

## Original Article

# Distribution of Mortality among 1 – 59 Month-Old Children Across Iranian Provinces in 2009: The National Mortality Surveillance System

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## Abstract

**Objective:** To determine the distribution of mortality in 1 – 59 month-old children across Iranian provinces in a national mortality surveillance system.

**Methods:** This national survey was conducted in 2009. A questionnaire was designed and standardized for collecting mortality data of children aged 1 – 59 months. The project team, consisting of collaborators from the whole 40 medical universities, filled in the questionnaires and returned them to the Ministry of Health and Medical Education (MOHME).

**Results:** The mortality in 1 – 59 month-old children was unequally distributed across provinces. The mortality was higher among children of less- educated mothers than in children of more- educated mothers. There was a reverse association between 1 – 59 months mortality and socioeconomic status across Iran as a whole and within most provinces.

**Conclusions:** Our results suggest that socioeconomic distribution in mortality of 1 – 59 month-old children favors the better-off in Iran as a whole and in most of its provinces. Investigating why mortality is higher in some provinces deserves special attention. Furthermore, it is advisable to conduct provincially-representative surveys to provide update estimates of different health situations and to allow their monitoring over time.

**Keywords:** Children mortality, distribution, Iran, national mortality registration system

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## Introduction

Child mortality rate is one of the most important measures of population health. As more than eight million children die each year all over the world,<sup>1</sup> child mortality has received special attention as part of the United Nations Millennium Development Goals (UNMDG).<sup>2</sup> In fact, over the past few decades, and particularly since the World Summit for Children in 1990,<sup>3</sup> there has been a growing interest in measuring child mortality, both as a health indicator and as a basic measure of human development.<sup>4</sup> This interest has brought renewed attention to the challenge of improving child survival, including a focus on understanding the reasons for differences in the rate of progress in various populations.<sup>5-7</sup> Some researchers have suggested that a decline in child mortality can be at least partially attributed to the improved measurement of child mortality.<sup>8</sup> Thus, increased policy discussion of

investment in child health is leading to calls for more timely and more local measurements of child mortality.<sup>9</sup> However, despite considerable efforts, limited experience exists on the impact of intervention strategies for many countries.<sup>4</sup> A vital registration system capturing all births and deaths is the optimal way to monitor child mortality; however, very few developing countries have such complete vital registration systems.<sup>10</sup>

Child mortality is often used as an indicator of population health. Moreover, in low- and middle-income countries, data on child mortality are comparatively reliable compared with other measures of population health.<sup>11</sup> Actually, child mortality is considered as a key health outcome in developing countries.<sup>12</sup> In countries with complete vital registration systems that capture all births and deaths, child mortality can be directly calculated, because one of the most important indices of health in each age group is its own mortality rate. In the absence of a complete vital registration system, however, child mortality must be estimated using live births.

Furthermore, with increasing concern about equity in child survival, it is questionable to be able to measure and monitor child mortality at the subnational level, because complete birth histories are clearly inappropriate for this purpose. Health policy makers always need appropriate and up-to-date information about mortality, in order to evaluate the efficacy of current system and to design of suitable intervention studies. There is a special emphasis on the health of Iranian children and therefore many preventive activities are being conducted for their health promotion.

Therefore, in 1997, the study on the registration of death and its causes was conducted in Bushehr Province as a pilot study in the Islamic Republic of Iran. In 1999, Semnan, Eastern Azarbaijan,

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and Chahar Mahal and Bakhtiary Provinces were added to this project. Another six provinces in 2000 and rest of the provinces have been added in 2002. The primary results of the mentioned studies have revealed that despite favorable results of current activities of improvement of national health and declining mortality in children, the current information system needs revision.<sup>13</sup>

This study aimed to design an appropriate process of registering mortality among 1 – 59-month-old Iranian children, and to assess the distribution of children's mortality across different Iranian provinces.

