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— Article—

Effect of Emotional Information on Breast Cancer Screening Attendance among Never-Screened Female Japanese Employees: a Cluster-Randomized Controlled Trial

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Abstract: This study investigates the effectiveness of emotional information and basic information with monetary support in breast cancer screening attendance among female employees who had never had it. A total of 120 stores of a retail company in Japan were randomly classified into four groups; control, emotional information (comic book), basic information with a subsidy application form (leaflet), and combination. Among employees aged 30–49 years, the odds ratios and 95% confidence intervals for screening attendance compared with the control group were 2.50 (0.73–8.56) for the comic book group, 1.99 (0.54–7.28) for the leaflet group, and 3.41 (1.08–10.81) for the combination group. No significant effect was found for employees aged 50 years and over. A combination of basic and emotional information with a subsidy application form was found to be effective for encouraging breast cancer screening attendance among never-screened female employees in their 30s and 40s.

Keyword: Breast cancer screening, cluster randomized controlled trial, comic book, emotional information, encouragement

Introduction

Worldwide, breast cancer is the most commonly diagnosed cancer and the leading cause of cancer death in women. Over 2 million new breast cancer cases and 684,000 deaths were reported in 2020[1)]. The 5-year relative survival rate for breast cancer is 99% when detected in the localized stage, but decreases as the stage progresses, even as far as 27% if the cancer has spread to a distant part of the body[2)]. Although some risk reduction might be achieved with primary prevention, it is impossible to prevent breast cancer completely. Therefore, to improve breast cancer outcomes and survival, early detection is of the utmost importance.

Biennial breast cancer screening has been shown to be effective for the early detection and prevention of advanced cancer. Recent studies have reported that mammographic breast cancer screening reduces the risk of mortality by 10%-40%[3-6)]. However, the screening rate in Asia remains lower than that in Western countries; for

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instance, the screening rate is only 36.4% in Japan and 58.9% in Korea, compared with 72.6% in the UK and 80.4% in the US[7]. Therefore, women who have never attended a breast cancer screening need to be encouraged to do so to improve the breast cancer screening rate in such countries.

The effectiveness of using small media, including brochures and coupons, to promote participation in cancer screening has been reported in previous studies[8-10]. It is also known that social and emotional support is important when providing knowledge and simple reminders to motivate people to change their health behavior[11]. Appealing to factors such as emotions within individuals makes it easier for them to imagine as their situations[12-14]. However, to our knowledge, few studies have directly investigated whether knowledge provision, financial support, or emotional interventions are effective for improving breast cancer screening rates.

Therefore, this study aimed to evaluate the effect of basic and emotional information with subsidy as monetary support on breast cancer screening attendance among never-screened female Japanese employees.

Methods

1. Study setting and procedure

A cluster-randomized controlled trial was conducted at a retail company in western Japan to evaluate the effect of different types of information on breast cancer screening attendance. The study intervention was conducted as a part of the company's health insurance for the consideration of better health services. A total of 120 supermarket stores of one company were randomly allocated into four groups to avoid contamination. An independent researcher generated the randomized assignment sequence for the stores using computer generated random numbers, which were stratified according to the number of employees and the percentage of employees who had previously attended a breast cancer screening.

The baseline survey was conducted from January to March 2012. A total of 3,680 female company employees aged 20 years or older answered a questionnaire regarding breast cancer screening at annual health checkups. Of these women, 111 had missing data, and 361 had a history of breast cancer. After excluding these women, 1,232 had attended a breast cancer screening and 1,976 had not; these 1,976 employees were analyzed in this study.

The study protocol was approved by the ethics committee of Shiga University of Medical Science in 2011 (approval No.: 23-134). We obtained individual informed consent from all participant for the use of information regarding cancer screening attendance and health records and the recommendation programs for cancer screening. We did not provide breast cancer screening for participants in this study. Participants were encouraged to spontaneously undergo cancer screening provided by the local government under the law.

