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Years of Potential Life Lost Due to Unintentional Drowning Mortality in Mazandaran Province, Iran

[1]Akbarpour Samaneh, [2]Asgari Samaneh, [3]Soori Hamid, [4]Khosravi Ardeshir and [5]Ghasempouri Khosro

[1]Department of Social Medicine, Babol University of Medical Sciences, Babol, Iran
[2]Clinical Research Development Center, Babol University of Medical Sciences, Babol, Iran
[3]Safty Promotion and Injury Prevention Research Center,
Shahid Beheshti University of Medical Sciences, Tehran, Iran
[4]Ministry of Health and Medical Education,Tehran, Iran
[5]Babol University, Iran

Abstract: Drowning is as one preventable cause of morbidity and mortality in the World and Iran that is neglected in public health. This study aimed to present the epidemiological pattern and estimate the years of life lost due to drowning mortality as one of the important health indicators in Mazandaran province of Iran. Data on drowning from various sources were employed in this study (Death Registry System, Legal Medicine Organization, and weekly report of Ministry of Health in Babol and Mazandaran, 2008) The YLL was calculated using the standard Global Burden of Diseases method. In 2008, 273 people (91.2% male and 8.8% female) with the mean age of 25.3±11.7 years died from drowning. Overall, 175 people were tourists and 98 people were residents of Mazandaran province. The drowning death rate was 3.3 per 100,000 populations. The number of years lost was 7211 (4579 tourists and 2632 residents). The number of years lost rate was 89 per 100,000 in residents. Most YLL was seen to age group 10-19 years. Considering burden of drowning statistics and unknown risk factors of drowning in Mazandaran, we hope the information in this study can help politics in intervention planning in the province.

Key words: Epidemiology · Drowning · Burden · Mazandaran province · Iran

INTRODUCTION

Falling and being immersed in water that result in drowning is as one preventable cause of morbidity and mortality that is neglected in the public health problems [1,2]. According to the latest definition, death resulting from submersion or immersion under water or any other liquids is defined as drowning [3,4]. There is an estimation of about 400 000 annual drowning deaths worldwide and in 2004, an estimated 388 000 people died from drowning, making that a major public health problem worldwide [4,5]. Drowning is the 3rd leading cause among unintentional accident, accounting for 7% of all deaths from accidents [6], 97% occurred in low-and middle-income countries [6, 2]. For instance, China and India together contribute 43% of the world's drowning deaths and 41% of the total global DALYs [7, 8]. In some countries, drowning is the first or the second leading cause of all deaths in children [9]. In Iran, the average annual number of drowning deaths is 1200, which is a serious problem in the country [10,11]. Road traffic injuries and drowning are the top two causes of fatal injuries in the northern regions of Iran (Gilan and Mazandaran) [12]. According to the latest report from the Legal Medicine Organization of Iran in 2008, the highest rate of drowning mortality among all of provinces in Iran is in Mazandaran province (8.6 per 100000 population) [13].

Developing health services strategies is an essential factor for improving the community health which needs enough level of awareness and allocation of the disease and their reasons [14].

Health planners and policy makers need to access burden of diseases and injuries in the community as single number for need assessment and health priority

Corresponding Author: Asgari Samaneh, Clinical Research Development Center, Babol University of Medical Sciences, Babol, Iran. Tel: +98-911-3275084.

setting. YLL (Years of Life Lost Due to Mortality) introduced by WHO is a new metrics to quantify the burden of disease and injury's mortality. This measure shows how many years the individual would have lived if he or she had avoided premature death. The use of YLL allows researchers combine a single indicator years of life lost from premature death in every age group [15, 16]. YLL is used for need assessment and priority setting [15]. Lack of reliable studies on drowning mortality and its burden in Iran [11, 17] particularly in the north [18] and considering it as the second cause of injury deaths in Mazandaran [12, 13], seems that a need of a study to present the epidemiological pattern of unintentional drowning mortality and determination of its burden is essential. Thus, this study was calculated YLL for drowning mortality in this province.

MATERIALS AND METHODS

This study is a cross-sectional study of unintentional drowning deaths occurring in Mazandaran Province from March 2008 to March 2009. This study has been approved by the Ethics Committee of Safety Promotion and Injury Prevention Research Center, Shahid Beheshti University of Medicine Ethics Review Board.

