Breast cancer screening among shift workers: a nationwide population-based survey in Korea

Heesook Son^a and Youngmi Kang^b

^aRed Cross College of Nursing, Chung-Ang University, Seoul, Republic of Korea; ^bCollege of Nursing Science, East-West Nursing Research Institute, Kyung Hee University, Seoul, Republic of Korea

ABSTRACT

We aimed to examine the association between shift work types and participation in breast cancer screening (BCS) programs by comparing rates of participation for BCS among regular daytime workers and alternative shift workers using data from a nationally representative, population-based survey conducted in Korea. In addition, the results were analyzed according to sociodemographic factors, including occupation, education, income, private health insurance, age, and number of working hours a week. This secondary cross-sectional analysis used data from the 2012 Korean National Health and Nutritional Examination Survey. The target population included women aged ≥ 40 years who responded as to whether they had undergone BCS in the previous year. Accordingly, we analyzed survey data for a total of 1,193 women and used a multivariate logistic regression analysis to evaluate the differences in factors affecting BCS between regular daytime and alternative shift workers. A logistic regression analysis was performed considering private health insurance as a significant sociodemographic factor for BCS among regular daytime shift workers. In contrast, none of the tested variables could significantly predict adherence to BCS among alternative shift workers. The results of this study suggest the need for the development of comprehensive workplace breast cancer prevention programs by considering shift work types. More attention should be given to female workers with low education levels, those who are uninsured, and young workers to improve the participation rate for BCS at the workplace.

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Introduction

In many fields, including manufacturing and service work, global industrialization has resulted in 24-h (i.e. continuous) operations and various employment practices that involves alternative shift work, or shift schedules outside of regular daytime hours [1]. According to a report from the Ministry of Employment and Labor in Korea published in 2011, 15.2% of employees were engaged in shift work [2]. An altered work schedule is known to have negative effects on employees' health; in particular, alternative shift workers are more vulnerable to chronic diseases such as diabetes [3], hypertension [4], and cardiovascular diseases [5].

In addition to chronic diseases, there is accumulating evidence that the prevalence and risk of breast cancer is high among night shift employees, which increases with longer durations of night work [6]. Breast cancer was found to be the leading cause of 2,354 deaths in Korea in 2015, and 18,381 women are diagnosed with breast cancer each year [7]. Previous studies revealed that sociodemographic factors, including low income, low educational level, old age, not having a fixed source

of health care, and absence of health insurance, are barriers to breast cancer screening (BCS) [8–10].

Given these increased risks, it is important for alternative shift workers to participate in BCS, as early detection and treatment can reduce mortality [11]. However, a previous study that investigated differences in BCS adherence between a variety of shift work positions using data from the 2010 National Health Interview Survey in the US found that alternative shift workers were less likely to adhere to BCS recommendations than daytime shift workers [12]. Furthermore, little is known about the sociodemographic factors influencing BCS across shift work positions. The present study aimed to examine the association between shift work types and participation in BCS programs by comparing regular daytime workers and alternative shift workers using data from a nationally representative, population-based survey conducted in Korea. In addition, the results were analyzed according to sociodemographic factors, including occupation, education, income, private health insurance, age, and number of working hours a week.

Methods

Study population and design

The Korean National Health and Nutritional Examination Survey (KNHANES) is a nationwide cross-sectional surveillance system [13]. Using a stratified, multi-stage, and clustered probability sampling method, the Korean Ministry of Health and Welfare has conducted the KNHANES since 1998 to assess the health and nutritional status of the Korean population. Approximately 10,000 individuals are included in each annual survey, which gathers information about socioeconomic status, health-related behaviors, and health care utilization through health interviews, health examinations, and nutrition surveys. In the current study, data from the fifth KNHANES (V; 2010–2012), conducted in 2012, were subjected to a cross-sectional analysis.

Subjects were asked if they had undergone cancer screening tests within the past year. Respondents who had previously been diagnosed with any type of cancer ($n = 217$, 2.7%) were excluded from the analysis because they were more likely to have undergone regular screening. According to the National Cancer Screening Program Guidelines in Korea, BCS begins at 40 years of age [14]. Therefore, this study evaluated data for 1,193 women aged ≥ 40 years and identified whether they had undergone BCS during the previous year. Permission was obtained from the Korea Centers for Disease Control and Prevention prior to using the raw data. For this study, we followed the open procedure for raw data established by the Centers for Disease Control and Prevention. The University Institutional Review Board approved the study (No: 1,041,078–201410-HR-144–01).

