



The prevalence of sleep disorders among Iranian older adults: A systematic review and meta-analysis

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Abstract

One of the most important problems that the older adults is sleep disorders, where poor quality sleep claims the third rank of problems of the older adults. This study aims to determine the prevalence of sleep disorders among Iranians older adults through a systematic review and meta-analysis. The present study was conducted through meta-analysis method within the year range of March 2000–July 2018 by searching in ScienceDirect, Medline (PubMed), Barakat and Magiran, SID, and Google Scholar databases. Analysis was conducted in Comprehensive Meta-analysis software. Prevalence of the sleep disorder in the older adults Iranians was obtained as 48.9% (95%CI: 40.4–57.4%). The maximum prevalence of sleep disorder among the older adults in Tehran was observed in 2011 with 88.4% (95%CI: 82.6–92.5%), while the minimum prevalence of sleep disorder in Tehran was observed in 2013 with 22.8% (95%CI: 18.9–27.1%). Based on Meta regression, with the increase in the sample size and the year of the research, prevalence of sleep disorder in the older adults grows, which is statistically significant ($p < 0.05$). The results of this study suggest that prevalence of sleep disorder in the older adults in Iran is high, which requires serious interventional measures on the part of health policymakers.

Keywords Sleep disorder · Prevalence · Older adults · Iran · Meta-analysis

Background

Population aging has changed into one of the important challenges of the public health in recent years (Jandaghi et al., 2003; Islam & ZaffarTahir, 2002; Khazaei Jalil, Azmoon, Abdohali, Ghomi, & Shamsizadeh, 2015). According to World Health Organization (WHO) statistics, the population of the older adults worldwide will increase from 65 million to 2 billion people by 2050 (Khazaei Jalil et al. 2015).

In the last census conducted in Iran in 2016, the share of the 60-year-old and above older adults was more than 9.3%,

which compared to the census in 2011, it shows an ascending and growing trend (Gavril & Heuveline, 2003; Nabavi, Shoja, Mohammadi, & Rashedi, 2014).

With population aging the risk of life with chronic diseases increases. Moreover, chronic diseases will follow various medical, social, and psychological problems (Nabavi et al., 2014; Safarkhanlo & Rezaeighahrodi, 2017; Sohrabi et al., 2008; Sajadi & Biglarian, 2007), causing restrictions in physical activity and diminished quality of life of the older adults (Canbaz, Sunter, Dabak, & Peksen, 2003; Beiranvand, Shokoohi, Babanejad, Behzadifar, & Delpisheh, 2013; Lam & Lauder, 2000).

One of the most important problems faced by the older adults is sleep disorders, which afflict more than half of senior citizens and affect their lives (Reid et al., 2006; Hellström, Hellström, Willman, & Fagerström, 2014). Sleep is one of the basic human needs and any disorder in its natural course can cause reduced efficiency and incidence of different problems in the person (Hellström, Hellström, Willman, & Fagerström, 2014). In the old age, some changes are developed in the quality and structure of sleep and circadian rhythm, resulting in incidence of sleep disorders and frequent complaints in the older adults (Harrington & Avidan, 2005). Accordingly, sleep disorder and poor quality sleep, following

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headache and digestive disorders, claim the third rank of the problems of the older adults, and is one of the most important complaints and reasons of senior citizens referring to physicians (Ancoli-Israel & Martin, *n.d.*). Any policymaking and intervention for sleep disorder prevalence in the older adults require precise information of the problem's frequency. Also, since the statistics presented in Iran about sleep disorder prevalence in the older adults show variable and divergent values and the general statistics of this prevalence is not accurate, comprehensive, and clear, the question of this research is that "what is the general prevalence of sleep disorder in the older adults of the country?" This study aims to determine the prevalence of sleep disorder in Iranians older adults through a systematic review and meta-analysis.

