ORIGINAL ARTICLE

Knowledge, Awareness on Breast Cancer, and Practice of Breast Self-examination Using Virtual Reality Among Community in Kuantan: A Cross-sectional Study

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ABSTRACT

Introduction: The World Health Organization Global Breast Cancer Initiative aims to prevent 2.5 million breast cancer deaths worldwide between 2020 and 2040. Recently, virtual reality (VR) has been deemed to be a promising tool to improve public awareness of breast cancer through immersive experiences. This study aimed to provide baseline information on the level of knowledge and awareness of breast cancer as well as the practice of breast self-examination using VR among the community near the International Islamic University Malaysia (IIUM) Kuantan Campus. **Materials and methods:** A cross-sectional study was conducted among Kuantan residents, consisting of university staff, students, and the general population through convenience sampling (n = 64). A set of questionnaires was pre-tested among 18 Kuantan residents and was later utilised for the preliminary findings. The data obtained was analysed using SPSS version 28. **Results:** The content validation index was 97.5% with a reliability of 0.89. The median age of the respondents was 22.00 (3), female (82.8%), Malay (93.8%), and non-married (90.6%). The median score for knowledge of breast cancer risk factors was 13.00 (3), knowledge regarding breast cancer signs and symptoms was 9.00 (2), awareness of breast cancer and breast self-examination was 77.00 (20), and the practice of breast self-examination was 64.00 (36). **Conclusion:** These preliminary findings revealed that the majority of the respondents possessed an above-satisfactory level of knowledge of breast cancer risk factors, signs and symptoms, as well as a moderate practice of breast self-examination. The findings of this study suggest that the VR approach to breast cancer awareness programmes has the potential to increase public awareness of breast cancer.
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Keywords: Breast self-examination, Knowledge, Awareness, Practice, Virtual reality

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INTRODUCTION

Globally, there were a total of 7.8 million women who were diagnosed with breast cancer in the past five years as of the end of 2020 (1). In 2022, 2.7 million women were diagnosed with breast cancer, whereas 670, 000 deaths were associated with breast cancer globally (1). The age-standardised incidence rate (ASR) of cancer was 101.6 per 100,000 women in 2016 (1). Meanwhile, in Malaysia, a different rate was observed among the three major races, namely Malay, Chinese, and Indians. Malay women had the highest lifetime risk, followed by Indian and Chinese women, with 1 in 30 Malay women, 1 in 24 Indian women, and 1 in 22 Chinese women acquiring breast cancer at some point in their lives (2) (2) .

Early recognition of risk factors as well as signs and symptoms of breast cancer is very important for early treatment. The most common risk factors reported in previous studies were advanced age, early menarche, delayed childbirth, and a reduced period of breastfeeding. Additionally, an unhealthy lifestyle, being sedentary, and obesity were modifiable risk factors for breast cancer. Moreover, women with prolonged use of hormonal replacement therapy or hormonal contraceptives have a higher risk of breast cancer (3–5).

At the same time, having knowledge of the signs and symptoms of breast cancer may allow early detection of the presence of lumps, pain, swelling, and thickening of

the breast or under the armpit, as well as discharge from the nipple, whether bloody or any other than breast milk. Furthermore, changes in the breast are also a vital sign for the early development of breast cancer. Changes on the skin of the breast, such as redness or irritation and dimpling, size and shape of the nipple, size and shape of the breast itself, and pulling of the nipples, were related to breast cancer (5–11).

Awareness programmes were most often carried out in the conventional method through seminars as well as one-to-one teaching and verbal consultations. These approaches are usually less likely to encourage breast cancer patients to participate actively in the teaching session. Previous studies from local and abroad setting showed that there is a need to enhance teaching strategies from conventional to applying technological advancements to capture information, increase the interest and improve the skills of the respondents or learners (12,13). A meta-analysis highlighted that virtual reality (VR) provides a sense of spatial presence and is able to improve knowledge but not skills and satisfaction in nursing education (14,15).

There are three types of VR systems: immersive, semi-immersive and non-immersive (16–18). Immersive VR is characterised by full immersion using a head-mounted display. This will provide the patient with a view of a computer-generated world instead of the real world (19). On the other hand, the non-immersive type is characterised by a computer screen where the user can communicate with the external world simultaneously while being connected to the virtual world.