Instruments

Workers were categorized as those who worked only in the daytime (regular daytime shift) and those with other work schedules (alternative shift); workers were also categorized by occupation: manual work (simple labor, agriculture, forestry, and fishery) and professional, office, and service work. Educational level was classified as high school or less and college or higher. Income was categorized as lower to middle and middle to upper percentiles. Private health insurance status was categorized as yes or no. Age and working hours per week were considered continuous variables.

Statistical analysis

Data were analyzed using SPSS for Windows, version 23. KNHANES uses a complex probability sampling method, and ignoring its design may yield biased estimates and overstated significance levels [15]. Therefore, the current study used weighted samples with stratified and clustered variables to account for sampling complexity. Descriptive statistics were used to compare

sociodemographic factors between the two shift work types. The t-test and chi-squared test were used to identify differences in sociodemographic factors among those who adhered to the BCS recommendations. Finally, a logistic regression analysis was conducted to predict BCS behaviors. The level of significance was set at 0.05.

Results

The overall prevalence of BCS was 81.5%, with adherence rates of 81.3% and 82.2% among regular daytime and alternative shift workers, respectively (insert Table 1 near here). Among regular daytime shift workers, the adherence of BCS was high among those who had a private health insurance ($p = 0.001$). Other sociodemographic factors did not differ between adherent and non-adherent groups in both regular daytime and alternative shift workers. (insert Table 2 near here) presents the differences in sociodemographic factors, such as differences in education, occupation types, private health insurance, and age between the two shift work types among those who adhered to the BCS recommendations.

A logistic regression analysis was conducted to identify sociodemographic factors influencing BCS adherence (insert Table 3 near here). In the combined model, income, private insurance status, and age predicted BCS adherence. Female workers with no private insurance, low income, and those who were young were less likely to undergo BCS. In the worker subgroup analyses, having no private insurance was a consistent significant predictor of a lower likelihood of BCS adherence among regular daytime shift workers. In contrast, none of the variables were significant predictors of BCS among alternative shift workers.

Discussion

In the present study, we examined whether BCS adherence differs according to shift work type among a representative Korean working women population using data from a population-based survey. The overall BCS rate among the Korean women examined in this study was 81.5%, which is similar to the target of 81.8% (of the eligible population) set by the Healthy People 2020 guidelines [16]. In this study, we found no difference in BCS adherence between regular daytime shift workers (81.3%) and alternative shift workers (82.2%). These findings contradict those of an earlier study conducted by Tsai et al. [12], which is the only previous study on the effect of shift work type on BCS adherence, and thus, limiting possible discussion on the topic. In particular, Tsai et al. [12] reported that alternative shift workers were more likely to be non-adherent to BCS recommendations than women who worked regular daytime shifts [12].

Table 1. Breast cancer screening behaviors of regular daytime and alternative shift workers.

Variables	Regular daytime shift workers (n=1,002, Weighted n=12,672,126)					Alternative shift workers (n=191, Weighted n=2,631,129)				
	Weighted (N)	Total (N=1,002)	Adherent (N=815), N (%)	Non-adherent (N=187), N (%)	p value	Weighted (N)	Total (N=191)	Adherent (N=157), N (%)	Non-adherent (N=34), N (%)	p value
Education	12,665,407	1001	815 (81.42)	186 (18.58)	.433	2,631,129	191	157 (82.20)	34 (17.80)	.831
≤ High school	9,487,795	846	685 (80.97)	161 (19.03)		1,900,604	140	114 (81.43)	26 (17.57)	
≥ College	3,177,612	155	130 (83.87)	25 (16.13)	.821	730,525	51	43 (84.31)	8 (18.38)	.640
Occupation types	11,359,372	837	680 (81.24)	157 (18.76)		2,409,169	165	136 (82.42)	27 (17.58)	
Manual	8,161,392	681	552 (81.06)	129 (18.94)		1,782,758	121	99 (81.82)	22 (18.18)	
Professional/office/service	3,197,980	156	128 (82.05)	28 (17.95)		626,411	44	38 (86.36)	6 (13.64)	
Income	12,516,174	993	808 (81.37)	185 (18.63)	.104	2,573,948	187	154 (82.35)	33 (17.65)	.340
Lower to middle	6,487,742	515	409 (79.42)	106 (20.58)		1,418,281	98	78 (79.59)	20 (20.41)	
Middle to upper	6,028,432	478	399 (83.47)	79 (16.53)	.001	1,155,666	89	76 (85.39)	13 (14.61)	.051
Private health insurance	12,523,509	992	810 (81.65)	182 (18.35)		2,593,294	188	155 (82.45)	33 (17.55)	
Yes	9,665,534	714	601 (84.17)	113 (15.83)		2,100,164	151	129 (85.43)	22 (14.57)	
No	2,847,975	278	209 (75.18)	69 (24.82)		493,130	37	26 (70.27)	11 (29.73)	
Age		Mean (SD)	Mean (SD)	Mean (SD)	.674		Mean (SD)	Mean (SD)	Mean (SD)	.825
		56.43 (10.73)	56.80 (10.30)	56.35 (13.59)			54.41 (9.61)	52.79 (8.28)	53.15 (9.69)	
Working hours a week		40.87 (19.22)	36.85 (19.97)	39.60 (20.11)	.090		48.87 (21.80)	39.42 (21.03)	37.82 (19.56)	.686

SD, standard deviation.

