prior to the study. This might have changed the concept of accident among the motorcyclists.
51,52,53,54,55,57,58,59,60

3.1.2. Medical consequences of motorcyclists' accidents

As far as the medical consequences concern, this study confirms the vulnerability of the motorcyclist to lower limb injuries, constituting 20 percent of all the reported medical problems. Some authors have also focused on the crash phase, providing analysis of fatal crash typing and circumstances.^{8,18} It has to be said that although the literature is considering the lower extremity as the most injured part of the body, though the percentage of being the lower limbs involvement in motorcycle accidents varies broadly from 20 to 60 percent in different studies.^{8,30} Our finding shows that about 44 percent of the motorcyclists had injury in their feet while this figure is 27 percent for the hands. Head and face were involved in 23 percent of them, other parts of body with less frequency were trunk, scapula and pelvic.

Nevertheless, the distal segments of both the upper and lower limbs are involved with a greater probability than the proximal one. The possible reasons for lower limb injuries have been suggested to be multi factorial. These include lack of training and skills, lack of preventive strategies such as leg protection devices and unsuitable or inadequate footwear. These devices are too expensive and in most circumstances the total costs of these devices will be more than the price of the motorcycle itself.^{63,65}

Helmet usage has been shown to be highly effective in reducing the adverse outcomes of motorcycle injuries and contributing to the reduction of health care expenses⁴⁵. The effectiveness of mandatory use of helmet in preventing severity of physical trauma has been evaluated as well. These studies have uniformly found that the presence of helmet law, representing an external social control, contributes to the high helmet wearing rates in many countries reducing motorcycle-related morbidity and mortality.^{17,27,41,62,64,68} We did not include the outcome of the accident in motorcyclists who were wearing helmet compare to those that not wearing helmet at the time of crash. (This was Included in limitation of the study) In this study we found that more than 97 percent of motorcyclists believed that using a helmet could bring safety to them and preventing them from sustaining serious injuries and deaths. About 97% of the motorcyclists owned at least one helmet.

3.1.3. Attitude of motorcyclists about wearing helmet

In attitude part, the study revealed the following attitude which was said by the motorcyclists. Wearing helmet is be looking funny and embarrassing to some of the motorcyclists, is disturbing to some of them, is generating heat particularly in humid and tropical cities, and is blocking the hearing of motorcyclists. Embarrassing while wearing a helmet was the amazing excuse which was mentioned by some of the participants. Among all the above statements generating heat and blocking the hearing while using helmet were found statistically significant in both study groups. Odds ratio were calculated for both the study groups and the odds of the criteria in safe community group vs. the other group were considered. The odds ratio was significant between two groups in two items namely generating heat by helmet and hearing blockage of the motorcyclists while put on a helmet. ($P < 0.05$, CI 95percent) About 74 percent of the motorcyclists in both study groups believed that public education is a good way to

Promote helmet wearing rate among the riders, 72 percent of the participants believed on the law enforcement for raising helmet wearing rate, the third suggestion was on accessibility of helmet with lesser price and good quality (39percent). Other suggestions were: improving helmet designing to suit the local climate (6.8percent) and to developing new legislation (11.2 percent).

About 13 % of all motorcyclists in the study (before and after) wore one form of helmet or the other. Neither in safe community practicing cities nor safe community non-practicing cities showed any changes during the two studies period. Studies of helmet use in other countries show low rate of helmet usage. In this country helmet wearing is not covered by the compulsory helmet law on roads. Low rate for helmet usage in this study differs from other similar studies. For instance a study in south west Nigeria on 2009 on helmet wearing rate among the motorcyclists was reported as high as 82% though it was a self reporting. Measuring correct usage of helmet was not a criterion to look for in our study. But in many similar studies it was noticed that about 50% of motorcyclists wore helmet correctly. In a study conducted in Oyo state in Nigeria about 82.0% of the motorcyclists reported that they used helmets. Although only 8.6% reported that they always wore their helmets, 4.6% most of the times, 68.8% sometimes, while 18.0% said they never wore a helmet when riding. Our study revealed that more motorcycles' rider faced with crash in safe community setting compare to safe community non practicing cities. But more motorcycles' riders wore helmet while riding and during the recorded crashes with less sustaining multiple injuries. The reason behind this could be explained as the outcome of strengthening of surveillance system in safe community setting compare to safe community non practicing cities. Same reason is applicable in case of motorcyclists' death rate which has been increased in Fars safe community after implementation of the program.

