




# Identify Affecting Factors on Total Fertility Rate: A Systematic Review

Sanaz Borzoiempour<sup>1</sup>, Gisoo Alizadeh <sup>1</sup>, Hasan Jafary<sup>2</sup>, Rahim Khodayari Zarnaq <sup>1,\*</sup>

<sup>1</sup> Department of Health Policy and Management, School of Management and Medical Informatics, Tabriz University of Medical Sciences, Tabriz, Iran

<sup>2</sup> Department of Health Management and Economics, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

\*Corresponding author: Medical Philosophy and History Research Center, School of Management and Medical Informatics, Tabriz University of Medical Sciences, Tabriz, Iran.  
Email: rahimzarnagh@gmail.com

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## Abstract

**Background:** The total fertility rate (TFR) is a key indicator of population dynamics and health. It shows the average number of children a woman would have in her lifetime, based on the current fertility rates for different age groups. Various factors affect the TFR, such as social, economic, political, technological, environmental, and health factors. By analyzing these factors and how they influence the TFR, policymakers and planners can design and implement interventions to achieve optimal population and health outcomes.

**Methods:** We searched PubMed, Scopus, ISI Web of Science, and ProQuest databases, as well as the Google Scholar search engine systematically. We searched for studies from 13 December 2021 - 20 May 2022, without time limits. We included studies that described at least one driver of TFR. We applied the STEEPH framework (social, technology, environmental, economic, political, and health) method to analyze the qualitative data.

**Results:** We included 64 studies from 26 countries. We identified 410 drivers of TFR, and classified 181 drivers into six main categories: Social, technological, environmental, economic, political, and health. The main factors that lower the fertility rate are education, aging, poverty, postponing marriage (social), exposure of women to mass media (technology), type of residence and living in urban areas, road accidents (environmental), income and economic situation (recession and inflation), unemployment, debt, women's employment (economic), government policies (political), use of anti-fertility drugs (health). The main drivers that raise the fertility rate are having first child girls, women's proximity to their workplace (social), use of assisted reproductive technology (technology), living in rural areas and natural and unnatural disasters (environmental), improvement in men's labor market conditions, employment opportunities (economic), increased parental leave (political), high infant mortality (health).

**Conclusions:** We identified a comprehensive list of effective drivers that have increased or decreased TFR in different parts of the world. It is necessary to review these drivers considering the specific conditions and social, cultural, economic, and political coordinates of each country. This review should inform policymakers' actions in this area.

**Keywords:** Fertility, Total Fertility Rate, Drivers, Economic, Environmental, Health System, Social, Technology, Systematic Review

## 1. Background

Population and related issues are among the most complex and multidimensional challenges that human societies face (1). Population policies, which affect the changes in population size and composition, are crucial for the economic and social development of any society (2). Pavel Demeny defines population policies as specific programs that governments use to intentionally influence demographic changes, either directly or indirectly (3). These policies are not only aimed at

controlling or increasing population growth but also address a broader range of population issues and problems (4). Demographic changes have significant impacts on various aspects of life, such as markets, environment, education, employment, and ultimately economic growth (5). These changes are determined by the factors of fertility, mortality, and migration. Assuming that there is no migration in a population, the population size and composition will depend on the balance between fertility and mortality. That is, in the absence of immigration, the losses caused by mortality can only be compensated and controlled by fertility, and

if the fertility rate exceeds the mortality rate, the population will grow (6).

From a demographic perspective, the fertility rate is the most important phenomenon that affects population fluctuations and is the main factor that causes changes in the size, growth rate, and structure of the population in a society. Fertility studies are more important than other demographic phenomena (mortality and migration) (7, 8). The most important indicators that measure the fertility rate in a society are the total fertility rate (TFR) and the average number of children a woman has in her lifetime. A generation can survive if every woman has at least two children, but some men and women do not marry or have children for various reasons. Therefore, each couple should have an average of 2.1 children to keep the population stable (9, 10). The fertility rate changes due to various factors and different studies have shown that this process does not follow the same trend in different countries (11).

