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ORIGINAL ARTICLE

An enquiry into the frequency of drowning cases in the provinces bordering the Caspian Sea, the Persian Gulf, and the Oman Sea from 2011 to 2014

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Abstract

Introduction: In Iran, few studies have been carried out on the frequency of drowning cases in the country's southern and northern coasts. The aim of this study is to evaluate the frequency of drowning cases in the provinces with northern and southern coastal margins from 2011 to 2014 and to examine the risk factors related to drowning mortality.

Methods: This cross-sectional analytical study made use of the data from The Country's Reports of Drowning in the Provinces Bordering the Caspian Sea, the Persian Gulf and the Oman Sea by the Center of Disaster Management and Emergency Response, Office of Disaster Prevention and Safety Promotion, Iran, which were also registered at the Health Departments of Universities of Medical Sciences in Mazandaran, Guilan, Golestan, Khuzestan, Bushehr, and Hormozgan. The data were statistically analyzed by SPSS V.16 software. For descriptive analysis, frequency percentage, mean, and standard deviation were used.

Results: The highest frequency of drowning was related to Mazandaran Province (65.3 percent). Among instances of drowning, the majority of them led to death (64.7%). Men (79.5%) had the highest percentage of cases. Age group *20-24 years* (20.4%) had the highest number of drowning. Most drowning incidents happened during summer, the month of August (30.6), and guest people (from other provinces) (72.9%).

Conclusions: With regard to the findings of this study and the rate of drowning and deaths related to drowning, it is required that more comprehensive prevention programs be designed to deal with this health problem and to reduce losses and tolls. Improving the beaches and increasing the protected areas at coastal stretches of the country are among the safety measures that can be helpful in this regard.

Key Words: Frequency; Drowning; Iran; Caspian Sea

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Introduction

Drowning is one of the important public health hazards which is often overlooked. (1) According to the latest report from the World Health Organization in 2012, drowning was the cause of about 372 thousand deaths in the world. (2) This figure represents the importance of the issue on public health. Worldwide, 10% of all deaths are caused by accidents (3) and drowning is the third leading cause of unintentional deaths (after traffic injuries and fall) and is responsible for 7% of deaths related to accidents. Also, 95% of unintentional drownings occurs in countries with low and middle incomes (4, 5).

In Iran, the highest number of accidental deaths are related to road traffic, burning, and fall, respectively. However, in northern Iran (Guilan and Mazandaran provinces), drowning is the second leading cause of unintentional injury-related death (6).

According to the statistics of Forensic Medicine Site in Iran in 2013, 1033 people and in 2012, 1072 ones lost their lives because of drowning. As an example, on the vacation of August 2014, only during four days, 23 people lost their lives due to drowning in the two Northern provinces (7).

World Health Organization has introduced some factors as the most important risk factors of drowning which are as follows:

1. Age: Children under 5 have the highest number of deaths from drowning in the whole world.

2. Gender: Mortality rate of men are twice higher than that of women, which is due to greater exposure to water as well as riskier behavior such as swimming alone or drinking alcohol before swimming and sailing.

3. Exposure to water: Fishermen and children who are around uncovered and unprotected water sources.

4. Other risk factors: Lower socioeconomic level; children who are unsupervised, either alone or with another child around the water; using alcohol near or in the water; medical conditions such as epilepsy; tourists who are not familiar with the features of the water of the area (8, 9)

In Iran, a few studies have been carried out on the prevalence of drowning in the country's southern and northern coasts. The most recent studies in this regard have been in Tehran Province from 2002 to 2006, Khuzestan Province from 2002 to 2006, and Guilan and Mazandaran provinces in 2008.

The aim of this study was to evaluate the frequency of drowning in the provinces of northern and southern coastal margins, from 2011 to 2014, and to investigate the risk factors of drowning. By determining these local risk factors, it is possible to make plans to prevent and reduce the rate of drowning in the country.

Methods

In this cross-sectional analytical study, all cases of drowning in the provinces bordering the Caspian Sea as well as all cases of drowning in the provinces bordering the Persian Gulf and the Sea of woman were examined from 2011 by census method, which consisted of all those who drowned at the time of the study (2011-2014) in provinces adjacent to the sea or lake. Drowning information of four consecutive years was analyzed. To extract data, the study made use of "a country report of drowning in the provinces bordering the Caspian Sea, the Persian Gulf and the Oman Sea reported by the Center for Disaster Management and medical Emergency (pre-hospital emergency), the Office of Accident Prevention and Safety Promotion. It should be noted that these data were also recorded in the Health Departments of Medical Sciences at Universities of Mazandaran, Gilan, Golestan, Khuzestan, Hormozgan and Bushehr. In addition, the data available were compared and matched with the information recorded in databases of Red Crescent, Emergency 115, Police and Forensic Medicine departments.