Mazandaran province located in the northern Iran bordering the Caspian Sea with a population of about 3 million residents in 2008 [19]. Various data sources were addressed on drowning in Mazandaran to complete the information

In this report, we prefer to use an International Classification of Disease (ICD_10) coding system for recognizing an accidental drowning death (codes: V90-V94, W15-W16, W65-W74, X92, X38 and Y21) [20].

All cases that were registered by the Legal Medicine Organization of Mazandaran Province (242 cases), Death Registration System of Mazandaran province in the Ministry of Health Department (86 cases) and the weekly reports of the Health Department of Sari and Babol University of Medical Sciences (187 cases) included in this study. The weekly reports were obtained from the records sent to the active surveillance system for unintentional drowning mortality in north of Iran (this system register information from Death Registry System, Ambulance, local Police, Red Crescent, and Tourism Organization).

In the first phase, the list of data from three organizations was compared and according to the subjects' first names, surnames, age, sex, fathers name, date of death, place of death, the duplicated or replicated cases were removed by helping experts from every organization. After removing duplicates, we found 273 persons who died because of drowning in Mazandaran. For quality control on these data (273 cases), we found 242 cases out of 273 registered in Legal Medicine Organization. Every case has a birth certificate and national ID card copy in these organizations and we cheeked this information for all cases. But 31 out of 273 cases were not registered in Legal Medicine (these cases registered 21 cases in DRS and 10 cases in Weekly Report). We found 17 cases in the national organization for civil registration software. The validity of these data (17 cases) was confirmed. And for rest of data (14 cases), were forwarded by local sources. This confirmed that every case was that reported from 2 or more organizations.

The total population estimation of residents in Mazandaran province in 2008 was derived from Statistical Center with growth rate equals to 1.16 [19]. Considering the negligible change sex and age ratio from 2006 to 2008, we used sex and age ratio in 2006 census in Mazandaran for the estimation of this ratio in 2008 [21]. For calculating the rates in this study, the population of tourists removed from the denominator. The SPSS software (version 17.0) was employed and the descriptive epidemiological characteristics of drowning and comparing residents and tourists status were conducted using student's t-test and after that we calculated the Years of Life Lost (YLL) using the World Health Organization's (the GBD) standard methods [22]. According to this method for calculating YLL, the standard life expectancy and number of drowning deaths in sex and age groups were used for calculating the YLL formula (1 formula) in excel software spreadsheet. In other word, YLL are calculated from the number of deaths multiplied by a standard life expectancy at the age at which death occurs.

In general, scientists are using the same standard life expectancy for both YLL and deaths at each age.

The value of C = 0.1658 and β = 0/04 was used for the standard age weighting and R = 3% for the discount rate according to WHO recommendation [23].

$$YLL = NCe^{(ra)} / (\beta + r)^2 [\, e^{-(\beta+r)(L+a)} [-(\beta+r)(L+a)-1] - e^{-(\beta+r)a} [-(\beta+r)a-1]] \quad (1)$$

In this formula, r is the discount rate (GBD standard value is 0.03), C is the age-weighting correction constant (GBD standard value is 0.1658), b is the parameter from the age-weighting function (GBD the standard value is 0.04), is the age of onset, and L is the time lost due to premature mortality.

RESULTS

This study showed that from March 2008 to March 2009, 273 people drowned in Mazandaran province, 35.9% (98 cases) were residents and 64.1% (175 cases) were tourists.

With respect to the gender distribution, no statistically significant differences can be seen between tourists and residents.

The percentage of males was drowned dramatically higher than females (91.2% vs. 8.8%). The mean age of drowned victims was 25.3±11.7. With respect to the victims residential situation, we found a statistically significant (p=0.02) differences between the mean age of visitors (26.6±12.2) and local people (23.1±11).

The province population during the study was estimated around 2978495 [19]. From this population, the death rate was 3.3 per 100,000 (male 6.2 and female 0.54 per 100,000). Most people were in the 15-29 years age group (64.5 %). Table 1 shows the frequency of people in the different age groups and sex groups in residents and tourists.

The places of death were the sea with unprotected area (n=251, 91.9%), however, only 29.4% (80 cases) of the drowned persons were residents and the rest (n=171, 62.6%) were tourists and 4 cases of drowned victims in to the (residents=1.1%, tourists =0.37%). The second common place of drowning was the river (residents=5.1%, tourists =0.73 %). Only 2 cases (0.7%) of all drowned victims were drowned in the wading (Table 2). Also the most frequent cities of drowning in this province were reported as: Mahmoudabad (n=56, 20.5%), Babolsar (n=54, 19.8%), Nowshahr (n=44, 16.1%) and the other cities of province (43.6%).

