The mortality rate from self-harm in Iran

Article *in* Public Health · September 2020

DOI: 10.1016/j.puhe.2020.06.015

17 authors, including:

Zahra Ghodsi
Tehran University of Medical Sciences
32 PUBLICATIONS **117** CITATIONS
SEE PROFILE

Sahar Saeedi Moghaddam
Shahid Beheshti University of Medical Sciences
55 PUBLICATIONS **513** CITATIONS
SEE PROFILE

Payam Vezvaei
Tehran University of Medical Sciences
6 PUBLICATIONS **9** CITATIONS
SEE PROFILE

Mahdi Yoosefi
2 PUBLICATIONS **4** CITATIONS
SEE PROFILE

Public Health 186 (2020) 44–51

Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevier.com/locate/puhe

Original Research

The mortality rate from self-harm in Iran

Z. Ghodsi [a], S.S. Moghaddam [b], P. Vezvaei [c], M. Yoosefi [j], N. Rezaei [b], S. Saadat [c], A. Sheidaei [d], M. Sharif-Alhoseini [c], F. Sadeghian [k], N. Ahmadi [b], S.B. Jazayeri [e], P. Salamati [c], A. Khosravi [f], M. Moradi-Lakeh [g], A.H. Mokdad [h], G. O'Reilly [i], V. Rahimi-Movaghar [c, *]

[a] Department of Midwifery, Tuyserkan Branch, Islamic Azad University, Tuyserkan, Iran
[b] Non-Communicable Diseases Research Center, Endocrinology and Metabolism Population Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran
[c] Sina Trauma and Surgery Research Center, Tehran University of Medical Sciences, Tehran, Iran
[d] Department of Epidemiology and Biostatistics, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran
[e] Department of Surgery, Kaiser Permanente Fontana Medical Center, Fontana, CA, USA
[f] Deputy for Public Health, Ministry of Health and Medical Education, Tehran, Iran
[g] Preventive Medicine and Public Health Research Center, Iran University of Medical Sciences, Tehran, Iran
[h] Institute for Health Metrics and Evaluation, University of Washington, Washington, USA
[i] Department of Epidemiology and Preventive Medicine, School of Public Health and Preventive Medicine, Monash University, Melbourne, Australia
[j] Endocrinology and Metabolism Research Center, Endocrinology and Metabolism Clinical Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran
[k] Center for Health Related Social and Behavioral Sciences Research, Shahroud University of Medical Sciences, Shahroud, Iran

ARTICLE INFO

Article history:
Received 5 November 2019
Received in revised form
22 April 2020
Accepted 7 June 2020

Keywords:
Mortality
Self-harm
Iran
Epidemiology

ABSTRACT

Background: Self-harm–related death is one of the most unfortunate, tragic, and regrettable types of death owing to injuries with a variety of socio-economic and cultural causes. The study aimed to determine the trend in the mortality of self-harm by sex and age at national and provincial levels in Iran over a period of 26 years.

Methods: The Iran Death Registration System (DRS), cemetery databanks in Tehran and Esfahan, and the national population and housing censuses of Iran were used for this study. Using a growth model, the population was estimated in the age groups. Incompleteness, misalignment, and misclassification in the DRS were all considered and addressed accordingly. We used a spatio-temporal and Gaussian process regression model to estimate mortality rates in children and adults.

Results: Over the study period, 67,670 deaths were estimated owing to self-harm across the country. The overall age-standardized mortality rate decreased from 4.32 per 100,000 (95% unit interface (UI): 3.25–5.75) to 2.78 (2.15–3.59) per 100,000 between 1990 and 2015, a reduction of approximately 35.65%. The M/F ratio was 2.03:1 with an annual percent change of −2.38% and −1.37% for women and men, respectively. The annual self-harm mortality rate was higher among individuals aged 15–24 years, as well as it was more in men during the study period.

Conclusion: Mortality from self-harm has declined over the study period in Iran. Higher rates in men and in population aged 15–24 years, with considerable variation by province, were the distinguishing features of self-harm. Iran needs to improve monitoring through a comprehensive multisectoral strategy; and most importantly, provide timely, effective and low-cost preventive interventions.

* Corresponding author. Sina Trauma and Surgery Research Center, Sina Hospital, Hassan Abad Square, Imam Khomeini Avenue, Tehran, Iran. Tel.: +989153422682; fax: +982166757009.

E-mail addresses: ghodsi2003@yahoo.com (Z. Ghodsi), s.saeedimoghaddam@gmail.com (S.S. Moghaddam), payam.vezvaei@gmail.com (P. Vezvaei), moein.yoosefi@yahoo.com (M. Yoosefi), nazila_r@yahoo.com (N. Rezaei), soheilsaadat@tums.ac.ir (S. Saadat), Ali.sheidaei@gmail.com (A. Sheidaei), sharif.mahdi@gmail.com (M. Sharif-Alhoseini), farsadeghian@gmail.com (F. Sadeghian), Naserahmadi3002@gmail.com (N. Ahmadi), s.b.jazayeri@gmail.com (S.B. Jazayeri), psalamati@sina.tums.ac.ir (P. Salamati), ardeshir.khosravi@gmail.com (A. Khosravi), mazmoradi@yahoo.com (M. Moradi-Lakeh), mokdaa@uw.edu (A.H. Mokdad), gerard.oreilly@monash.edu (G. O'Reilly), v_rahimi@sina.tums.ac.ir, v_rahimi@yahoo.com (V. Rahimi-Movaghar).

https://doi.org/10.1016/j.puhe.2020.06.015
0033-3506/

Introduction

Globally, suicide which is defined as 'an act of self-inflicted injury or self-poisoning with non-fatal or fatal outcome'[1] is responsible for around 800,000 premature deaths annually, accounting for 1.4% of all deaths in 2015.[2] It is ranked as the 15th leading cause of death in both sexes in 2015 and is expected to rise to the 12th leading cause of death by 2030.[3,4] Self-harm is a significant public health problem is important because it is among the preventable public health concerns.[5] On the other hand, in 15- to 29-year-olds, it is the second main cause of death worldwide.[2] The Eastern Mediterranean Region (EMR) reported 28,695 deaths, and a significant increase of death from self-harms of 100% from 1990 to 2015; this increase was much greater than the worldwide trend of 19%.[6] The crude self-harm rate in Iran was 5.0 and 3.1 per 100,000 populations in 2016 for men and women, respectively.[7]

To address the problem, an awareness of self-harm mortality trend helps to stimulate the implementation of preventive strategies, potentially leading to a decrease in the effects of self-harm on society and healthcare systems especially in low- and middle-income countries (LMICs).[3]

