Research Paper

Associations of Sleep Problems and Self-regulation With Interpersonal Aggression Among Healthcare Workers

Shakiba Rezaei[1], Azita Chehri[1*], Saeede Sadat Hosseini[1], Mokhtar Arefi[1], Hassan Amiri[1]

1. Department of Psychology, Faculty of Literature and Humanities, Kermanshah Branch, Islamic Azad University, Kermanshah, Iran.

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ABSTRACT

Background and Purpose: Sleep problems and aggression are common among healthcare workers due to shift work and constant interaction with patients and their relatives. The present study examined the associations between sleep problems, self-regulation, and interpersonal aggression among healthcare workers.

Materials and Methods: In this cross-sectional study, 400 healthcare workers were selected from four state-run hospitals in Kermanshah City, Iran, using a multi-stage random sampling between March 2021 and March 2022. The sample size was selected using the N>50+8m standard formula. The participants completed several standard scales, including the Pittsburgh sleep quality index, the Berlin questionnaire, the insomnia severity index, the self-regulation questionnaire, and the Buss-Perry aggression questionnaire. The obtained data were analyzed using the Pearson correlation, hierarchical multiple regression techniques, and standardized z scores.

Results: The Mean±SD age of the participants was 32.5±8.8 years and 70% were female. All sleep problems, including poor sleep quality, sleep apnea, and insomnia severity, are significantly related to the total score of interpersonal aggression and all its subfactors (P<0.001). The results showed that adding self-regulation to sleep problems to predict aggression greatly reduces the effect of sleep problems, especially the insomnia severity (P<0.001).

Conclusion: The results showed that self-regulation is not only a protective factor for aggression but also indirectly protects against aggression by controlling the severity of insomnia. Because both sleep problems and self-dysregulation are modifiable risk factors for interpersonal aggression, psychological interventions can target these risk factors.

Keywords: Aggression, Insomnia, Protective factors, Self-regulation, Sleep apnea, Sleep quality

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*** Corresponding Author:**
Azita Chehri, Assistant Professor.
Address: *Department of Psychology, Faculty of Literature and Humanities, Kermanshah Branch, Islamic Azad University, Kermanshah, Iran.*
Tel: *+98 (83) 372431816*
E-mail: *azitachehri@yahoo.com*

Introduction

Healthcare workers, due to their continuing workplace challenges and job burnout (about 30% to 60% affected) [1], are a community vulnerable to mental health problems and maladaptive behaviors such as aggression [2]. Although the research body in the past mainly focused on workplace violence against health workers [3], aggression towards clients and patients is also common in one-third of healthcare workers [2]. Aggression is an instinctive behavior that can be disproportionate or proportionate, depending on the situation [4]. Proportionate aggression is an adaptive behavior subject to social values, whereas disproportionate or extreme aggression is maladaptive, occurring in the face of actual or perceived risk [4]. Disproportionate aggression includes four categories: Anger, hostility, verbal aggression, and physical aggression [5]. Lifetime aggression is also prevalent in up to 80% of adult populations across cultures [6-8] and about 68% in Iranian adults [9-11].

Aggressive behaviors bear many consequences, including emotional problems, physical injuries, academic or work inability, psychosomatic complaints, chronic physical disability, and mortality [12-13]. Etiological studies are continuously trying to identify risk factors for aggression to facilitate the delivery of therapeutic interventions [14]. However, a better understanding and identification of the biopsychosocial factors associated with aggression can help formulate strategies and prevent it [15]. A fresh study classified risk factors for aggression into three general categories: Cortical thickness, personality pathology, and trauma exposure [14]. Nevertheless, aggression is a complex phenomenon affected by multiple risk factors, such as sociodemographic factors [10, 11, 15], physical illness and medication [10, 16], mental health conditions [15, 17], and sleep problems [18-20].

