National and Sub-national Trend and Burden of Injuries in Iran, 1990 – 2013: A Study Protocol

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Abstract

Background: Worldwide, injuries are a major public health concern and make a considerable contribution to the disease burden. The present study is a component of the National and Subnational Burden of Diseases, Injuries, and Risk Factors from 1990 to 2013 (NASBOD) study in Iran, which was designed to investigate the burden of most important injuries (road traffic injuries, falls, burns, poisonings and drownings) at the national and sub-national levels in Iran. In this paper we explain definitions, organization, injuries selection process, data sources, data gathering methods, and data analyses of the national and sub-national burden of injuries study in Iran.

Methods: The burden of most important injuries in current metric of DALYs at the national and sub-national levels in Iran over 1990-2013 will be estimated through comprehensive reviews of either published or national data sources. Statistical modeling will be used to impute the missing data on the burden of selected important injuries for each district-year.

Conclusion: The results of present study can help health policy makers to plan more comprehensive and cost-effective strategies at national and sub-national level for prevention and control of burden caused by injuries.

Keywords: Burden of diseases, injury, Iran, study protocol

Introduction

Injuries are a major public health concern all over the world and particularly in low and middle income countries.[1] Based on data compiled as part of the global burden of diseases (GBD) 2000 project,[2] it is clear that injuries make a considerable contribution to the disease burden in all countries in all regions of

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the world. Furthermore, the global injury-related disease burden is expected to rise over the next 20 years, particularly the burden due to road traffic injuries (RTI).[3] Data also suggest that the majority of deaths currently due to injury take place in the low- and middle-income countries, and almost half occur in young people, i.e. those aged between 15 – 44 years.[3]

The first National Burden of Diseases Study in Iran was conducted in 2003 by the Ministry of Health and Medical Education (MOHME) in collaboration with World Health Organization (WHO).[4] The estimated results showed that injuries caused the highest disability-adjusted life year (DALY) in all ages and both sexes (28 % of the total) and the highest proportion of DALYs caused by injuries, were due to years of life lost due to premature death (YLL) in all. The GBD study in 2000 showed that Iran ranks third in the world regarding its high injury-related mortality rate; with approximately 70.0 – 94.9 deaths per 100,000.[3] Iran has higher injury-related mortality rate in comparison with high income countries in Eeastern Meditrranean Region (EMR) , in which the total mortality rate due to injuries equals 51.1 Deaths per 100,000.

Globally, RTIs accounted for 23 % of all deaths[5] and more than 90 % of RTI deaths occurred in low and middle income countries.[6] The number of RTI continues to rise all over the world, but there has been an overall downward trend in RTI deaths in high income countries since 1970s, and an increase in many low and middle income countries.[7] RTIs are predicted to rise from 10th rank in 2002 to 8th rank by 2030 as a contributor to the GBD.[8] If appropriate action is not taken The overall global increase is expected to be 67 % by 2020.[9]

In 2002, the mortality rate due to RTIs per 100,000 was 19 globally 26 in Eastern Mediterranean, 29 in sub-Saharan Africa, 19

in the United States, 9 in Canada, and 6 in Germany, while in Iran the figure was 44 per 100,000, and had the highest RTI death rate in comparison with any other country for which reliable estimates could be made[10] and ranked third among all countries for its DALYs.[4] According to the first NBD study done by the MOHME in 2003, RTIs has only been recently recognized as a leading public health concern in Iran and were reported as the leading causes of DALYs.[10] According to the NBD study in Iran, 2003, RTIs hadthe highest burden in all ages and both sexes that contribute to 15.1 %, 5.3 %, and 9.1 % of total YLL, YLD and DALY respectively among unintentional injuries.[4]

Burns are among the most devastating injuries and contribute to a major global public health crisis.[11] Burns are the 4th most common type of trauma worldwide, followedby traffic accidents, falls, and interpersonal violence and cause more than 1 % of the global burden of disease.[12] Burnsare one of the main causes of disability and mortality and have severe economic and social consequences.[13] The global incidence of fire-related injuries in 2004 was estimated to be 1.1 per 100,000 with the highest rate in Southeast Asia and the lowest rate in the North America.[14] WHO estimated that 310,000 people died in fires in 2004 across the world, and more than 95% of fatal fire-related burns occurred in low and middle income countries, with a global mortality rate equal to 4.8 per 100,000 per year.In EMR, fire-related mortality rate was 5.6 deaths per 100,000 that is higher than the global mortality rate.[15]

Iran has a high incidence of burns, contributing to a significant public health concern in terms of mortality, morbidity, and permanent disabilities.[16] According to GBD data in 2000, Iran ranked second in the world regarding fire-related mortality rate, which equaled 4.01 – 4.80 deaths per 100,000.[3] Iran, like other low and middle income EMR countries, has high fire-related mortality rate in comparison with high income EMR countries with 1.5 deaths per 100,000.[3]