All of the data extracted from the report were used confidentially and only by those in the study. Dissemination of information was generally performed without any mention to the names of individuals. The data collected were recorded in a checklist including age, sex, area of drowning, result of drowning, presence of emergency services at the time of drowning, reason of drowning, and use of rescue equipment. Then, the data were statistically analyzed by SPSS V.16 software. For descriptive analysis, frequency percentage, mean, and standard deviation were used.

Results

After extracting and matching the data, the frequency of drowning in the whole country in 2011, 2012, 2013, 2014 were 333, 319, 285 and 388 instances, respectively. In 2011, from the total number of drowning cases, 212 instances (63.7%) died and 121 cases (26.3%) were successfully resuscitated; in 2012, 217 deaths (68%) and 102 recoveries (32%) were recorded; in 2013, 215 people died (70.5%) and 92 people survived

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(29.5%); and in 2014, 213 fatal cases (45%) and 175 (55%) recoveries were recorded.

Of all instances of drowning, 280 (84%) cases were men and 53 cases (16%) were women in 2011; and 249 (78.1%) men and 70 (21.9%) women in 2012, 229 (80.3%) men and 56 (19.7%) women in 2013, 295 (76%) men and 93 (24%) women in 2014 were registered.

During the 4 years, most cases of drowning were in the age group 20 to 24, which covered 26.4% of all cases in 2011, 21% in 2012, 21.6% in 2013, and 15% in 2014 (Table 1).

Mazandaran Province reported the highest frequency of drowning over these years, which consisted of 233 (70%), 212 (66.5%), 181 (59.3%), 239 (62%) cases in the years 2011 through 2014 respectively (Table 2).

The City of Babolsar in the years 2011 (57 people, 17.1%) and 2013 (75 ones, 24.6%), and the city of Mahmudabad in the years 2012 (70 ones, 21.9%) and 2014 (78 cases, 20%) had the highest cases of drowning.

The highest number of drowning was in August in the years 2011 (26.7%), 2012 (27%) and 2014 (40.5%), and in the year 2013, the month of June had this position (31.1%) (Table 3).

Most of the drowned in each of the years were non-native residents, including 62.5%, 76.2%, 72.5%, and 75% of the cases from 2011 to 2014 respectively (Table 4).

And finally the limits outside the *healthy sea plan* took the highest tolls in the years 2011 to 2014, the frequency percentage of which were 70.9% in 2011, 70.2% in 2012, 73.4% in 2013, and 76% in 2014 (Table 5).

Table 1: Frequency and percent of the drowned cases in terms of age from 2011 to 2014

Age group	2011		2012		2013		2014		Total	
	R	Death	R	Death	R	Death	R	Death	R	Death
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
0-4	4 (3.3)	7 (3.3)	3 (2.9)	9 (4.14)	5 (5.55)	6(2.7)	10 (4.69)	6 (3.4)	22 (4.2)	28 (3.4)
5-9	3 (2.47)	9 (4.24)	3(2.9)	10(4.61)	7(7.77)	9(4.2)	9(4.22)	10(5.7)	22(4.2)	38(4.6)
10-14	10(8.26)	10(4.27)	5(4.90)	13(5.99)	15(16.7)	17(7.9)	18(8.49)	16(9.1)	48(9.1)	56(6.8)
15-19	14(11.5)	42(19.8)	17(16.8)	37(17.1)	12(13.3)	42(19.5)	31(4.55)	26(14.8)	74(14.1)	147(17.9)
20-24	30(24.7)	58(27.3)	17(16.8)	50(23.0)	12(13.3)	50(23.2)	32(15.0)	25(14.3)	91(17.3)	183(22.3)
25-29	27(22.3)	40(18.8)	18(17.6)	30(13.8)	15(16.7)	32(14.8)	33(15.4)	21(12.0)	93(17.7)	123(15.0)
30-34	8(6.61)	14(6.60)	13(12.7)	15(6.91)	8(8.88)	20(9.3)	25(11.7)	22(12.6)	54(10.3)	71(8.7)
35-39	8(6.61)	4(1.88)	6(5.88)	16(7.37)	4(4.44)	15(6.9)	15(7.04)	17(9.7)	33(6.3)	52(6.3)
40-44	9(7.43)	9(4.24)	8(7.84)	9(4.14)	3(3.33)	7(3.2)	13(6.01)	9(5.1)	33(6.3)	34(4.1)
45-49	5(4.13)	5(2.35)	5(4.90)	7(3.22)	5(5.55)	7(3.2)	13(6.01)	5(2.8)	28(5.3)	24(2.9)
>=50	3(2.47)	14(6.60)	7(6.86)	21(9.67)	4(4.44)	10(4.6)	14(6.57)	18(10.3)	28(5.3)	63(7.7)
Total	121(100)	212(100)	102(100)	217(100)	90 (100)	215(100)	213(100)	175(100)	526(100)	819(100)

