Explanatory social variables of under-5 mortality caused by injury in Isfahan Province, Islamic Republic of Iran

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Abstract

Background: Injuries are a major cause of disease, long-term disability and death. Injury-related damage accounts for 12% of the burden of disease worldwide. Recently, significant improvements in child health have been achieved in the Islamic Republic of Iran: under-5 mortality was reduced substantially from 1990 to 2013. Nevertheless, injury is still a significant cause of mortality in this age group.

Aim: Because of their vulnerability and the high rates of injury-related mortality among children under-5, this study aimed at investigating selected explanatory social variables of injury-related mortality.

Methods: The study was conducted using the Commission on Social Determinants of Health conceptual framework among children aged under-5 years in Isfahan Province. Using the national child mortality surveillance system 1433 under-5 mortalities during 2010–2015 were secondary analysed.

Results: We found 403 (28%) cases were related to injury. Most of the deaths occurred in 706 infants (49.2%), among boys (54.8%) and urban residents (78.9%). Multivariate logistic regression showed that mothers' low education level, age 1–5 years', living in a support centre and having financial problems increased the odds of under-5 mortality caused by injury (odds ratio > 1, *P*-value ≤ 0.05).

Conclusion: Considering the importance and impacts of social factors on injury-related mortality among children, health policy-makers should initially consider the social determinants of health approach in child health programmes to inform interventions aimed at reducing injury-related mortality.

Keywords: child mortality, injury, social determinants of health, Iran

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Introduction

Today, injuries are one of the major concerns in public health in the category of noncommunicable disease (*1*); they are a major cause of disease, long-term disability and death in most countries (*2*). Injury-related conditions account for 12% of the burden of disease and for the high level of unintentional mortality at the global level (*3*). According to a 2014World Health Organization report, injuries give rise to more than 5 million deaths annually, i.e. 9% of the world's deaths (*4*). Further, non-fatal consequences of injuries include hospitalization, temporary or permanent disability, and mental disorders (*4*).

Although injuries are viewed as a predictable phenomenon (*5*), they remain a growing problem in developing countries, and are forecast to be the second greatest cause of disability in these countries till 2020. Because of their physiological and developmental limitations and behavioural characteristics, children are one of the most vulnerable groups; injuries are common and have critical importance, especially in developing countries (*6*). Given their vulnerability to injuries (*7*) and the high rates of child injury mortality, childhood injuries are a major priority, as well as a public health issue (*8*). Childhood injuries not only lead to high rates of mortality but also

cause high rates of disability: thousands of children are condemned to spending the rest of their lives with disability (*4*). In addition to those who die from injuries each year, children who survive may require continuous rehabilitation care that affects all aspects of their life and their family's livelihood.

A 2010 study on assessing the cause of mortality in the Islamic Republic of Iran showed that unintentional injury-related mortalities and traffic-related mortalities accounted for 6.7 and 4.2% of under-5 mortalities respectively (*9*). Also, the most common causes of children mortality are: traffic accidents (43.0%), closure of the respiratory tract (10.7%), drowning (9.7%), burns (7.3%), and falls (6.8%) (*10*).

Globally, under-5 mortality was reduced from 90.6 to 42.5 per 1000 live births, and annual under-5 mortality rates were reduced from 12.7 million to 5.9 million in 2015 (*11*). In the Islamic Republic of Iran, trends show that during recent years, significant improvements have been achieved in child health. According to a 2014 report, under-5 mortality was reduced from 107 000 in 1990 to 25 000 in 2013 (*12*). Despite this substantial reduction, injury is still one of the significant causes of mortality in this age group.

