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Research Article

The effectiveness of WhatsApp messages on the uptake of screening mammography: a randomized controlled trial

Deepak Patel*[1], Mike Greyling[2], Ntokozo Mabena[1], Sandra Lehmann[1], Mosima Mabunda[1], Jon Patricios[3]

[1]Discovery Vitality Johannesburg, South Africa.
[2]Data Management and Statistical Analysis, Johannesburg, South Africa
[3]Wits Sport and Health (WiSH), School of Clinical Medicine, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

Corresponding Author: *deepakp@discovery.co.za*

ABSTRACT

Objectives. Breast screening and early detection have positively influenced survival rates for breast cancer. We conducted a randomized-controlled trial involving 7235 eligible members of the Discovery Health Medical Scheme, who were also members of the Vitality health-promotion programme, to test whether WhatsApp messaging would increase the booking of a screening mammogram.

Methods: Participants aged 50–70 years were randomly allocated to five groups. Individuals in the control condition did not receive any messages, while the four intervention groups received WhatsApp messages with 1) a simple reminder; 2) a reminder with a link to an online booking platform; 3) a reminder with telephone numbers of radiology practices, or 4) a combination of messages 2 and 3. The primary outcome was the cumulative screening rate one month after the last of four messages. We employed logistic regression models to test the relationship between the messaging and the probability of undergoing a mammogram.

Results: Individuals who received a reminder by WhatsApp had double the odds of obtaining a mammogram compared to those members who did not receive a reminder. The inclusion of an online booking platform or providing telephone numbers of radiology practices did not increase the likelihood of having a mammogram. Two other patient variables, receipt of a past mammogram and frequency of utilization of healthcare, were predictive of mammogram uptake.

Conclusion: The results of this trial demonstrate that simple reminders, sent via an accessible social media platform such as WhatsApp, can nudge individuals eligible for a mammogram to obtain one.

Keywords: Mammography, WhatsApp messaging

INTRODUCTION

Breast cancer is the world's most prevalent cancer. In 2022, there were 2.3 million women diagnosed with breast cancer and 670,000 deaths from breast cancer globally.(1) In Southern Africa, accurate statistics regarding the incidence and mortality of breast cancer are scanty.(2) Based on data from the Cancer Registry by the South African National Institute of Communicable Diseases (3) for 2019, the age-standardized incidence rates of breast cancer in females for South Africa were 34 per 100,000.

In the developed world, the recorded increase in the incidence of cancer is believed to be essentially the consequence of the widespread adoption of screening in populations.(4) Such improved screening and early detection have positively influenced survival rates (5) and lowered healthcare costs related to treatment.(6) Mammography is the most widely recommended screening modality for the detection of breast cancer.(7–9) South Africa does not have a national mammography screening programme,(10) and there are scarce data on screening rates in the country. (11) What is known is that there are marked differences in mammography screening rates between the public and private healthcare sectors in South Africa.(12) However, the rate of breast cancer screening in the private sector in South Africa is still considerably lower than screening rates in high-income countries such as the United States,

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where 70% of eligible women screen,(13) and the United Kingdom, where 65.3% of eligible women had screened in the previous three years before 2022.(14) In 2018, before restrictions related to COVID-19 were imposed, 28.9% of women aged 50–74 years on the Discovery Health Medical Scheme (DHMS) obtained a mammogram.(15) These low mammography screening rates are concerning, given the compelling evidence for the benefits of early detection of breast cancer. This is particularly evident in the private health sector, where mammography screening is funded through risk benefits (insured benefit), raising the question of why eligible women with a funded benefit do not take up screening. Moreover, for eligible women, a doctor's referral is not mandatory for booking a mammogram at a radiology practice.

The primary aim of the study was to assess the effectiveness of a direct online booking platform in improving screening rates among DHMS members who are also part of the Vitality health promotion programme. The programme encourages and rewards members for engaging in health-promoting activities such as physical activity, healthy eating, and preventive activities such as vaccinations and screening.(16) A secondary objective of the study was to test the use of WhatsApp as a means of communicating information about screening mammography.

METHODS

Female members of Vitality and DHMS who were 50-70 years of age, who had not claimed for a mammogram in the 3 years preceding September 2023, and whose recorded residential address was the city of Johannesburg or Pretoria, in South Africa, were eligible for the study. Women who were previously diagnosed with breast cancer were excluded.

The study sample of 7235 members was randomly allocated to the following intervention and control arms.