Surveillance of injuries in Iran has shown that burns are the most common cause of unintentional home-related injuries accounting for 40 % of those injuries in all ages.[17] According to report of another survey in Iran, 12 % of all deaths in all ages are due to unintentional injuries and burns are the second most common cause of injury- related deaths after RTIs.[18] The first NBD Study in Iran, 2003, showed that burnsare the 13th most frequent cause of the burden of disease in the country.[4] The GBD study in 2000 showed that fire-related burn mortality was 4.01 – 4.80 per 100,000.[3]

It was estimated that 283,000 people died due to falls all across the world in 2000.[19] WHO reports that, in 2002, one quarter of all fatal falls occurred in developed countries.[20] According to the NBD Study in 2003 in Iran,[4] falls are the 6th most frequent cause of the burden of disease among 21 first causes and contribute to highest DALYs after RTIs among all unintentional injuries in the total population of Iran. 7 %, 3.7 %, and 2.5 % of total YLL, YLD and DALY of diseases are due to falls. YLDs constitute more than 80 % of all the induced burden of falls[4] that as a main cause of disability; have severe financial and psychological consequences for victims and their families. Other important injuries in most countries of world such as Iran include drownings and poisonings that either of them constitutes a considerable part of DALYs due to injuries.

Drowning is a preventable, unintentional injury with a remarkable mortality rate.[21] It is the third non-intentional injury resulting in death and accounting for 7 % of all injury-related deaths.[22] In 1990, the number ofdeathsdue to drowning was higher than wars (504,000, vs. 502,000).[23] According to GBD 2000 data, an estimated 449,000 people drowned worldwide (7.4 per 100,000 population) and in terms of DALYs more than 1.3 million life years were lost due to premature death and disability resulting from drowning.[24] In 2004, it was estimated that 388,000 people died due to drowning.[22] Hence, drowning was considered as a major public health problem worldwide in 2004.

It is estimated that 97 % of drowning occurs in low- and middle-income countries.[24] Although over 60% of the world's drowning occurs in Western Pacific Region and South-East Asia Region,[22] the African Region has highest drowning mortality rates (13.1 per 100,000, eight times higher than that in Australia or USA.[25]

In 2001, the rate of death due to drowning as a specific cause in Iran was estimated to be 2.6 (0.9 to 4.1) per 100,000. There was a geographical variation with the highest rate in the northern part of Iran.[23] The NBD Study in 2003 in Iran showed that 62882 years (DALYs) were lost due to drowning(5.94 yearsper 100,000) and, it was the 12th most frequent cause of YLLs and the 4th most prevalent cause of YLLs among all unintentional injuries in the total population of Iran.[4,21] According to the report released by the Forensic Medicine Organization of Iran in 2008, Mazandaran province had the highest rate of drowning mortality rate among all of provinces in Iran (8.6 per 100000).[21]

A poison is described as any substance that is harmful for health when ingested (eaten), inhaled (breathed), injected, or absorbed through the skin.[3] Poisoning-related emergency is one of the most frequent reasons of emergency referrals and is a significant health problem in most developing countries.[26] Accidental poisonings pattern depends on cultural, environmental, and social restraints. It is estimated that poisoning occurred generally with medicines (41 %); petrol (17 %); insecticides, raticides, pesticides (9 %); opioids (8 %); carbon monoxide gas (4 %); and poisonous plants and mushrooms (4 %).[27] According to a study by Paulozzi, et al. in the US (2007), it is estimated that unintentional poisonings are the second leading cause of unintentional injury deaths, exceeded only by motor vehicle fatalities.[28] There are few reports on the burden and epidemiological patterns of poisoning-related mortality in the most developing countries.An estimated 315,000 people worldwide died due to unintentional poisoning and a total number ofpoisoning injury burden (DALYs), was 8,235,000 in 2000.[29] Europe (EUR) and South-East Asia (SEAR) together accounted for over one-half of the total number of DALYs lost globally due to poisoning.[3] Worldwide, over 60 % of deaths due to poisoning occurs among adolescents and adults aged between 15 – 59 years and the majority of DALYs lost to poisoning are among young children and young adults.[30] In 2010, DALYs estimated for poisoning was 140.51 per 100,000 and it comprised 0.54 % of DALYs of all cause, in Iran. According to these estimates, poisoning has negative change in the period of time from 1990 to 2010 and shows a decreasing trend in these years.[31]

There are several but dispersed studies at sub-national level in Iran that showed inequality in mortality exists among the provinces of Iran.[32] Principled and prospective planning and resource allocation in the country requires a comprehensive survey regarding burden of diseases and injuries at the national and sub-national level. The present study is a component of the National and Sub-national Burden of Diseases, Injuries, and Risk Factors from 1990 to 2013 (NASBOD) study in Iran,[33] which has been designed to investigate the burden of most important injuries (RTIs, falls, burns, poisonings and drownings) at the national and sub-national levels in Iran. In this paper we explain definitions, organization,

injuries selection process, objectives, data sources, data gathering methods, data analyses and deliverables of the national and sub-national burden of injuries study in Iran.