Sleep problems, which are included in the list of potential risk factors for the manifestation of aggressive behaviors [18-20], have a wide range of sleep disorders. However, the three categories of insomnia, sleep apnea, and poor sleep quality are among the most important sleep problems. Insomnia is characterized by persistent difficulty with sleep initiation, maintenance, consolidation, or quality that occurs despite adequate opportunity and circumstances for sleep [21]. Sleep apnea, also known as obstructive sleep apnea, is a sleep disorder in which periods of stopped breathing or shallow breathing occur more frequently during sleep. Each break lasts from a few seconds to a few minutes and occurs several times a night [22]. Poor sleep quality is a more general sleep disorder that includes several problematic components in subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, use of sleeping pills, and daytime dysfunction [23]. A meta-analytic review estimated the overall prevalence of sleep disorders to be 50% in Iran [24]. Sleep disorders are also common problems among healthcare workers, and their prevalence reaches about 80% [25].

Although cross-sectional and longitudinal associations between sleep problems and aggression are reported by some review studies [19, 20, 26, 27], other studies have attempted to identify protective factors for aggression, such as reading, regular physical exercise, sexual satisfaction, financial management, social network, intimate relationship, empathy, coping, self-control, emotion regulation, and self-regulation [10, 28-33]. Self-regulation is a multidimensional construct that includes cognitive, motivational-emotional, and physiological processes affecting the active control of goal-directed actions [34]. Self-regulation plays an active role in some systems, including active control, initiation, moderation, continuity, and coordination [34]. Many studies have reported higher levels of aggression in individuals with poor self-regulatory mechanisms [29, 31, 32]. The results of some studies, but not in Iran, support the role of self-regulation and some similar mechanisms in managing the aggressive behavior of health workers [2, 35, 36].

In addition to direct associations of sleep disorders and self-regulation with aggressive behaviors in health workers [2, 25, 35-37], the results of several studies specifically show that emotional self-regulation also mediates the effects of sleep problems on aggression [28-30]. However, previous studies on the protective role of self-regulation for aggression caused by sleep problems are limited in several aspects. First, these studies only reported the associations between sleep quality, deprivation, and aggression. Therefore, other sleep problems, such as sleep apnea and insomnia symptoms, have been neglected. Second, some studies did not include all aggression subscales, including anger, hostility, verbal aggression, and physical aggression. Third, different population groups (e.g. adolescents, adults, elderly, students, outpatients, and inpatients) were the target of previous studies [9, 10]. However, healthcare workers, who are a group at risk for sleep disorders (about 80%) and aggression (about 30%) [2, 25], have been largely ignored. Fourth, previous studies have mainly focused on violence against healthcare workers rather than the manifestations of aggression in them [11, 38].

However, the present study is novel and covers all four mentioned limitations. According to these considerations and limitations of the previous research, the present study aimed to explore the associations of both sleep problems (i.e. insomnia, sleep apnea, and poor sleep quality) and self-regulation with types of aggression (i.e. anger, hostility, verbal aggression, and physical aggression) among health workers. The study examined the association between sleep problems, self-regulation, and interpersonal aggression among health workers.

Materials and Methods

Study design and samples

The statistical population of the current cross-sectional study included all healthcare personnel working in four state-run hospitals in Kermanshah City, Iran, from March 2021 to March 2022. Using a multi-stage random sampling method, 450 healthcare staff were invited to participate in the study. The research team first randomly selected four government hospitals. Then, some departments of each hospital were randomly selected, and the staff list was provided. Finally, we randomly selected a few people from each department in proportion to the total number of people working there. The final sample consisted of physicians (n=62), nurses (n=233), guard staff (n=40), and service personnel (n=65). The sample size was calculated using two different methods. First, we calculated the power of the analyses and sufficiency of the sample for a small to medium anticipated effect size=0.20, power level=0.90, and α=0.05 for multiple regressions, including four predictor variables [39]. This analysis revealed a sample size of 82 for the present study. Second, we calculated the sample size for multiple regressions using a standard formula (N>50+8×number of predictor variables) [40, 41]. This analysis also revealed a sample size of 82 people for the present study. However, we used a sample size five times larger than the calculated amount to reduce all sampling errors, including α and β errors and the margin of error [41]. The sampling process was as follows. We invited 430 people to complete the questionnaires and 410 questionnaires were returned to the research team. The final sample consisted of 400 subjects after removing 10 subjects with large missing data. We included subjects fluent in Persian with an age range from 20 to 60 years, free from any pharmacotherapy or psychotherapy in the last 4 weeks, no substance abuse or drug addiction, and agreed to participate in the study. We also excluded physically disabled samples and subjects with many missing or invalid answers. The data collection process started after receiving the code of ethics from the Ethics Committee.

