Gastrointestinal and Cardiovascular Effects of Shiftwork in Nurses

Narges Kaydani[1], MSc;
Kourosh Zarea[2], PhD; Ahmad
Soltanzadeh[3], PhD

[1]Department of Nursing, School of Nursing and Midwifery, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[2]Department of Nursing, School of Nursing and Midwifery, Nursing Care Research Center in Chronic Diseases, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[3]Department of Occupational Health & Safety Engineering, Faculty of Health, Qom University of Medical Sciences, Qom, Iran

Correspondence:
Ahmad Soltanzadeh, PhD;
Department of Occupational Health & Safety Engineering, Faculty of Health, Qom University of Medical Sciences, P.O. Box: 37156-14566, Qom, Iran
Tel: +98 25 37842226
Email: soltanzadeh.ahmad@gmail.com

Abstract

Background: Gastrointestinal and cardiovascular diseases are considered to be among the consequences of shiftwork in nursing staff. This study aimed to investigate the prevalence of gastrointestinal and cardiovascular diseases and model their consequences in nurses.

Methods: This cross-sectional study was conducted in seven hospitals in Khuzestan Province in 2020. The participants of the study were 652 nurses. The data were collected through a questionnaire developed by Choobineh et al. The questionnaire included demographic questions and shift work related health effects. The modeling was performed via logistic regression in SPSS 22.

Results: The prevalence of gastrointestinal (52.53% vs. 35.19%) and cardiovascular (35.02% vs. 22.22%) disorders were significantly higher in shift-working nurses than in day-working ones (P<0.05). In addition to shiftwork, work experience, working hours per week, and hospital wards significantly affected the prevalence of gastrointestinal disorders in nurses (P<0.05). The shiftwork system, age, work experience, and working hours per week had significant positive correlations with the prevalence of cardiovascular diseases in nurses (P<0.05). Furthermore, the chance of having gastrointestinal and cardiovascular diseases was 2.73 and 2.08 times more in shift-working nurses than in day-working ones, respectively.

Conclusion: Beside the shift work, the findings of the study indicated the important role of other risk factors, such as age, work experience, working hours per week, and hospital wards for the prevalence of gastrointestinal and cardiovascular diseases in nurses. Therefore, it is recommended that these factors should be taken into account while trying to manage, control, and reduce such negative consequences in nurses.

Introduction

The world today appreciates the added importance of shiftwork more than day work because it can offer modern societies considerable technical, economic, social, and humanistic advantages. Nevertheless, despite the positive effects of such a new working trend on the world's economy and quality of social services, shiftwork can ruin the workers' health and cause several types of disorders threatening their physical and mental health.[1-3]

Shiftwork can lead to adverse socioeconomic consequences because it can increase the risk of accidents and injuries and negatively affect the workers' safety, especially in the night shift.

Epidemiologic studies have proven that disorders in circadian rhythms resulting from shiftwork and working the night shift are positively correlated to insomnia, gastrointestinal disorders, cardiovascular diseases, mental disorders, and musculoskeletal disorders.[4-6] Complex workplaces such as hospitals are of key importance to societies and governments because of their significant role in looking after the health condition of people and their lives. In these workplaces, the combination of shiftwork with several other risk factors, such as challenging physical and cognitive needs and lack of complete control on one's work, as well as mental and social stressors, can exert negative effects on individuals' health conditions.[4, 7, 8] Nursing and nurses focus on providing people with healthcare and medical services. Therefore, nurses' mental and physical health is a key issue in its own right for medical and healthcare systems.[4, 7]

Several studies have demonstrated that the negative impacts of facing different occupational risk factors such as shiftwork together with personal and organizational risk factors can harm the nurses' health and deteriorate their performance either directly or indirectly, resulting in traumatic events capable of impairing organizational efficiency.[3, 7, 9] Research shows that shift-workers, for instance working the night shift, are mentally and physically weaker than their day-working counterparts because they suffer more from insomnia, stress, family and social turmoil, incompatibility mechanisms, lack of physical activity, and some other personal health deficits.[10-12] These findings underline the fact that studying, analyzing, and modeling the possible effects of shiftwork on the nurses' health has a great significance, and each of such studies can identify and analyze specific disorders and problems and thus help reduce the prevalence of these disorders in nurses.[4, 7]