Table 2. Differences in sociodemographic factors according to shift work types among those who underwent breast cancer screening.

Variables	Regular daytime shift worker (n=815) N (%)	Alternative shift worker (n=157) N (%)	χ^2	p value
Education			11.77	.001
≤ High school	685 (84.0)	114 (72.6%)		
≥ College	130 (16.0)	43 (27.4)		
Occupation types			5.60	.018
Manual	552 (81.2)	99 (72.3)		
Professional/office/service	128 (18.8)	38 (27.7)		
Income			0.00	.99
Lower to middle	409 (50.6)	78 (50.6)		
Middle to upper	399 (49.4)	76 (49.4)		
Private health insurance			5.76	.016
Yes	601 (74.2)	129 (83.2)		
No	209 (25.8)	26 (16.8)		
Age	Mean (SD)	Mean (SD)	t	p value
	56.8 (10.30)	52.79 (8.28)	5.32	.000
Working hours a week	36.85 (19.97)	39.42 (21.03)	1.46	.146

SD, standard deviation.

We observed that alternative shift workers who adhered to BCS recommendations were more educated, were working in professional offices or had a service occupation, had a private health insurance, and were younger when compared with the regular daytime shift workers. Results of the regression analysis revealed that female workers with a low income, no private health

insurance, and those who were younger were less likely to undergo BCS. This finding is similar to that of previous studies that targeted women [8–10]. In our study, regular daytime shift workers who had a private health insurance were more likely to adhere to BCS recommendation than alternative shift workers, which is partly similar to the findings by Tsai et al. [12] reported that alternative shift workers who had at least some college education, worked in manual occupations, did not have private insurance, and were younger were less likely to adhere to BCS recommendations than regular daytime shift female workers [12].

Limitations

To the best of our knowledge, this is the first study to explore the differences in BCS adherence and sociodemographic factors between regular daytime and alternative shift workers using a population-based sample whose findings are representative of the Korean working women population. However, our study had some limitations. First, a cross-sectional design was used; thus, the causality regarding the associations between BCS adherence and related factors cannot be confirmed. Therefore, the results should be interpreted cautiously. Second, the results should not be generalized to other populations, such as women with a family history of breast cancer, because of the high likelihood of adherence of BCS.

This study has implications for the workplace and public health. Our findings raise some important points regarding the development of comprehensive workplace breast

Table 3. Logistic regression analysis of predictors of breast cancer screening adherence among women aged ≥ 40 years.

Variables	Combined model		Regular daytime shift workers		Alternative shift workers	
	OR	95% CI	OR	95% CI	OR	95% CI
Daytime workers	.746	.457, 1.219				
$\geq$ College	1.104	.510, 2.391	1.285	.574, 2.880	.361	.047, 2.743
Manual work	1.164	.589, 2.300	1.380	.715, 2.666	.274	.026, 2.919
Lower income	.644*	.424, .976	.655	.414, 1.037	.525	.210, 1.313
No private health insurance	.466**	.284, .762	.482*	.269, .865	.285	.069, 1.185
Age	1.031*	1.003, 1.060	1.029	.999, 1.060	1.054	.973, 1.142
Work hours a week	.996	.985, 1.007	.992	.982, 1.002	1.021	.991, 1.052

* $p < 0.05$; ** $p < 0.01$, OR, odds ratio; CI, confidence interval.

cancer prevention programs by considering shift work types. More attention should be given to female workers with low education levels, those who are uninsured, and those who are young to improve the participation rate for BCS at the workplace. In addition, our results indicate that enhanced marketing intended to inform employers and workers regarding national cancer screening program recommendations and private insurance, which covers the full cost of BCS, may be an effective strategy to increase overall screening rates among female workers.

Conclusion

In conclusion, our findings add to the accumulating literature on the importance of shift work type. Therefore, a more thorough investigation on the relationship between shift work type and BCS rate needs to be performed by systematically verifying all necessary information about shift work schedule, including frequency. In addition, differentiating between barriers to BCS between regular daytime and alternative shift workers in the workplace may be helpful to design shift-worker friendly strategies to enhance the BCS rate.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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