We first identified the samples and assured them about confidentiality. Then, the sample sociodemographic data, including gender and age groups, marital status, job condition, education level, and history of life-threatening illness, were collected using a self-report form. In the next step, 5 valid questionnaires to measure predictor and criterion variables were delivered to all participants by an experienced clinical psychologist. All questionnaires were distributed among the participants by a psychologist with a master's degree (Shakiba Rezaei) trained by the supervisor (Azita Chehri). The predictor variables included poor sleep quality, sleep apnea, insomnia severity, and self-regulation, which were evaluated using the Pittsburgh sleep quality index (PSQI), the Berlin questionnaire (BQ), the insomnia severity index (ISI), and the self-regulation questionnaire (SRQ), respectively. The criterion variable was evaluated using the Buss-Perry aggression questionnaire (BPAQ).

Research tools

The Pittsburgh sleep quality index (PSQI) is a validated, self-report questionnaire comprising 18 items divided into 7 dimensions [23]: Subjective sleep quality (question 9), sleep latency (item 2 mean score and item 5a score), sleep duration (question 4), sleep efficiency (questions 1, 3, and 4), sleep disturbance (mean of items 5b and 5j), use of sleeping pills (question 6), and daytime dysfunction (mean of items 7 and 8). Each question has a score of 0-3, with a maximum score of 3 for each component. A set of these seven dimensions makes up the total score on the scale, which ranges from 0 to 21. The cutoff score for poor sleep quality is typically 5 or higher. Scores above this cutoff point indicate sleep disturbance in the individual. An initial validation study reported the scale's Cronbach α equal to 0.83 and reported discriminant validity of the scale [23]. Also, the Persian version of PSQI is a good tool with acceptable discriminant validity and has a Cronbach α value of about 0.80 [42]. Another study reported the Cronbach α of the Persian version of PSQI equal to 0.94 [43].

The Berlin questionnaire (BQ) contains 10 questions in 3 categories to assess the risk for sleep apnea. Category I included 5 items related to snoring. Category II included 3 items related to daytime sleepiness, and category III included two items on the history of hypertension and or body mass index (BMI)>30 kg/m^2. The differential validity of this questionnaire has been reported as acceptable [44]. The Persian version of BQ is a good screening tool with acceptable discriminant validity, and it had an agreement coefficient reliability above 0.80 [45].

The insomnia severity index (ISI) is a 7-item questionnaire used to measure the severity of insomnia. The index measures problems with sleep onset, sleep maintenance, early morning awakening, sleep dissatisfaction, sleep disturbances affecting daytime functioning, the impact of sleep disturbances on quality of life, and distress caused by sleep disturbances. Each item is given a score from 0 to 4 depending on its severity, and a total score is calculated by adding the scores of these 7 items [46]. A validation study confirmed both the reliability (α>0.80) and convergent validity of the Persian version of the scale with polysomnographic variables [47]. Another study in Iran [43] reported that the Cronbach α of the Persian version of ISI was acceptable (α=0.92).

The self-regulation questionnaire (SRQ) is a 31-item questionnaire that assesses the ability and severity of self-regulation. The questionnaire is rated on a Likert-type scale from 1 to 5 (strongly disagree or strongly agree). The person's score ranges from 31 to 155, with higher scores indicating higher levels of self-regulation [48]. A previous study in Iran [34] reported that the reliability of this questionnaire is acceptable (α=0.93).

The Buss-Perry aggression questionnaire (BPAQ) is a 29-item scale used to measure aggression. The questions were scored on a 5-point rate, ranging from "extremely uncharacteristic of me" to "extremely characteristic of me". The BPAQ contains four subscales: Anger, hostility, verbal aggression, and physical aggression. The scores are normalized on a scale of 0 to 1, with 1 being the highest level of aggression [5]. According to a previous report [49], the test-retest reliability of the Persian version of PSQI equals 0.78, and factor analysis methods confirmed the scale's validity.

Data analysis

Data related to the continuous variables (age, aggression, poor sleep quality, sleep apnea, insomnia severity, and self-regulation) were reported as Mean±SD, and categorical data (gender groups, marital status, job condition, education level, history of life-threading illness) as frequency and percentage. We also compared the distribution of other variables, including marital status, education level, job condition, and life-threatening diseases.

