



Macro Socioeconomic Determinants of Suicide in Iran: A Time Series Study during 1991-2023

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Abstract

Background: Although suicide is ultimately committed by individuals, it is influenced by a wide range of factors, from micro to macro levels.

Methods: This time-series research examines the relationship between macro socioeconomic variables and the suicide rate from 1991 to 2023. The data were collected from the Statistical Center of Iran (SCI), the Central Bank of Iran (CBI), and the World Bank (WB). Time series charts were used to describe the data, and an auto-regressive distributed lag (ARDL) model was employed for examining the relationship among variables using the Microfit 5 software.

Results: The results indicate a significant negative relationship between inflation, urban population, and women's participation in the labor force with suicide, but a significant positive relationship between mobile phone penetration and labor force participation with suicide rate. Furthermore, literacy and GDP per capita were not associated with the suicide rate.

Conclusion: Macro socioeconomic indicators impact on suicide rates. By better understanding the mechanism of this impact and appropriate planning, suicide rates can be reduced.

Keywords: Suicide; Socioeconomic determinants; Time series; Iran

Introduction

Suicide is an acute social and public health problem all over the world (1). Each year, over 700 thousand people lose their lives through suicide worldwide, and much more have suicide attempts (2). Demographically, suicide is more common among men (3,4), youth (5), the elderly (6), singles (7), divorcees (7), rural residents (8), and developing countries (5); besides, it's mostly being committed in spring (9). Suicide occurs in all societies regardless of political, religious, and eco-

nomic contexts (10). The main question that by the way remains is why suicide occurs.

The suicide rate in Iran has increased rapidly in recent decades. Although many studies in Iran have examined suicide and related psychological (11,12), medical (13), sociological (14,15), and economic (16) factors, these studies have emphasized micro-level factors. Micro-level factors that focus on individual or small-scale issues definitely affect suicide, but macro socioeconomic variables that pertain to large-scale, also influence suicide



(17). In Iran, there have been major changes during the recent decades in macro socioeconomic indicators due to the revolution, war, rapid population growth, international sanctions, and government development programs that potentially affect suicide; however, their role in the suicide rate has not received due attention.

Theoretically, in examining the relationship between macro socioeconomic indicators and suicide four approaches have been presented.

1) The suicide rate decreases as macro socioeconomic indicators improve. Enhancing macro socioeconomic indicators decreases depression, anxiety, fear, and mental disorders, and promotes self-esteem, social contact, and social status of individuals in society (18). Yin et al. (19) indicated with the improvement of economic growth in China during 2004-2013, the suicide rate decreased. The suicide rate decreased with the improvement of economic growth and income indicators in China during 1982-2005 (20).

2) The suicide rate increases as macro socioeconomic indicators improve. Improving economic indicators leads to urbanization, which changes values and beliefs (21) and paves the way for the growth of suicide. Examining 53 countries showed that suicide increases with an increase in GDP (22). With increased women's participation in the labor force, the suicide rate increased in the United States during 1948 to 1984 (23).

3) The suicide increases as macro socioeconomic indicators decline. The process of recession and economic decline damages individuals' status, making it difficult for them to adapt their expectations to their abilities (5,24). Furthermore, socio-economic decline leads to the emergence of stress (25) and unemployment (26), which might increase suicide. With increased unemployment in the United States between 1948 and 1982, the suicide rate also increased (27). By examining 26 European countries in the period of 1970-2007, it was reported that with the increase in the unemployment rate, suicide has increased (28). The economic crisis of 1997 and 1998 led to an increase in suicide in Japan, South Korea, and Hong Kong (29).

4) The suicide decreases as macro socioeconomic indicators decline. According to Henry and Short (30), the suicide rate would decrease if people attributed their hardship to the socioeconomic macrostructure, and it would increase if people blame themselves for their hardships. On the other hand, the reduction of suicide in times of declining socioeconomic indicators may be due to government social assistance to vulnerable individuals in such situations (28). By examining 63 countries from 2000 to 2011, the suicide rate decreased with the decline of the economic situation (31). Mäkinen (32) examined 18 countries and found that there was a negative relationship between unemployment and suicide. Stuckler et al. (28) by investigating 26 European countries demonstrated that the increase in the unemployment rate in Finland and Sweden caused a decrease in suicide. The economic crisis in 1998 did not increase suicide in Taiwan and Singapore (29).