2. Intervention

Two types of interventions were used in this study:

Comic book

Social and emotional support is thought to be important in appealing for behavioral change, so we created a comic book as a vehicle for an emotional approach targeting women in their 30s and 40s (Figure S1-a). In an attempt to have the reader consider the content as a personal matter, the heroine of the comic book was a 40-year-old female employee who was working at a supermarket store. The plot of the comic book involved the heroine attending a cancer screening as a result of a colleague in her 30s receiving a breast cancer diagnosis, and then undergoing treatment for the early-stage cancer found during the screening. We also created a dialogue between the heroine and her husband and elementary and junior high school children. Demographic data and the benefits of breast cancer screening as basic information of breast cancer and screening were also included in the comic book to provide knowledge.

Leaflet

We also created a leaflet composed of basic information on breast cancer screening on the front and an application form for subsidies on the back (Figure S1-b). Although it was created to have an attractive design, it still provided simple information on the importance of early screening for breast cancer and the subsidy payment amount and methods.

Employees were randomly assigned to four groups by store (30 stores each): one control group and three types of intervention groups (The Type A intervention group received the comic book only, Type B received the leaflet only, and Type C received both the comic book and leaflet).

In Japan, mammographic breast cancer screening is conducted by all municipalities and recommended as part of public policy to reduce mortality rates. The health insurance provider for the company in this study provides subsidies to monetary support breast cancer screening attendance. This subsidy system was explained using posters in each store. Employees in any group could apply for the subsidy (up to 5,000 JPY ≃ **45 USD**), which covered the cost of mammographic breast cancer screening in most cases. The control group received information about the subsidies from only the posters. Conversely, participants in the intervention group received the information from not only posters in the stores, but also leaflets and/or comic books individually.

The Type A group received the comic book in June 2013, the Type B group received the leaflet in June and November 2013, and the Type C combination group received the comic book in September and November and the leaflet in June and November 2013.

3. Data collection

The post-intervention survey was conducted from January to March 2014. The outcome of this study was breast cancer screening attendance after the intervention (within 1 year before the post-intervention survey). New attendance at a breast cancer screening was calculated through self-administered questionnaires.

Family histories of breast diseases, confidence in future health, marital status, and educational status were also obtained. Those who answered "yes" to the question "Are you confident in your future health?" were defined as confident in their future health. Educational status was classified as less than 12 years or 12 years and over. We also confirmed whether the participants were an eligible for a free cancer screening program provided by the local government.

4. Statistics

Descriptive analyses were performed using the chi-squared test for categorical variables or the independent t-test for continuous variables. Logistic regression models with the control group serving as the reference group were used to evaluate the odds ratios (ORs) and 95% confidence intervals (CIs) for new breast cancer screening attendance. Age, educational status, confidence in future health, marital status, and possession of a free screening voucher were included in the multivariate logistic regression analysis. The analyses were implemented following stratification by age group: 20–29, 30–49, and 50 years and over. Since some participants were moved to another store after the allocation, analyses excluding those whose intervention group changed due to the move were also conducted. All analyses were performed using SPSS Statistics ver. 24.0 for Windows (IBM Japan, Tokyo, Japan). P values <0.05 were considered significant.

Results

A total of 1,976 employees who had never attended a breast cancer screening were classified into four groups by stores in 2013. Before the post-intervention survey in 2014, some participants in each group had retired. Therefore, 1,894 participants remained for the follow-up assessment. Finally, after excluded those with missing data, 1,693 participants were analyzed: 437 in the control group, 389 in the Type A group, 359 in the Type B group, and 508 in the Type C group (Figure 1).