Regarding the main objectives and analyses, we measured the relationship between predictors (poor sleep quality, sleep apnea, insomnia severity, and self-regulation) and criterion (all aggression subscales) variables using the Pearson correlation coefficients. In the next step, hierarchical linear regression analyses were used to identify the variables associated with aggression and its subscales. Before performing regression analyses, the non-violation of statistical assumptions (data normality, Durbin-Watson: Between 1.5 and 2.5, and the variance inflation factor: VIF <4) was checked and established [40, 41]. By entering all sleep problems in block 1 and self-regulation in block 2, we attempted to calculate both R^2 and ΔR^2. We compared ΔR^2 to determine how much additional variance of self-regulation was predicted in the outcome (i.e. aggression subscales). The sleep problems and self-regulation in all models correlated to aggression subscales were identified using the ENTER method. We also reported β regression coefficients for all predictors in both blocks. Then, the differences in the β coefficients for sleep problems between blocks 1 and 2 (before and after entering the self-regulation variable) were reported using standardized z-scores. Because a larger sample size increases the power of statistical models and prevents biased results, we refrained from independently analyzing the subgroups (e.g. doctors or nurses) [40]. All statistical analyses were performed using SPSS software, version 25 (IBM Corp., Armonk, NY, USA) for two-tail tests and a P<0.05.

Results

Table 1 presents the sample's distribution of demographic variables and disease history. As seen, 70% of the samples were female, 76% were married, and 58% were nurses. The Mean±SD of age is 32.5±8.8 (between 20 and 55 years). This Table also shows that about 6% of the sample have a life-threading illness history.

Table 2 presents the descriptive data Mean±SD and Pearson correlations between the predictor (poor sleep quality, sleep apnea, insomnia severity, and self-regulation) and criterion (aggression) variables. According to Table 2, the correlations between self-regulation and aggression variables are strongly significant (P<0.001). The negative correlations range from −0.623 (verbal aggression) to −0.726 (the total score of aggression). However, the correlations between all sleep and aggression variables are weakly to moderately significant (P<0.001). The correlations with the aggression subscales range from 0.306 to 0.385, 0.298 to 0.367, and 0.456 to 0.521 for poor sleep quality, sleep apnea, and insomnia severity, respectively.

Table 3 presents the hierarchical linear regressions predicting sleep problems and self-regulation as blocks to predict the aggression subscales and total score. In block 1, three sleep problems, including poor sleep

Table 1. The participants' demographic characteristics and disease history

Variables		No. (%)/Mean±SD
Gender	Female	280(70)
	Male	120(30)
Age (y)		32.5±8.8
Marital status	Single	97(24.3)
	Married	303(75.7)
Education level (y)	12	5(1.3)
	14	62(15.5)
	16	175(43.8)
	18-22	158(39.5)
Occupation	Guard	40(10)
	Service force	65(16.2)
	Nurse	233(58.3)
	Physician	62(15.5)
Life-threading illness	None	375(93.7)
	Cardiovascular	16(4.0)
	Cancer	1(.3)
	Respiratory	8(2.0)

quality, sleep apnea, and insomnia severity, significantly predict all aggression subscales and total scores (all R^2 ranging from 0.211 to 0.284, P<0.001). While poor sleep quality and sleep apnea are mostly mildly non-significantly related to aggression subscales, insomnia severity is strongly related to aggression and all subscales (β ranging from 0.373 to 0.483, P<0.001). In block 2, three sleep problems and self-regulation significantly predict all aggression subscales and total scores (ΔR^2 ranging from 0.192 to 0.256, all P<0.001). In other words, self-regulation increases by 19.2% to 25.6%, the power of predicting aggression by sleep problems. Thus, self-regulation is strongly related to aggression, and all subscales (β ranging from −0.574 to −0.663, P<0.001).

Table 2. The descriptive data and Pearson correlations between the predictor and criterion variables (n=400)

Predictors	Mean±SD	Aggression				
		Physical (25.75±6.12)	Verbal (14.47±3.87)	Anger (18.45±5.15)	Hostility (21.97±5.64)	Total (80.65±18.91)
Poor sleep quality	7.21±2.30	0.356	0.306	0.369	0.359	0.385
Sleep apnea	1.85±1.73	0.362	0.298	0.308	0.353	0.367
Insomnia severity	11.03±4.64	0.471	0.456	0.494	0.473	0.521
Self-regulation	108.01±15.74	−0.659	−0.623	−0.690	−0.663	−0.726

All correlations are significant at P<0.001.