Materials and Methods

Organizing working group

A national expert working group, which includes those experts, who have expertise in public health, global health, and epidemiology, was formed to address unmet needs. The national expert working group offers consultations on the selection of injuries and the practical definition of diseases.Subsequently during the course of the study the working group will supervise the statistical modeling methods, the interpretation of results, and the publication strategy. Also an international expert advisory group will collaborate in the project.

Injuries selection process

In this study in order to select injuries, a list of the more important injuries in Iran was initially selected according to the result of GBD 2000 to 2010,[3,8,34] and first national burden of diseases study in Iran, 2003.[4] Based on the experts' opinions, five criteria were used for prioritizing injuries (incidence, mean age of affected population, fatality, disability, and data accessibility). Then, experts independently gave score to each injury according to these criteria. A score of one (the lowest score) was given if the injury had low incidence, low fatality and/or disabilities and low data accessibility; a score of five (the highest score) was given if it had high incidence, high fatality and/or disability, and convenient and comprehensive data availability. As for the mean age, lower ages were given the maximum score and higher ages had minimum scores. The total score then was summed for each injury. Finally, injuries were prioritized based on this overall score. According to this prioritization, road traffic injuries (RTIs), falls, burns, poisonings, and drowningwere the selected injuries in our study.

Definition

RTI:In this study,a RTI is considered as an event that leads to injury and/or property damage, involves a vehicle in transport, and occurs on a road or whilst the vehicle is still in motion after running off the public highway.[3] We used WHO International Classification of Diseases version 10 (ICD–10) codes for RTIs which were: pedestrian, V01 – V04, V06 – V09; bicycles, V10 – V19; motorized two-wheeler, V20 – V29; motorized three-wheeler, V30 – V39; car/van, V40 – V59; truck, V60 – V69; bus, V70 – V79; and other road users, V80 – V86.[35]

Burns: In the present study according to the ICD–10, burns in terms of etiology are classified as those caused by exposure to fire, flames and smoke (X00 – X09), contact with heat substances and hot liquid (X10 – X19), lightening (X33), exposure to corrosive substances (X46, X49), and exposure to electric current (W85 – 87).[35] Therefore, burns include injuries caused by heat from hot liquids, flame, electrical heating appliances, electricity, chemical burns (both external and internal corrosions), and hot gases and lightening. Sun-light burning and radiation-related burning of the skin and subcutaneous tissue are not defined as burn in this classification.

Fall related injury: According to ICD–10 classification, falls were coded W00-W19, which include a wide range of falls including those on the same level, upper level, and other unspecified falls. Falls are usually defined as "in- advertently coming to rest on the ground, floor or other lower level, excluding intentional change in position to rest in furniture, wall or other objects".[35]

Poisoning

According to ICD–10, all unintentional poisoning-related deaths and non-fatal outcomes caused by exposure to noxious substances are classified as "poisoning" (with the exception of those which are intentional or for which the intent is undetermined as well as those resulting from reactions to drugs). According to ICD–10 classification, poisoning is coded X40 – X49.

Drowning

The category "drowning" as used here refers to all unintentional drowning and submersions. Those which occur as result of cataclysms, transport and water transport accidents are excluded from the definition used here. According to ICD-10 classification, drowning is coded W65 – W74.[35]

Nature of injury codes (N-codes): We will use the GBD N-codes to identify a type or location of a medical condition on the body. GBD nature of injury categories are presented in Table 1.

Data sources

We will use 2 sorts of data sources including published literature, which we will find in our systematic literature review, and national data sourcesthat include national death registration system; national forensic medicine system, hospital data survey (HDS), health surveys, national police statistics, emergency medical services (EMS), and section 92 of the fourth development plan.

Published literature
Systematic literature review

In order to achieve comprehensive and vast coverage of published articles through scientific panel, a comprehensive literature review was performed using PubMed, Medline, Thomson Reuters (formerly ISI) Web of Science, Scopus, as the main international electronic data sources. These electronic resources were searched using MeSH terms, EMTree, and related key words. Additionally, the domestic electronic resources including IranMedex, IranDoc and Scientific Information Database (SID) were included because of their comprehensive coverage and access to national journals, thesis and conference abstracts. Our electronic search strategy for RTIs, burns, falls, poisonings, and drownings are shown in web appendix 1.

Inclusion and exclusion criteria

In our search strategy, publication year was limited to 1990 – 2013without language and age restrictions. Only studies pertaining to Iran conducted at national and sub national levels for road traffic, burning, and fall injuries were included. Letters, opinion pieces, evaluation of medical interventions, case reports, and case series were excluded from this review.

Study selection process

The selected articles will be evaluated by a reviewer. The reviewer scans the titles. After article title including phase, article abstract will be reviewed. Abstracts will be reviewed by a reviewer, and if the reviewer agrees that the article is not concordant with inclusion criteria, the article will be excluded. After abstract including phase, the full text of that article will be extracted and reviewers will review articles using standard criteria.