In spite of increasing the rate of crashes in safe communities than non safe communities, sustaining multiple injuries have dropped. It means that the severity of injuries to motorcyclists was less. In study conducted in Iran on auditing the community based initiatives (CBI) program showed that all the CBI programs were not sustained. Reasons behind this could be explained as less or non involvement of community into the programs' activities. In another study in Islamic republic of Iran Motorcyclists' death by world health organization on 2006 was targeting the evaluation of CBI program supports the same founding that active involvement of community is lacking in all CBI sites. Our study revealed about 50% of motorcyclists had at least one pillion. One by ten of motorcyclists had carried more than one pillion with the same

motorcycle. None of the pillions wore helmet. The same result reported by other authors in developing countries. It seems that it requires urgent interventions for pillions. In our study the rate and profile of pillions remained the same during both studies at both settings. Other studies have also reported low rates of helmet usage among children and female pillions. Neglecting remained the same in safe community settings but rose rapidly in safe community non practicing settings. This is explained by the fact that even though the helmet law was not enforced fully, officials of the safe community were undertaking a campaign for helmet use by motorcyclists during the study period. when motorcyclists were asked what suggestions do they have to help for promoting helmet usage among motorcyclists, recommendations were including the compulsory helmet law enforcement by the police department, enhancing public education by officials from the education and health department, access to helmet on discount rate, developing new legislation and finally developing helmet with new design suitable for local climate. The later differs in safe community compare to non safe community settings; our result could be comparable with other studies. This might be attributed to the tropical climate in the study area. Tropical designed helmets with optimal ventilation have thus been advocated for use in tropical countries. Study on the reasons for non-use of helmets among motorcyclists reported that about a third of respondents mentioned discomfort from the heat caused by wearing helmet as the most important reason for non-use or inconsistent use. Another study on attitudes of pillion passengers to helmet use mentioned among other reasons that female passengers were reluctant to wear a helmet because they felt it would ‘mess up their hairstyles. No female riders were included to our study and female pillions were very less. Helmet use was same among commercial motorcyclists compared with non-commercials.

104,105,108,116,117

3.1.4. Behaviors of motorcyclists about wearing helmet

Analysis of behavioral part of the study revealed that the helmet was used by only 13 percent of the motorcyclists; while the rate of self reporting ownership of at least one helmet was around 97percent among the motorcyclists.

More than 77percent of the motorcyclists in both study cities knew that the serious injuries and death can be prevented by wearing a crash helmet while riding motorcycle. This finding goes parallel with a Meta analysis study which was achieved by Liu BC et.al. On 2009 they selected sixty-one observational studies of varying quality. Despite methodological differences there was a remarkable consistency in results, particularly for death and head injury outcomes.¹¹⁹ Motorcycle helmets were found to reduce the

risk of death and head injury in motorcyclists in crashed situation. From four higher quality studies helmets were estimated to reduce the risk of death by 42 percent and from six higher quality studies helmets were estimated to reduce the risk of head injury by 69 percent.^{77,78,97,98,103,104,105}

72 percent of the motorcyclists believed that the law enforcement for helmet usage is the most effective single tool to promote helmet usage among the motorcyclists. It is worth to say that the law of helmet wearing has been adopted nationwide since many years ago but has not been enforced adequately. Many studies have revealed and proved the above statement which was said by the motorcyclists. Dr. Ivers et al. had examined the effect of motorcycle helmet legislation on helmet wearing rates.¹¹⁹ They showed that legislation and enforcement if accompanied by public acceptance of an intervention, is likely to dramatically increase helmet wearing at a population level¹¹⁹. Given the protection afforded by motorcycle helmets, high helmet wearing rates should translate into reductions in population head injury and death rates. For countries motorcycle riding is a common form of transportation but helmet use is low, helmet legislation enforcement would be the most cost-effective ways to reduce the burden of injury in the community dramatically.^{14,26,36,45} In terms of necessity of holding a proper license by motorcyclists, 93 percent of the motorcyclists knew that to hold a regular motorcycle driving license is mandatory by law and is very important in terms of safety. Of assessing this part of the study, we found that the rate of holding a driving license was only 40 percent among the motorcyclists. When we asked for the reason, majority said that ignorance was the main reason. This finding suggests that the enforcement of the motorcycle licensing is weak and needs to be considered.

When we put the same question for not wearing helmet in spite of all its advantages, they answered in different categories. Mostly said to wear a helmet is disturbing to them, while others mentioned that wearing helmet causes narrowing field of vision and blocks their hearing, some participants mentioned that helmets which are available in the market are too heavy to be used constantly, forgetfulness to take helmet while leave home in the morning was mentioned by some groups of motorcyclists, this group further mentioned that in this case nobody will be questioning you for not wearing helmet as well. Most of the participants mentioned two or more reasons for not wearing a helmet.