Around the world, the data quality and availability of suicide are poor. Only 80 member states report good quality data and can directly estimate suicide rates. Despite that, the poor quality data are not unique to suicide; there are greater under-reporting and misclassification for suicides than the other causes of death. Many risk factors were considered to be related to self-harm rate, including medical conditions,[8] demographic characteristics,[9] and socio-economic conditions,[10] which mostly may be related to regions of residence.[11] Epidemiologic studies help us to determine contributing factors in different regions of a country; in addition differences by sex and age groups will be useful to understand underlying risk factors and detecting regions that are at a higher risk of self-harm. Iran is a vast country with a large socio-economic and cultural diversity. There is a diversity ethnically (Turks, Kurds, Arabs, and others) in the border provinces in the country. All 31 provinces of Iran have diversities in terms of social development from desirable to very unfavorable and are many differences in the factors affecting the fatal self-harm. This study, by examining the factors influencing the further reduction of deaths in some provinces during the 26-year period, can have a positive effect on the improvements of other provinces in this country. Moreover, it provides valuable and valid information which is necessary for implementing locally-appropriate control and prevention strategies. Therefore, this study was designed to evaluate the trend in mortality rate due to self-harm by sex and age at national and provincial levels in Iran from 1990 to 2015 over a period of 26 years.

Methods

The National and Subnational Burden of Diseases, Injuries, and Risk Factors (NASBOD) study was conducted to determine the burden of 291 diseases and their 67 risk factors at national and subnational levels across Iran. Age was categorized into 19 groups using five-year intervals and for each sex separately from 5 to 9 years to 85+ years.

This study was conducted with the use of prospectively collected data. International Classification of Disease-10 coding of X60-X84.9 was used to classify the cause of death and subsequently modified to match the Global Burden of Disease (GBD) coding.[12] Hence, all intentional self-harm and purposely self-inflicted poisoning or injuries, intentional overdose, as well as suicide (attempted), were included.

Data

In this study the Death Registration System (DRS) was the source of death data in Iran between 1995 and 2010. It was an incomplete data source for some years and provinces. There were no DRS mortality data from 'Behesht-e-Zahra' cemetery (Tehran) and 'Bagh-e-Rezvan' cemetery (Esfahan) during the periods from 1995 to 2010 and from 2007 to 2010, respectively. To obtain sex and age population-based data for the years 1996, 2006, and 2011, the national population and housing censuses by the Statistical Center of Iran were used. Finally, a growth model was used to estimate the population for the years 1990–2015. Owing to modifications in the administrative boundaries such that the number of provinces increased from 24 in 1990 to 31 in 2015, the 2011 divisions of 31 provinces were used as a base. However, misclassifications were observed in age and sex grouping, external causes of death injury codes, and geographical areas. Different statistical methods were used to estimate levels and trends of death and cause-specific mortality rates by sex and age groups in all provinces for 26 years.[13]

Statistical modeling

A spatio-temporal model and Gaussian process regression was used to estimate the levels and trends of child and adult mortality rates (AMRs) in Iran during the study.[14–16] To estimate the level and trend of death rates, the combination of Maternal Age Cohort and Maternal Age Period and, as the Summary Birth History was used to estimate child mortality rate. To calculate the AMR, Locally Weighted Scatter-plot Smoother methods were used to incorporate the Generalized Growth Balance (GGB), Synthetic Extinct Generation (SEG), and GGB-SEG models after the calculation of the completeness of the DRS using the three estimates of mortality distribution. Then the DRS data were adjusted in terms of death count correctness. To impute sex and age multiple imputations by Amelia package in R statistical software were used which did not exceed 5% of missing values in these variables. To impute cause of death a multinomial imputation, a two-stage approach was performed using STATA 11 software. To obtain the cause of death fractions, and also to extrapolate the 1995–2010 results to the 1990–2015 period, a mixed effect and spatio-temporal models were used.

In this study Annual Percent Change (APC) and Average Annual Percent Change (AAPC) were reported. Because AAPC takes into account the trend transitions, we reported AAPC and APC. All data were analyzed using R version 3.0.2 and Stata 11 software. Age-standardized rates were calculated by direct method and considering the Iranian population in 2015 as a standard population.

Results

Between 1990 and 2015; 67,670 deaths occurred due to self-harm in Iran of which 45,635 were men (67.4%) and 22,035 women (32.6%). The male-to-female ratio was 2.03:1, and an APC was −2.38% and −1.37% for women and men, respectively. In both men and women, those who were aged 15- to 24-years-old, with 18,992 deaths, had the highest number of deaths among all age groups. This age group contributed to 28.1% of all deaths due to self-harm (29.6% among men and 24.9% among women) at the national level during the 26 years of study (Fig. 1).

The overall age-standardized mortality rate owing to self-harm in Iran decreased between 1990 and 2015. The age-standardized

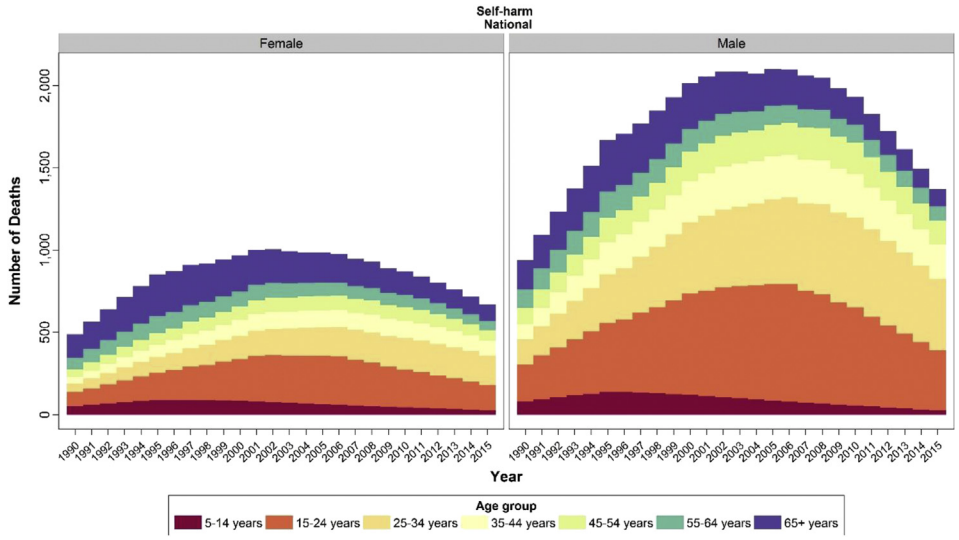

Fig. 1. The number of deaths due to self-harm at different age groups by sex between 1990 and 2015.

mortality rate was 4.32 (95% unit interface (UI): 3.25–5.75) per 100,000 in 1990 and 2.78 (2.15–3.59) per 100,000 in 2015, with a −1.75% APC during the 26 years of the study at the national level. During the study period, the APC was not constant. In the period from 1990 to 1995, the national APC was 41.4%, followed by a dramatic change in APC to −3.7% from 1995 to 2000 period. The decreasing trend of the APC continued until it peaked in magnitude at −25.7% during the period from 2000 to 2005, followed by an APC of −18.1% during the period from 2005 to 2010. After this increase, the APC saw another decreasing trend and reached −28.7% during the 2010 to 2015 period. Further AAPC of this time trend decreased by 6.4% from 1990 to 2015.