The TFR is influenced by factors such as the decline of moral values in society, the income and savings of families, access to contraceptive methods, the implementation of family planning policies by governments, social norms, and the costs of raising and educating children (10). The TFR has been declining steadily in the world statistics since 1950 and has dropped significantly in the last seven decades (12). In 2020, the TFR was 4.2%, which was lower than 5% in 1960, 7.3% in 1980, and 7.2% in 2000 (13). The TFR was 5 children per woman in the early 1950s, it decreased to 4.5 children per woman in 1970, and then to less than 3 children in 1990. There are considerable differences in the reduction of the TFR between countries, but developing countries have experienced a rapid decline in the TFR in recent decades (2). The total fert TFR ility rate in the world went from 6 children per woman in 1960 to 2.5 children in 2013, which shows the global decline in the fertility rate (14, 15). The process of reducing the fertility rate is influenced by various factors, such as the increase in the education level of parents, the number of children, the age of the spouse, and the age of the woman at the time of the first pregnancy (16-18). Baki-Hashemi et al. stated that the desire to be a parent and economic pressures are the most important factors that affect childbearing. Childbearing is related to social, political, cultural, and economic factors, and it depends a lot on the attitude and awareness of women and men (19).

The decline in the young population of the country leads to a decline in human capital and the active force of society, and at the same time, an increase in the elderly population, which creates a serious problem

such as the rising costs of care, health, and treatment of the elderly. Many people attribute this problem to the population control policy and other factors such as economic problems, lower marriage rates, higher divorce rates, higher marriage age, lower number of children, and the preference of families to have only one child (6, 20). In recent years, population aging and low TFR and their negative effects have raised various economic and political concerns in the countries of the Middle East and North Africa region and have resulted in changes in the population policies of some countries, including Iran and Turkey (2).

## 2. Objectives

This study aimed to identify the drivers that affect the fertility rate in the world in the framework of STEEP (analysis of social, economic, technological, environmental, and political factors on the fertility rate) through a systematic review.

## 3. Methods

### 3.1. Study Design

We used a systematic review method to review the published studies that examined the determinants of TFR.

### 3.2. Search Strategy

We searched for quantitative and qualitative studies and expert opinions without a time limit in PubMed, Scopus, ISI Web of Science, and ProQuest databases. The first search was on 13 December 2021, and the supplementary search was on 20 May 2022. We also hand-searched the reference lists of other reviews to find additional studies. We excluded studies that were only published as abstracts. Box 1 shows the search strategy proposed for the PubMed database. We modified this strategy for other databases as well.

### 3.3. Study Inclusion Criteria

We included published studies that were related to TFR and that reported at least one TFR determinant. We excluded conference paper abstracts (where full analysis was not available), case reports, and studies with low quality in methodology, based on the Joanna Briggs Institute (JBI) checklist (21).

### 3.4. Study Selection Process

**Box 1.** Search Strategy for the PubMed Database

| Variable      | Strategy   |
|---------------|--|
| Search string | ((("Fertility"[Title/Abstract] OR "Bearing" [Title/Abstract] OR "Fecundity" [Title/Abstract] OR "Fructification"[Title/Abstract] OR "Richness"[Title/Abstract] OR "Fruition"[Title/Abstract] OR "Productivity"[Title/Abstract] OR "Fecundity"[Title/Abstract] ) And ("Birth Rates"[Title/Abstract] OR "Rate, Birth"[Title/Abstract] OR "Fertility Rate"[Title/Abstract] OR "Fertility Rates"[Title/Abstract] OR "Total fertility rate") [Title/Abstract]) AND (("Driver"[Title/Abstract] OR "Driving force" [Title/Abstract] OR "Factor"[Title/Abstract])) |

Two reviewers independently reviewed the title and abstract of each article. They then retrieved and independently assessed the full texts of the studies for inclusion or exclusion. They resolved any disagreements on the eligibility of studies either through discussion or by a third party.