Methods

This study is systematic and meta-analysis, and is an outcome of extracting the findings of studies conducted on prevalence of sleep disorder in the Iranians older adults within the age range over 60 years of Iran (Nobahar & Vafai, 2007; Torabi, Shahriari, Zahedi, Rahmanian, & Rahmanian, 2013; Ahmadi, Salar, & Faghizadeh, 2004; Bahrami, Dehdashti, & Karami, 2017; Safa, Adib-Hajbaghery, & Moradi, 2016; Varmaghani, Nazari, Sharifi, Fakhrzadeh, & Arzaghi, 2017; Hatami, Eshrati, & Kalateh, 2016; Davari, Aghdak, & Babak, 2016; Mousavi, Tavabi, Iran-Pour, Tabatabaei, & Golestan, 2012; Borhaninejad, Momenabadi, Hossseini, Mansori, & Sadeghi, 2014; Abdollahzadeh & Mehranpour, 2017; Alizadeh, Fakhrzadeh, Sharifi, Zanjari, & Ghassemi, 2013; Aliasquarpoor & Eybpoosh, 2012; Izadi Avanj, Adib Hajbaghery, & Kafai, 2013). It includes the papers published in internal and foreign journals as well as search in Iranian databases of SID, Magiran, Barakat knowledge network system, along with foreign databases including Medline (PubMed), ScienceDirect, and Google Scholar within the age range of March 2000–July 2018.

The International Classification of Sleep Disorders n (ICSD-3) is the authoritative clinical text for the diagnosis of sleep disorders, Disorders are grouped into six major categories: including Insomnia, Sleep Related Breathing Disorders, Central Disorders of Hypersomnolence, circadian Rhythm Sleep-Wake Disorders, Parasomnias, Sleep Related Movement Disorders (Michael, 2012; Robert Auger et al., 2015).

The search process in these databases involved use of Persian keywords including sleep disorder, sleep quality, and the older adults alongside English words. In investigating the English databases, their English translations were searched. Finally, when searching in Google scholar engine, both English and Persian terms were searched, where (AND) and (OR) operators were used in combination to have a more

comprehensive access to all papers. Accordingly, OR operator was used to investigate common names about a specific disorder such as (Older adults OR Aged), (Sleep disorders OR Sleep Wake Disorders OR Long Sleeper Syndrome OR Short Sleeper Syndrome OR Sub Wakefulness Syndrome, while AND word was used between the keywords through corresponding the words in MeSH Explorer.

The Selection Criteria and Assessment of the Quality of Papers

First, all papers were collected using the selected keywords and by the completion of search, a list of the papers' abstract was prepared. After hiding the specifications of the papers including the journal name and author's name, full text of the papers was provided to the reviewers. Every paper was studied by two reviewers independently, and if a paper was rejected, the reason of the rejection was mentioned. In case of disagreement between the two reviewers, the paper was reviewed by a third reviewer. The Persian and English papers were adapted from cross-sectional studies on the prevalence and frequency of sleep disorder in Iranians older adults with selection criteria to be included in the study, and other review studies, case studies, cohort, and interventional studies were excluded from the list of papers. In this study, to achieve gray literature and document which has not been published for any reason, search in Google and the websites associated with the subject was also performed.

In order to investigate the studies, STROBE checklist was used. This checklist includes 22 sections, where 18 of its subjects are general which can be used for all observational studies including cohort, case study, and cross-sectional study. On the other hand, 4 subjects are specific which are dependent on the type of study and capture different aspects of methodology including study objectives, determining proper sample size, type of study, sampling method, research population, data collection method, definition of variables and method of investigating the samples, data collection instrument, objectives of interest in this study, the utilized statistical test, and presentation of the study findings. Based on evaluation of the quality of the studied papers, a checklist on the information of the selected papers including the researcher's name, papers title, year and place of study, number of samples, frequency, and prevalence of sleep disorder in studies was prepared based on PRISMA 2009.

Statistical Analysis

In each study, the prevalence of sleep disorder in the Iranians older adults was obtained. Heterogeneity of the studies was examined by I^2 test. Generally, the heterogeneity is categorized into three groups: heterogeneity of less than 25% (low); between 25 and 75% (moderate), and above 75% (high). The

data were analyzed by Comprehensive Meta-analysis software (Biostat, Englewood, NJ, USA version 3).