The age-standardized mortality rate from self-harm increased in men from 5.26 (4.01–6.92) in 1990 to 8.04 (6.29–10.28) per 100,000 in 2000. Then the rate began to decrease to 3.73 (2.91–4.78) and maintained this downward trend until 2015. In women, the mortality rate from self-harm increased from 3.33 (2.46–4.52) in 1990 to 4.58 (3.42–6.11) in 1995 and after that, it had a decreasing trend until 2015 when the mortality rate was 1.82 (1.38–2.40) (Table 1, Fig. 2). Details of the time trend of the age-standardized mortality rate at the provincial level are presented in Appendix 1.

Over the 26-year period, there was a decreasing age-standardized mortality rate due to self-harm in both sexes at the national level (Table 1).

Only two provinces had an increase in the APC of the female mortality rate: Kermanshah and Khuzestan with an APC of 0.44% and 0.46%, respectively. The APC of male mortality rate increased in four provinces despite the national trend as follows: Gilan (0.01%), Hamadan (0.28%), Khuzestan (0.43%), and Kermanshah (0.84%). In Gilan and Hamadan, the trend of the APC varied by sex, such that the APC of the male mortality increased despite its decrease amongst women (Table 1).

Razavi Khorasan and Qom were the provinces with the greatest decrease in the APC of mortality rate among women (−4.47%) and men (−4.35%), respectively. Khuzestan and Kermanshah were the two provinces with an increase in the APC between 1990 and 2015, at 0.046 and 0.84% in women and men, respectively (Table 1).

Zanjan was the province with the greatest difference of APC between men and women, with a 3.04% greater decrease of the APC in women than men. Khuzestan had the smallest difference of the APC between men and women with a 0.03% greater increase of the APC in women than men (Table 1).

Discussion

This study is the most comprehensive examination in Iran to assess the trend of self-harm mortality by sex and age at national and provincial levels over a period of 26 years to implement programs and help to reduce the burden of self-harm deaths. Despite an increase between the years of 2005–2010, the self-harm mortality rate has decreased in the study period from 1990 to 2015. The decrease in age-standardized mortality rate due to self-harm mirrors global deaths reported by the GBD[4] but with a smaller decrease. Over the same period, the pattern has been similar to that in the EMR which has experienced a smaller decrease in self-harm mortality than the other World Health Organization (WHO) regions.[6]

The longitudinal trend revealed substantial improvements by sex and age in self-harm–related mortality. The longitudinal trend has shown acceleration in the self-harm mortality rate from 1990 to 1995 in women and the 1990s for men across the country. This could be due to the crisis of economic resulting from the Iraq-Iran War and the parallel threat to health.[17] It was determined with a considerably decelerating slope of 2.38% and 1.37% for women and men, respectively. Some studies have shown an increase in self-harm in a longitudinal trend after a period of economic crisis.[18,19] The age-standardized mortality of men due to self-harm was also higher during the entire period of the study as was at the global level.[4] However, at the same time, the gender gap (M/F ratio) for self-harm was 2.4 in the EMR.[6]

Several studies have demonstrated a higher mortality rate among men than women.[20–22] The reasons for this gender difference stem from psychological and socio-economic factors based on genetic gender differences.[23,24] Women often commit suicide after emotional issues, whereas men often commit suicide after experiencing financial failure.[25] A study in Japanese showed that unemployment and economic pressure are a single positive predictor rate on suicide-related mortality in men.[26] Studies showed that men use more violent and fatal suicide methods than women.[27] In addition, gender differentiation in methods of suicide attempts could explain why the self-harm–related mortality rate is higher among men.[28]A systematic review on 17 studies showed the male gender among the main risk factors for completed suicide.[29]

As shown in the results, the most vulnerable age group for death by self-harm in both sexes belonged to the 15–24 age groups. A study in Bangladesh showed a significantly greater risk of 6.31 and

Table 1
National and subnational age-standardized mortality rate due to self-harm per 100,000 in 1990, 1995, 2000, 2005, 2010, and 2015 with Annual Percentage Change (APC) of death between 1990 and 2015 by sex.