### 3.5. Assessment of the Studies' Reporting Quality

The reporting qualities of the studies were evaluated by the JBI checklist. Any disagreements on appraisal were resolved through discussion. Furthermore, the reviewers resolved their disagreements on study inclusion by arbitration and/or by a third reviewer. Full-text retrieval was performed for studies that met all prespecified inclusion criteria.

### 3.6. Data Extraction, Synthesis, and Analysis

We included any article that mentioned at least one determinant in this study. We extracted data from texts for quantitative studies. The data included author, country, publication year, study description, objective, and results. We used the PRISMA flow diagram to select the included studies. The analysis had two steps. First, we summarized the characteristics of the studies by author, country, publication year, study description, objective, and results. We reviewed the selected studies thoroughly and extracted the necessary data. Second, we focused on the determinant factors of TFR in the study results and described them descriptively. We used the EndNote X7 software to organize the studies, read the titles and abstracts, and identify duplicates.

## 4. Results

### 4.1. Selection and Characteristics of the Study

The initial search yielded 9,161 studies. After applying the exclusion criteria, 536 studies were screened. After reviewing the full texts, 302 studies were eliminated from the study. We did not remove any studies due to

low methodology quality, which we checked using the JBI checklist. Finally, we reviewed 220 studies that had examined the determinants of TFR. [Figure 1](#) shows the results of this systematic review ([Figure 1](#)).

### 4.2. The Systematic Review of Total Fertility Rate Reduction Factors

The systematic review of this study on the main factors of TFR reduction revealed that this reduction is influenced by various social, technological, environmental, economic, political, and health factors. The social category with 33.25% and the economic category with 25.42% had the most drivers, while the technology (3.13%) and environmental categories (9.40%) had the fewest drivers. We identified 62 drivers in the social field, and the most frequent and important drivers that decreased fertility were education, age increase, poverty, marriage delay, divorce, living in slums, career damage, and migration. The most frequent and important drivers that increased fertility were having a female first child, women living close to their workplace, and rural women's culture.

### 4.3. Qualitative Outcomes

We provided the details of the characteristics of the studies as supplementary material. Among the final articles, the most frequent ones were secondary studies (demographic and health survey data, panel data, census data, national data and surveys, and population survey data). The next categories in terms of frequency were quantitative studies (modeling, regression), descriptive (cross-sectional), and analytical (prospective and retrospective cohort) studies. Other methods, such as content analysis and intervention studies, had the lowest frequency and were in the last ranks. The countries studied were distributed as follows: Out of 69 countries, 34.80% were from the Asian continent (24 countries) and had the highest frequency. Most of the studies were from China (11.36%) and were published between 2019 and 2022 (44.55%). In addition, most studies had examined both sexes ([Table 1](#)).