The seasonal variations in mortality by drowning during the hot seasons were clear. July, August, September, June, May, respectively, were the most common months when death due to drowning happened.

According to the World Health Organization (GBD method), with 3% discount rate and age-weights ($C = 0.1658$ and $\beta = 0/04$) in different age categories, the number of years lost life in all age groups was estimated 7211 years (6548 years for male and 663 years for female). These years 2632 years were related to residents (222years for females and 2410 years for males) and the rest are those related to tourists (441 years for females and 4138 years for males).

In Mazandaran province the years of life lost rate in 2009 for different age categories by considering the reduction rate was calculated for the residents.

Table 1: Distribution of drowning by age group and gender in Mazandaran 2008

	Resident		Non-resident		
Age group	Male	Female	Male	Female	total
0-4	3(3.3%)	-	-	-	3(1.1%)
5-14	9(10%)	1(12.5%)	11(6.9%)	3(18.8%)	24(8.8%)
15-29	56(62.2%)	6(75%)	104(65.4%)	10(62.5%)	176(64.5%)
30-44	16(17.8%)	1(12.5%)	27(17%)	2(12.5%)	46(16.8%)
45-59	5(5.6%)	-	13(8.2%)	1(6.2%)	19(6.9%)
60 +	1(1.1%)	-	4(2.5%)	-	5(1.9%)
Total	90(100%)	8(100%)	159(100%)	16(100%)	273(100%)

Table 2: Spatial distribution of drowning at Mazandaran province at 2009

Place of event	Total of drowned	Resident	Non-resident
Unprotected area	251	80	171
Un Isolated area	(91.9%)	(29.36%)	(62.6%)
Protected area	4	3	1
Isolated area	(1.5%)	(1.1%)	(0.37)
River	16(5.9%)	14(5.1%)	2(0.73%)
wading	2(0.7%)	1(0.37)	1(0.37)
Total	273(100%)	98(36%)	175(64%)

Table 3: the life lost years with considering social values in resident and non-resident people

	Daly in Resident		Daly in Non-resident		
Age Group	Female	Male	Female	Male	Total Daly
0-4	-	90	-	-	90
5-14	29	264	88	321	702
15-29	167	1548	280	2851	4847
30-44	26	394	51	658	1128
45-59	-	99	22	260	381
60-69	-	15	-	40	55
+70	-	-	-	8	8
Total	222	2410	441	4138	7211

Table 4: The life lost years with considering social values per 100,000 population in resident

	Death Rates		Daly		
Age Group	Female	Male	Female	Male	Total Daly
0-4	-	3.1	-	120	47
5-14	0.5	3.9	20	116	66
15-29	1.2	11.1	33	306	169
30-44	0.3	4.7	8	117	62
45-59	-	2.5	-	50	30
60-69	-	1.5	-	23	12
+ 70	-	-	-	-	-
Total	0.54	6.2	10	160	89

For tourists this number was not calculated because of the population for denominator was not available.

10 years (YLL) per 100,000 persons was estimated for female life and 160 years for male in resident. The highest life lost years were seen in the age groups of 15-29, 5-14 (169, 6 per 100,000 population/year, respectively). (Table 3).

In Mazandaran province, 90.8 % of the number of years lost related to males and 9.2 % to females. Also 63.5% of years lost was related to tourists and the rest (36.5%) for the residents. Among all the tourists, 90.4 % of these years lost was related to male and 9.6% female. This percentage was around 91.5% (male) and 8.5% (female) in residents. In general, the highest number of life lost years was seen in age group of 15-29 (Table 4).

DISCUSSION

Our study showed the overall mortality rate of drowning in Mazandaran province in 2008 was 3.3 per 100,000 populations, which was lower than the national rate of drowning, reported by LMO in 2008 (8.6 per 100,0000 populations) [13]. The reason of this difference was that, in this study the mortality rate was calculated without tourists, due to unknown denominator population, while in LMO reports, they consider also the non-residents drowned victims in calculating mortality rates. The world mean rate of drowning mortality is 6.8 per 100,000 populations [2] which was higher than the reported rate of death in Mazandaran province. However, MZ's drowning rate was higher than developed countries (1-1.3 per 100,000 populations) [5]. On the other hand, this rate number is calculated by removing non-residents drowned, if we did not remove tourists, drowning mortality in Mazandaran was much higher than 3.3.