Therefore, because of the changes in Iran's suicide rate on one hand, and recent fluctuations in Iran's socioeconomic structure on the other, this study aims to examine the relationship between macro socioeconomic indicators and the suicide rate in Iran from 1991 to 2023.

Methods

This research is a quantitative longitudinal study conducted using a time series method. The study investigated the relationship between macro socioeconomic variables and suicide in Iran from 1991 to 2023. To measure suicide rate, the annual number of suicides per 100,000 population was calculated. To assess macro socioeconomic indicators, variables including literacy rate, labor force participation, women's participation in the labor force, urban population, GDP per capita, mobile cellular subscription, and inflation were employed. Research data were collected from the Statistical Center of Iran (SCI), the Central Bank of Iran (CBI), and the World Bank (WB). To describe the data, time series charts were used, and to examine the relationship between the research

variables, the autoregressive distributed lag (ARDL) cointegration technique using Microfit 5 software was utilized. The ARDL is a solution to determining both short- and long-term relationship between series that are non-stationary. In other words, it is used in determining the short- and long run relationship irrespective of whether the underlying variables are $I(0)$, $I(1)$ or a combination of both. In such situation, the application of ARDL approach to cointegration will give realistic and efficient estimates (33).

Ethical Approval

The authors did not collect any primary data or undertake research activities that involved human participants or animals in completing this review.

Results

The descriptive findings of the research are described below based on charts. According to Fig. 1, the suicide rate, having had an increasing trend, has increased from 4.1 in 1991 to 8.2 in 2023. Fig. 2 shows that GDP per capita has increased from 1027 US\$ in 1991 to 4502 in 2023.

The women's labor force participation has increased from 10.6% in 1991 to 16.8% in 2023 (Fig. 3).



Fig. 1: Suicide rate during 1991-2023 (per 100.000 population)