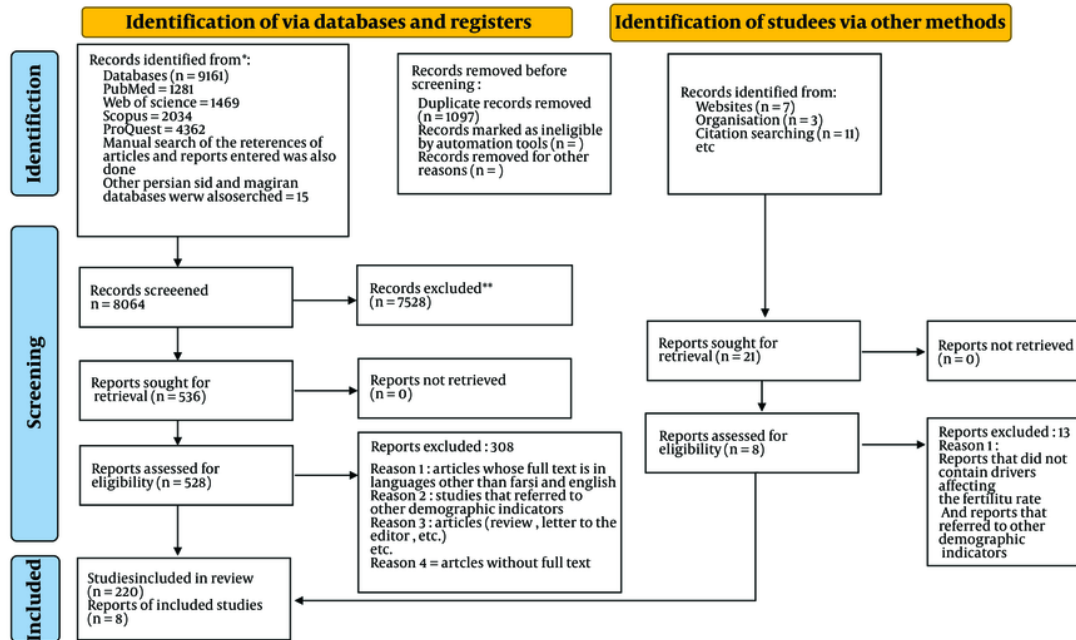


Figure 1. PRISMA 2020 flow diagram

We reported the findings using the STEEP model (S, social; T, technological; E, environmental; E, economic; P, political). After the data extraction phase, we collected many drivers that were important and numerous in the field of fertility. We reported those drivers in a separate category, Health H (Health), along with this model.

We identified 410 drivers in total. After removing duplicate drivers and holding several meetings with the research team to adjust the drivers, we finally identified 181 drivers in six main categories. The social category had the most drivers, while the environmental and technological categories had the fewest drivers.

The social category had 62 drivers (33.25%), the technology category had 6 drivers (3.31%), the environmental category had 17 drivers (9.40%), the economic category had 46 drivers (25.42%), the political category had 29 drivers (16.52%), and the health category had 21 drivers (11.60%). The social (25.33%) and economic (42.25%) categories had the most drivers, while the technology (31.3%) and environmental (40.9%) categories had the fewest drivers.

In Table 2, the most important and most common factors affecting the increase and decrease of the

fertility rate are listed based on the final articles from the systematic review.

### 5. Discussion

Regarding the social factors that reduced fertility, Götmark, and Andersson studied the reasons for the decline in fertility rates in 141 countries from all regions of the world. They mentioned family planning and education level as the main reasons (22). In another study by Afolabi and Palamuleni in 2022, they reported that high education was the reason for the fertility rate decline in South African countries (23). In 2020, in a study in sub-Saharan Africa, Abdul-Aziz et al. reported age, education level, couple's education, equality, and the ideal number of children as the factors of fertility rate changes in sub-Saharan African countries (24). In 2012, Burger et al. reported that improving the education level and lowering the marriage rate were among the factors of fertility decline in South Africa (25). These studies showed the importance of the drivers of education and age in decreasing the fertility rate, and these results were also confirmed in this study. In other studies, such as the Syllabus study in (2003), factors such as women's higher education level and their wish