Results

Based on the investigations done on prevalence of sleep disorder in Iranians older adults which included papers published in internal and foreign journals and search in the databases of Barakat Knowledge, Magiran, SID, and Network System, 42 papers were obtained. Also searches in Medline (PubMed), ScienceDirect, and Google scholar offered 42, 193, and 351 papers, respectively. Then, the papers which fulfilled the inclusion criteria were 230 (based on initial investigations by eliminating 542 repeated papers). Eventually, by removing 195 irrelevant papers and eliminating 21 papers through secondary investigations, finally 14 papers were introduced into the meta-analysis process (Fig. 1), the relevant papers were included in the meta-analysis, based on which 14 suitable papers were included in this stage (Table 1) (Nobahar & Vafai, 2007; Torabi, Shahriari, Zahedi, Rahmanian, & Rahmanian, 2013; Ahmadi, Salar, & Faghihzadeh, 2004; Bahrami, Dehdashti, & Karami, 2017; Safa, Adib-Hajbaghery, & Moradi, 2016; Varmaghani, Nazari, Sharifi, Fakhrzadeh, & Arzaghi, 2017; Hatami, Eshrati, & Kalateh, 2016; Davari, Aghdak, & Babak, 2016; Mousavi, Tavabi, Iran-Pour, Tabatabaei, & Golestan, 2012; Borhaninejad, Momenabadi, Hossseini, Mansori, & Sadeghi, 2014; Abdollahzadeh & Mehranpour, 2017; Alizadeh,

Fakhrzadeh, Sharifi, Zanjari, & Ghassemi, 2013; Aliasquarpoor & Eybpoosh, 2012; Izadi Avanj, Adib Hajbaghery, & Kafai, 2013).

The publication bias of the results was measured by funnel plot through Egger's test as well as 0.05 significance level (Fig. 2) with significance level of 0.05, suggesting that publication bias has not been statistically significant ($p = 0.101$).

The total samples participating in the study were 8400 individuals within the age range of 60–92 years old. Based on the results obtained from it ($I^2 = 97%$) and high heterogeneity in the included studies, random effects model was used to combine the results of studies together.

The prevalence of a sleep disorder in the older adults Iranians based on this meta-analysis was obtained as 48.9% (95% CI: 40.4–57.4%). The maximum and minimum prevalence of sleep disorder was observed in older adults in Tehran (2011) with 88.4% (95% CI: 82.6–92.5) (Aliasquarpoor & Eybpoosh, 2012) and in Tehran (2013) with 22.8% (95% CI: 18.9–27.1) (Alizadeh, Fakhrzadeh, Sharifi, Zanjari, & Ghassemi, 2013) (Fig. 3). In this figure, the prevalence of sleep disorder in the older adults has been shown in terms of random effects model, in which the black square represents the prevalence, and the length of the line segment on which the square lies is the 95% confidence interval in each study. The diamond sign represents the prevalence in the entire country for all studies. To investigate the effects of potential factors in the heterogeneity of sleep disorder prevalence in the older adults, meta-regression was used for both the sample size and year of study (Figs. 4 and 5). Based on

Table 1 Specifications of studies entered the study

Row	Author	Publication year	Area	Participants' Age	Sample size	Prevalence	Quality Assessment
1	Nobahar (Nobahar & Vafai, 2007)	2007	Semnan	>65	200	67	Moderate
2	Torabi (Torabi, Shahriari, Zahedi, Rahmanian, & Rahmanian, 2013)	2013	Jahrom	67.7 ± 7.3	360	70.3	Moderate
3	Ahmadi (Ahmadi, Salar, & Faghihzadeh, 2004)	2004	Zahedan	>65	200	46	Moderate
4	Bahrami (Bahrami, Dehdashti, & Karami, 2017)	2017	Damghan	73.7 ± 12.1	34	23.5	High
5	Safa (Safa, Adib-Hajbaghery, & Moradi, 2016)	2015	Kashan	63.5 ± 2.2	370	42.4	Moderate
6	Taheri (Varmaghani, Nazari, Sharifi, Fakhrzadeh, & Arzaghi, 2017)	2017	E. Azerbaijan	69.3 ± 7.2	189	48.7	High
7	Hatami (Hatami, Eshrati, & Kalateh, 2016)	2016	Markazi	>60	200	38	High
8	Davari (Davari, Aghdak, & Babak, 2016)	2016	Isfahan	>60	4321	62.8	High
9	Mousavi (Mousavi, Tavabi, Iran-Pour, Tabatabaei, & Golestan, 2012)	2012	Tehran	76.8 ± 8.05	772	46.2	Moderate
10	Borhaninejad (Borhaninejad, Momenabadi, Hossseini, Mansori, & Sadeghi, 2014)	2014	Kerman	60–74	400	44.6	Moderate
11	Abdollahzadeh (Abdollahzadeh & Mehranpour, 2017)	2017	S. Khorasan	68 ± 6.3	400	30	High
12	Alizadeh (Alizadeh, Fakhrzadeh, Sharifi, Zanjari, & Ghassemi, 2013)	2013	Tehran	60–69	400	22.7	Moderate
13	Asgharpour (Aliasquarpoor & Eybpoosh, 2012)	2011	Tehran	75.7 ± 12.3	164	88.4	Moderate
14	Izadi (Izadi Avanj, Adib Hajbaghery, & Kafai, 2013)	2013	Kashan	71.8 ± 5.9	390	44.3	Moderate