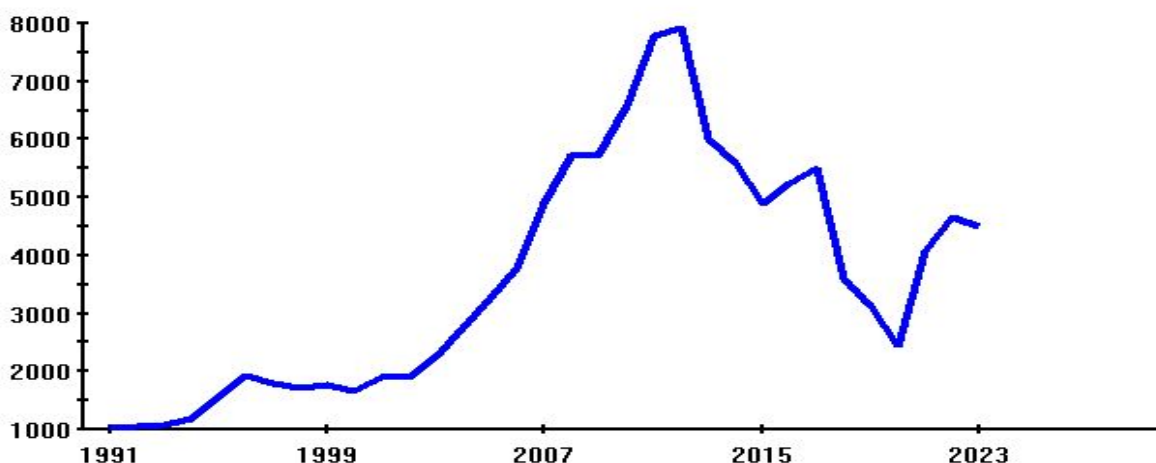


Fig. 2: GDP per capita during 1991-2023

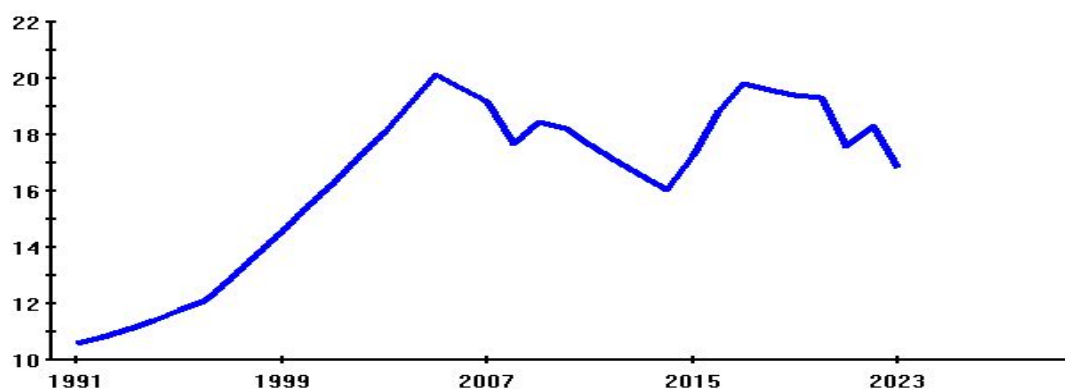


Fig. 3: Women's participation in labor force during 1991-2023

The labor force participation rate has decreased from 46.6% in 1991 to 41.1% in 2023 (Fig. 4). Moreover, as depicted in, the inflation rate has

increased from 26% in 1991 to 32.9% in 2023 (Fig. 5).

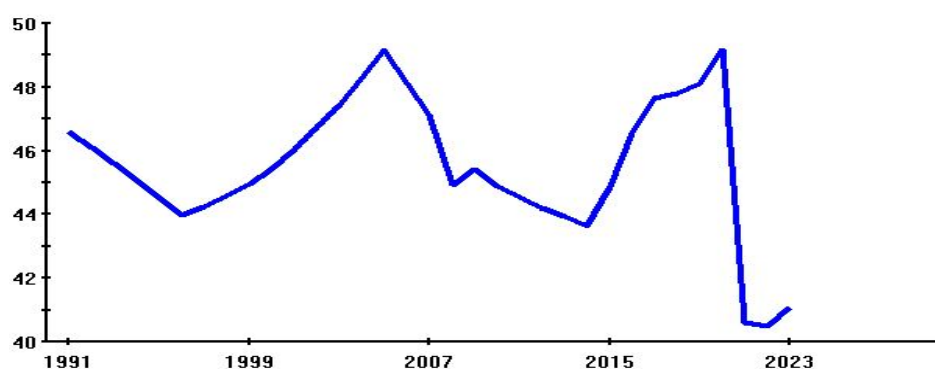


Fig. 4: Labor force participation during 1991-2023

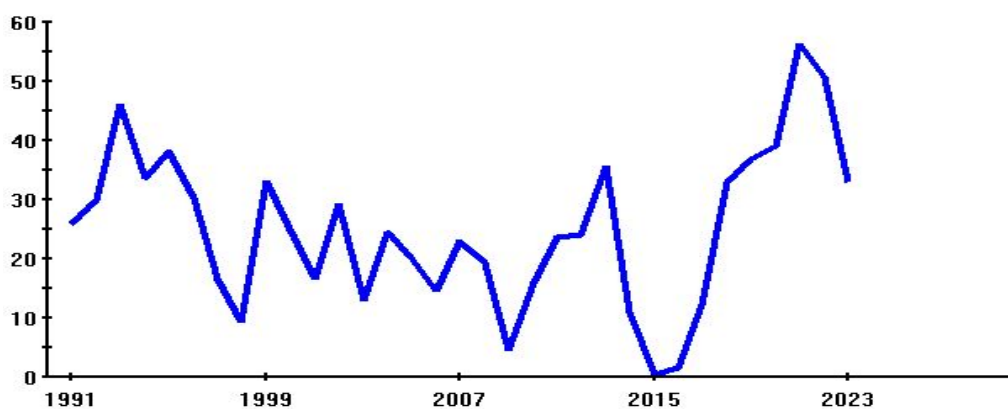


Fig. 5: Inflation rate during 1991-2023

Mobile phone subscriptions have increased from zero percent in 1991 to 164.6 percent in 2023 (Fig. 6). The urban population has increased

from 32.8 million in 1991 to 68 million in 2023 (Fig. 7). Finally, Fig. 8 shows that the literacy rate has increased from 74% in 1991 to 90% in 2023.

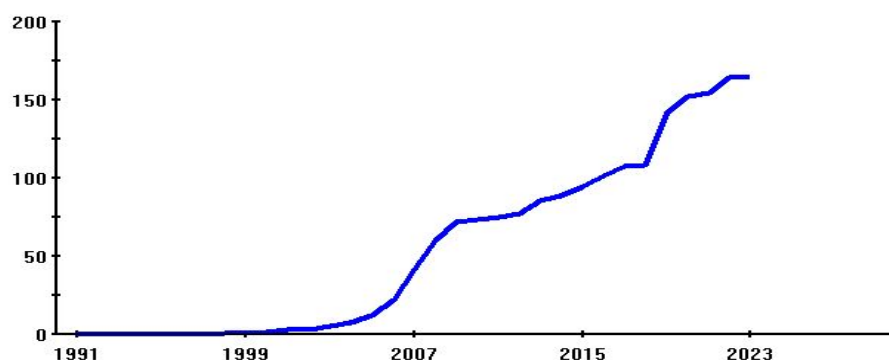


Fig. 6: Mobile cellular subscription during 1991-2023 (per 100 population)