Table 3. The hierarchical linear regressions predicting both sleep problems and self-regulation as blocks to predict aggression

Variables		Physical		Verbal		Anger		Hostility		Total	
		β	P	β	P	β	P	β	P	β	P
Block 1	Poor sleep quality	0.059	0.976	0.021	0.732	0.104	0.082	0.068	0.255	0.072	0.217
	Sleep apnea	0.126	0.027	0.061	0.295	0.014	0.799	0.108	0.059	0.089	0.106
	Insomnia severity	0.483	<0.001	0.410	<0.001	0.423	<0.001	0.373	<0.001	0.478	<0.001
	R^2	0.239	<0.001	0.211	<0.001	0.252	<0.001	0.239	<0.001	0.284	<0.001
Block 2	Poor sleep quality	−0.073	0.162	−0.106	0.052	−0.037	0.466	−0.065	0.217	−0.075	0.118
	Sleep apnea	0.078	0.112	0.014	0.784	−0.038	0.424	0.059	0.228	0.035	0.428
	Insomnia severity	0.109	0.042	0.162	0.004	0.150	0.004	0.114	0.033	0.143	0.004
	Self-regulation	−0.596	<0.001	−0.574	<0.001	−0.635	<0.001	−0.601	<0.001	−0.663	<0.001
	Change in R^2	0.208	<0.001	0.192	<0.001	0.236	<0.001	0.211	<0.001	0.256	<0.001

Table 3 for block 2 also shows that adding self-regulation to three sleep problems to predict aggression dramatically reduces the effect of sleep problems, especially the insomnia severity (from β=0.373 to 0.483 for all types of aggression to β=0.109 to 0.162). Table 4 presents that all standardized β coefficients for insomnia severity in blocks 1 and 2 are strongly different (z scores ranging from −3.098 to −5.882, P<0.001).

Discussion

The present study aimed to investigate the associations of sleep problems (poor sleep quality, sleep apnea, and insomnia) and self-regulation with aggression subscales, including anger, hostility, verbal aggression, and physical aggression among health workers. Previous studies show that aggressive behaviors and sleep disorders are common problems among health workers [2, 25]. Our results show that all sleep problems are significantly (but with weak to moderate effect sizes) related to the total score of aggression and all its subscales. Although one study did not find significant relationships between sleep problems and aggressive behaviors [50], several other studies reported the associations between some sleep problems (e.g. insomnia and sleep apnea) and aggression in both adult populations [18-20, 26] and other specific populations such as patients with epilepsy [27, 51]. Some studies also reported the relationship between sleep problems (e.g. insomnia and poor sleep quality) and aggressive behaviors among health workers [25, 37]. For example, one study found that poor sleep quality was significantly related to all aggression subscales [25]. However, studies among healthcare workers are few, and we found no contrary findings suggesting that sleep problems are not associated with aggression.

We found that insomnia severity, poor sleep quality, and sleep apnea are the most important sleep problems associated with all subfactors of aggression. This finding is consistent with previous studies investigating healthcare workers [25, 37]. Sleep problems can impair

Table 4. Differences in the standardized β coefficients for sleep problems between blocks 1 and 2

Sleep Problems	Physical		Verbal		Anger		Hostility		Total	
	z	P	z	P	z	P	z	P	z	P
Poor sleep quality	−1.863	0.031	−1.795	0.036	−1.992	0.023	−1.877	0.030	−2.075	0.019
Sleep apnea	−0.684	0.247	−0.663	0.254	−0.733	0.232	−0.695	0.243	−0.764	0.222
Insomnia severity	−5.882	<0.001	−3.835	<0.001	−4.230	<0.001	−3.098	<0.001	−5.303	<0.001

prefrontal cortex function, weakening top-down inhibition of aggressive behaviors [52]. The biological basis for the relationships between these phenomena is still unknown, and only speculative hypotheses have been put forward to explain them [27].