Fig. 1 The flowchart on the stages of including the studies in the systematic review and meta-analysis (PRISMA 2009)

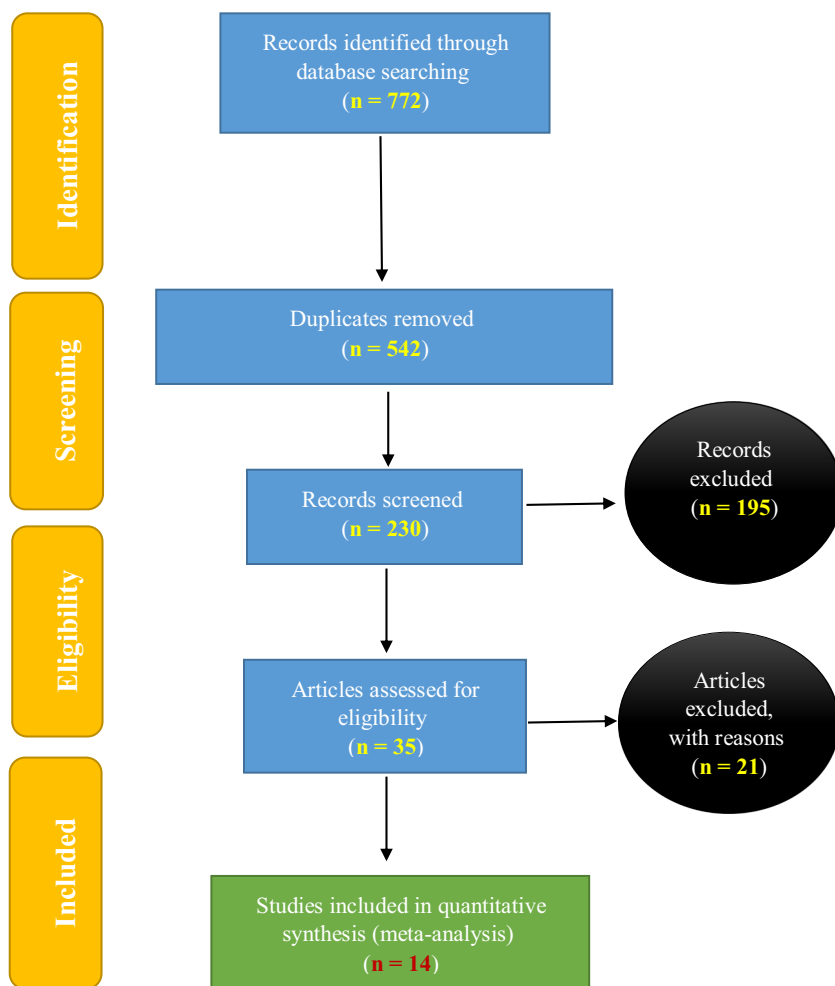
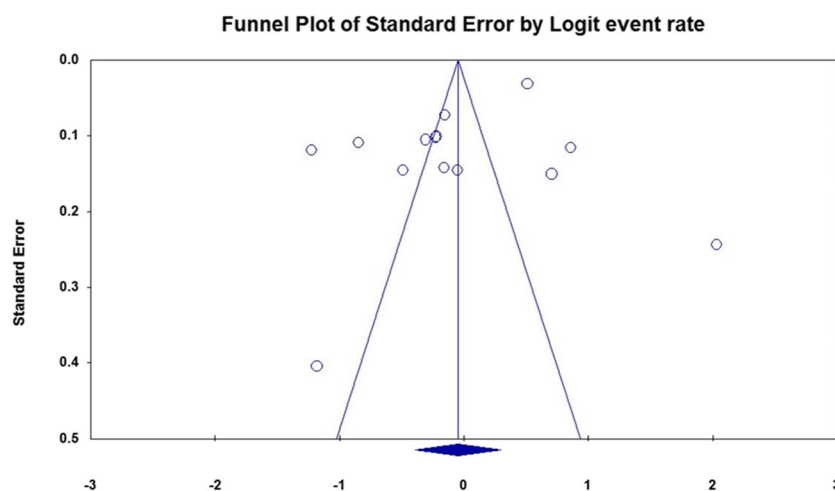