1) The "*reminder*" only group received a standard WhatsApp message based on the Cancer Association of South Africa (CANSA) recommendation for breast cancer screening and a reminder to screen for breast cancer if they had not done so in the preceding 2 years.
2) The "o*nline booking*" group received the same WhatsApp message reminder, but, it included a direct online link to a radiology practice booking site set up by the Radiology Society of South Africa. (https://rssa.co.za/radiology-practices-in-sa/services/#!?Accredited=true&Procedure=Mammography&Take=10).
3) The "*telephone contact number*" group also received the WhatsApp message reminder, but with a list of telephone numbers of radiology practices in the vicinity of the member.
4) The "*online booking*" and *"telephone contact numbers"* group also received the WhatsApp reminder message, but included both the online link and telephone numbers of radiology practices.
5) The *"no message"* control group did not receive any WhatsApp messages reminding them to do a screening mammogram.

The first set of messages was sent on 27 September 2023, with reminders sent on 3 November 2023, 5 December 2023, and 31 January 2024. The final dataset for analysis was compiled on the 4th March 2024.

Measures

The primary outcome of the study was the uptake (recorded as a claim by a member of the DHMS) of mammography during the study period. Women who underwent a mammogram at any stage of the study were excluded from the next round of messages.

Several variables were considered as potential covariates and/or moderators of the relationship between the WhatsApp message and the outcome. These included the following:

Age: Grouped into four categories: 51-54, 55-59, 60-64, and 65 -70 years.

Previous mammogram: Women who had previously undergone a mammogram.

Socio-economic status (SES): Members were categorized into low, medium, and high SES.

Vitality status: The level of engagement with the Vitality programme was grouped into five categories: Blue, Bronze, Silver, Gold, and Diamond.(16) For this analysis, the top 3 (Silver, Gold, and Diamond) were grouped into a single category.

In addition, two indicators noted whether the members had recorded *physical activity* on the Vitality programme and whether they had completed a *Vitality Health Check* (consultation with a healthcare provider where blood pressure, blood glucose, blood lipids, body mass index, waist circumference, and smoking status are recorded) in the year before the study (September 2022 to September 2023).

Resource Utilization Band (RUB) and *Frequency Utilization Band (FUB):* These are measures of healthcare usage based on the Johns Hopkins Adjusted Clinical Groups Systems software,(17) calculated from combinations of diagnosed conditions and the member's characteristics, and were also used in the analysis. The RUB value (0-5) is based on total expected healthcare claims related to the disease burden, while FUB (0-10) measures the expected frequency with which a member engages with the healthcare system/doctor for routine care. Both measures were calculated over 12 months before the study.

Family size: The size of the family was grouped into four categories: 1, 2, 3, and 4 (families with four or more individuals).

As the "reminder" was common to all the intervention arms, the four intervention conditions (messaging options) were coded as having three distinct variables (*reminder, online booking, and telephone contact number*). This allows for

the primary test (reminder, yes or no) as well as the potential differential effect of the *online booking* platform and the provision of *telephone contact numbers*.

Data Analysis

As the primary outcome of the study was a binary variable (receipt of a mammogram, or not), a logistic regression was the appropriate statistical tool to examine the impact of the experimental conditions while controlling for the covariates in the model.(18) Data were analysed with SAS/STAT 9.4 (19) using the SAS Logistic procedure.

Ethics

The Human Research Ethics Committee of the University of the Witwatersrand approved the study protocol.

Results

Of the 7235 members included in the study, the number of members and percentages of individuals who underwent mammography, per group, are shown in Table 1. The significance of the WhatsApp reminder and other associated variables to the primary outcome of the study is highlighted in Table 2. Table 3 presents the findings of the logistic regression analysis, which assesses the significance of each of the different variables studied.

DISCUSSION

Based on the behavioural change technique taxonomy of Michie et al.,(20) (which allows for comparison of behavioural interventions irrespective of whether a theoretical model is used to test interventions), the interventions used in this study can be categorized as "prompts" (reminders) and "instruction on how to perform a behaviour", namely, to book a mammogram.

Social media platforms, such as WhatsApp, offer the potential to communicate with large numbers of individuals in a targeted manner, with a relatively low-cost approach. Researchers have used WhatsApp to encourage other health behaviours such as influenza vaccine uptake,(21) promoting physical activity,(22) and for smoking relapse prevention for recent quitters.(23) Globally, reports on the use of WhatsApp to encourage breast cancer screening are scanty. Muniasamy et al. (24) found that WhatsApp was an effective medium for marketing free mammography amongst women from a low-income community in Kuala Lumpur. They reported that informing women about the

Table 1: Women who obtained a mammogram per study group

	Mammogram Performed	
Message Group	**Number of Women**	**Percentage of Group**
1 – *Reminder*	192	13.1%
2 – *Online booking*	174	11.9%
3- *Telephone contact numbers*	172	11.9%
4 – *Online booking* and *telephone contact numbers*	165	11.5%
5- *Control - No message*	91	6.4%
Total	794	11%

Table 2: Univariate regression analysis of study variables

Variable	DF	Wald χ^2	P-Value
Intercept			
Reminder	1	9.23	0.0024*
Online booking	1	0.29	0.5891
Telephone contact number	1	0.52	0.4715
Physical Activity Recorded	1	1.29	0.2552
RUB	1	2.46	0.1171
Socio-Economic Status	1	0.88	0.3471
Previous mammogram	1	12.50	0.0004*
Vitality Health Check	1	2.09	0.1484
Age Group	3	2.58	0.4607
Family Size	3	4.22	0.2383
Vitality Status	2	5.23	0.0731
FUB	3	11.86	0.0079*

DF – Degrees of Freedom, RUB – Resource Utilization Band; SES – Socio-Economic Status; VHC – Vitality Health Check; FUB – Frequency Utilization Band.