Loaction	Female						
	Year						APC 1990–2015 (%)
	1990	1995	2000	2005	2010	2015	
Alborz	1.23 (0.86–1.74)	1.71 (1.21–2.41)	1.53 (1.1–2.12)	1.25 (0.91–1.71)	1.27 (0.93–1.74)	0.9 (0.65–1.23)	−1.23
Ardebil	4.32 (3.24–5.76)	6.01 (4.55–7.87)	4.98 (3.88–6.39)	3.71 (2.91–4.7)	3.05 (2.39–3.88)	1.96 (1.53–2.51)	−3.1
Bushehr	4.93 (3.64–6.65)	6.91 (5.24–9.1)	6.18 (4.79–7.94)	5.48 (4.27–6.98)	4.28 (3.3–5.55)	2.94 (2.23–3.85)	−2.05
Chahar Mahall and Bakhtiari	4.68 (3.53–6.17)	6.56 (5.01–8.58)	6.27 (4.87–8.05)	5.28 (4.11–6.78)	4.02 (3.1–5.19)	2.68 (2.05–3.48)	−2.21
East Azarbaijan	3.52 (2.66–4.64)	4.94 (3.77–6.47)	4.35 (3.37–5.62)	3.22 (2.51–4.12)	2.59 (2.03–3.31)	1.85 (1.44–2.36)	−2.55
Esfahan	2.2 (1.58–3.05)	2.99 (2.16–4.12)	2.5 (1.83–3.41)	2.05 (1.5–2.79)	1.56 (1.14–2.11)	1.02 (0.75–1.39)	−3.04
Fars	2.99 (2.26–3.96)	4.43 (3.38–5.77)	4.22 (3.27–5.42)	3.94 (3.06–5.07)	3.28 (2.53–4.23)	2.48 (1.9–3.24)	−0.75
Gilan	2.74 (2.05–3.66)	3.56 (2.7–4.7)	3.18 (2.44–4.13)	2.59 (1.99–3.35)	2.34 (1.8–3.04)	1.63 (1.24–2.12)	−2.06
Golestan	4.24 (3.19–5.61)	6.28 (4.79–8.2)	5.66 (4.4–7.28)	4.85 (3.76–6.23)	4.01 (3.09–5.17)	2.88 (2.19–3.76)	−1.54
Hamadan	3.64 (2.81–4.74)	5.24 (4.07–6.68)	4.62 (3.66–5.84)	4.02 (3.19–5.04)	3.25 (2.57–4.11)	2.26 (1.77–2.89)	−1.89
Hormozgan	3.49 (2.51–4.85)	5.14 (3.78–6.97)	4.53 (3.41–6.01)	4.3 (3.26–5.67)	3.48 (2.6–4.63)	2.47 (1.82–3.35)	−1.37
Ilam	8.53 (6.3–11.49)	11.85 (8.82–15.82)	12.46 (9.55–16.2)	11.15 (8.59–14.31)	8.01 (6.18–10.31)	5.6 (4.29–7.24)	−1.67
Kerman	4.04 (3.12–5.22)	5.69 (4.47–7.24)	4.39 (3.48–5.52)	3.4 (2.68–4.3)	2.6 (2.02–3.34)	1.71 (1.3–2.22)	−3.39
Kermanshah	4.02 (3.11–5.18)	6.12 (4.79–7.81)	7.92 (6.3–9.93)	7.53 (6.01–9.37)	5.85 (4.66–7.34)	4.49 (3.55–5.65)	0.44
Khuzestan	2.14 (1.62–2.83)	3.33 (2.52–4.37)	3.01 (2.3–3.9)	3.43 (2.65–4.42)	3.03 (2.34–3.91)	2.4 (1.85–3.09)	0.46
Kohgiluyeh and Buyer Ahmad	8.46 (5.99–11.84)	11.18 (8.05–15.47)	9.54 (7–12.97)	8.27 (6.18–10.99)	6.01 (4.55–7.89)	3.75 (2.84–4.91)	−3.2
Kordestan	4.64 (3.43–6.25)	6.3 (4.76–8.33)	6.46 (5.04–8.25)	5.34 (4.24–6.68)	4.27 (3.39–5.35)	2.93 (2.31–3.69)	−1.82
Lorestan	5.78 (4.38–7.6)	8 (6.17–10.32)	6.93 (5.47–8.75)	5.98 (4.77–7.48)	4.5 (3.58–5.65)	2.81 (2.21–3.56)	−2.84
Markazi	3.76 (2.82–5)	5.13 (3.91–6.69)	4.11 (3.18–5.28)	3.41 (2.64–4.39)	2.82 (2.18–3.64)	1.8 (1.37–2.35)	−2.91
Mazandaran	3.34 (2.46–4.53)	4.3 (3.19–5.77)	3.61 (2.71–4.81)	2.95 (2.2–3.94)	2.16 (1.6–2.91)	1.5 (1.1–2.03)	−3.15
North Khorasan	7.6 (5.51–10.4)	10.56 (7.81–14.31)	7.98 (5.99–10.61)	6.08 (4.6–8.04)	4.47 (3.37–5.91)	2.95 (2.21–3.91)	−3.71
Qazvin	3.69 (2.79–4.87)	5.21 (4–6.78)	4.5 (3.5–5.76)	3.52 (2.76–4.48)	2.81 (2.19–3.59)	1.78 (1.38–2.3)	−2.87
Qom	2.38 (1.62–3.49)	3.14 (2.16–4.53)	2.75 (1.91–3.94)	2.34 (1.63–3.34)	1.75 (1.23–2.47)	1.19 (0.84–1.68)	−2.73
Razavi Khorasan	4.45 (3.34–5.94)	6.29 (4.74–8.33)	5.63 (4.27–7.42)	3.93 (2.96–5.19)	2.57 (1.94–3.41)	1.42 (1.06–1.88)	−4.47
Semnan	5.04 (3.57–7.05)	6.36 (4.59–8.7)	5.04 (3.71–6.81)	4.3 (3.18–5.79)	3.53 (2.6–4.75)	2.45 (1.8–3.31)	−2.85
Sistan and Baluchestan	3.92 (2.75–5.53)	4.84 (3.44–6.79)	4.28 (3.12–5.86)	3.73 (2.73–5.06)	2.81 (2.07–3.83)	1.8 (1.32–2.45)	−3.07
South Khorasan	6.2 (4.52–8.51)	8.09 (5.95–10.94)	7.13 (5.33–9.52)	5.81 (4.34–7.77)	4.37 (3.25–5.86)	3.05 (2.25–4.1)	−2.8
Tehran	1.3 (0.81–2.09)	1.71 (1.09–2.7)	1.54 (0.99–2.38)	1.22 (0.8–1.86)	0.97 (0.64–1.47)	0.59 (0.39–0.9)	−3.11
West Azarbaijan	4.67 (3.52–6.18)	6.13 (4.69–7.99)	5.47 (4.28–6.99)	4.5 (3.54–5.68)	3.76 (2.97–4.74)	2.66 (2.1–3.36)	−2.22
Yazd	3.65 (2.72–4.87)	4.7 (3.52–6.22)	3.96 (3–5.21)	3.46 (2.62–4.55)	2.8 (2.12–3.69)	1.91 (1.43–2.52)	−2.57
Zanjan	4.89 (3.54–6.75)	6.87 (5.19–9.09)	5.82 (4.53–7.45)	4.15 (3.21–5.35)	3.21 (2.4–4.27)	1.91 (1.38–2.62)	−3.69
National	3.33 (2.46–4.52)	4.58 (3.42–6.11)	4.11 (3.12–5.41)	3.42 (2.61–4.47)	2.67 (2.04–3.51)	1.82 (1.38–2.4)	−2.38
Location	Male						
	Year						APC 1990–2015 (%)
	1990	1995	2000	2005	2010	2015	
Alborz	2.11 (1.55–2.85)	3.1 (2.31–4.16)	3 (2.27–3.96)	2.49 (1.9–3.25)	2.27 (1.73–2.96)	1.4 (1.06–1.84)	−1.62
Ardebil	6.11 (4.81–7.78)	9.06 (7.21–11.38)	9.5 (7.66–11.74)	7.26 (5.89–8.9)	6.13 (4.95–7.53)	3.96 (3.18–4.91)	−1.72
Bushehr	4.86 (3.75–6.29)	7.64 (5.96–9.77)	8.59 (6.83–10.75)	7.1 (5.7–8.84)	5.45 (4.33–6.85)	2.46 (1.92–3.15)	−2.69
Chahar Mahall and Bakhtiari	5.15 (4.02–6.57)	7.61 (5.99–9.62)	8.82 (7.03–11)	7.91 (6.33–9.85)	6.61 (5.27–8.31)	4.29 (3.37–5.44)	−0.73
East Azarbaijan	5.28 (4.13–6.74)	9.1 (7.17–11.53)	9.58 (7.65–12.01)	8.06 (6.45–10.02)	6.74 (5.38–8.4)	4.71 (3.77–5.88)	−0.46
Esfahan	2.7 (2.02–3.63)	4.2 (3.15–5.59)	4.82 (3.66–6.33)	4.43 (3.37–5.78)	4.04 (3.1–5.27)	2.62 (2–3.43)	−0.12
Fars	5.72 (4.47–7.32)	8.98 (7.07–11.35)	9.9 (7.88–12.43)	7.83 (6.21–9.84)	6.84 (5.41–8.63)	4.39 (3.45–5.58)	−1.05
Gilan	5.48 (4.27–7.01)	7.63 (6.02–9.64)	8.79 (7.06–10.93)	8.87 (7.12–11)	8.69 (6.98–10.81)	5.5 (4.39–6.88)	0.01
Golestan	5.04 (3.93–6.42)	8.64 (6.83–10.95)	8.81 (7.03–10.99)	8.22 (6.58–10.26)	6.68 (5.29–8.42)	3.72 (2.9–4.75)	−1.21
Hamadan	9.37 (7.53–11.63)	14.56 (11.81–17.88)	16.21 (13.32–19.63)	14.99 (12.32–18.17)	13.98 (11.41–17.13)	10.05 (8.13–12.4)	0.28
Hormozgan	5.2 (3.98–6.78)	8.76 (6.78–11.3)	9.57 (7.6–12.06)	8.87 (7.01–11.14)	5.75 (4.48–7.37)	4.22 (3.22–5.51)	−0.84
Ilam	8.01 (6.1–10.41)	11.58 (8.97–14.9)	13.08 (10.28–16.55)	12.38 (9.72–15.67)	10.9 (8.55–13.85)	7.32 (5.69–9.39)	−0.36
Kerman	8.07 (6.48–10.08)	11.31 (9.15–13.95)	9.71 (7.92–11.88)	8.56 (6.96–10.5)	6.42 (5.16–7.97)	4.49 (3.56–5.68)	−2.31
Kermanshah	6.59 (5.29–8.2)	11.32 (9.15–13.94)	12.88 (10.53–15.76)	13.24 (10.85–16.15)	11.58 (9.46–14.19)	8.12 (6.54–10.02)	0.84
Khuzestan	3.07 (2.38–3.95)	5.42 (4.23–6.94)	5.63 (4.42–7.16)	5.67 (4.48–7.14)	4.96 (3.93–6.26)	3.42 (2.69–4.32)	0.43