Fig. 4, with the increase in the sample size, sleep disorder prevalence in the older adults increases, which has a statistically significant difference ($p < 0.05$). Figure 5 also reports that with furthering the years of study, the sleep disorder prevalence in the older adults also increases, which was also statistically significant ($p < 0.05$).

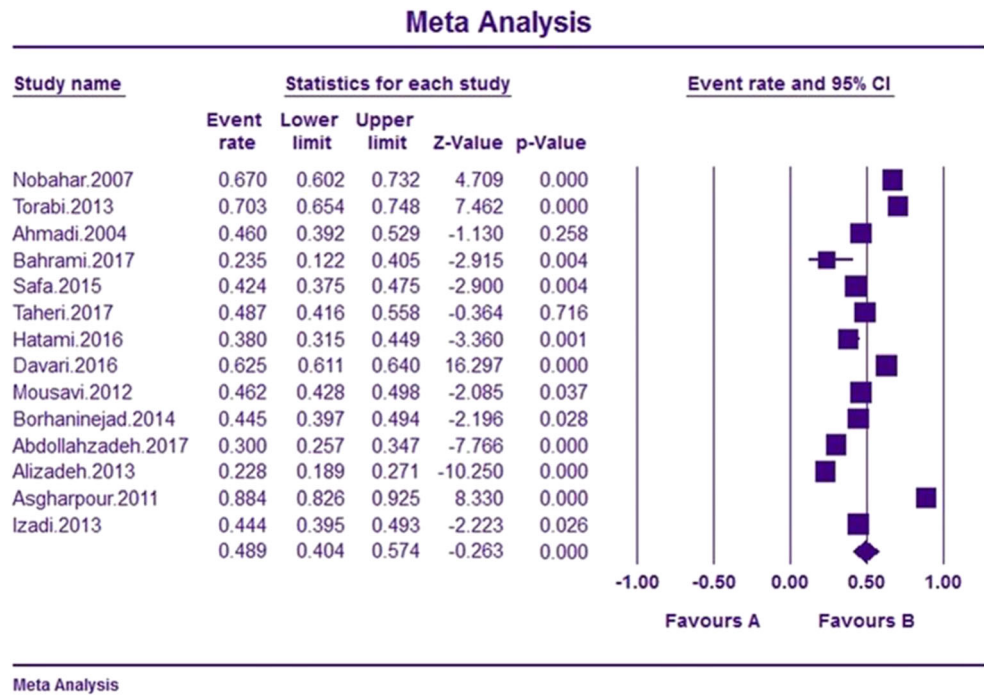
Fig. 2 The funnel plot of the results related to prevalence of sleep disorder in older adults Iranians



Discussion

Old age is a positive event in the life of any individual and longer life with a desirable quality during these ages will set the ground for the public health. The older adults cope with various physical and psychological problems and are at