Table1. GBD Nature of Injury Categories

N1	Lacerations, multiple wounds, other dislocations, and eye injuries
N2	Injury requiring urgent care
N3	Injury requiring emergency care
N4	Fracture of clavicle, scapula, humerus, or skull
N5	Fracture of sternum, rib, or face bone
N6	Fracture of other extremities
N7	Fracture of radius or ulna
N8	Fracture of femur
N9	Fracture of hip
N10	Fracture of patella, tibia, fibula, or ankle
N11	Fracture of pelvis
N12	Dislocation of joint
N14	Burns < 20 % of body
N14	Burns > 20 % of body
N19	Amputation of one lower or upper limb
N20	Amputation of finger, including thumb
N21	Injured nerves
N22	Spinal cord lesion below neck
N23	Fracture of vertebral column
N24	Spinal cord lesion below neck
N25	Minor traumatic brain injury
N26	Moderate or severe traumatic brain injury
N28	Severe chest injury

Table 2. Characteristics of data sources on injuries in Iran

		Type of reported outcome			Coverage	
Type of data	Source of data	Death	Non-fatal	Start year	National	Sub - national
health survey	Demographic and health survey (DHS)	- - - - - - - -	✓	- - - - - - - -	✓	✓
Registration Records	National death registration system	- - - - - - - -	- - - - - - - -	- - - - - - - -	- - - - - - - -	✓
	National forensic medicine system	✓	- - - - - - - -	- - - - - - - -	✓	- - - - - - - -
	National police statistics	✓	✓	- - - - - - - -	✓	- - - - - - - -
	Emergency Medical Services	- - - - - - - - -	✓	- - - - - - - -	✓	✓
	Section 92	- - - - - - - -	✓	2010	✓	✓
Hospital datasets		- - - - - - - -	✓	- - - - - - - -	- - - - - - - -	✓

Quality assessment

For quality assessment in the present study, we used the quality assessment form, which was confirmed by expert opinion and consists of the following parts: general information about the study, methodological aspects of the study including the type of study, sampling method, sample size and etc. Accordingly, each item attained a special score based on this statement. If the study achieved the required methodological quality, it was passed on to data extraction.The data extraction sheet contained the following items: general information of study; population detailed characteristics, injury specific characteristics (E-code and N-code) and study outcomes indicators.

National data sources

All available data sources regarding injury deaths in Iran include national death registration system in most provinces, and the national forensic medicine system in all of the provinces. The death registration systems in Iran have high population coverage and are relatively complete. Data sources for non-fatal injury in Iran includeHospital Data Survey (HDS), health surveys, national police statistics, emergency medical services (EMS), and section 92

of the fourth development plan. Table 1 highlights the main data sources and indicators collected within each data set that is available for the present study in Iran.

The availability of data source in Iran

In general, there are two primary sources for estimating non-fatal injuries (HDS and health surveys) that have complementary strengths and both of them can be either national or sub-national. Non-fatal injuries can be estimated reliably based on the detailed data of HDS. In HDS, approximately 600,000 samples of the Iranian hospital records will be systematically collected from all hospitals in all provinces for the time period defined in the study.[36] In addition to these two primary sources, othersources are also available in Iran such as national police statistics, EMS, and section 92 of the fourth development plan.

As surveys collect information from victims, they can only provide limited descriptions of the N-codes, making assessment of injury severity and its public health burden difficult. Instead, surveys typically contain reliable information regarding the external causes of the injury events. On the other hand, hospital administrative records provide high resolution medical description of injuries but cannot be used for estimating population incidence

because of the difficulty in identifying the underlying population. It has been shown that both fatal and non-fatal injuries are severely undercounted in police reports.[37] The extent of police under-reporting is not related with economic development. However, these data sources, altogether, can provide measurements of the burden of non-fatal injury in Iran.

Statistics

In estimating trend and burden of injuries in national and sub-national levels we will face with three major problems as follows: 1) For estimating trend and burden of injuries in national and sub-national levels, we needdata for all provinces in the desired period; therefore, it is expected that data on injuries be unavailable for some provinces; 2) In many surveys age, sex and living area (rural/urban) categories are not concordant with NASBOD study and additionally all surveys do not include these data categories; and 3) A number of provinces have been broken down to 2 or more during the desired period of time. Therefore, to tackle these problems, two different statistical models, i.e. Spatio-temporal and Bayesian multilevel autoregressive models will be used to estimate mean/prevalence and uncertainty interval. We are using two models to verify that the results are not model-dependent.

Spatio-temporal model

Temporal and spatial correlations are crucial points in estimating trend and burden of injuries in national and sub-national level, because most of the required data will be correlated to time and space. Spatio-temporal modeling with conditional autoregressive model prior to spatial random effects is one of the statistical models for this type of data.[38] In the spatial structure, it is assumed that the data closer in space are more correlated than those far in space. Therefore, in this structure, the model borrows information from near area units, which improves the estimates for areas with missing values and/or those with small number of observations. Additionally, for dealing with misalignment of area units we will use spatio-temporal misalignment modeling.