Consequently, given that hospitals and medical centers include shiftwork more than other occupational sectors, their personnel and workers run the risk of suffering from mental, physical, and social disorders more than others. Some studies report that the chance of contracting chronic gastrointestinal and cardiovascular diseases as well as other diseases is higher in shift-working nurses, especially those working the night shift. Diseases prevalent in shift-working workers,[5, 6] particularly in nurses,[4] include breast cancer,[13] colorectal cancer,[8] diabetes,[14] performance and safe behavior deterioration, obesity,[15] and mental disorders such as relational disorders with one's spouse and children.[16] Thus, this study aimed at investigating the prevalence of gastrointestinal and cardiovascular diseases and modeling their consequences in nurses. It is noteworthy that the findings of various studies on the prevalence of cardiovascular diseases as well as gastrointestinal disorders have been sometimes different and contradictory. Therefore, the innovation of this study included modeling these health effects in nursing staff and identifying and evaluating the contribution of various variables in the prevalence of these disorders.

Methods

This cross-sectional study was carried out in seven hospitals in Khuzestan Province in 2020. This study included all nurses (652 nurses) working in seven hospitals in Khuzestan Province. The census-based method was utilized to select the sample. The participating nurses belonged to different hospital wards: emergency (88 nurses), internal (115 nurses), surgery (122 nurses), children (110 nurses), CCU (111 nurses), and ICU (106 nurses). All the participants signed the informed consent forms of the study. A total of 636 nurses (out of 652 ones) filled out the questionnaire of gastrointestinal and cardiovascular effects of shiftwork (97.54% participation rate). Inclusion criteria were having more than one year of work experience. Exclusion criteria included family history of gastrointestinal and cardiovascular diseases, as well as unwillingness of individuals to participate in the study.

Instrument and Data Collection

The data of the study were collected by a comprehensive questionnaire designed and developed by Choobineh et al.[1, 2, 5, 6] Based on research conducted by Choobineh and his colleagues, the Cronbach's alpha of this questionnaire was 0.81. It is noteworthy that the questionnaire of Choobineh et al. was developed to assess shift work and its effects in the petrochemical industry. Therefore, in line with the aim of the current study, which was modeling the effects of shiftwork on the prevalence of gastrointestinal and cardiovascular diseases in nurses, the questionnaire was revised and modified to some degree. Of note, the Cronbach's alpha coefficient of the revised version of the questionnaire was found to be $\alpha=0.86$ in this study. This standardized questionnaire includes some sections on demographic information and personal characteristics (age, work experience, marital status, education level, and the number of children), the shiftwork system features (working hours per day and clockwise/anticlockwise shiftwork, and shiftwork schedule), gastrointestinal disorders (appetite increase or decrease, constipation/diarrhea, indigestion, gastric ulcers, and stomach ache/sour stomach), and cardiovascular diseases (heart palpitations, chest pain, and high blood pressure).[1, 2, 5, 6]

Additionally, the data on health effects were collected on a ranking scale involving nothing, sometimes (less than 5 times per year), often, and always. As to the data collection process, first, after coordination with the supervisors, the questionnaires were provided to the nurses, and then a complete

explanation of its content and how to complete the questionnaires were provided to them. This process took 1 to 2 hours for each hospital ward.

Analysis and Modeling

The analysis and modeling of the data were carried out using SPSS version 22. The significance level was set at 0.05. Because the data were normally distributed, t-test was utilized to compare the means of independent variables (age, work experience, and working hours per week), and Chi-squared test was used to analyze the difference in the prevalence of gastrointestinal and cardiovascular diseases between shift-working nurses and day-working nurses. The analysis and modeling of variables influencing the prevalence of gastrointestinal and cardiovascular diseases in nurses were carried out using the logistic regression test. In this modeling procedure, the analysis of the effects of gastrointestinal and cardiovascular risk factors was performed by the forward wald model of logistic regression. To model the data, we first analyzed the significance of correlations between each independent variable affecting gastrointestinal and cardiovascular diseases, and then the qualified parameters and variables (P<0.25) were entered into the regression analysis model.[17]

Results

Of 636 nurses, 162 were day-working nurses and 474 were shift-working ones. The results of t-test for the comparison of the demographic information of the two groups (day-working and shift-working nurses) revealed that the two groups were not significantly different in terms of age, work experience, working hours per week, and the number of children (P>0.05). Moreover, the results of Chi-square test on the demographic characteristics of the two groups showed that day-working nurses and shift-working nurses were not significantly different in terms of gender and marital status (P>0.05), yet they were significantly different regarding the education level (P=0.033) (Table 1).