Fig. 3 The total prevalence of sleep disorder among older adults Iranians based on random model



increased risk of developing chronic diseases, loneliness, and seclusion, which in turn results in expenditure of costs for the family and government, thus reducing the quality of life of people. Thus, understanding the situation of the older adults health and the factors develop and affect quality of life of them can be effective in developing practical and infrastructural plans as well as in reducing their diseases and problems (Sharif-zade & MoodiM, 2010; Sadeghiyan, Raei, & Hashemi, 2011; Nejati, 2009). In Iran and considering the progressive growth of the older adults’s population in the country, the diseases and health of them demands more attention. It is estimated that more than half of the older adults suffer from sleep disorders, where these disorders influences their lives considerably (Hellström, Hellström, Willman, & Fagerström, 2014). Poor sleep quality can predispose the older

adults to incidence of cognitive disorders, somnolence during the day, frequent naps, diminished performance during the day, and incur various socioeconomic consequences to the older adults, their family, and the society (dos Santos, Mansano-Schlosser, & Ceolim, 2013). Sleep disorder and its low quality in the older adults cause increased risk of psychological disorders, dependence on sedative drugs and their improper use, and increased probability of risks such as accidents and falls in the older adults. All these cause loss of functional capacity and personal independence of the older adults and eventually contributing to their dependence on others (dos Santos, Mansano-Schlosser, & Ceolim, 2013; Yang, Ho, Chen, & Chien, 2012; Harrington & Lee-Chiong Jr., 2007).

In the present study and in investigations done on sleep disorders among the older adults, the total prevalence of sleep

Fig. 4 The meta-regression diagram of prevalence of sleep disorder in the older adults by each individual sample size

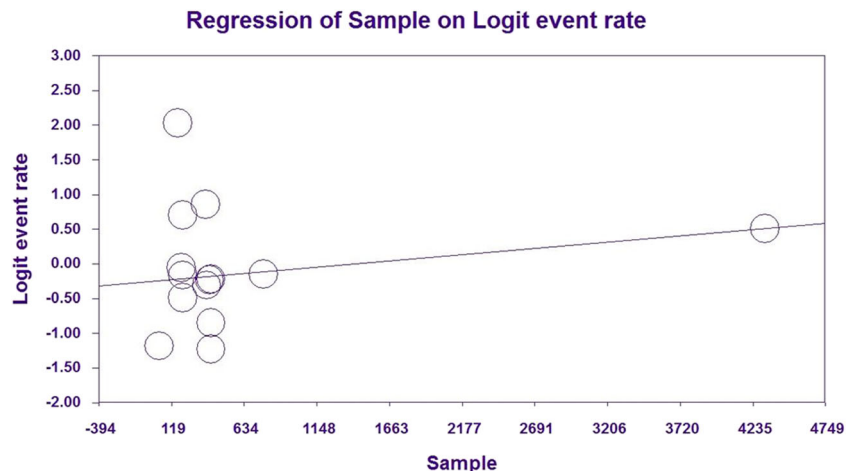
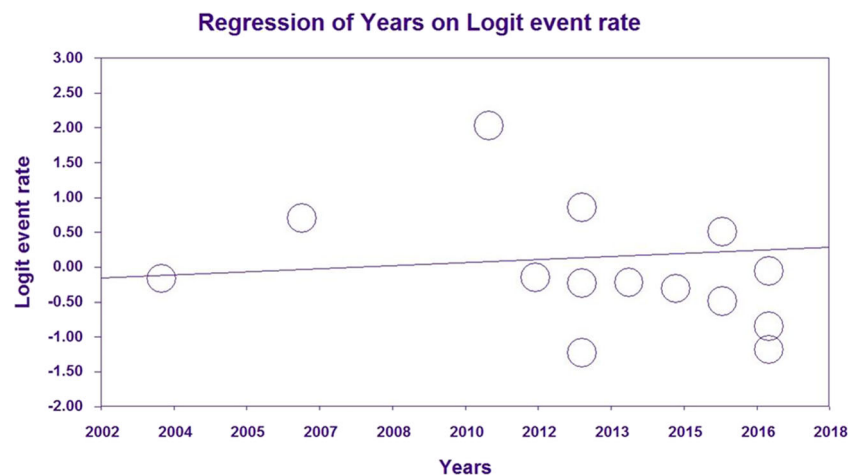