The high rate of drowned victims is related to the geography of the region. This province is located in the north of Iran; around 338kms, bordering Caspian Sea and swimming is one of the people's hobbies in hot seasons. This indicates the increase rate of drowning in Mazandaran province as compare to the other developed countries.

In study in 2005 [18], Davoudi *et al.* has reported unintentional drowning rate for Mazandaran and Gilan to be 4.2 per 100,000 resident population.

This number is higher than comparing the results in the present study. This result shows drowning mortality decreased in these years, which probably can be due to reduced exposure, creating preventive programs, and recreational place expansion.

In this study, drowning death rates for males was 6 times higher than females. Comparing this number with the results in different studies is very high [24-28]. Most cases drowned were in the sea and unprotected sea area. The reason maybe be religious and cultural limitations for women in Iran. On the other hand, men have higher risk than of women (eg, swimming alone in unprotected area, and also men are more at risk of exposure to women in water environment. For example water games, boat rides.

With respect to age, the young adult group (15-29) had higher drowning rate (64.5%), which supports the previous study in this province [18].

The majority of study about drowning reported that most of these cases occurred under 4 years old and above 20 years old [29-31] Most drowned victims among the young children (under 5 years age) in the world occurred in bathtubs. Drowning in this age group also occurred in toilets and water pond [32], in this province, few people use bathtub and few houses have pools. And in Iran, especially in Mazandaran province, most drowning sites happened in open waters area.

Other reasons could be that the majority of drowning cases in this province are tourists, and tourists during their trips usually take more care of their children than what residents do [33].

The results of this study show that, 267 cases drowned in the sea. majority of this happened out of the protected area in the absence of supervision or unprotected area (98%). The absence of sufficient and suitable amount of swimming places compare with the population of province and tourist could be the reason of high percentage. Due to high population density in protected area people are encourage to swimming in unprotected area. On the other hand, this indicates that the sea protected area is managed well so that drowning in this place is very low.

In our study, we did not have any report on drowning in the house or tub and very few reports and river, which is different with result of various studies in developed countries [34, 35]. In addition, the duration of the study may have effect in our conclusion (1 year). Or because of the availability and proximity of the sea for residents and tourists in Mazandaran, people use pond and river less in this province.

The number of years lost life on all age groups was estimated 7211. The number of years lost for residents of this province was around 2632 years (89 years per 100,000 populations).

This number comparing with the national rate in Iran 94.5 per 100000 populations is very low [36]. Although the number of drowned victims is higher than the other provinces in Iran, we only consider the residents, thus the burden of drown was reduced.

The burden of drowning for men was calculated 160 per 1000000 comparing national average value 147.7 per 100000, and for women we calculated 10 per 100000 comparing national average 40.2 per 100000 [34].

Of course we used different information source (Death Registry System, Legal Medicine Organization, and Ministry of Health) for this study but the national study in 2003 is used on data source (death registration system). Maybe it is one of the reasons of the differences of these numbers.

The number of years lost for children up to 4 years of age and the young children between 5-14 is 47 and 66 years per 100,000 populations, respectively, which is lower than the previous national study in the province [34] in 2003 (165 and 145 per 100,000 populations, respectively). For the age group, 30-44 the number of years lost was estimated 62.1 years, which is higher than average national number (48.4). The mean reason for this is the exciting sea in Mazandaran that affect these changed numbers.

The Years of life lost in Mazandaran in males are much higher than females; this report is consistent with other studies [34-36]. The highest number of life lost years was seen in age group 15-29 [table2].

There were some limitations in this study. First, there was not enough information in the victim's medical backgrounds. This study was retrospective study and so some data were unavailable. We did not have 2008 population in Mazandaran and the estimated population based on census 2006.In conclusion, we found that the rate of drowned death in Mazandaran was lower that the global drowned death rate, but higher than the developed countries.

In addition, males likely die due to drowning than females. Among the various water places, the sea (out of the protected area) has the highest drowning mortality rates. Finally, we think that it will be worthwhile to analyze the burden of drowning in other provinces of Iran for a better conclusion.

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