The results of the frequency distribution of day-working and shift-working nurses based on different hospital wards demonstrated that the highest frequency for shift-working nurses belonged to surgery (18.78%), internal (17.93), and ICU (16.88) wards, and the highest frequency for day-working nurses belonged to children (20.99%), surgery (19.75%), and CCU (18.52%) wards (Figure 1). In addition, the comparative results of hospital wards based on their shiftwork system showed that there were significant differences across different hospital wards in this regard (P<0.05).

The analysis of the prevalence of gastrointestinal disorders in nurses revealed that these disorders were significantly more prevalent in shift-working nurses than in their day-working counterparts (P<0.05). The most prevalent type of gastrointestinal disorders in shift-working and day-working nurses

Table 1: The results of analyzing demographic characteristics of the participating nurses

Demographic characteristics		Day-working nurses (n=162)	Shift-working nurses (n=474)	P value
Age (year)		37.62±5.36	36.9±5.14	0.205
Work experience (year)		11.33±4.55	11.87±5.01	0.112
Working hours per week		54.61±4.35	50.9±4.10	0.072
No. of children		1.35±0.79	1.66±1.15	0.195
Gender	Female	118 (72.84%)	352 (74.26%)	0.118
	Male	44 (27.16%)	122 (25.74%)	
Marital status	Single	107 (66.05%)	218 (46%)	0.084
	Married	55 (33.95%)	256 (54%)	
Education level	BSN	131 (80.87%)	163 (34.39%)	0.033
	MSN or higher	31 (19.13%)	311 (65.61%)	

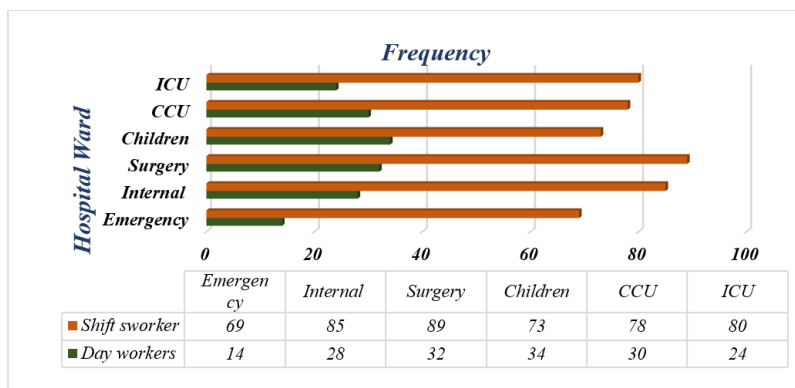BSN: Bachelor of Science in Nursing; MSN: Master of Science in Nursing

Figure 1: Results of the frequency of the studied nurses in different hospital wards.

included indigestion, and the lowest prevalent type of gastrointestinal disorders in the two nurse groups included constipation/diarrhea (Table 2).

The analysis of the prevalence of cardiovascular diseases in nurses showed that such disorders were significantly more prevalent in shift-working nurses than in day-working ones (P<0.05). The most prevalent types of cardiovascular diseases in shift-working and day-working nurses comprised high blood pressure. Additionally, the lowest cardiovascular diseases in the two nurse groups included heart surgery (Table 3).

The results of t-test and Chi-square analyses of gastrointestinal and cardiovascular diseases in the two independent groups (day-working and shift-working nurses) showed that the shiftwork system, age, work experience, working hours per week, the number of children, gender, marital status, education level, and hospital wards were qualified to enter the logistic regression model (P<0.25). The modeling results demonstrated that the shiftwork system, work experience, working hours per week, and hospital wards had significant positive correlations with gastrointestinal disorders (P<0.05). It was also observed that the chance of having gastrointestinal disorders was higher in shift-working nurses than in

day-working ones (P<0.001, OR=2.73) and higher in nurses working more than 48 hours a week than in nurses working fewer hours (P<0.008, OR=1.78). Furthermore, it was found that the chance of having gastrointestinal disorders was significantly higher in shift-working nurses compared to day-working ones (P<0.008; OR=1.55). The findings also showed that the prevalence of gastrointestinal disorders in different hospital wards was as follows: ICU (OR=1.9), surgery (OR=1.86), internal (OR=1.55), CCU (OR=1.45), and emergency (OR=1.4) (Table 4).