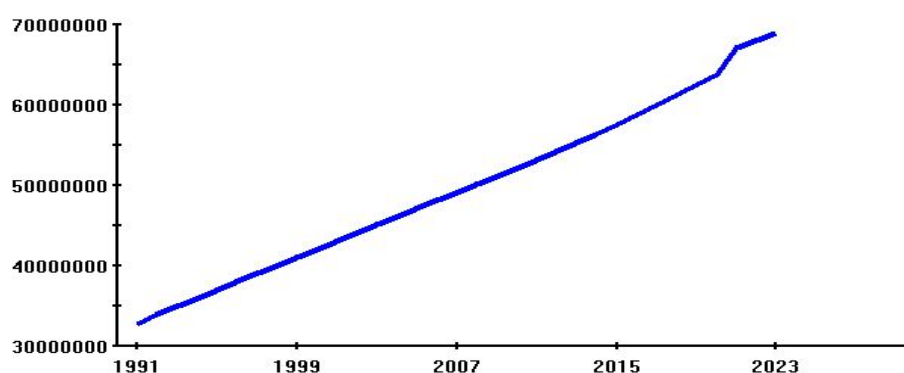


Fig. 7: Urban population rate during 1991-2023

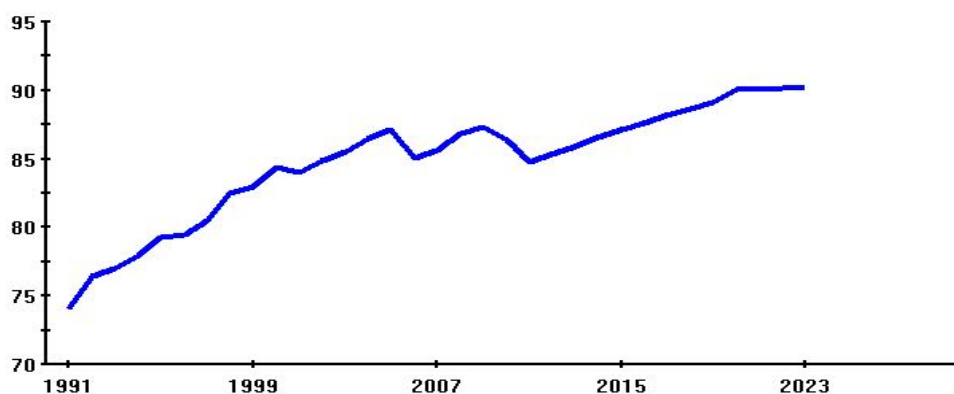


Fig. 8: Literacy rate during 1991-2023

To investigate the relationship between macro socioeconomic indicators and suicide, initially,

the short-run relationship with a maximum 2-year lag was estimated through the ARDL model us-

ing Schwartz Bayesian criterion and logarithmic scores. Based on Table 1, inflation without lag and with a one-year lag, urban population without lag and with one- and two-year lags; mobile phone subscriptions without lag, labor force par-

ticipation without lag, literacy without lag; women's participation in the labor force without lag and with a two-year lag, and GDP per capita with a two-year lag have a significant impact on suicide.

Table 1: Short-run relationship between macro socioeconomic indicators and suicide rate