Our results also showed a significant negative relationship between self-regulation and all subscales of aggression. This finding is consistent with the results of previous studies among various population groups [28-30, 32, 33]. Conversely, one study did not report any significant relationship between some components of emotion regulation and aggression [53]. However, the results of some other studies supported the importance of self-regulation and similar mechanisms in health workers' management of aggressive behavior [2, 35, 36, 54]. Self-regulation refers to internal and or transactional processes that enable individuals to direct their activities toward goals under changing circumstances over time [55]. People with high self-regulation continuously perform self-evaluation and self-monitoring, which can lead to self-organization and more adaptive behaviors. These are likely to be more self-efficacious and conscientious individuals who try to commit to a healthy lifestyle, including stress management, regular exercise, healthy eating, and regular sleep patterns. Therefore, poor self-regulation may be the direct and indirect facilitator of aggression.

Although aggression is a mental health problem with multifactorial risk factors (e.g. sociodemographic factors, physical illness and medication, and mental health conditions) that go beyond sleep problems and emotional dysregulation [10, 11, 15-17], we wanted to know what changes are made in the effect sizes of sleep problems when the self-regulation variable is added to the list of sleep variables in the regression models. Consistent with previous studies that showed the mediating role of emotional regulation in the relationship between sleep quality and aggression [29, 30], our results showed that adding self-regulation to the list of three sleep problems to predict aggression greatly reduces the effect size of both insomnia severity and in a milder way poor sleep quality. Although entering the variables with strong correlation into the regression model generally reduces the intensity of the associations of other predictor variables with the criterion variable [40], the finding means that the self-regulation (because of making very significant changes in the models) is directly a protective factor for aggression and indirectly reduces aggression by controlling the severity of insomnia. Although we could find no studies reporting a protective role of self-regulation on aggression by controlling sleep problems, a study by Demichelis et al. [29] showed that emotion regulation mediates the effects of sleep on aggression. However, self-regulation through promoting a healthy lifestyle [56] and increasing commitment to plans and goals dramatically reduces the risk of sleep problems and aggression.

We believe that the present study represents a pioneering work in reporting associations between three sleep problems and all subfactors of aggression. To our knowledge, previous studies do not report a protective role of self-regulation for aggression by controlling sleep apnea and insomnia severity [28-30]. However, the present research faces some limitations. First, using a cross-sectional design and self-report instruments prevents the reporting of causal relationships between the variables [57]. However, longitudinal evidence from future studies could provide valuable information for mental health researchers and clinicians. Second, some evidence supports the different symptoms and prevalence of aggression between men and women [58]. Although the comparison of gender groups was not the aim of the present study, future reports could use independent analyses for men and women. Third, most participants were between 20 and 40 years old, which can be a warning to generalize the findings to other age groups. Last, our sample was limited to health workers because they suffer more from sleep problems due to shift work. Thus, generalizing the present findings to other groups of society requires caution.

Conclusion

The present results showed that all sleep problems (positively) and self-regulation (negatively) are significantly related to the total score of aggression and all its subfactors, including anger, hostility, verbal aggression, and physical aggression. We found that the self-regulation variable is a protective factor for aggression and indirectly protects against aggression by controlling sleep problems, especially for insomnia severity. However, both sleep problems and self-dysregulation are modifiable risk factors for interpersonal aggression. Potentially, delivering interventions that promote self-regulation by controlling sleep problems may significantly prevent aggressive behaviors in adult health workers. However, the present study is limited to a cross-sectional design that includes only health workers and does not provide the results of gender and age subgroup analysis. Therefore, longitudinal evidence from future studies across the subgroups can give valuable information to mental health researchers, clinicians, and policymakers.

Ethical Considerations

Compliance with ethical guidelines

All procedures performed in the study involving human participants were conducted following the 1964 Helsinki Declaration. The study procedures were approved by the Ethics Committee of Kermanshah University of Medical Sciences (Code: IR.KUMS.REC.1402.130). Written informed consent was obtained from all individual participants included in the study.

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Authors contributions

Conceptualization: All authors; Methodology and analysis: Shakiba Rezaei and Hassan Amiri; Data collection: Shakiba Rezaei; Investigation: Saeede Sadat Hosseini and Mokhtar Arefi; Writing: All authors; Supervision: Azita Chehri.

Conflict of interest

The authors declared no conflict of interest.

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