Currently, health approaches are much wider and biomedical approaches to health and disease have shifted to social context approaches; special attention is also being paid to nonmedical determinants of health. Each of these, including the social determinants, has a significant effect on health, either directly or indirectly, so they are called “the cause of causes” (*13*). That is, social determinants of health, such as income, education, occupation, nutrition, social class, the health system and so on, have an important impact on health or ill health. If these are overlooked, it is difficult to achieve the desired health goals and improve health system performance (*14*). Considering the importance and prevalence of injury-related mortality among children and the increasing trend worldwide (*15*), and given the role of social-related factors in the recognition, prevention and reduction of such mortality, the current study aimed at investigating the explanatory social variables of under-5 mortality caused by injury in Isfahan Province during 2010–2015.

Methods

Data

This study was a cross-sectional secondary analysis of data, which extracted the required data from the national child mortality surveillance system. All under-5 mortalities (1433) in Isfahan Province during 2010–2015 were analysed.

Setting and population

Isfahan is one of the largest and most important cities in central Asia and is located in the centre of the Islamic Republic of Iran. According to the 2011 Iranian population and housing census, the population of the Isfahan Province is 4 879 312 (50.74% male, 49.26% female); approximately 4.16 million (85.4 %) reside in urban areas, 0.71 million (14.6%) in rural areas and the rest are residents of nomadic areas (*16*). The majority of men (90.70 %) and women (84.75 %) in the province are literate: around 3.6% of the population are foreigners, mostly from Afghanistan and Iraq.

Definition of variables

Social variables for the current study were selected based on the Commission on Social Determinants of Health conceptual framework (*17*). This categorizes the factors that affect the distribution health and well-being in the society in three levels: socioeconomic and political context; structural determinants and socioeconomic status; and intermediary determinants. With regard to the availability of information, we investigated the impact of some structural factors, including mother's education, household's financial problems and nationality and some intermediary factors including biological (age, sex and history of chronic diseases), living conditions, environmental (area of residence) and health system-related factors (physical access to medicine, laboratory, radiology and ambulance services) on traffic and non-traffic injury-related mortalities. Non-traffic injuries include: closure of respiratory tract, poisoning, falling, contact with electricity, drowning, burns, being hit with a hard object, and so on. The age variable was categorized into 3 groups: neonate (< 28 days), infant (< 1 year), and 1–5 years old. Data on household financial problems were collected through a question in the national child mortality surveillance system: households were asked whether or not they have had financial problems.

Statistical analysis

Data were extracted, prepared and entered into *STATA/SE,* version 14. Then, data were analysed on 2 levels: descriptive (frequency and percent) and inferential (univariate and multivariate logistic regression). Since the outcome variable (under-5 mortality caused by injury) is binary (whether or not mortality is caused by injury), logistic regression was employed to calculate the odds ratio (OR) for the explanatory variables. To this end, first, univariate logistic regression between under-5 mortality caused by injury and each explanatory variable was calculated. Variables with a statistical significance level ≤ 0.05 were included in the multivariate logistic regression. To measure the fitness of the model and its forecasting power, the Pearson χ^2 test and the pseudo R^2 were used.

Results

Of the 1433 child mortalities in Isfahan in 2010–2015, 403 (28.1%) were injury-related (traffic and non-traffic) and 1030 (71.8%) were related to other factors. Most of the mothers, 599 (42.2%), had an education level under high school diploma; only 127 (9.4%) attended university (Table 1). The majority of deaths were among boys and infants. The majority of children were living in urban areas. Most of the children were living in 2-parent families, had physical access to medicine and diagnostics centres, were transferred by ambulance and did not have any chronic diseases.

During 2010–2015, the proportion of some causes of injury-related mortality was reduced and for some others it increased (Figure 1). Closure of the respiratory tract showed the highest reduction, 25.1%. However, despite an 8.5% reduction in traffic injuries, such incidents were still among the major causes of mortality. Among the others, drowning accounted for a 7.8% increase and falls for 2.6%.

The univariate logistic regression showed that the relationship between under-5 mortality caused by injury and all the structural and intermediary variables (except for nationality) was statistically significant (P-value < 0.05). Accordingly, nationality was excluded in the multivariate logistic regression model. Table 2 shows the multivariate logistic regression as the final model between under-5 mortality caused by injury and the selected explanatory variables.