Regressor	Coefficient	Standard Error	T-ratio [Prob.]
Suicide (-1)	-.76058	.2369	-3.209 [.049]
Suicide (-2)	-1.697	.0326	-4.651 [.019]
Inflation	-.167	.0326	-5.119 [.014]
Inflation (-1)	-.209	.0560	-3.732 [.034]
Inflation (-2)	-.053	.0202	-2.619 [.079]
Urban population	153.7	29.4	5.223 [.014]
Urban population (-1)	116.3	28.8	4.033 [.027]
Urban population (-2)	-278.1	52.7	-5.273 [.013]
Mobile cellular subscription	.362	.095	3.808 [.032]
Mobile cellular subscription (-1)	.122	.056	2.151 [.121]
Mobile cellular subscription (-2)	.297	.097	3.046 [.056]
Labor force participation	30.1	5.880	5.128 [.014]
Labor force participation (-1)	6.7	4.531	1.485 [.234]
Labor force participation (-2)	-11.6	4.5	-2.575 [.082]
Literacy	12.3	3.1	3.920 [.030]
Literacy (-1)	.715	1.824	.392 [.721]
Literacy (-2)	-2.6	1.7	-1.529 [.224]
Women's participation in labor force	-15.8	3.4	-4.673 [.018]
Women's participation in labor force (-1)	-.518	2.111	-.245 [.822]
Women's participation in labor force (-2)	9.873	2.908	3.395 [.043]
GDP per capita	-.147	.091	-1.609 [.206]
GDP per capita (-1)	-.080	.091	-.877 [.445]
GDP per capita (-2)	.486	.119	4.061 [.027]
Constant	9.713	11.5	.844 [.460]

Next, the long-run relationship between macro socioeconomic indicators and suicide was estimated. Based on Table 2, inflation, urban population, and women's participation in the labor force

have a negative and significant effect on suicide; whereas, labor force participation and the number of mobile phone subscriptions have had a positive and significant effect on suicide.

Table 2: Long-run relationship between macro socioeconomic indicators and suicide rate

Regressor	Coefficient	Standard Error	T-ratio [Prob.]
Inflation	-.1242	.0224	-5.52 [.012]
Urban population	-2.2928	.3927	-5.83 [.010]
Mobile cellular subscription	.2271	.3626	6.26 [.008]
Labor force participation	7.2909	.9679	7.53 [.005]
Literacy rate	3.0016	1.396	2.14 [.121]
Women's participation in labor force	-1.8927	.4145	-4.56 [.020]
GDP per capita	.0747	.0294	2.53 [.085]
Constant	2.8091	3.252	.863 [.451]

Finally, Figs. 9 and 10 display the results for CUSUM (cumulative sum) and CUSUMSQ (cumulative of square) tests. The absence of any instability of the coefficients since CUSUM and

CUSUMSQ statistics fall into the critical bands of the 5% confidence intervals of parameter stability. Therefore, stability exists in the coefficients over the sample period.

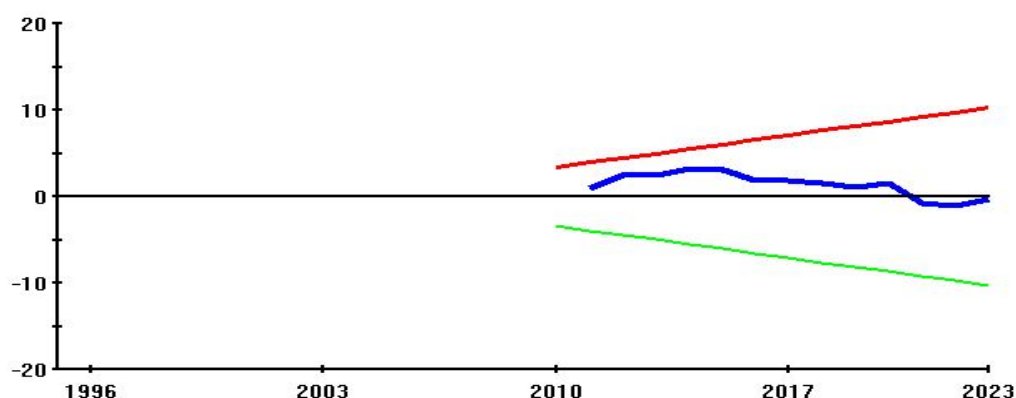


Fig. 9: Cumulative sum of squares of recursive residuals (CUSUM)

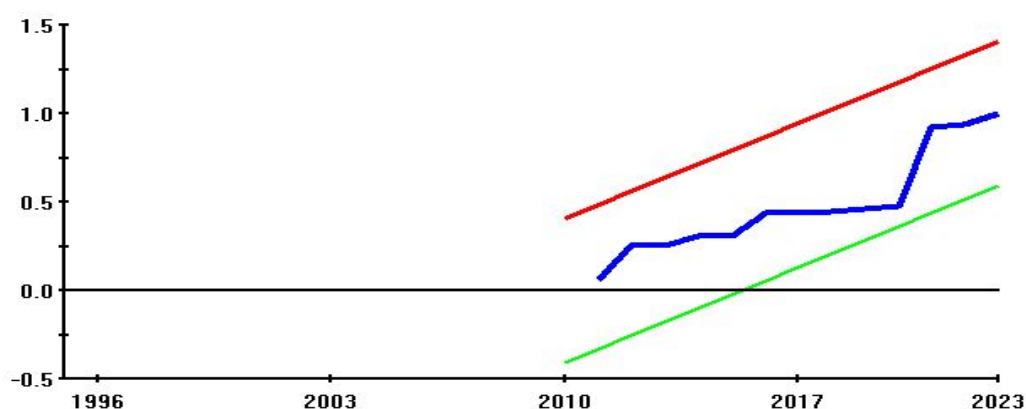


Fig. 10: Cumulative sum of squares of recursive residuals (CUSUMQ)