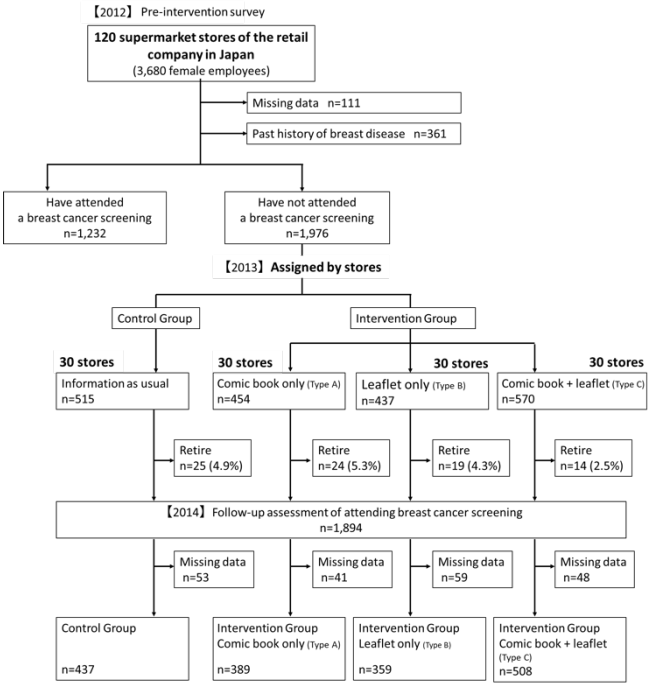

Figure 1: Flow diagram of the study

Comic book: Original comic book designed to promote behavioral change with a story of woman who undergoes treatment for breast cancer

Leaflet: A4-sized leaflet containing basic information and subsidies for breast cancer screening

The participants' mean age (standard deviation) was 43.7 (11.6) years. Overall, 265 participants were aged 20–30 years, 764 were aged 30–49 years, and 664 were aged 50–63 years. The characteristics of the participants in each group are shown in Table 1. No significant differences were found between groups.

The new breast cancer screening attendees included 68 participants: 2 aged 20–29 years, 31 aged 30–49 years, and 35 aged 50–63 years. The percentage of new breast cancer screening attendees in each group was 2.7% in the control group, 4.1% in the Type B group, 3.9% in the Type C group, and 5.1% in the Type D group. Odds ratios and 95% confidence intervals for new breast cancer screening attendance among participants who had never attended a breast cancer screening are shown in Table 2. Compared with the control group, the ORs (and 95% CIs) for new breast cancer screening attendance for all participants were 1.50 (0.69–3.23) for Type A, 1.45 (0.66–3.20) for Type B, and 1.99 (0.98–4.02) for Type C. The results among the participants aged 30–49 years were 2.50 (0.73–8.56) for Type A, 1.99 (0.54–7.28) for Type B, and 3.41 (1.08–10.81) for Type C. No differences were found among the four groups in participants aged 50–63 years. Only two participants in their 20s attended a breast cancer screening, so the ORs could not be calculated.

There were 14 participants who moved to another store after the allocation. The results did not change with the

exception of them; the results among the participants aged 30–49 years were 2.48 (0.72–8.56) for Type A, 1.98 (0.54–7.25) for Type B, and 3.39 (1.07–10.74) for Type C.

Table 1. Baseline characteristics of the participants by intervention group and store

	Control group [30 stores]	Comic book only (Type A) [30 stores]	Leaflet only (Type B) [30 stores]	Comic book + leaflet (Type C) [30 stores]	P
n	437	389	359	508	
Age (years)	42.9±11.6	43.9±11.7	44.3±11.6	43.9±11.5	0.368
Marital status, Yes	228 (52.2)	211 (54.2)	198 (55.2)	270 (53.1)	0.847
Education, >12 years	113 (25.9)	91 (23.4)	87 (24.2)	127 (25.0)	0.864
Confidence in future health, Yes	90 (20.6)	77 (19.8)	83 (23.1)	110 (21.7)	0.705
Family history of breast diseases, Yes	27 (6.2)	21 (5.4)	23 (6.4)	21 (4.1)	0.423
Target of voucher, Yes	110 (25.2)	100 (25.7)	94 (26.2)	127 (25.0)	0.980

Data are expressed as mean± standard deviation or number (%).
Target of voucher" indicates participants who were targeted for a free breast cancer screening voucher by local municipalities.