The OR for injury-related mortality in children of mothers with education less than diploma level was 2.01 compared with children of mothers with a university degree, i.e. education below diploma level among mothers doubled the odds of injury-related mortality in children. Having financial problems increased the odds of under-5 mortality caused by injury to 1.42.

For children aged 1–59 months, the OR was 1.87 compared with neonates (Table 4). The odds of mortality caused by injury was 1.38 times higher in boys than in girls. Chronic disease was a protective factor against injury-related mortality, i.e. children with a chronic disease were less likely (OR 0.7) to die from injury than children with no history of chronic disease. The OR for injury-related mortality was 0.06 for urban and 0.14 for rural areas, i.e. children living in nomadic areas had a much greater risk of mortality. Living with a single parent or with other relatives or growing up in care centres increased the odds of injury-related mortality (OR 1.17, 1.36 and 1.58, respectively), compared with situations where children live in a 2-parent family. Children who were not living with their either or both parents had a higher risk of injury-related mortality (Table 2). Physical access to medicine, laboratory/radiology and ambulance services reduced injury-related under-5 mortality (OR 0.14, 0.26 and 0.28 respectively).

To estimate goodness of fit, the Pearson χ^2 test was used. Our results showed that the explanatory variables we employed were highly illustrative of injury-related mortality. In the logistic regression, pseudo R^2 showed that the explanatory variables explained 33% of variance variation for injury-related mortality.

Discussion

Generally, our study showed that structural factors were risk factors for under-5 mortality caused by injury. Other factors, including residence in an urban area, physical access to health care services and history of chronic disease, were protective.

Our findings are to a certain extent consistent with those of other a number of other studies. The odds of injury-related mortality in boys was 36% higher than in girls. Studies conducted in the Islamic Republic of Iran (*18,19*) and Egypt (*20*) have also shown that the proportion of deaths is higher in boys. In our study, children aged 1–5 years have higher odds ratio for death than neonates; conversely, in an Iranian study, children aged 1–11 months had the highest odds ratio

for death (*19*). Our findings showed that the odds of injury-related mortality was higher in children living in a nomadic population than those living in urban and rural areas. It appears that factors such as lack of medical equipment and treatment facilities, insecure environment, inappropriate roads, high mobility and parents' unawareness have a role in the greater risk of injury-related mortality in nomadic populations. Delbarpoor et al. found that children living in rural areas had a higher risk of injury-related mortality (*19*). In Bangladesh, Chowdhury and Huda also showed that under-5 mortality was higher in rural than in urban areas (*21,22*), which is consistent with our findings. It is worth noting that children living in urban areas are more exposed to traffic-related injury than those living in rural areas or in a nomadic population, but at the same time they have better access to health care services. Therefore, despite the higher prevalence of traffic injuries among children living in urban areas, because of more access to health care services, their chance of survival is higher.

Our results showed that children not living with both parents, had higher odds of injury-related mortality. It can be concluded that living with a single parent because of work pressures (*23,24*) or depression (*25*) reduces the protective power of the parent and therefore increases injury-related mortality.

Mother's education is one of the social determinants of injury-related mortality. As we observed, children whose mother's education was under diploma level had higher odds of injury-related mortality. Studies conducted in the Islamic Republic of Iran (1*8,19,26*), India (*27*) and Sudan (*28*) showed that a higher level of education among mothers associated with a lower rate of injury-related mortality. It should be noted that mother's education, directly and indirectly, improves health, i.e. an educated mother, in comparison with an uneducated mother, is more aware of benefits of healthy behaviour and has greater knowledge, both of which affect a child's access to preventive and health care services (*15*).

The household's access to health care services (physical access to medicine, laboratory, radiology and ambulance) is among those social factors of health which directly affect injury-related mortality. In Nepal, Kravdal showed that using health care services can reduce injury-related mortality among children (*29*). To explain this issue it can be said that as access to health

care services and facilities improves, the opportunity to use them increases, which consequently prevents undesired health outcomes, including injury-related mortality.