Table 3: Odds ratios and 95% confidence intervals of experimental and significant variables

Coefficient	Logistic Regression Model		
	Odds Ratio	95% Confidence Intervals	
		Lower	Upper
Reminder	2.001	1.547	2.612
Online booking	0.956	0.814	1.123
Telephone contact number	0.943	0.803	1.108
Previous Mammogram	2.172	1.836	2.578
FUB (0-2) vs (5-6)	0.409	0.286	0.585
FUB (3-4) vs (5-6)	0.688	0.566	0.838
FUB (7-10) vs (5-6)	1.080	0.842	1.383

FUB – Frequency Utilization Band

free service with limited availability of bookings was significantly more effective than simply advertising the free service or advertising with a personalized message from the national director of the cancer society, in getting women to call and book a mammogram. Pereira AAC et al. (25) used WhatsApp as an interactive health education tool to educate women about breast cancer.

The current study adopted a pragmatic approach of testing low-cost and low-touch interventions in a real-life health promotion programme linked to a medical scheme. It was not based on any theoretical model, such as the Health Belief Model (26) or the Transtheoretical Model. (27) In this study, we used WhatsApp as a medium of communication. However, we did not compare WhatsApp to any other medium of communication.

The results of our study show that women who received a message via WhatsApp with a reminder to undergo a mammogram were significantly more likely to go for a mammogram compared to women who did not receive a message. Overall, the rate of screening amongst the combined group of women who received a message was double that of the group that did not receive the reminder message. Our findings, that a simple reminder is effective in getting eligible women to screen for breast cancer is in keeping with conclusions by Achary et al.,(28) who in an extensive systematic review of interventions to improve breast cancer screening behaviours, reported that prompts (reminders) were the most used intervention and were about 50% effective, compared to controls, in getting women to go for screening.

We also found that those who have previously had a mammogram were more likely to do so again (OR=2.2) as compared to women who had not previously been screened. This is in keeping with findings by Schueler et al.,(29) who reported that a history of screening for breast cancer strongly predicted mammography use. Past engagement in screening behaviour suggests that these women had previously overcome many of the barriers to screening.

The FUB score measures the expected frequency of interaction with healthcare providers/doctors. Individuals with higher FUB scores, compared to those with lower FUB scores, had a higher probability of undergoing a mammogram. This finding may indicate that subjects who consult their physician more frequently are more likely to receive a recommendation to screen. Schueler et al.(29) reported that not having a physician recommend mammography is an important reason why women did not undergo screening.

Our premise that lowering the hurdle to screening by providing a link to an online mammogram booking site or providing the telephone numbers of radiology practices would increase screening rates was not proven, as these two measures failed to improve the booking for a mammogram.

In our study, the age of subjects and socio-economic status did not influence the probability of obtaining a mammogram. While there is some differential in socio-economic status within the studied population, individuals who subscribe to a private health plan, and to the Vitality programme, generally belong to a higher socio-economic (and educational) status than the general South African population.(30) As such, both these variables fall within a restricted range, which may explain their lack of impact.

While our study did not prove the effectiveness of an online booking platform to increase screening rates, a doubling of screening rate amongst those who received a reminder, compared to those who did not, is an important finding in the context of a relatively low mammography screening rate amongst members of the Discovery Health Medical Scheme.

The strength of this study is that we tested interventions among real-life members of a private medical scheme, who were also members of a health-promotion programme. The findings will inform changes to the programme regarding communication prompts and have relevance for the promotion of other screening tests, such as cervical and colon cancer screening. Although our findings have the most relevance for the members of DHMS, they may not be generalizable to other populations, such as those that do not have access to private health care or to WhatsApp.

CONCLUSION

The results of this study demonstrate that simple reminders, sent via an accessible social media platform such as WhatsApp, can nudge individuals eligible for a mammogram to obtain one. This step could be the first of a series of interventions to facilitate breast cancer screening amongst members of a medical scheme.

Author's Contribution: D Patel conceived the study and wrote the manuscript. M Greyling and N Mabena did the statistical analysis. S Lehmann supervised and guided the analysis. M Mabunda and J Patricios contributed to planning, writing, and editing the manuscript.

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