## Methods

Data on birth history and on determinants of 1 – 59 months mortality were obtained from Iranian Demographic and Health Surveys (DHS), which are nationally representative surveys among ever-married women aged 15 – 49 years.<sup>13,14</sup> Questionnaires were sent to provinces late in 2008. Data were collected during the whole year 2009 in which our trained colleagues have filled in the received questionnaires across Iran, and returned them in early 2010.

It should be noted that since 1985, the responsibility of health in Iran has been delivered to Universities of Medical Sciences. The national data are gathered by these universities, and sent to the MOHME. In 2009, there were 40 medical universities (in 30 provinces) in Iran. In the primary step, a national qualitative health survey, including new questionnaire for gathering better information was conducted among health experts of the following three selected medical universities: Shahid Beheshti, Semnan, and Arak. The primary designed questionnaire was revised based on their comments. Then, the revised questionnaires were completed in Arak, located in the central part of Iran. By resolving the observed practical problems, in 2009 the final questionnaire was prepared and sent to the whole 40 medical universities. The nationwide data on mortality of children 1 – 59 months were collected and sent to the MOHME.

In addition to age and sex of deceased children, some other information was also collected across the country. These information included residency region (urban, rural, and nomad), living situation of child before death (living with one or both parents or other relatives), mother's education (illiterate, primary, some secondary, diploma, and university), the cause of death (accident or other causes), type of accident, place of death, the first place after transfer, speed of treatment, the observed signs and symptoms, and the history of child death in the family.

### Statistical analysis

All questionnaires were entered to a pre-designed program (Microsoft Access 2007). After determining the distribution of 1 – 59 months mortality in areas under coverage of various universities, these distributions were considered to interfere with the correlations with other variables. Chi-square test was applied for nominal and ordinal variables. Analysis of variance (ANOVA) and Student t-tests were used to determine the difference of continuous variables among groups. SPSS for Windows, version 19.0 (SPSS Inc., Chicago, Illinois, USA) was used for the analysis.

## Results

Table 1 presents the demographic characteristics of children's

deaths across Iran in 2009. Overall, in 2009, 5933 (3053 boys and 2880 girls) children aged 1 – 59 months were deceased in Iran; 51.5% were from urban areas, lived with both parents, and had the history of another child death in their family ( $P < 0.0001$ ). Mortality in 1 – 59-month-old children was unequally distributed across provinces (under coverage of medical universities). The mortality was higher among children of less- educated mothers than in children of more- educated mothers. There was a reverse association between 1 – 59 months mortality and socioeconomic status across Iran.

The distribution of accident as the main cause of death of children aged 1 – 59 months in different parts for both sexes is shown in Table 2. The distribution across various provinces was significantly different ( $P < 0.0001$ ).

With regards to death, the area under the coverage of Khorasan Razavi University (in north-east) had the largest number of deaths in both sexes, while areas under the coverage of Fasa (in south) and Gonabad (in north-east) universities had the lowest number of deaths. However, with regards to accident, Eastern Azarbaijan (in north-west) had the largest number of accidents throughout the country.

Some of death characteristics of deceased Iranian children had some substantial differences among two genders (Table 3). Boys had more accident than girls. Most of deaths took place in the accident place and during transfer and also in private section, and small part in the hospitals. Motor vehicles, drowning, being strangled, electric shock, and burning were respectively the most important causes of accidents. Overall, 83.2% of boys and 8.8% of girls were not transferred to hospital by ambulance, and 25% of boys and 26.6% of girls were not visited immediately by physicians. Economic problems had some effects on family access to healthcare facilities. The most common signs and symptoms were breathing disorders, inability to drink, drowsiness, fever, restlessness, vomiting, and convulsion, respectively.

## Discussion

This study is one of the first studies of its kind in showing the distribution of the mortality of 1 – 59 months children within a developing country. Furthermore, it fills a gap concerning the lack of information on children mortality within a region. It documented a reverse association of children mortality with socioeconomic status across Iran as a whole and within most of its provinces. The mortality in 1 – 59 month-old children seems to be unequally distributed across the country. The mortality was higher in children with less- educated mothers than in children of more- educated mothers.