Bayesian Multilevel Autoregressive model

Another advanced statistical model to tackle the challenges mentioned earlier is the Bayesian multilevel autoregressive model.[39] This model inputs observations hierarchically in districts, provinces, sub-regions, regions, and national levels, respectively. Additionally, in this model, each level borrows information from higher levels. Several components, such as heterogeneity of data sources, linear time trends, and nonlinear change over time, covariate effects, and nonlinearity of age effect are included in this model.

The Markov Chain Monte Carlo (MCMC) method for both of the abovementioned modeling will be used to perform Bayesian inference. All of the programs will be developed in R statistical packages.[16]

Ethics

In this study, since most of the usable data are secondary data, ethical consideration is not a major concern but if we need more information about a certain study, we will contact the corresponding authors and will acquire the relevant data by their consent. The name of these authors will be reported in our article as investigator authors. The present study has been approved by the ethical committee of Tehran University of Medical Sciences.

Discussion

Most previous estimates of disease, injury, and risk factor burden, in most countries, have been reported at national or global scale and only a few countries, namely Australia and Mexico[40,41] have previously reported sub-national burden of injury and disease.

The researchers estimated mortality and burden of disease caused by various injuries for Mexico and its states in 2004 using data from death registries, censuses, health examination surveys, and epidemiological studies. All analyses were performed at the state level, by sex and age groups. All Mexican states were grouped into six geographic regions on the basis of per-capita income, total mortality, and also a composite deprivation index. They also incorporate specific diseases, injuries, and risk factors into the transition framework at national as well as sub-national level to indicate whether regions are at different stages of the epidemiological transition.

In the burden of disease and injury study in Australia, the DALYs were calculated by cause, age and sex in 2003 and were projected 10 and 20 years beyond 2003. DALYs attributable to exposure to modifiable health risks (for injury include: tobacco use, alcohol consumption, illicit drug use, intimate partner violence, occupational exposure to hazard, child sexual abuse and osteoporosis) were also calculated. In addition to calculating DALY, differentials in DALYs between sub-populations (e.g., between state and territory Jurisdictions, socioeconomic groups, and remoteness categories) were estimated. Source of data in this Australian study included hospital data, health survey data on prevalence, incidence (from disease registers), case fatality (from cohort studies), remission (from cohort and intervention studies), clinical judgment, and information about changes over time in any of these variables. Trends in observed cause-specific mortality over the period 1979 – 2003 were analyzed and projected to 2023.

In an Iranian study, the first NBD study in Iran, the burden of disease and injury was estimated in Iran for the year 2003, using Disability-Adjusted Life Years (DALYs) at the national level and for six selected provinces. In this study, methods developed by WHO for NBD studies were applied to estimate disease and injury incidence for estimation of YLL, YLD and DALYs. They also compared their results with WHO estimates for Eastern Mediterranean region and sub-region burden of diseases in 2002.[4]

In our study, we will calculate burden and trend of injury at national and sub national level with focus on five important injuries (RTIs, falls related injuries, burns, poisonings, and drownings) in Iran and for a 21-year period (1990 to 2012) instead of one year. Moreover, inequality and its determinants will be also evaluated based on differentials in DALYs and trend of incidence between sub populations. Additional data source will be used in comparison with data sources used in the above-mentioned two countries. It is necessary for health policy decisions to have reliable estimates of the magnitude and distribution of injuries in population. Such analyses do not have to be restricted to the national level in many countries. Along with decisions regarding resource allocation and priority setting, relevant studies should be conducted to secure evidence-based policymaking. High quality data can help to establish the foundation for highlighting problems, identifying solutions, and evaluating the results of prevention strategies. Despite many efforts, data on the number and type of injuries are

very sparse in Iran. That is why we need fatal and non-fatal injury surveillance in our country. Over the past decade, three publications have been designed primarily to be presented to countries in order to assist them in the collection of data on non-fatal injury data and violence:guidance for surveillance of injuries due to landmines and unexploded ordnance (2000), injury surveillance guidelines (2001), and guidelines for conducting community surveys on injuries and violence (2004). Fatal injury surveillance in mortuaries and hospitals (2012) provided guidance to countries to learn how to set up a fatal injury surveillance system. We suggest that by adopting these guidelines, a fatal and non-fatal injury surveillance system for our country can be created. In order to transfer the knowledge achieved in the present study, we will use both the 'passive' and "active" strategies including: publication of articles in domestic and international journals, presenting research results in conferences, seminars, and domestic and international meetings, sending the complete or summary report of the research project to users, displaying the results on the web site, mailing or emailing articles, reports, or summaries for stakeholders, presenting results to reporters, radio and TV for dissemination, in the media and participation in interviews, holding briefings with stakeholders for presentation of research results. A potential limitation of this study is that the disability weights used in our analysis will be derived from international sources and applied without evidence of their validity in Iran. However, studies conducted elsewhere suggest that there are only minor variations across populations in the values people ascribe to different health states.