This study showed that financial problems increase the odds of injury-related mortality. The findings of other studies conducted in the Islamic Republic of Iran (*30–32*), Bangladesh (*22*) Sudan (*28*) and the Czech Republic (*33*) are also consistent with our findings. Children living in wealthy families are likely to be healthier (physical, mental and social health) than those who are not. Income poverty, through poor access to health care services, food insecurity, inappropriate housing conditions, residence in disadvantaged areas, etc., negatively affect the health situation and result in high mortality.

In regard to the protective effect of having chronic disease on injury-related mortality, it is likely that, because of their physical, mental or developmental problems, children with chronic disease are more carefully protected by their parents and engage in physical activities less often. Thus, such children are less likely to be at risk of injury.

Conclusion

As to the importance and effects of social factors on injury-related mortality in children, the social determinants of health approach needs to be taken into account in health policy-making for children. Specifically, more attention should be paid to education, household income, sex and children's living status to reduce child injury-related mortality. This may be achieved through intersectoral collaboration.

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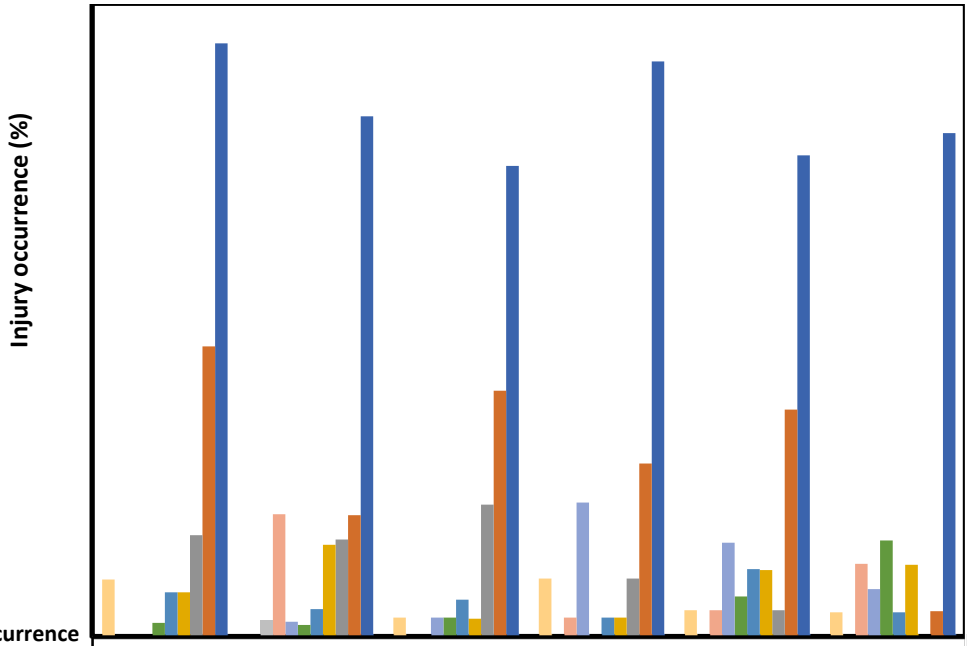

	2010	2011	2012	2013	2014	2015
Traffic injury	56.2	49.3	44.6	54.5	45.6	47.7
Closure of respiratory tract	27.5	11.5	23.3	16.4	21.5	2.4
Poisoning	9.6	9.2	12.5	5.5	2.5	0
Falling	4.2	8.7	1.7	1.8	6.3	6.8
Contact with hot water	4.2	2.6	3.5	1.8	6.4	2.3
Drowning	1.3	1.1	1.8	0	3.8	9.1
Complications and misadventure	0	1.4	1.8	12.7	8.9	4.5
Collision with stationary object	0	11.6	0	1.8	2.5	6.9
Contact with electricity	0	1.6	0	0	0	0
Other injury factor	5.4	0	1.8	5.5	2.5	2.3