Various major health programs and initiatives focus on children mortality; and most UN member states have agreed to the UNMDG of reducing the under-five mortality by two-thirds between 1990 and 2015.<sup>6</sup> Therefore, reducing regional disparities in mortality within countries is an important objective of national governments and international organizations.<sup>15,16</sup> Although in the recent years, many studies have been conducted on inequality and spatial distribution of children mortality in developing countries;<sup>17-25</sup> however, limited experience exists on the possible changes in inequalities across Iranian provinces, and their determinants.

It should be noted that the objective of our study was not to rank provinces according to their mortality distribution, but to show

**Table 1.** Demographic characteristics of deceased Iranian 1-59-month-old children in 2009

Characteristics	Male	Female	P-value
<b>Sex</b>	3053	2880	-
<b>Residency region</b>			<0.0001
Urban	1578	1467	
Rural	1285	1189	
Nomad	33	30	
<b>Living with</b>			<0.0001
Both parents	2955	2700	
Mother	33	37	
Father	7	6	
Other relatives	14	21	
Nursery center	18	19	
<b>Mother's education</b>			<0.0001
Illiterate	781	736	
Primary	897	852	
Some secondary	481	404	
Diploma	557	513	
University	139	126	
<b>Having a difficult to treatment refractory disease</b>	523	483	0.517
<b>History of child death in the family</b>			<0.0001
Boy	262	261	
Girl	517	479	

**Table 2.** Distribution of mortality from accident in 1-59 month-old children across areas under coverage of different medical universities in 2009

University*	Boys (Total)*	Girls (Total)
Western Azarbaijan	31 (162)	27 (116)
Eastern Azarbaijan	58 (169)	39 (142)
Ardebil	10 (54)	18 (71)
Isfahan	14 (187)	26 (151)
Iran	13 (102)	13 (105)
Ilam	6 (38)	3 (22)
Babol	7 (24)	1 (15)
Bushehr	0 (11)	3 (16)
Birjand	10 (46)	5 (45)
Tehran	6 (120)	7 (92)
Jahrom	4 (9)	4 (9)
Chahar Mahal and Bakhtiari	8 (27)	6 (20)
Razavi Khorasan	34 (315)	40 (328)
Northern Khorasan	8 (89)	15 (67)
Khozestan	48 (267)	37 (254)
Rafsanjan	8 (12)	1 (10)
Zabol	8 (32)	3 (30)
Zanjan	5 (11)	8 (14)
Sabzevar	3 (9)	4 (14)
Semnan	7 (19)	3 (10)
Sistan and Baluchestan	23 (143)	27 (153)
Shahrood	3 (13)	10 (17)
Shahid Beheshti	5 (79)	2 (80)
Fars	24 (127)	16 (131)
Fasa	0 (2)	1 (2)
Ghazvin	12 (56)	9 (39)
Qom	15 (48)	11 (47)
Kashan	11 (21)	2 (14)
Kordestan	18 (75)	19 (77)
Kerman	24 (108)	12 (97)
Kermanshah	17 (87)	15 (69)
Kohgiluyeh and Boyer Ahmad	13 (40)	7 (30)
Golestan	15 (49)	12 (48)
Gonabad	1 (8)	1 (3)
Gilan	20 (58)	12 (51)
Lorestan	22 (92)	12 (68)
Mazandaran	12 (34)	12 (33)
Markazi (Arak)	6 (28)	9 (42)
Hormozgan	11 (87)	16 (88)
Hamedan	15 (50)	7 (50)
Yazd	8 (50)	6 (64)
<b>Total</b>	<b>563 (2978)</b>	<b>481 (2734)</b>
<b>Chi-square Test</b>	<b>P &lt; 0.0001</b>	<b>P &lt; 0.0001</b>

\*: Alphabetic order; \*: Number of accidents (total number of deaths).

the distribution of children (1 – 59 months) mortality across Iran which can help health planning and policy-making for health promotion at national level.