The results of the present study can help decision makers prioritize diseases and injuries in Iran for more efficient resources allocation and also might improve the health system performance due to changes that could happen in health system using the results of NASBOD at national and subnational. The methods which we will use in NASBOD can also be a model for similar research projects in other developing countries.

Author's Contribution

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References

1. Segui-Gomez M, MacKenzie EJ. Measuring the public health impact of injuries. *Epidemiologic Reviews.* 2003; **25(1):** 3 – 19.
2. Peden M, McGee K, Krug E. *Injury: a leading cause of the global burden of disease, 2000.* World Health Organization; 2002.
3. Peden M, McGee K, Sharma G. The injury chart book: a graphical overview of the global burden of injuries. *Geneva: World Health Organization.* 2002; 5.
4. Naghavi M, Abolhassani F, Pourmalek F, Moradi Lakeh M, Jafari N, Vaseghi S, et al. The burden of disease and injury in Iran 2003. *Population Healthmetrics.* 2009; **7(1):** 9.
5. Bhatti MA, Ajaib MK, Masud TI, Ali M. Road traffic injuries in Pakistan: challenges in estimation through routine hospital data. *J Ayub Med Coll Abbottabad.* 2008; **20(3):** 108 – 111.
6. Trivedi A, Rawal D. Prevalence of road traffic accidents and driving practices among young drivers. *Age.* 2011; **61:**31 – 39.
7. Borowy I. Road traffic injuries: social change and development. *Medical history.* 2013; **57(1):** 108.
8. Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. *PLoS Medicine.* 2006; **3(11):** e442.
9. Dahl R. Vehicular manslaughter: the global epidemic of traffic deaths. *Environmental Health Perspectives.* 2004; **112(11):** A628.
10. Shahraz S, Bartels D, Puthenpurakal JA, Motlagh ME. Adverse health outcomes of road traffic injuries in Iran after rapid motorization. *Archives of Iranian Medicine.* 2009; **12(3):** 284 – 294.
11. Steinstraesser L, Flak E, Witte B, et al. Pressure garment therapy alone and in combination with silicone for the prevention of hypertrophic scarring: randomized controlled trial with intraindividual comparison. *Plastic and Reconstructive Surgery.* 2011; **128(4):** 306e – 313e.
12. Peck MD. Epidemiology of burns throughout the world. Part I: Distribution and risk factors. *Burns.* 2011; **37(7):** 1087 – 1100.
13. Pruitt B, Mason A. Epidemiological, demographic and outcome characteristics of burn injury. *Total Burn Care. London: D. Herndon Ed., Saunders Co.* 1996: 13.
14. Deshpande SK, Kulkarni SA, Gollapudy R. Topical formulation for diabetic foot ulcers. Google Patents; 2010.
15. Outwater AH, Ismail H, Mgalilwa L, Justin Temu M, Mbembati NA. Burns in Tanzania: morbidity and mortality, causes and risk factors: a review. *Int J Burns Trauma.* 2013; **3(1):** 18 – 29.
16. Aghakhani N, Rahbar N, Feizi A. Epidemiology of Burn Injuries in West Azerbaijan Province, Western Iran. *Iran Red Crescent Med J.* 2009; **11(1):** 85 – 89.
17. Mohammadi R, Ekman R, Svanström L, Gooya M. Unintentional home-related injuries in the Islamic Republic of Iran: findings from the first year of a national programme. *Public Health.* 2005; **119(10):** 919 – 924.
18. Othman N, Kendrick D. Epidemiology of burn injuries in the East Mediterranean Region: a systematic review. *BMC Public Health.* 2010; **10(1):** 83.
19. Woolf AD. The global perspective of osteoporosis. *Clinicalrheumatology.* 2006; **25(5):** 613 – 618.
20. Nasrullah M, Laflamme L, Khan J. Does economic level similarly matter for injury mortality in the OECD and non-OECD countries? *Safety Science.* 2008; **46(5):** 784 – 791.
21. Samaneh A, Samaneh A, Hamid S, Ardeshir K, KhosroG. Years of Potential Life Lost Due to Unintentional Drowning Mortality in Mazandaran Province, Iran. *World Applied Sciences Journal.* 2012; **20(10):** 1433 – 1438.
22. WHO. Drowning. 2012; Available from: URL: www.who.int/mediacentre/factsheets/fs347/en/.
23. Zolala F, Nasehi MM, Moosazadeh M, Azadeh H, Mirzajani M. Epidemiology of Drowning in Mazandaran, Iran: A Population Based Study. *Middle-East Journal of Scientific Research.* 2012; **11(7):** 969 – 973.
24. Peden M, McGee K. The epidemiology of drowning worldwide. *Injury Control and Safety Promotion.* 2003; **10(4):** 195 – 199.
25. Meel B. Drowning deaths in Mthatha area of South Africa. *Medicine, Science and the Law.* 2008; **48(4):** 329 – 332.
26. Lee HL, Lin HJ, Yeh SY, Chi CH, Guo HR. Etiology and outcome of patients presenting for poisoningto the emergency department in Taiwan: a prospective study. *Human & Experimental Toxicology.* 2008; **27(5):** 373 – 379.