(*continued on next page*)

Table 1 (*continued*)

Location	Male						
	Year						APC 1990–2015 (%)
	1990	1995	2000	2005	2010	2015	
Kohgiluyeh and Buyer Ahmad	7.25 (5.28–9.91)	9.77 (7.22–13.14)	10.98 (8.29–14.47)	10.52 (8.07–13.68)	8.29 (6.34–10.78)	5.35 (4.08–6.99)	−1.2
Kordestan	6.99 (5.37–9.03)	10.64 (8.34–13.53)	10.24 (8.24–12.71)	8 (6.52–9.81)	6.2 (5.05–7.6)	4.01 (3.24–4.97)	−2.19
Lorestan	7.07 (5.58–8.98)	11.21 (8.99–13.98)	13.24 (10.74–16.27)	12.32 (10.03–15.05)	10.29 (8.37–12.54)	6.83 (5.49–8.44)	−0.14
Markazi	6.72 (5.29–8.51)	9.58 (7.63–11.96)	10.01 (8.09–12.34)	7.84 (6.33–9.68)	7.35 (5.9–9.11)	4.51 (3.59–5.66)	−1.58
Mazandaran	5.5 (4.26–7.09)	8.06 (6.29–10.29)	8.03 (6.29–10.28)	7.4 (5.77–9.47)	6.61 (5.12–8.5)	4.63 (3.54–6.03)	−0.69
North Khorasan	8.33 (6.27–11.03)	12.08 (9.24–15.74)	10.54 (8.17–13.59)	8.51 (6.65–10.85)	7.06 (5.52–9.03)	4.62 (3.58–5.97)	−2.33
Qazvin	6.72 (5.3–8.51)	9.54 (7.62–11.91)	8.89 (7.17–11)	7.17 (5.81–8.81)	6.55 (5.29–8.05)	3.71 (2.98–4.62)	−2.35
Qom	5.3 (3.8–7.37)	6.69 (4.87–9.2)	5.59 (4.1–7.57)	4.12 (3.04–5.55)	2.94 (2.19–3.97)	1.74 (1.29–2.34)	−4.35
Razavi Khorasan	5.12 (3.93–6.68)	8.28 (6.41–10.68)	8.06 (6.29–10.31)	6.8 (5.29–8.76)	5.01 (3.88–6.43)	2.94 (2.27–3.8)	−2.19
Semnan	5.42 (4.04–7.24)	7.6 (5.75–10.01)	7.01 (5.38–9.13)	5.94 (4.54–7.71)	4.88 (3.74–6.36)	3.15 (2.4–4.14)	−2.14
Sistan and Baluchestan	4.35 (3.21–5.87)	6.04 (4.49–8.08)	5.1 (3.84–6.75)	4.03 (3.07–5.28)	3.72 (2.84–4.9)	2.76 (2.1–3.62)	−1.8
South Khorasan	7.29 (5.47–9.67)	9.27 (7.05–12.13)	8.81 (6.78–11.4)	8.09 (6.25–10.44)	6.94 (5.33–8.98)	4.56 (3.47–5.97)	−1.86
Tehran	3.98 (2.65–5.99)	6.01 (4.05–8.93)	5.17 (3.55–7.53)	3.7 (2.57–5.35)	2.68 (1.87–3.84)	1.53 (1.07–2.19)	−3.75
West Azarbaijan	5.78 (4.5–7.42)	8.45 (6.69–10.64)	9.07 (7.31–11.26)	7.62 (6.17–9.41)	6.54 (5.28–8.07)	4.51 (3.61–5.61)	−0.99
Yazd	4.7 (3.64–6.04)	6.68 (5.17–8.58)	6.23 (4.88–7.96)	5.37 (4.22–6.84)	4.41 (3.45–5.62)	2.99 (2.32–3.84)	−1.79
Zanjan	6.77 (5.13–8.93)	10.95 (8.58–13.92)	10.97 (8.82–13.62)	9.44 (7.53–11.76)	8.73 (6.78–11.19)	5.75 (4.28–7.64)	−0.65
National	5.26 (4.01–6.92)	7.98 (6.14–10.37)	8.04 (6.29–10.28)	6.88 (5.41–8.75)	5.74 (4.51–7.31)	3.73 (2.91–4.78)	−1.37

*Data in parentheses are 95% uncertainty intervals.