Abbreviation: R = Resuscitation

Table 2: Frequency and percent of the drowned cases per province from 2011 to 2014

Province	2011		2012		2013		2014	
	R	Death	R	Death	R	Death	R	Death
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Golestan	0 (0.0)	7 (3.3)	1 (0.98)	23 (10.6)	2 (2.22)	11 (5.11)	2 (1.01)	8 (5.1)
Gilan	7 (5.78)	29 (13.68)	14 (13.72)	37(17.05)	22 (24.44)	41 (19.07)	48 (24.37)	41 (26.11)
Mazandaran	79 (65.3)	154 (72.64)	73 (71.57)	139 (64.05)	47 (52.22)	134 (62.32)	140 (71.06)	99 (63.06)
Khuzestan	28 (23.4)	15 (7.07)	0 (0)	5 (2.3)	12 (13.33)	22 (10.23)	6 (3.04)	6 (3.82)
Bushehr	7 (5.78)	7 (3.3)	14 (13.72)	13 (5.99)	7 (7.77)	7 (3.26)	17 (8.63)	21 (13.37)
Total	121 (100)	212 (100)	102 (100)	217 (100)	90 (100)	215 (100)	197 (100)	157 (100)

Abbreviation: R = Resuscitation

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Table 3: Frequency and percent of the drowned cases per month from 2011 to 2014

Month	2011	2012	2013	2014
	N (%)	N (%)	N (%)	N (%)
April	14 (4.2)	19(5.95)	22(7.21)	19(4.9)
May	8(2.4)	15 (4.7)	6(1.96)	12(3.09)
June	60 (18.02)	76 (23.82)	33(10.82)	39(10.5)
July	84 (25.22)	61 (19.12)	103(33.77)	48(12.37)
August	89 (26.72)	86 (26.96)	59(19.35)	157(40.46)
September	78(23.42)	62 (19.43)	82(26.89)	113(29.12)
Total	333(100)	319(100)	305(100)	388(100)

Table 4: Frequency and percent of the drowned cases in terms of residence from 2011 to 2014

Residence	2011	2012	2013	2014
	N (%)	N (%)	N (%)	N (%)
Locale	119 (35.73)	72 (22.57)	82 (26.88)	89 (22.94)
Non-locale	208 (62.46)	243 (76.17)	213 (69.84)	294 (75.77)
Unknown	6(1.8)	4 (1.25)	10 (3.28)	5 (1.28)
Total	333 (100)	319 (100)	305 (100)	388 (100)

Table 5: Frequency of the drowned cases in terms of site of incidence from 2011 to 2014

Site	2011	2012	2013	2014
	N (%)	N (%)	N (%)	N (%)
Inside the healthy sea plan area	16 (4.80)	24 (7.52)	18 (5.90)	24 (6.18)
Outside the healthy sea plan area	236 (70.87)	224 (70.22)	215 (70.49)	295 (76.03)
Pool	16 (4.80)	10 (3.13)	5 (1.64)	16 (4.12)
River	47 (14.11)	31 (9.72)	59 (19.34)	35 (9.02)
Unknown	18 (5.40)	30 (9.40)	8 (2.62)	18 (4.64)
Total	333 (100)	319 (100)	305 (100)	388 (100)

Discussion

Based on the results of this study, Mazandaran Province had the highest rates of drowning through these years (2011 to 2014). Based on the results of previous studies, the frequency of drowning is high in Guilan, Mazandaran, and Golestan due to the existence of long coasts in these provinces and also in Kermanshah and Isfahan because of the major rivers of these provinces which attract travelers and tourists (10).

In the study by Davoodi et al (2005), the drowning rate of 4.2 per 100,000 cases was reported in the two provinces of Guilan and Mazandaran (11). In Akbarpoor's study (2011), the rate was 2.9 in the two provinces (12). These numbers show that the mortality rate has declined over these years, which can be due to the reduced exposure, establishment of preventive measures, or the improvement of recreational areas for swimming.

In our study, within the four continuous years of examining the country's drowning statistics, in spite of the fact that there was a slight annual reduction from 2011 to 2014, in 2014 we were faced with increasing numbers of drowning, which reflects the inadequacy of the measures taken in the fields of education and prevention.