27. Naghavi M, Pourmalek F, Shahraz S, Jafari N, Delavar B, Motlagh ME. The burden of injuries in Iranian children in 2005. *Popul Health Metr.* 2010; **8:** 5. doi:10.1186/1478-7954-8-5.

28. Paulozzi LJ, Ballesteros MF, Stevens JA. Recent trends in mortality from unintentional injury in the United States. *Journal of Safety Research.* 2006; **37(3):** 277 – 283.

29. Organization WH, Dept VP. *Injury Chart Book: Graphical Overview of theGlobal Burden of Injuries.* World Health Organization; 2002.

30. Ae-Ngibise KA, Masanja H, Kellerman R, Owusu-Agyei S. Risk factors for injury mortality in rural Tanzania: a secondary data analysis. *BMJ Open.* 2012; **2(6):** 001721.

31. Institute for HealthMetrics and Evaluation. Available from: URL: http://viz.healthmetricsandevaluation.org/gbd-compare/ (Accessed Date: 1/ April /2013).

32. Khosravi A, Taylor R, Naghavi M, Lopez AD. Differential mortality in Iran. *Population health metrics.* 2007; **5(7):** 1 – 15.

33. Farzadfar F, Delavari A, Malekzadeh R, Mesdaghinia A, Jamshidi HR, Sayyari A, et al. NASBOD 2013: Design, definitions, and metrics. *Arch Iran Med.* 2014; **17(1):** 7 – 15.

34. Murray CJ, Ezzati M, Flaxman AD, Lim S, Lozano R, Michaud C, et al. GBD 2010: design, definitions, and metrics. *The Lancet.* 2012; **380(9859):** 2063 – 2066.

35. Organization WH. *ICD-10: International statistical classification of diseases and related health problems: tenth revision.* World Health Organization; 1989.

36. Niakan Kalhori SR, Tayefi B, Noori A, Mearaji M, Rahimzadeh S, Zandian E. Inpatient data, inevitable need for policy making at national and sub-national levels: A lesson learned from NASBOD. *Arch Iran Med.* 2014; **17(1):** 16 – 21.

37. Bhalla K, Naghavi M, Shahraz S, Bartels D, Murray C. Building national estimates of the burden of road traffic injuries in developing countries from all available data sources: Iran. *Injury Prevention.* 2009; **15(3):** 150 – 156.

38. Parsaeian M, Farzadfar F, Zeraati H, Mahmoudi M, Rahimighazikalayeh G, Navidi I, et al. Application of spatio-temporal model to estimate burden of disease, injuries and risk factors in Iran 1990 – 2013. *Arch Iran Med.* 2014; **17(1):** 28 – 33.

39. Kasaeian A, Eshraghian MR, Rahimi Foroushani A, Niakan Kalhori SR, Mohammad K, Farzadfar F. Bayesian autoregressive multilevel modeling of burden of diseases, injuries and risk factors in Iran 1990 – 2013. *Arch Iran Med.* 2014; **17(1):** 22 – 27.

40. Begg SJ, Vos T, Barker B, Stanley L, Lopez AD. Burden of disease and injury in Australia in the new millennium: measuring health loss from diseases, injuries and risk factors. *Medical journal of Australia.* 2008; **188(1):** 36.

41. Stevens G, Dias RH, Thomas KJ, Rivera JA, Carvalho N, Barquera S, et al. Characterizing the epidemiological transition in Mexico: national and subnational burden of diseases, injuries, and risk factors. *PLoS Medicine.* 2008; **5(6):** e125.