4.04 times for self-harm among 15–17 and 18–24 years vs the 25–64 years, respectively.[30] There have been several studies to indicate that self-harm is more common in youths than in adults[31–34] and in accordance with the report of WHO, it was the second leading external cause of death at the 15–29 age group in 2016.[2] There are many mental stresses for young men in connection with finding a job, marriage, and living expenses. In addition, coping with crises is a learned behavior that can be based on age and advanced mental and social maturity. That is, as age increases, along with the growth of other psychological and biological aspects, coping methods will also change.[35] In addition, many psychiatric illness onset during young adulthood, might account for an increase in suicide risk during this time.[36–38]

Gathered data sets at national and provincial levels reported a similar pattern of the self-harm–related mortality in most provinces. However, there were discrepancies between provinces based on the different sociodemographic index (SDI) ranking of provinces and their psychological structures. Lower socio-economic status, poor medical care accessibility, and access to emergency services[4,39] could all partly explain the differences in the self-harm mortality patterns between the provinces.

Owing to the vastness of the country and diverse climate, the provinces of Iran have a large economic, social, and cultural diversity. There are ethnically diverse in the border provinces and social development diverse from desirable to very unfavorable in all 31 provinces of the country. Therefore, there are many different factors such as culture, religious or SDI that could affect the rate of self-harm related mortality.

The highest self-harm mortality rate in both sexes was observed in the three western provinces in 2015. Conducted studies in west provinces in Iran revealed a high self-harm mortality rate, particularly in the 15–24 year age group.[40–42] The studies in Iran showed the high mortality rate suicide, a high prevalence of poisoning method of suicide, and a high fatal poisoning in Ilam and Kermanshah, two western provinces of the country. It could be due to similar culture and behavioral patterns in these provinces.[40,41,43]

This study also showed the lowest self-harm–related mortality across Iran in Tehran and Alborz provinces in 2015. A study in Iran showed the provinces of Tehran and Mazandaran among higher SDI and more developed compared with other provinces.[44] A study in Iran showed that Tehran and Mazandaran provinces have higher SDI and are more developed in comparison to other provinces.[39] Health-related indicators, as well as advanced delivery services, quality of life, and social facilities all could be reasons.[45–47]

This study also showed that Razavi Khorasan and Qum provinces, two religious provinces had the greatest decrease of APC for more than 26 years. Self-harm as forbidden in Islamic beliefs, as well as adequate emergency department services could be the reasons.[48–50]

During the study period Kermanshah, Khuzestan, Hamadan, and Gilan were accompanied by an increase of APC. The Iraq-Iran war, poor medical management services, non-standard storage of pesticides, could all be reasons for more self-harm mortality in these regions. A study in the southwest of Iran, among the suicide causes, poisoning due to Parquet that is a pesticide in this region, was the common type.[49–52] Some studies demonstrated a very high self-harm mortality rate among agricultural workers, unskilled laborers, and the rural population.[21,48] Pesticide-related self-poisoning contributes about 30% of global self-harms with the highest incidence occurring in the rural agricultural areas of LMICs.[2]

Results showed that a difference of the APC between men and women was highest in Zanjan province; meanwhile, the lowest difference was seen in Khuzestan province. Women in Zanjan have been shown to have the higher tendency for education, as

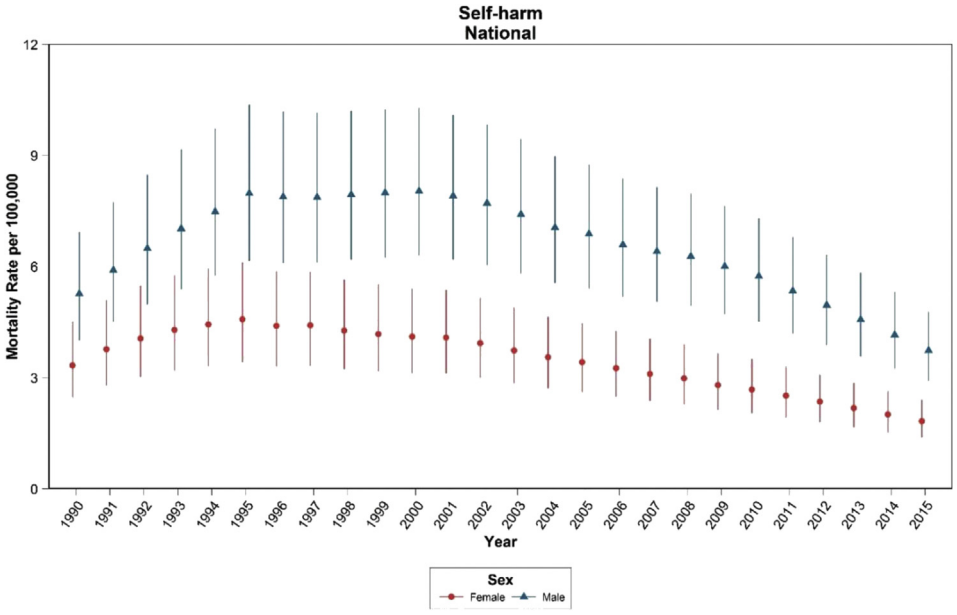

Fig. 2. Time trend of age-standardized mortality rate due to self-harm by sex at the national level from 1990 to 2015.

well as higher life expectancy in comparison with men, which can be a possible reason for much lower self-harm rate of women in this province.[53] A study in Korea showed that the low educated women faced with more suicide risks.[54] However, further research is needed to recognizing the related factors in these regions.

As mentioned previously, both men and women in Khuzestan experienced psychological problems owing to the long period of war in the region.[49] These problems, then, may have led to increased self-harm attempts in both men and women because they both experienced bombing and war. Besides that, poisoning and self-burns which are considered the most common method of self-harm in the region[55] are available for both men and women, resulting in the low difference of the APC between genders in this region.

The findings of this study can be used to inform the self-harm of preventive actions, the early detection of severe depression, and effective measures in cases of drug poisoning all could be effective. There needs to be an increase in the efforts of policymakers in the direction of integrated planning in the formulation, implementation and monitoring to reduce of self-harm.[45,49,56–58]

Strengths and limitations

This study is the first on the mortality trend of self-harm at national and provincial levels in Iran. It is a recent study, which is valuable because it examines patterns and changes of fatal self-harm over time. Because we had access to a comprehensive database for this study, we were able to determine provincial differences in the aspect of self-harm–related mortality in the country. We should note the limitations. Importantly, due to cultural and social issues, all self-harm mortality could not be captured by the DRSs; hence, we could provide our results based only on the reported data.

It is recommended that there be further studies to determine in-depth information regarding self-harm risk factors and self-harm motives. in addition, it is recommended that future research examines the use of different self-harm methods between age groups. These factors may relate to both a specific method using and also the risk of future self-harm.

Conclusion

This study documented the epidemiology of fatal injury due to self-harm in Iran and showed a considerable decline during 26 years except for 2005–2010. The study also demonstrated a higher risk of mortality due to self-harm among the younger men. Moreover, the results showed increased self-harm mortality from 1990 to 1995 in women and across the 1990s in men. The findings showed the variations in the self-harm rates by geographical regions in the country. Strategies are needed to improve preventive programs and health services and to implement preventive interventions especially for those provinces with an increase of APC, or a slower deceleration in self-harm mortality.