Based on previous reports, the average death by drowning in Khuzestan province is 3.9 per 100,000 people a year. This number is comparatively lower than the world average of deaths from drowning that is 6.8 per 100,000 people per year. Nonetheless, the average of drowning deaths in European countries and America, which have higher economic revenues, is only 1 to 1.3 per 100,000 (12-14). However, inside our country, Mazandaran province with its long beaches and many tourism attractions has a higher rate of drowning (7.6 per 100,000 people a year) than Khuzestan province and the global average (15), which reveals the necessity for precise planning and control of the coasts of this province.

Based on the results of this study, the rate of drowning is far more in males than females. According to Monsef et al's study, drowning in men was 2.1 times more common than in women (16).

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Other studies have confirmed these figures (17 and 15). Also, in studies conducted by Peden et al, and in a study carried out in Louisiana, and in Singapore, drowning rate in men were higher than in women (18-20). Perhaps, the reason underlying this across the world is that males have more accessibility to swimming places, and they also take higher risk and do high-risk behaviors such as swimming alone and swimming in illegal areas. And in one respect, Iranian women, culturally and socially, have limitations to swim in natural and unprotected areas.

Most victims of the present study were in the age group of 20-24 years. Also, in Monsef et al study, the age group 20 to 24 years had the highest number of deaths (16), which is in line with the studies carried out in Mazandaran (21, 17) and in different countries (11). There have also been studies which reported the greatest percentage of death to be in children under 5 years of age (12).

In Brenner et al's study, which is done based on the information of the year 1995 in America, drowning has been introduced as the second leading cause of death in children aged 1-19 years (22).

In another study conducted by Wintemute on the drowning American children, children under 5 and boys aged 15-19 years were two high risk groups in terms of drowning (23).

In the study conducted in Louisiana, people aged 25 to 35 years had the highest mortality rate (3.8 per 100,000). Children under 4 years of age, who constitute 10% of all cases of drowning, had the second highest mortality rate among all age groups (3.5 cases per 100,000 people) (24).

In another study conducted by Steensberg, 349 cases of accidental drowning occurred from 1989 to 1993 in Denmark where a big share of drowning belonged to children aged 0-4 years, middle-aged men, and elderly men (24).

In the study by Langley et al in New Zealand, the age groups of 0-4 and 15-24 years had the highest mortality rate (25).

In a study by Tan et al in China, children aged 1 to 9 years and people over 60 years of age drowned more than other age groups (26).

The reason for high prevalence of drowning in childhood is probably high curiosity, high mobility, and lack of proper understanding of the dangers. Generally, 82% of children's drowning occurs in homes; also children under 1, usually drown in the bathtub, bucket of water and sink basins (27). However, this study investigated cases of drowning at the sea coasts, and it is young people who, more than other ages, use the sea for swimming.

In this study, most cases of drowning happened outside the *healthy sea plan* area, which could be due to lack of protected areas in the seaside in proportion to the number of people using the beaches. That is why people are encouraged to swim outside the healthy sea plan limits. On the other hand, this suggests that in the healthy sea plan area, management and supervision are well carried out by medical aids and rescue teams in the protected areas, which has decreased the number of deaths caused by drowning in these places (16).

Based on the results of previous studies, most cases of drowning happened in the seas and next in rivers (10, 16 and 26). Also, in Tan's study, the sea, rivers and swimming pools were the places in which most victims of drowning died (26). In our study, areas outside the healthy sea plan area, rivers, and areas inside the healthy sea plan area had the highest number of drowning, respectively.

In terms of time, most cases of drowning happened in the summer and the highest prevalence was in August. Too much heat in summer attracts people to go for swimming and water sports and the use of natural waters available. Accordingly, there will be more incidents of drowning. There are also many studies that have confirmed the effects of seasonal and weather factors in the incidence of drowning, which is consistent with the results of our study (16 and 12).

Conclusions

The prevalence of drowning is still high and not acceptable in spite of preventive measures. With regard to the results of this study and the rate of drowning and deaths caused by it, it is required that more and more comprehensive preventive programs be designed to deal with this health hazard and to lessen the tolls it causes. The improvement of the beaches and increased number of protected areas in coastal stretches of the country's seas are some measures that can be helpful in this regard.

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RM, HNS and FHAM: Idea and Design, MTS, AJ, LM , HNS and FHAM: Data gathering and assessing the data bases, MR and MN: coded the data and data analysis, AJ and LM: drafting the manuscript, RM, MR, HNS, MN: critically revised the manuscript

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