Appendix 1

• **Search strategy of injury: Road trafic injury**
o **PubMed** ((Iran [Mesh] OR "I.R.Iran" OR "I.R. Iran" OR "IR Iran" OR "I R Iran OR "Islamic Republic of Iran' OR "Iran (Islamic Republic of) OR "Iran (Islamic Republic))" OR "Iranian" OR "Iranians")AND ("Transportation"[Mesh] OR traffic[tw] OR transport*[tw] OR road[tw]) AND ("Wounds and Injuries"[Mesh] OR "Accidents"[Mesh] OR crash*[tw] OR accident*[tw] OR incident*[tw] OR collision*[tw] OR Injur*[tw]))
o **ISI Search strategy** ((Iran [OR "I.R.Iran" OR "I.R. Iran" OR "IR Iran" OR "I R Iran OR "Islamic Republic of Iran' OR "Iran (Islamic Republic of) OR "Iran (Islamic Republic))" OR "Iranian" OR "Iranians")AND ("Transportation" OR traffic OR transport* OR road) AND ("Wounds and Injuries"OR "Accidents" OR crash* OR accident* OR incident* OR collision* OR Injur))
o **Scopus Search strategy** ((Iran [OR "I.R.Iran" OR "I.R. Iran" OR "IR Iran" OR "I R Iran OR "Islamic Republic of Iran' OR "Iran (Islamic Republic of) OR "Iran (Islamic Republic))" OR "Iranian" OR "Iranians")AND ("Transportation" OR traffic OR transport* OR road) AND ("Wounds and Injuries"OR "Accidents" OR crash* OR accident* OR incident* OR collision* OR Injur))
• **Search strategy of injury: Fall injury**
o **PubMed Search strategy** ((((((Iran) OR "I.R.Iran") OR "IR Iran") OR persia*) OR "Iranian*")) AND ((((("accidental fall"[Title/Abstract]) OR "accidental falls") OR "fall-related fractures"[Title/Abstract]) OR "injurious falls"[Title/Abstract]) OR ((injury[MeSH Terms]) AND fall[Title/Abstract]))
o **ISI Search strategy** ((Iran) OR "I.R.Iran" OR "IR Iran" OR persia* OR "Iranian*") AND ("accidental fall" OR "accidental falls" OR "fall-related fractures"OR "injurious falls" OR ((injury) AND fall)))
o **Scopus Search strategy** ((Iran) OR "I.R.Iran" OR "IR Iran" OR persia* OR "Iranian*") AND ("accidental fall" OR "accidental falls" OR "fall-related fractures" OR "injurious falls" OR ((injury) AND fall)))
• **Search strategy of injury: Drowning**
o **PubMed Search strategy** ((((((((((aspiration[Text Word]) AND water)) OR ((suffocation[Text Word]) AND water)) OR ((asphyxiation[Text Word]) AND water)) OR ((submersion[Text Word]) AND water)) OR ((immersion[Text Word]) AND water)) OR drowning*) OR near-drowning*[Text Word]) AND (((Iran) OR "I.R.Iran" OR "IR Iran" OR persia* OR "Iranian*")))
o **ISI Search strategy** (((aspiration AND water) OR (suffocation AND water) OR (asphyxiation AND water) OR (submersion AND water) OR (immersionAND water) OR drowning*) OR near-drowning*) AND (((Iran) OR "I.R.Iran" OR "IR Iran" OR persia* OR "Iranian*")))
o **Scopus Search strategy** (((aspiration AND water) OR (suffocation AND water) OR (asphyxiation AND water) OR (submersion AND water) OR (immersion AND water) OR drowning*) OR near-drowning*) AND (((Iran) OR "I.R.Iran" OR "IR Iran" OR persia* OR "Iranian*")))
• **Search strategy of injury: Poisoning :**
o **PubMed Search strategy** (((((((((injury[MeSH Terms]) AND poisoning[Title/Abstract])) OR ((mortality[MeSH Terms]) AND poisoning*[Title/Abstract])) OR poisoning*[Text Word]) OR accidental poisoning*) OR accidental poisoning[Text Word]) AND ((((Iran) OR "I.R.Iran") OR "IR Iran") OR persia*) OR "Iranian*"))))
o **ISI Search strategy** ((injury AND poisoning) OR (mortality AND poisoning) OR poisoning*OR accidental poisoning* OR accidental poisoning) AND ((((Iran) OR "I.R.Iran") OR "IR Iran") OR persia*) OR "Iranian*"))
o **Scopus Search strategy** ((injury AND poisoning) OR (mortality AND poisoning) OR poisoning*OR accidental poisoning* OR accidental poisoning) AND ((((Iran) OR "I.R.Iran") OR "IR Iran") OR persia*) OR "Iranian*"))
• **Search strategy of injury: Burning**
o **PubMed Search strategy** ((((((((Iran) OR "I.R.Iran") OR "IR Iran") OR persia*) OR "Iranian*"))))) AND ((((((((((("Heat Trauma"[Text Word]) OR "Heat Injuries"[Text Word]) OR "Heat Injury"[Text Word]) OR "Burning Accident"[Title/Abstract]) OR "burn trauma"[Text Word]) OR "Burning Injuries"[Text Word]) OR "burn trauma"[Text Word]) OR "Burns Trauma"[Text Word]) OR "burn Incident") OR ((burn[Title/Abstract]) AND Accident*[Title/Abstract])) OR ((burn[Title/Abstract]) AND injur*[Title/Abstract]))
o **ISI Search strategy** ((Iran OR "I.R.Iran" OR "IR Iran" OR persia*) OR "Iranian*") AND (("Heat Trauma" OR "Heat Injuries" OR "Heat Injury" OR "Burning Accident" OR "burn trauma" OR "Burning Injuries" OR "burn trauma" OR "Burns Trauma" OR "burn Incident"OR (burn AND Accident*)OR (burn AND injur*))
o **Scopus Search strategy** ((Iran OR "I.R.Iran" OR "IR Iran" OR persia*) OR "Iranian*") AND (("Heat Trauma" OR "Heat Injuries" OR "Heat Injury" OR "Burning Accident" OR "burn trauma" OR "Burning Injuries" OR "burn trauma" OR "Burns Trauma" OR "burn Incident"OR (burn AND Accident*)OR (burn AND injur*))