Of assessing the behavioral part of the study, less than 15 percent of the motorcyclists were carrying more than one passenger at the time. About half of motorcyclists had a

number plate fixed on their motorcycles. There was no statistically difference found between two city groups. ($P < 0.05$, CI 95percent)

This may be explained through the level of socio economic factors of the motorcycle riders, since motorcycle in low and middle income countries are usually made for the lower socio economic groups, this could influence to raise the risk of injury. Psychosocial factors are one of variables set; access to material resources, such as an adequate income and decent housing, the organization of work and occupational exposure, health behaviors may also partly explain the association between SES and healthy life style. At an area level, favorable community socio-economic conditions reflect an area's material resources and access to high-quality municipal services (e.g. safe roads). Multiple explanatory factors are likely to be operating simultaneously to produce an injury occurrence (i.e. the helmet use and road conditions on motorcycle fatalities) and affect an injury outcome (i.e. access to high-quality treatment and rehabilitation).^{3,7,28,82}

The self reporting ownership of motorcycle and the only source of the income of the family were 85 percent in both the study groups. About 73 percent reported at least one experience on motorcycle crashes during the year prior to the study but only very few of them had worn helmet at the time of crashing.^{87,88,89}

3.1.5. Conclusion and Implications for prevention

Effective efforts at improving traffic safety require some attentions to be paid for safety improvements in all 12 (or nine) cells of the Haddon Matrix. Similarly, different agencies and organizations whose policies target the same cell (such as the multitude of those that focus on affecting driver behaviors in the pre-crash period) should establish ways to work collaboratively to maximize their impact. This study helped a group to reveal many field of motorcycle accident prevention at 3 levels. Using the Haddon matrix was a useful, user friendly and highly beneficiary tool.

The proportion of motorcyclists observed for wearing helmets remained the same in both the studies (before and after). This suggests the safe community program should target motorcyclists and pillion passengers as one of the highest risk group. The beneficial effect of enforcement on safety compliance among motorcyclists suggests the need for educational campaigns that would highlight the benefits of wearing motorcycle helmet. The more community involvement in priority settings and

intervention part of safe community plan of action is an essential factor to ensure the sustainability of model which would be planned.

3.1.6. Adding to the field

Sustainability of the safe community model is an important factor to have a positive impact to the motorcyclists' death. As the whole finding the death rate from the motorcyclists is high, young male adult of 15-40 are the main victims of motorcycle accidents in both studied communities (comparable with the world report). Except for the Bushehr safe community which was started on 1997 and halted some years later, the other safe communities had the preventing phenomenon on motorcyclists' death compare with the non- practicing safe community cities at the beginning but some years later the effect factor declined in safe communities. The United Nations General Assembly has announced 2011 to 2020 as the Decade of Action for Road Safety. Promoting helmet usage among the motorcyclists is the most cost effectiveness interventions which can overcome severe concussions to the head and improve the outcomes. It will be benefit to make the decade ahead safer for motorcyclists.

3.1.7. Limitations

- Seasonal variation and time of day for helmet usage was not considered for the study.
- Multi sources of data gathering boosts possibility of multiple counting

4. ACKNOWLEDGEMENTS

- The author acknowledges all research staff including interviewers, data analysts and officials in study sites.

-This work was carried out with the extremely encouraging support by my main-supervisor Dr. Reza Mohammadi, Division of Social Medicine, Department of Public Health Science, Karolinska Institutet. I proposed him this project in 2006 when he was in Iran for a scientific meeting at the CDC at the ministry of health and medical education. I requested him to accept to be the main supervisor for this project. He supported me in all aspect during my PhD course. I'm grateful for his regular daily contact and dedicated mentoring. My thanks to him for his timely execution of all assigned postgraduate courses and other required curriculum components of the program as specified in the general and individual study plans.

- Thanks to Professor Leif Svanström, WHO Collaborating center on safety promotion, Department of Public Health Sciences, Division of Social Medicine. His support was encouraging to complete this project. His presence in the department and in the project as a co-supervisor was an asset to the scientific growth of this project.

- Many thanks to Mr. Mehrdad Zarrabi for editing the thesis.

- I cannot mention the name of all my colleagues who have helped me to complete this study, but I am most thankful to all of them for their continuous encouragement and support and I hope the best in life for them.

- Give thanks to all motorcycle riders and their pillions who contributed to this project.

- Finally my special thank to Dr. Gouya, the general director for CDC in Iran who supported me in every step during my study. He is inspiring me and without his generous support I would have not been able to continue my study.

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