The results of the relationship between shiftwork and cardiovascular diseases in nurses revealed that these disorders had significant positive correlations with the shiftwork system, age, work experience, working hours per week, number of children, gender, marital status, education level, and hospital wards. Hence, all the abov-ementioned variables were qualified to enter the regression model (P<0.25). The results of modeling variables affecting the prevalence of cardiovascular disease in nurses demonstrated that the shiftwork system, age, work experience, and working hours per week had significant positive correlations with cardiovascular diseases (P<0.05). It was found that the chance of having cardiovascular

Table 2: The results of analyzing the prevalence of gastrointestinal disorders in the participating nurses

Gastrointestinal disorders	Day-working nurses (n=162)	Shift-working nurses (n=474)	P value
Increase or decrease in appetite	15 (9.26%)	78 (16.46%)	0.005
Constipation/diarrhea	9 (5.56%)	48 (10.13%)	0.012
Indigestion	23 (14.20%)	109 (23.00%)	0.004
Gastric ulcers	19 (11.73%)	97 (20.46%)	0.001
Stomach ache/sour stomach	16 (9.88%)	90 (18.99%)	0.001
Gastrointestinal disorders	57 (35.19%)	249 (52.53%)	0.001

Table 3: The results of analyzing the prevalence of cardiovascular diseases in the participating nurses

Cardiovascular diseases	Day-working nurses (n=162)	Shift-working nurses (n=474)	P value
Heart palpitations	8 (4.94%)	37 (7.81%)	0.002
Chest pain	14 (8.64%)	59 (12.45%)	0.031
High blood pressure	21 (12.96%)	90 (18.99%)	0.006
Heart surgery	2 (1.23%)	9 (1.90%)	0.023
Cardiovascular diseases	36 (22.22%)	166 (35.02%)	0.001

Table 4: The regression modeling of parameters affecting gastrointestinal disorders in the participating nurses

Independent variable		OR	SE	CI$_{95\%}$	P value
Experience		1.55	0.04	(1.47, 1.63)	0.001
Shiftwork System	Day work			1.0	0.001
	Shift work	2.73	0.58	(1.59, 3.87)	
Working hours per week	≤48 hrs			1.0	0.008
	≥48 hrs	1.78	0.11	(1.56, 2)	
Hospital wards	Children			1.0	0.001
	Emergency	1.4	0.06	(1.28, 1.52)	
	CCU	1.45	0.12	(1.21, 1.69)	
	ICU	1.9	0.21	(1.49, 2.31)	
	Surgery	1.86	0.18	(1.51, 2.21)	
	Internal	1.55	0.09	(1.37, 1.73)	

Table 5: The regression modeling of parameters affecting cardiovascular diseases in the participating nurses

Independent variable		OR	SE	CI$_{95\%}$	P value
Age		1.37	0.1	(1.17, 1.57)	0.001
Experience		1.22	0.07	(1.08, 1.36)	0.007
Shiftwork System	Day work			1.0	0.001
	Shift work	2.08	0.37	(1.35, 2.81)	
Working hours per week	≤48 hrs			1.0	0.001
	≥48 hrs	1.45	0.08	(1.29, 1.61)	

diseases was significantly higher in nurses with the mean age of OR=1.37 and mean work experience of OR=2.08. Besides, it was observed that such a chance was 2.08 times higher in shift-working nurses than in day-working nurses (P<0.001, OR=2.08). Finally, results showed that the chance of having cardiovascular diseases was 1.45 times higher in nurses working more than 48 hours per week than in those working fewer hours a week (<48 working hours per week) (Table 5).

Discussion

The aim of present study was modeling gastrointestinal and cardiovascular effects in the nursing staff. Accordingly, the findings indicated that working on shiftwork with some variables including working in different hospital wards, working hours and some demographics variables including age and work experience could cause serious health problems such as gastrointestinal and cardiovascular diseases.