**Table 1.** Characteristics of the Studies Included in the Qualitative Synthesis

| Characteristic                         | No. of Studies (%) |
|--|--------------------|
| <b>Continent</b>                       |                    |
| Asia                                   | 24 (34.80)         |
| Europe                                 | 17 (24.63)         |
| Africa                                 | 14 (20.80)         |
| North America                          | 7 (10.15)          |
| South America                          | 4 (5.80)           |
| Australia                              | 2 (2.90)           |
| Pacific Ocean                          | 1 (1.44)           |
| <b>Country</b>                         |                    |
| China                                  | 25                 |
| America                                | 13                 |
| South Korea. South Africa              | 12                 |
| Bangladesh                             | 7                  |
| Australia, Iran, Ethiopia              | 6                  |
| Russia, India                          | 5                  |
| Taiwan, Uganda, Germany                | 4                  |
| Japan, Finland, Canada, Israel, Sweden | 3                  |
| Other countries...                     | 2 and 1            |
| <b>Publication year</b>                |                    |
| 1990 and below                         | 1 (0.45)           |
| 1991 - 1994                            | 8 (3.63)           |
| 1994 - 1998                            | 5 (2.27)           |
| 1999 - 2002                            | 9 (4.10)           |
| 2003 - 2006                            | 12 (5.45)          |
| 2007 - 2010                            | 14 (6.37)          |
| 2011 - 2014                            | 26 (11.81)         |
| 2015 - 2018                            | 47 (21.37)         |
| 2019 - 2022                            | 98 (44.55)         |
| <b>Total</b>                           | <b>220 (100)</b>   |

to delay marriage until the end of their education were considered the main causes of TFR reduction in OECD member countries (26). Likewise, Adio and Erkol reported in a study in that women with higher education and income levels tend to have fewer children (27). According to Westley et al., the increase in the education level and the employment rate of women has led to a decrease in TFR (28). Similarly, Westoff et al. argued that the decline in TFR in sub-Saharan countries is due to the increase in the education level of the people (29). In another study by Kulu et al. in 21 European countries in 2020, they reported the proportion of divorced people in the region and the fertility level in neighboring regions as the factors of fertility rate changes in these regions (30).

Regarding the factors that increase the fertility rate, in a study by Wang et al. in 2021 in China, they reported that having a female first child is one of the reasons for increasing the fertility rate in this country (31). In

another study by Wei et al. in China in 2018, they reported that the culture of rural women is a factor that increases the fertility rate (32). And in another study by Wei, et al. in China in 2018, they reported the culture of rural women as a factor that increases the fertility rate (32). Therefore, the results of the studies mentioned in different parts of the world were consistent with the results of this analysis regarding the effect of social factors on the increase and decrease of the TFR rate. This shows the importance of the impact of these drivers on the fertility rate in all regions of the world and the need to pay special attention to these drivers in policymaking.

In the economic field, we identified 46 drivers, among which the most frequent and important drivers that decreased fertility were income and economic situation (economic downturn and inflation), unemployment, debt, women's employment, displacement and temporary jobs, and the competitive

**Table 2.** The Most Important and Most Frequent Drivers Effective in Increasing and Decreasing the Fertility Rate

| Category and Effect                   | Factors   |
|---------------------------------------|---|
| <b>Social</b>                         |   |
| Effective in reducing fertility (-)   | Education, rising age, poverty, marriage postponement, divorce, living in slums, harm to their careers, and migration   |
| Effective in increasing fertility (+) | having a female firstborn child, women living near their place of work, rural women's cultural  |
| <b>Technology</b>                     |   |
| Effective in reducing fertility (-)   | Exposure of women to mass media   |
| Effective in increasing fertility (+) | Use of assisted reproductive technology   |
| <b>Environmental</b>                  |   |
| Effective in reducing fertility (-)   | Type of residence and life in urban areas, road accidents   |
| Effective in increasing fertility (+) | Living in rural areas, disasters (natural and unnatural)  |
| <b>Economic</b>                       |   |
| Effective in reducing fertility (-)   | Income and economic situation (economic recession and inflation), unemployment, debt, employment of women, displacement and temporary nature of jobs, competitive employment market |
| Effective in increasing fertility (+) | Improvement in men's labor market conditions, employment opportunities, and family allowances   |
| <b>Political</b>                      |   |
| Effective in reducing fertility (-)   | Government policies in different countries (Vietnam's two-child policy, China's one-child policy), political sanctions  |
| Effective in increasing fertility (+) | Increasing parental leave, and maternity leave and granting financial incentives  |
| <b>Health</b>                         |   |
| Effective in reducing fertility (-)   | The effect of infections, infertility, use of anti-fertility drugs  |
| Effective in increasing fertility (+) | High infant and child mortality rate  |