Table 2. Odds ratios and 95% confidence intervals for new breast cancer screening attendance among never-attendees

	Control group	Comic book only (Type A)	Leaflet only (Type B)	Comic book + leaflet (Type C)
Overall	n=437	n=389	n=359	n=508
Screening attendance, n (%)	12 (2.7)	16 (4.1)	14 (3.9)	26 (5.1)
Model 1	1.00	1.48 (0.69–3.17)	1.38 (0.63–3.03)	1.87 (0.93–3.75)
Model 2	1.00	1.50 (0.69–3.23)	1.45 (0.66–3.20)	1.99 (0.98–4.02)
By age group				
20–29 years	n=79	n=59	n=54	n=73
Screening attendance, n (%)	0 (0.0)	1 (1.7)	0 (0.0)	1 (1.4)
30–49 years	n=204	n=181	n=157	n=222
Screening attendance, n (%)	4 (2.0)	8 (4.4)	6 (3.8)	13 (5.9)
Model 1	1.00	2.32 (0.69–7.82)	1.98 (0.55–7.15)	3.13 (1.00–9.77)
Model 2	1.00	2.50 (0.73–8.56)	1.99 (0.54–7.28)	3.41 (1.08–10.81)
50–63 years	n=154	n=149	n=148	n=213
Screening attendance, n (%)	8 (5.2)	7 (4.7)	8 (5.4)	12 (5.6)
Model 1	1.00	0.92 (0.33–2.62)	1.04 (0.38–2.85)	1.07 (0.43–2.69)
Model 2	1.00	0.90 (0.31–2.58)	1.15 (0.41–3.20)	1.22 (0.48–3.11)

Model 1: adjusted for age
Model 2: adjusted for age, confidence in future health, marital status, educational status, and whether they had been targeted for a free screening voucher

Discussion

In this study, we investigated the effectiveness of different information types on breast cancer screening attendance among female Japanese employees who had never attended a breast cancer screening. In the 30-49-year-old group, the combination of leaflets and comic books showed effectiveness compared with the control group, who received only collective notifications. No significant effect was seen in the 50 years and over age group.

The combination of the comic book used in this study, which had a story line designed to appeal to emotions to motivate attendance at a cancer screening, and the leaflet with an application form for subsidies was effective in only the 30-49-year-old group. The reason for the age group differences was considered to be that the comic book worked well as an emotional approach for employees in their 30s or 40s. Self-efficacy, perceived threats, and

perceived benefits vs. perceived barriers have been reported to influence cancer screening uptake[15-17]. Several studies have suggested the usefulness of comics in both education and health promotion[18-21]. Comics are a medium that convey information visually in the form of a story, attract readers' interest, and are generally considered pleasurable to read[18]. They give readers the capacity to project their identity into the story line and empathize with characters, which makes the experience of reading comics unique for each person[19]. The 40-year-old heroine in the comic book was an employee of a supermarket store with elementary and junior high school children; this may have helped employees in their 30s or 40s empathize with and relate to the heroine, especially those who had similarly aged children. Previous studies have also demonstrated the effectiveness of tailored interventions to promote breast cancer screening[10,22-24]. Tailored messaging that understands the characteristics of the targeted audience helps to influence the target population's decisions and promote behavioral change. The comic book might also have been exerted its effects as a tailored message for female employees in their 30s or 40s. Alternatively, the comic book or the leaflet may have encouraged people who had known for the first time that they could get breast cancer at their own age to attend cancer screening. Those aged 50 years and over may had some knowledge about breast cancer, and to some extent they may have attended cancer screening naturally or with a little provocation.

However, even for employees in 30-49-year-old group, no significant effect was observed with the comic book alone. Although not significant, the ORs increased in the Type A (comic book only) group among 30-49-year-olds, but not in the other age groups. One reason why no significant effect was found might be that the number of distributions was different. The comic book was distributed to the Type A group only once, whereas the leaflet only and the combination of comic book and leaflet were distributed to the Type B and Type C groups twice each, respectively, during the intervention period. Therefore, the effect of the comic book only might be underestimated.