Author statements

Acknowledgments

The authors would like to appreciate for partnership of deputy for health of Iran's Ministry of Health and Medical Education. The authors would like to appreciate Dr. Farshad Farzadfar, Chair of Non-Communicable Diseases Research Center (NCDRC) of Endocrinology and Metabolism Research Institute of Tehran University of Medical Sciences, who is the principal investigator of the NASBOD study. The authors would like to thank Dr. Mohammadreza Zafarghandi, Chair of Sina Trauma and Surgery Research Center, Tehran University of Medical Science. In addition, the authors would like to thank Dr. Mehrdad Azmin and the staff at NCDRC and Dr Zahrasadat Azadmanjir for their wholehearted cooperation.

Ethical approval

The Ethics Committee of Tehran University of Medical Sciences approved the study with the reference number of IR.TUMS.EMRI.REC.1396.00175.

Funding

This work was funded by the Ministry of Health and Medical Education of Iran [grant number: 1391-01-101-150] and Sina Trauma and Surgery Research Center, Iran [number: 0891/12-08-2018].

Competing interests

None declared.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2020.06.015.

References

1. Värnik A, Kõlves K, van der Feltz-Cornelis CM, Marusic A, Oskarsson H, Palmer A, et al. Suicide methods in Europe: a gender-specific analysis of countries participating in the "European Alliance against Depression". *J Epidemiol Community* 2008 Jun 1;**62**(6):545–51.
2. WHO suicide fact sheet: world health organization. Available online: http://www.who.int/mediacentre/factsheets/fs398/en/. (Reviewed January 2018).
3. Bartolomeos K, Kipsaina C, Grills N, Ozanne-Smith J, Peden M. *Fatal injury surveillance in mortuaries and hospitals: a manual for practitioners*. Geneva: World Health Organization; 2012.
4. GBD 2015 Mortality and Causes of Death Collaborators. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980-2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet* 2016 Oct 8;**388**(10053):1459–544.
5. Office for National Statistics. *Consultation on definitions of avoidable mortality*. 16 Febuary 2011.
6. Mokdad AH. GBD 2015 eastern mediterranean region intentional injuries collaborators. Intentional injuries in the eastern mediterranean region, 1990-2015: findings from the global burden of disease 2015 study. *Int J Publ Health* 2018;**63**(Suppl 1):39–46.
7. *Global health estimates 2016: deaths by cause, age, sex, by country and by region, 2000-2016*. Geneva: World Health Organization; 2018.
8. Ikeda RM, Kresnow M-j, Mercy JA, Powell KE, Simon TR, Potter LB, et al. Medical conditions and nearly lethal suicide attempts. *Suicide Life-Threatening Behav* 2001;**32**(Supplement to Issue 1):60–7.
9. Organization WH. *Public health action for the prevention of suicide: a framework*. 2012.
10. Pompili M, Innamorati M, Vichi M, Masocco M, Vanacore N, Lester D, et al. Inequalities and impact of socioeconomic-cultural factors in suicide rates across Italy. *Crisis* 2011;**32**(4):178–85.
11. Hirsch JK. A review of the literature on rural suicide: risk and protective factors, incidence, and prevention. *Crisis J Crisis Interv Suicide Prev* 2006;**27**(4):189.
12. 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.
13. Sheidaei A, Gohari K, Kasaeian A, Rezaei N, Mansouri A, Khosravi A, et al. National and subnational patterns of cause of death in Iran 1990-2015: applied methods. *Arch Iran Med* 2017;**20**(1):2–11.
14. Mohammadi Y, Parsaeian M, Farzadfar F, Kasaeian A, Mehdipour P, Sheidaei A, et al. Levels and trends of child and adult mortality rates in the Islamic Republic of Iran, 1990-2013; protocol of the NASBOD study. *Arch Iran Med* 2014;**17**(3):176–81.
15. Mehdipour P, Navidi I, Parsaeian M, Mohammadi Y, Moradi Lakeh M, Rezaei Darzi E, et al. Application of Gaussian Process Regression (GPR) in estimating under-five mortality levels and trends in Iran 1990 - 2013, study protocol. *Arch Iran Med* 2014;**17**(3).
16. Parsaeian M, Farzadfar F, Zeraati H, Mahmoudi M, Rahimighazikalayeh G, Navidi I, et al. Application of spatio-temporal model to estimate burden of diseases, injuries and risk factors in Iran 1990 - 2013. *Arch Iran Med* 2014;**17**(1):28–33.
17. Kondilis E, Giannakopoulos S, Gavana M, Ierodiakonou I, Waitzkin H, Benos A. Economic crisis, restrictive policies, and the population's health and health care: the Greek case. *Am J Publ Health* 2013;**103**(6):973–9.
18. Shin SD, Suh GJ, Rhee JE, Sung J, Kim J. Epidemiologic characteristics of death by poisoning in 1991-2001 in Korea. *J Kor Med Sci* 2004;**19**(2):186–94.
19. Parkkari J, Sievänen H, Niemi S, Mattila VM, Kannus P. Injury deaths in the adolescent population of Finland: a 43-year secular trend analysis between 1971 and 2013. *Inj Prev* 2016;**22**(4):239–46.
20. Kordrostami R, Akhgari M, Ameri M, Ghadipasha M, Aghakhani K. Forensic toxicology analysis of self-poisoning suicidal deaths in Tehran, Iran; trends between 2011-2015. *Daru* 2017;**25**(1):15.
21. Krakowiak A, Piekarska-Wijatkowska A, Kobza-Sindlewska K, Rogaczewska A, Politański P, Hydzik P, et al. Poisoning deaths in Poland: types and frequencies reported in Lodz, Krakow, Sosnowiec, Gdansk, Wroclaw and Poznan during 2009-2013. *Int J Occup Med Environ Health* 2017;**30**(6):897–908.
22. Jiang G, Choi BC, Wang D, Zhang H, Zheng W, Wu T, et al. Leading causes of death from injury and poisoning by age, sex and urban/rural areas in Tianjin, China 1999-2006. *Injury* 2011;**42**(5):501–6.
23. Karch D. Sex differences in suicide incident characteristics and circumstances among older adults: surveillance data from the national violent death reporting system-17 U.S.States, 2007–2009. *Int J Environ Res Publ Health* 2011;**8**:3479–95.
24. Altemus M. Sex differences in depression and anxiety disorders: potential biological determinants. *Horm Behav* 2006;**50**:534–8.
25. Oyekcin DG, Sahin EM, Aldemir E. Mental health, sociality and hope lessens among university students in Turkey. *Asian journal of psychiatry* 2017;**29**:185–9.
26. Liu Y, Zhang Y, Cho YT, Obayashi Y, Arai A, Tamashiro H. Gender differences of suicide in Japan, 1947-2010. *J Affect Disord* 2013;**151**(1):325–30.
27. Tsirigotis K, Gruszczynski W, Tsirigotis M. Gender differentiation in methods of suicide attempts. *Med Sci Mon Int Med J Exp Clin Res* 2011;**17**(8):PH65.
28. Med Sci Mon Int Med J Exp Clin Res: international medical journal of experimental and clinical research, 17(8), PH65.
29. Teti GL, Rebok F, Rojas SM, Grendas L, Daray FM. Systematic review of risk factors for suicide and suicide attempt among psychiatric patients in Latin America and Caribbean. *Rev Panam Salud Públic* 2014;**36**(2):124–33.
30. Sharmin Salam S, Alonge O, Islam MI, Hoque DME, Wadhwaniya S, Ul Baset MK, et al. The burden of suicide in rural Bangladesh: magnitude and risk factors. *Int J Environ Res Publ Health* 2017;**14**(9).
31. Alam N, Chowdhury HR, Das SC, Ashraf A, Streatfield PK. Causes of death in two rural demographic surveillance Sites in Bangladesh, 2004–2010: automated coding of verbal autopsies using InterVA-4. *Glob Health Action* 2014.
32. Sullivan EM, Annest JL, Simon TR, Luo F, Dahlberg LL, Centers for Disease Control and Prevention (CDC). Suicide trends among Persons aged 10-24 Years - United States, 1994-2012. *Mmwr-Morbidity and Mortality Weekly Report* 2015;**64**(8). Cover1-205.
33. Yusuf HR, Akhter HH, Chowdhury ME, Rochat RW. Causes of death among women aged 10–50 Years in Bangladesh, 1996–1997. *J Health Popul Nutr* 2007;**25**:302–11.
34. Silenzio VMB, Pena JB, Duberstein PR, Cerel J, Knox KL. Sexual orientation and risk factors for suicidal ideation and suicide attempts among adolescents and young adults. *Am J Publ Health* 2007;**97**:2017–9.
35. Kadivar P, Zahedi F. The coping Styles and suicide attempted among the female undergraduate students. *Soc Welfare* 2007;**6**(25):111–32.
36. O'Neill S, McLafferty M, Ennis E, Lapsley C, Bjourson T, Armour C, et al. Socio-demographic, mental health and childhood adversity risk factors for self-harm and suicidal behaviour in College students in Northern Ireland. *J Affect Disord* 2018;**239**:58–65. 15.
37. Barrett P, Griffin E, Corcoran P, O'Mahony MT, Arensman E. Self-harm among the homeless population in Ireland: a national registry-based study of incidence and associated factors. *J Affect Disord* 2018;**229**:523–31. 15.
38. Asadi H, Hoseini Razi S, Jalili P. Prediction of university students suicide based on religious beliefs, social Support, coping strategies and General health. *Appl Psychol* 2013;**6**(4):87–101 [Farsi].
39. Stringhini S, Carmeli C, Jokela M, Avendaño M, Muennig P, Guida F, et al. Socioeconomic status and the 25 × 25 risk factors as determinants of premature mortality: a multicohort study and meta-analysis of 1·7 million men and women. *Lancet* 2017;**389**(10075):1229–37.
40. Azizpour Y, Asadollahi K, Sayehmiri K, Kaikhavani S, Abangah G. Epidemiological survey of intentional poisoning suicide during 1993-2013 in Ilam Province, Iran. *BMC Publ Health* 2016;**16**(1):902.
41. Najafi F, Beiki O, Ahmadijouybari T, Amini S, Moradinazar M, Hatemi M, et al. An assessment of suicide attempts by self-poisoning in the west of Iran. *J Forensic Leg Med* 2014;**27**(7):1–5.
42. Jamshidiha Gh, Gholipoor S. Correlation between modern life style and suicide in Lac girls and women. *Evaluating of Iran social issues* 2010;**1**.
43. Ghodsi Z, Moghaddam SS, Saadat S, Yoosefi M, Rezaei N, Ostadrahimi H, et al. Trend of fatal poisoning at national and provincial levels in Iran from 1990 to 2015. *Publ Health* 2019;**170**:78–88.
44. Sheikh Biglu R. Identifying the deprived areas of Iran using combined ranking. *J Manag Syst* 2011;**2**(7):53–70 [In Persian].
45. Roshanaei GH, Safari M, Faradmal J, Karami M, Kouselo Z. Ranking and clustering Iranian provinces based on important health indicators of vital horoscope in rural areas by using multivariate methods. *Koomesh* 2016;**17**(2):278–88.
46. Tahari Mehrjardi MH, Babaei Mybodi H, Morovati Sharifabadi A. Investigation and ranking of Iranian provinces in terms of access to health sector indicators. *Health Inf Manag* 2012;**9**(3):369.
47. Hosseini Seyedi yaghoub EA. Ranking of the provinces in terms of having socio-economic indicators. *Plan. Budg. Q.* 2000;**5**(1):101–21.
48. Rezaeian MVR, Tabatabie S, Salem Z, Esmaili A. Suicide in islamic faith. *J Rafsanjan Univ Med Sci* 2007;**6**(4):15–30.
49. Noroozi A, Ramezani A, Comparison of suicide facts in Dareshahr City with national suicide trends . Farhang journal (?) 16(48, 49) , 104-131.
50. Alinejad S, Zamani N, Abdollahi M, Mehrpour O. A narrative review of acute adult poisoning in Iran. *Iran J Med Sci* 2017;**42**(4):327.