Figure 1. Distribution of cause of death according to type of injury in children under-5 years in Isfahan (2010–2015)

Table 1. Descriptive characteristics of children from the under-5 mortality records in Isfahan (*n* = 1433) (2010–2015)

Characteristic	No.	%
	Structural	
Mother's education		
Illiterate	185	13.7
Below high school diploma	599	44.2
High school Diploma	440	32.5
University degree	127	9.4
Household's financial problems		
Yes	384	40.2
No	571	59.7
Nationality		
Iranian	1340	93.5
Foreign	93	6.4
	Intermediary	
Age		
Neonate (< 28 days)	170	11.8
Infant (< 1 year)	706	49.2
1–5 years	557	38.8
Sex		
Male	786	54.8
Female	647	45.1
History of chronic diseases		
Yes	453	38.4
No	726	61.5
Residence		
Urban	1131	78.9
Rural	295	20.6
Nomadic	7	0.5
Child's living status		
Living with 2 parents	1250	87.2
Living with mother	91	6.3
Living with father	33	2.3
Living with relatives	18	1.2
Living in supportive centres	19	1.3
Other	22	1.5
Physical access to medicine		
Yes	713	65.3
No	379	34.7
Physical access to laboratory or radiology		
Yes	698	65.9
No	361	34.1
Physical access to ambulance		
Yes	720	65.0

No	385	35.0

Table 2. Multivariate logistic regression model between under-5 mortality caused by injury and selected explanatory variables, Isfahan (2010–2015)

Characteristic	Coefficient	SE	OR	*P*-value	95% CI
			Structural		
Mother's education					
Illiterate	0.243	0.563	1.27	0.186	0.412–3.450
Below high school diploma	0.702	0.458	2.01	0.012	1.831–4.563
High school diploma	0.522	0.456	1.68	0.252	0.685–4.125
University degree[a]	–	–	1	–	–
Household's financial problems					
Yes	0.427	0.269	1.42	0.012	2.141–1.093
No[a]	–	–	1	–	–
			Intermediary		
Age					
Neonate[a] (< 28 days)	–	–	1	–	–
Infant (< 1 year)	0.454	0.525	1.35	0.512	4.350–0.554
1–5 years	0.735	0.510	1.87	< 0.001	5.416–1.45
Sex					
Male	0.322	0.254	1.38	0.024	2.254–1.152
Female[a]	–	–	1	–	–
History of chronic disease					
Yes	–0.652	0.384	0.07	< 0.001	0.146–0.032
No[a]	–	–	1	–	–
Residence					
Urban	–0.726	0.426	0.06	0.010	0.510–0.011
Rural	–0.537	0.284	0.14	0.018	0.646–0.019
Nomadic[a]	–	–	1	–	–
Child's living status					
Living with 2 parents[a]	–	–	1	–	–
Living with mother	0.151	0.116	1.17	0.001<	3.263–0.392
Living with father and other relatives	0.478	0.347	1.36	0.001<	4.575–0.094
Living in supportive centres and other places	0.562	0.422	1.58	< 0.001	2.613–0.424
Physical access to medicine					
Yes	0.445–	0.380	0.14	< 0.001	0.460–0.045
No[a]	–	–	1	–	–
Physical access to laboratory or radiology					
Yes	0.036–	0.025	0.26	0.026	0.779–0.022
No[a]	–	–	1	–	1
Physical access to ambulance					
Yes	0.317–	0.249	0.28	0.001<	0.464–0.173
No[a]	–		1	–	–
Coefficient of determination		Pseudo $R^2 = 0.330$			
Likelihood ratio		$\chi^2 = 223.00$; $P < 0.001$			
Pearson's goodness of fit test		Pearson $x^2 = 582.91$; $P < 0.001$			

SE = standard error; OR = odds ratio; CI = confidence interval.
[a]Reference category.