labor market. The most frequent and important drivers that increased fertility were the improvement in men's labor market conditions, employment opportunities, and family benefits. Regarding the economic factors that reduced fertility, Karabchuk, in a study in 2020, reported that the job instability of adults was the reason for the decline in the fertility rate in Europe (33). In 2019, Yong et al. also reported that the high competition for prestigious jobs in the developed countries of East Asia was one of the reasons for the decline in the fertility rate in these regions (34). In another study by Schaller, in 2016, the improvement in women's working conditions was reported as the reason for the decline in the fertility rate in the United States (35). In a study by Currie and Schwandt in 2014, unemployment was reported as the reason for the decline in the fertility rate in the United States (36). Adsera and Menendez also reported in 2011 that the economic recession and the increase in unemployment were the reasons for the decline in the fertility rate in America (37) and Dartanto in Southeast and South Asian countries (38). Martin et al. also reported in a study in 2013 that changes in their income level and the relatively high costs of raising children

decreased the fertility rate (39). Westley and colleagues reported in a study in 2010 that one of the important factors in the reduction of TFR in the East Asian region was the decrease in the number of marriages, which was due to the high costs of marriage (28).

Regarding the economic factors that increased the fertility rate, Schaller et al. reported in a study in 2016 in the United States that the improvement in the labor market conditions of men increased the fertility rate (35). In another study by Milovanska-Farrington in 2019, family allowance was reported as the reason for the increase in the fertility rate in Europe (40). These studies in different parts of the world confirmed the importance of the drivers identified in this study, which shows that these drivers are very important for the changes in the fertility rate in the economic field, and they should be considered in policymaking for this category of economic drivers.

Another important and influential factor in the fertility rate is political factors. We identified 29 drivers in this area, among which the most frequent and important drivers that reduced fertility were government policies in different countries (Vietnam's

two-child policy, China's one-child policy), and political sanctions. The most frequent and important drivers that increased fertility were increasing parental leave, maternity leave, and giving financial incentives. Regarding the political factors that reduced fertility, Huihman reported that the government's support for family planning programs was the main reason for the increase in the use of contraceptives and the reduction of fertility in Southeast Asia (2). In a study by Gietel-Basten et al. published in 2019 in China, they showed that the implementation of the one-child policy in China had reduced the fertility rate in this country (41). In a study by Ngo in 2020 in Vietnam, it was reported that the implementation of the two-child policy in Vietnam had reduced the fertility rate in this country (42). Fertility has declined in Iran as a result of the population policies implemented in the past years, such as the family planning program that was officially launched in 1988 as part of the country's first economic and social development plan. This program significantly reduced the fertility rate from 1986 to 1991. Another policy was the establishment of the Birth Control Council in the Ministry of Health in 1989. Moreover, the "Family and Population Regulation Law" passed by the Guardian Council in 1993 deprived the fourth child of some economic and social benefits (43). Regarding the political factors that increased the fertility rate, Malkova in a study conducted in Russia in 2018, reported that parental leave boosts the fertility rate (44).

Another major factor influencing fertility is technology. In this area, six drivers were identified, among which the most important and frequent driver for lowering fertility was women's exposure to mass media, and the most important and frequent driver for raising fertility was the use of reproductive technology. Regarding the technological factors that reduce the fertility rate, Guldi and Herbst in a study conducted in 2017, stated that the expansion of broadband internet access influenced the fertility decisions of teenagers and led to a decline in the fertility rate in the United States (45). In another study conducted by Robinson and Harbison. in 1995, exposure to modern media was one of the causes of falling fertility rates in Kenya, an African country (46). Similarly, Westoff et al. argued that the decrease in TFR in sub-Saharan countries was due to their exposure to mass media, especially television (29). These results were also confirmed in the present study regarding the effective technological factors in increasing the fertility rate. In a study conducted in 2021, Lazzari et al., stated that the use of assisted reproductive technology was the reason for the increase in the fertility rate (47).