The leaflet with an application form for subsidies was expected help reduce the financial barriers and provide an opportunity to attend a screening; however, no significant effect was observed. According to Ueda et al., vouchers are effective for increasing the cancer screening participation rate[9]. With subsides, people have to pay first and get cash back later. In other words, with vouchers, people do not have to pay any upfront costs; this difference might affect the screening uptake. Komoto et al.[25] reported that the percentage of users was under 30% in a situation involving the distribution of vouchers. Because the combination of leaflets and comic books was effective in this study, increasing motivation by appealing to emotion and providing financial assistance were suggested to be important and may mutually enhance each other.

Comprehensive worksite programs are known to be important for the prevention of cancer and other diseases[26,27]. Employers are in a unique position to promote the health, reduce the health risks, and support the well-being of their employees through effective programs. At workplace, it is relatively easy and regular access to a large number of people with different health conditions and interests. The company that participated in this study did not offer breast cancer screening, so employees were required to attend screenings on their own. Improving accessibility to cancer screening as part of a wellness program, that is, providing cancer screening in the workplace, could help improve cancer screening rates even further.

The interventions used in this study were conducted at a single company consisting of employees with similar occupations. The company stores were stratified according to the number of employees in each store and the percentage of employees who had attended a breast cancer screening, and then randomly allocated into four groups. Therefore, we believe that this study had a good level of baseline comparability among groups. However, it is presumed that the emotional effects of the comic book and the incentives from subsidies were influenced by the participants' social, economic, and cultural backgrounds. Therefore, future studies will be needed to verify whether the results obtained in this study can be applied to populations with other backgrounds. Also, since the allocation was made for each store, the possibility of contamination cannot be denied if there were interaction between participants beyond the store. In addition, this study included employees who had never attended a breast cancer screening. Breast cancer screening has been recommended to have on a regular basis. This study examined interventions to trigger the new breast cancer screening, the interventions are needed to be designed to encourage regular visits to the screening.

Conclusion

Among the female employees in their 30s and 40s who were in the same age group as the main character of the comic book and had never attended a breast cancer screening, the combination of emotional information using comic books and the individual distribution of an application form for subsidies with basic information was effective for promoting new attendance at a breast cancer screening. No significant effects were seen in those aged 50 years and over. These results suggest that the characteristics and background of participants are important considerations when performing an emotional

intervention.

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Figure S1-a: Example of the comic book used in the present study

Figure S1-b: Leaflet used in the present study

The front of the leaflet consisted of information about breast cancer screenings, the women targeted for subsidies, and the payment method. The back of the leaflet consisted of an application form for subsidies.

乳がん検診受診経験のない女性従業員に対する情動的受診勧奨ツールの乳がん検診受診啓発効果: クラスターランダム化比較試験

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和文抄録： 本研究では、クラスターランダム化比較研究により、乳がん検診を受けたことのない女性従業員への乳がん検診受診啓発における情動的受診勧奨ツールの効果について年代別に検討した。小売業企業の計 120 事業所を 30 事業所ずつ無作為に非介入群、情報提供群（乳がん検診に関する基本的情報と補助金申請書のチラシ配布）、情動的介入群（読み手の感情に訴えるマンガ冊子配布による受診勧奨）、チラシとマンガの両方を配布する重点介入群の 4 群に割り付け、それぞれの事業所に勤務する女性従業員に媒体を配布した。その後 1 年間における乳がん検診受診について、30～49 歳の従業員では検診受診のオッズ比と 95%信頼区間は、非介入群と比較して情報提供群で 1.99 （0.54-7.28）、情動的介入群で 2.50 （0.73-8.56）、重点介入群で 3.41 (1.08-10.81)であった。50 歳以上の従業員では有意な関連は見られなかった。従来型の情報提供による受診勧奨に情動的受診勧奨ツールを組み合わせることで、乳がん検診を受けたことのない 30～40 代の女性従業員の検診受診促進に効果がある可能性が示された。

キーワード： 乳がん検診，クラスターランダム化比較試験，マンガ，情動的受診勧奨，がん検診受診啓発