Discussion

Based on the long-run relationships, there is a negative and significant relationship between the urban population and the reduction of suicide. This relationship has roots in the first theoretical approach. The negative and significant relationship between the urban population and the suicide rate in Iran is probably because in Iran more services and facilities are available to people residing in cities (34). Naturally, the availability of psychological, medical, and health services can

reduce the suicide rate. This research finding is consistent with the results of research of Emamgholipour et al. (35) in Iran.

There is a negative and significant relationship between women's participation in the labor force and the reduction of suicide. This relationship being consistent with the first theoretical approach shows that labor force participation has brought calmness, independence, and dignity for women. This research finding is consistent with the results of research already done in 70 coun-

tries worldwide (36), and research done in the United States (37).

In addition, there is a negative and significant relationship between inflation and suicide, such that as inflation has increased, the suicide rate has decreased. This research finding is consistent with the fourth theoretical approach. Specifically, Iran's economy is a state-run economy (38) and for this reason, people probably rather than themselves, deem the government as responsible for problems and difficulties including inflation; as a result, with the increase of inflation, the suicide rate has decreased. In England and Wales (17), and in Turkey (39), with increasing inflation, the suicide rate increased, but in Italy (40) there was no significant relationship between inflation and the suicide rate. As mentioned, the difference in the results of this study with other studies is probably because, unlike England, Wales, and Turkey, Iran's economy is a state-run economy.

The number of mobile phone subscriptions has had a positive and significant impact on suicide. The relationship between increasing mobile phone subscriptions and suicide is theoretically consistent with the second theoretical approach. There is some clear evidence stating that mobile phones disrupt privacy, create addiction, and cause anxiety and depression (41). Mobile phones, due to individualism, limitation of social relationships, and increase of isolation that they cause, have increased social harms such as divorce in Iran (42). This research finding is consistent with the results of the cross-sectional in South Korea (43), which showed that excessive use of mobile phones increases the risk of suicide.

Ultimately, there is a positive and significant relationship between labor force participation and suicide. The positive relationship between increasing labor force participation and suicide is consistent with the second theoretical approach. Normally, it is expected that with the increase in labor force participation and employment, the risk of suicide would have decreased. The increase of employment does not necessarily reduce suicide, rather what is important is the type of employment (44). In this regard, in Australia, if

jobs are created in incomplete forms, in a way that people fail to use their thorough capabilities in their jobs, the risk of suicide would increase (45). In Iran, officially, anyone who works for one hour a week is considered as being employed, but given the country's economic structure, this hour of employment in no way meets the livelihood needs. Such employment is likely to provide grounds for suicide.

Some limitations should be regarded in this research. 1) While several significant variables were included in the model, incorporating additional factors like unemployment and the internet might produce more valid results. 2) This research has concentrated on the overall number of suicides, but distinguishing between males and females may lead to more precise results. 3) The negative relationships between inflation, urban population, and women's participation in the labor force with suicide, and the positive relationships between mobile phone penetration and labor force participation with suicide rate, do not necessarily hold for individual cases.

Conclusion

Suicide remains a social and public health issue worldwide, which is no exception in Iran. Over the past few decades, suicide has increased rapidly in Iran. In fact, due to some events such as the revolution of 1979, war, population increase, international sanctions, and development programs in the recent decades, major changes have occurred in socioeconomic macro indicators in Iran expected to affect suicide. In this regard, socioeconomic macro indicators would certainly affect suicide. The increase in urban population, women's participation in the labor force, and inflation led to a reduction in suicide, while the increase in mobile phone subscriptions and labor force participation led to an increase in suicide. In addition, literacy and GDP per capita have not changed the suicide rate. Accordingly, the suicide rate in Iran can be reduced by accurately evaluating changes in socioeconomic macro structures and proper planning for them.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors declare that there is no conflict of interests.

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