There are some suggestions for the observed differences in mortality distribution. For instance, the differences in children mortality between urban, rural, and nomad communities might largely be explained by differences in the access to first care facili-

ties. Furthermore, in most provinces, nutritional standards have improved, women's literacy has increased, and the numbers of healthcare facilities are expanded. These changes were paralleled by different patterns of children mortality in various provinces. Moreover, during recent years, the Iranian population has become better educated and wealthier which is reflected in an increase in the proportion of children born to mothers with at least some pri-

**Table 3.** Death characteristics of deceased Iranian 1–59 month-old children in 2009

Characteristics	Boys (n=2978)	Girls (n=2734)	P-value
<b>Death due to accident</b>	563	481	<0.0001
<b>Place of death</b>			0.081
Accident place	251	212	
During transfer	102	107	
Health center	68	36	
Private section	124	107	
Hospital	36	31	
<b>Type of accident</b>			0.125
Motor vehicles	236	214	
Drowning	65	37	
Falling	43	33	
Burn	54	41	
Poisoning	28	19	
Being strangled	59	64	
Trauma	18	23	
Animal bites	9	13	
Electric shock	59	48	
<b>First place of treatment</b>			0.000
Hospital	1888	1668	
Health center	272	240	
Private section	373	327	
Health home	57	68	
Traditional treatment	9	8	
Nowhere	240	290	
Unknown	214	200	
<b>Transfer by ambulance</b>	501	444	0.051
<b>Injection during transferring</b>	343	299	0.894
<b>Immediate visit by physician</b>	2235	2008	0.002
<b>The reason of not visiting by physician</b>			0.30
Absence of physician	41	29	
Overcrowded number of patients	89	80	
<b>Advice for treatment</b>	2248	2068	0.04
<b>Immediate treatment</b>	2240	2022	0.264
<b>Family access to recommended treatment</b>	2159	1970	0.038
<b>Family access to the laboratory and radiology</b>	2050	1844	0.193
<b>Economic problems- effect on family access</b>	688	579	0.106
<b>Recommended transfer</b>	656	571	0.002
<b>Transferred cases</b>	394	319	0.201
<b>Observed signs</b>			
Breathing disorders	1488	1329	0.179
Inability to drink	809	783	0.376
Convulsion	463	392	0.052
Vomiting	466	464	0.392
Drowsiness	811	759	0.308
Bleeding	137	128	0.942
Abdominal pain	144	114	0.466
Dysentery	42	54	0.128
Restlessness	484	411	0.040
Fever	720	713	0.040
Other	399	376	0.094

mary education.

Our study implies that widening socioeconomic disparities in different parts of the country are not inevitable; declining difference among provinces may occur as well, certainly in absolute terms. An equitable distribution of rural development might be an important factor for preventing widening in disparities in children mortality. We can deduce the reasons for the existing conditions from experts, as well as from local information in some provinces, but research-based evidence is scarce to provide clear explanations, especially in the urban areas. For instance, utilization of healthcare facilities in Sistan and Baluchestan (in south-east) is known to be still far less than the rest of the country; this is not only because of low availability of healthcare facilities, but also as a result of people's attitude.<sup>14</sup> The current study proposes the need for better defining the determinants of both inequality and levels of children mortality, as well as the contribution of each factor to different provinces.

Furthermore, based on the published report of the MOHME,

more than 80% of mortality in children aged 1 – 59 months occur in hospitals.<sup>13,17</sup> Therefore, the further focus must be on the determination of hospital facilities and different distribution of in-hospital mortality.

## Conclusion

Our results suggest that different pattern of mortality distribution in 1 – 59 months children favors the better-off in Iran as a whole and in most of its provinces. Investigating why mortality distribution is much different in some provinces deserves special attention. In addition, it is advisable to conduct provincially-representative surveys to provide update estimates of health disparities and to allow their monitoring over time.

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