Fig. 5 The meta-regression diagram of prevalence of sleep disorders in the older adults by the year of study



disorder in Iranians older adults was reported as 48.9% based on meta-analysis. It is estimated that between 30 and 45% of the world's population suffer from insomnia and with ageing, this level also grows (Izadi Avajji, Adib Hajbaghery, & Afazel, 2009). The epidemiological studies conducted in this regard have shown that 57% of the older adults have had sleep problems and disorders (Ahmadi, Khankeh, Mohammadi, Fallahi, & Reza Soltani, 2010). In the studies performed on prevalence of sleep disorders in the older adults, high and different values have been reported. In an Italian study, prevalence of sleep disorder was reported as 50% (Mazza, Della Marca, De Risio, et al., 2004), in US it was over 50% (Roepke & Ancoli-Israel, 2010), and in Sweden (Lindstrom, Andersson, Lintrup, Holst, & Berglund, 2012) the value was reported as 70% of the older adults.

In a study conducted in Taiwan, it was reported that over 49% of the older adults have a poor sleep quality (Chia, Tung, Chin, & Chang, 2011). On the other hand, in another study in this country it was reported that prevalence of insomnia in western countries is 10–40% and in Taiwan it is over 25% (Yang, Ho, Chen, & Chien, 2012). In a Korean study, prevalence of sleep disorder was reported as 60% (Park, Yoo, & Bae, 2013), and in another study in USA prevalence of insomnia was reported to be over 57% (Mc Call, 2004). Bazargan et al. (Bazargan, n.d.) studied the older adults population of Afro-Americans and reported that around 13% of these individuals sleep less than 4 h at night and 14.5% of them wake up during their night sleep, with this awakening period lasting for 30 min.

In different studies (Safa, Adib-Hajbaghery, & Moradi, 2016; Bani, Hasanpour, Malakuti, Abedi, & Ansari, 2014) environmental factors such as noise, light, cold, heat, and physical factors such as coughs, pain, dyspnea and frequent urination, psychological factors such as anxiety and worry have been mentioned as the most important causes of sleep disorders in the older adults. These studies report that environmental factors are among the most important factors disturbing sleep and it is possible to improve their sleep quality through environmental health education in the older adults

(Safa, Adib-Hajbaghery, & Moradi, 2016). The studies done on investigating the sleep disorders in the older adults emphasize that most seniors use drugs to overcome their sleep problems (Safa, Adib-Hajbaghery, & Moradi, 2016). Lindstrom reports 17% for this level of drug consumption (Lindstrom, Andersson, Lintrup, Holst, & Berglund, 2012). On the other hand, another study suggests that 39% of sedative drugs are used for people above 60 years of age (Ahmadi, Khankeh, Mohammadi, Fallahi, & Reza Soltani, 2010). This value is considerable given the numerous side effects of sedatives in the older adults and prescription of sedatives in the older adults given the various complications and kidney problems, methods such as reinforcing suitable sleep habits, lifestyle and diet modification, regular exercise, alternative medicine, and developing educations to the older adults regarding complications of the drugs should be considered.

Various reports suggest that all in all countries of the world due to diminished fertility rate and enforcement of birth control policies, the population of individuals above 60 years of age which account for the senior citizens is growing more rapidly than any other age group (Hoseyni, Keshavarz, Amin, Maleki, & Abkenar, 2010; Asefzadeh, 2010). However, in Iran due to the socioeconomic development and the advances in the healthcare system, life expectancy has increased and the population ageing has become facilitated. The predictions in Iran show that the population above 60 years old will reach more than 10% by 2025 (Ghaderi et al., 2012; Raoufi, 2006). Thus, considering the rapid trend of older adults's population growth in the country, lifestyle modification, preventive measures, and screening for the at-risk older adults should be considered to prevent physical disabilities.

Conclusion

The results of this study indicated that prevalence of sleep disorders in Iranians older adults is very high and thus health

policymakers should pay a special attention to the older adults's health and consider serious interventional measures in this regard.

Compliance with Ethical Standards

Disclosure of Potential Conflicts of Interest The authors declare that they have no conflict of interest.

Research Involving Human Participants and/or Animals This research has not been done in human participants and/or animals.

Informed Consent Ethics approval was received from the ethics committee of deputy of research and technology, Kermanshah University of Medical Sciences. Reference Number: IR.KUMS.REC.1397.965. Since this study was not conducted in human participants, there was no need for informed consent.

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