Of note, given the observed significant difference between shift-working and day-working nurses in terms of the prevalence of gastrointestinal and cardiovascular diseases on the one hand and the non-significant difference between the two groups in terms of personal and demographical variables, it can be predicted that such personal and demographic variables have marginal effects on the prevalence of the above-mentioned disorders in nurses. The results of t-test and Chi-square showed that different variables had significant relationships with gastrointestinal disorders. The results of logistic regression modeling demonstrated that, in addition to shiftwork, covariates such as work experience, working hours per week, and hospital wards could exert significant effects on the prevalence of gastrointestinal disorders in nurses. The results of the study also revealed that the chance of having gastrointestinal disorders was 2.73 times higher for shift-working nurses than for day-working ones, and working long hours could enhance the chance of contracting such diseases by 78%. Moreover, it was observed that the prevalence of gastrointestinal disorders in nurses working in the surgery ward and ICU ward was 1.9 and 1.86 times more than that of such disorders in nurses working in other hospital wards. The prevalence of these disorders was also 1.55 times more in nurses having longer work experience. Several studies have reported that any impairment in the circadian rhythm (24-hour cycle of the body) of the

gastrointestinal system can cause disorders in gastric acid secretion, which in turn can lead to gastric ulcers in the long run.[18-20] Studies conducted by Choobineh and his colleagues show that not only shiftwork but also long working hours and long work experience can increase the risk of contracting gastrointestinal diseases because people are exposed to various risk factors (for example, working the night shift, long shiftwork in a day or a week, and arduous physical and mental workplace challenges) for a longer time.[2, 5, 6] Consistent with these findings, the results of Bushnell et al.'s study showed that shift work and long working hours caused health effects.[21] Various gastrointestinal disorders associated with shift work, long working hours, and heavy physical/cognitive work demands have been reported in some studies.[22]

Long-term exposure to various occupational risk factors can have different effects on people's health, such as cardiovascular diseases and other health effects.[23-25] The results of analyzing and modeling the effects of shiftwork on cardiovascular diseases also revealed that different single-variable parameters correlated significantly with such disorders. Accordingly, the logistic regression modeling results showed that shiftwork together with age, work experience, and working hours per week covariates had significant effects on the prevalence of cardiovascular diseases in nurses. Moreover, the results showed that the chance of having cardiovascular diseases in shift-working nurses was 2.08 times higher than in day-working nurses. Likewise, experiencing longer working hours, such as working overtime, can increase the risk of suffering from such disorders by almost 50%. Furthermore, the regression model also showed that age and work experience significantly influenced the prevalence of cardiovascular diseases in nurses as those older and with more work experience were predicted to suffer 1.37 and 1.22 times more from cardiovascular diseases, respectively. In general, there are mixed findings regarding the detrimental effects of shiftwork on cardiovascular diseases; whereas some studies have reported significant effects,[26-28] some others have found no significant relationships. For instance, Choobineh et al. reported that although cardiovascular diseases were quite prevalent in shift-workers, there was no significant difference between shift-workers and dayworkers in this regard.[1, 5, 6] The results of the current study are in the same line with the former group because

it was observed that cardiovascular diseases were significantly more prevalent in shift-working nurses than in their day-working counterparts with shift-working nurses running the risk of contracting such disorders 2.08 times more. Similar to gastrointestinal disorders, cardiovascular diseases are influenced by some other factors apart from shiftwork. In agreement with the findings of this study, research shows that age, work experience, and working hours are the three factors that can significantly affect the prevalence of cardiovascular diseases in workers.[29, 30] The results of some studies, such as the findings of Puttonen et al., and Sun et al.'s studies, showed that shift work and long working hours, as well as physical and psychological demands in occupational activities were important risk factors for this type of disorder.[31, 32]

It should be noted that although this study is a comprehensive study which aimed to investigate the effects of the shiftwork system and personal/organizational risk factors on the prevalence of gastrointestinal and cardiovascular diseases in nurses, it has its own limitations. For example, despite the random review of medical records of the subjects, it should be noted that we used the self-reported data. Therefore, based on the findings of the study and authors' experience, it is suggested that longitudinal, futuristic studies should be carried out to investigate and analyze the risk factors influencing gastrointestinal and cardiovascular diseases in nursing society. Moreover, more comprehensive studies with larger samples can lead to more valid results.

Conclusion

The findings of logistic regression modeling demonstrated that in addition to the shiftwork system and working the night shift, other variables such as age, work experience, long working hours, and working in different hospital wards with heavy physical and cognitive work demands significantly influenced the prevalence of such disorders in nurses. Therefore, it is recommended that these risk factors should be taken into account when policies are formulated to manage, control, and reduce the prevalence of these disorders in nurses. Therefore, despite the impossibility of eliminating shift work for nurse staff, it is recommended that working hours should be reduced, especially in night shifts. Do not use older people in night shifts. People with gastrointestinal or cardiovascular diseases, even those with a high chance of developing these disorders, should not be employed in high-risk hospital wards.

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