51. Lee HC, Lin HC, Tsai SY, Li CY, Chen CC, Huang CC. Suicide rates and the association with climate: a population-based study. *J Affect Disord* 2006;**92**(2-3):221–6.
52. Jamshidi F, Fathi G, Davoodzadeh H. Investigation Paraquat poisoning in southwest of Iran - from Sign to mortality and morbidity. *Arch Med Sadowej Kryminol* 2017;**67**(1):35–45.
53. Baseri B, Farhadi Kia A. The analysis of factors affecting human development index in Zanjan province. 3 2008;**16**(47):5–23.
54. Park SK, Lee CK, Kim H. Suicide mortality and marital status for specific ages, genders, and education levels in South Korea: using a virtually individualized dataset from national aggregate data. *J Affect Disord* 2018;**237**:87–93.
55. Ahmadi A, Mohammadi R, Stavrinos D, Almasi A, Schwebel DC. Self-immolation in Iran. *J Burn Care Res* 2008;**29**(3):451–60.
56. Shirazi HR, Hosseini M, Zoladl M, Malekzadeh M, Momeninejad M, Noorian K, et al. Suicide in the Islamic Republic of Iran: an integrated analysis from 1981 to 2007. *East Mediterr Health J* 2012;**18**:607–13.
57. World Health Organization. *Preventing suicide: a community engagement toolkit*. 2018.
58. World Health Organization. *Prevention of mental disorders*. 2004.