In the field of environmental factors, 17 drivers were identified, among which the most important and frequent drivers for lowering fertility were the type of residence and living in urban areas, road accidents, and the most important and frequent drivers for raising fertility were living in rural areas and disasters (natural and unnatural). Regarding the environmental factors that increase the fertility rate, Hirschman also suggested that urbanization was an effective factor in reducing TFR in Southeast Asia (2). Slibos proposed that the transition from traditional and agricultural-based societies to industrial societies was one of the reasons for the decline in TFR among OECD member countries (26). Here's the revised text with the specified grammar corrections and capitalizations:

These results were also confirmed in the present study. In a study conducted by Robinson and Harbison in 1995, they stated that the urban lifestyle was one of the reasons for the decrease in the fertility rate in Kenya, an African country (46). Finally, health-related factors were identified as influential factors. In this area, 21 drivers were identified, among which the most important and frequent drivers for lowering fertility were the impact of infections, infertility, and the use of anti-fertility drugs. The most important and frequent drivers for raising fertility were the high mortality rate of infants and children. Regarding the health factors that reduce the fertility rate, in a study conducted by Majumder and Ram in 2015, they mentioned the increase in the use of contraceptives, changing the marriage pattern, and induced abortion in Asian countries as some of the causes of the decrease in the fertility rate (48). Slibos cited the increase in the use of contraceptives as one of the important causes of TFR reduction among OECD member countries (26). Westoff et al. and Westley et al. reported an increased rate of use of health and family planning technologies among residents of Asia and sub-Saharan Africa (28, 29). In a study conducted by Robinson and Harbison, they stated the reasons for the decrease in the fertility rate in Kenya, an African country (46).

Regarding the health factors that increase the fertility rate, in a study conducted by Dartanto in 2013, he showed that infant and child mortality rates were positively associated with fertility rates in Southeast and South Asian countries (38). Basu, in a study on the decline of global TFR, demonstrated that fertility rates remain high when infant mortality rates are high because parents are not sure about the survival of their children (49). Therefore, in line with the results of the present systematic review, the results of other studies

also highlighted the importance of health-related factors in reducing TFR in different parts of the world.

Among the limitations of the present review, it can be mentioned that there may be factors affecting the fertility rate that are not mentioned in the articles, and in this case, they are not included in our study. Also, according to the inclusion criteria, only articles that were published in Persian and English were included in the study, in which case it is possible that relevant articles in other languages were excluded from the study.

### 5.1. Conclusions

In this systematic review, we found a large number of factors that have an impact on the TFR in various regions and countries. These factors include social, economic, political, technological, environmental, and health drivers that can either lower or raise the TFR. Some of these drivers are common across different contexts, while others are specific to certain populations or settings. Therefore, it is important to examine these drivers carefully and understand how they interact with each other and with the local conditions and characteristics of each country. By doing so, we can gain better insight into the dynamics and trends of population and health in different parts of the world. This insight can help policymakers and planners design and implement effective and appropriate interventions that can address the challenges and opportunities related to population and health. Such interventions should aim to achieve optimal outcomes for both individuals and societies, taking into account their needs, preferences, values, and rights.

### Footnotes

**Authors' Contribution:** R.H, S.B, contributed to the conception and/or design of the work; R.H, S.B, G.A, H.J, contributed to the acquisition, analysis, and/or interpretation of the data; S.B, drafted the manuscript; R.K, S.B, G.A, critically revised the manuscript. All authors gave final approval and agreed to be accountable for all aspects of the work, ensuring integrity and accuracy.

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**Data Availability:** The dataset presented in the study is available on request from the corresponding author during submission or after publication.

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