To date, the application of VR in healthcare-related research is limited in developing nations due to logistical reasons. Previous studies found that VR is able to reduce anxiety and pain among cancer patients (18,20–24), facilitate patient education (25–27), improve patients' help- seeking behaviour, promotion among breast cancer survivor on body image awareness (16), controlling side effects after chemotherapy or symptom management (28–30) and improve engagement with healthcare professionals (17,18,31,32). However, the use of VR in enhancing early detection of breast cancer is limited (33). The technology-based approach using VR seems to be a promising teaching strategy to improve knowledge of the current breast awareness programme. Thus, this study aimed to evaluate the level of knowledge and awareness about breast cancer as well as the practice of breast self-examination using VR among the community in Kuantan as a preliminary finding.

MATERIALS AND METHODS

Population and Setting

A cross-sectional study was conducted in May 2023 among the community in Kuantan, Pahang, Malaysia, consisting of university staff, students, and the general public. Prior to conducting this study, ethical approval was obtained from the Kulliyyah of Nursing, Postgraduate Research Committee (KNPGRC), International Islamic University Malaysia Research Committee (IREC 2023-048). Notification to the Majlis Bandaraya Kuantan (MBK) was also given before conducting the study.

The 64 respondents were conveniently recruited by the researchers (SNS and AQA) and author (ANA) when they attended the Breast Cancer Awareness (Hybrid) 2023-Outreach Event on May 12th and 13th, 2023, at the Kulliyyah of Nursing. The participants have experience using the VR headset, live within a 10 km radius of Kuantan, and have no history of cybersickness symptoms or motion sickness. Explanations of the study procedure were given prior to obtaining their consent.

Sample size calculations

The sample size was determined by both method, calculation using single proportion formula by Pocok's formula and the Raosoft Software. In the manual calculation, the confidence interval was set at 1.96 (for a 95% CI), precision at 0.05, p-value is set 0.015 based on previous study (34). On the other hand, for calculation using the software was set at margin error of 5%, confidence level of 95%, population size of 526,000 (based on current Kuantan population size) and response distribution of 50%. The calculation of the sample size obtained from manual calculation was 25 while using the software was 377 after adding up 10% attrition. Thus, having 64 respondents for the sampling was considered fulfilling the minimal requirement of the sample size for the current study.

Research Instrument

The questionnaire set consisted of six parts related to breast cancer and virtual reality: 1) Part A on sociodemographic data of the respondents; 2) Part B has 17 items measuring risk factors; 3) Part C has 10 items assessing the knowledge of signs and symptoms in a dichotomous choice of 'yes' or 'no'; 4) Part D has 10 items measuring awareness towards BSE; 5) Part E has 10 items describing the practice of BSE in extreme end the 10-point Likert scale ranged from 0 points for strongly disagree to 10 points for strongly agree; and 6) Part F consists of 12 items on the impact of the virtual reality approach in breast cancer awareness programmes. This questionnaire was a combination of a newly developed domain (Part F) (LY2024W03320) and a previously copyrighted questionnaire (Parts A to E) (LY2022W05583).

Permission to adopt and modify the copyrighted questionnaire was granted by the author (SNS). The validation process was performed by six expert panels prior to the pilot study and obtained a content validity index (CVI) of 0.975. Prior to the actual study, a pilot

study was conducted among 18 respondents from Pertubuhan Indera Mahkota, where most of them were residents of Kuantan, Pahang.

Pilot study

There were three procedures involved in the pilot study: 1) translation, 2) validation, and 3) reliability to ensure the compatibility of the items in the newly developed Part F.

Stage 1: Translation procedure

The questionnaire from a previous study was adopted with modifications, which were later forward and backward translated into Malay by one of the researchers (ANA). Subsequently, it was back translated to English. A comparison was made between the original English instrument and the back-translated Malay instrument, which was harmonised.

Stage 2: Validation procedure

The questionnaire used in this study undergoes a content validation process by six expert panels from nursing backgrounds. Each reviewer received an evaluation kit that included a cover letter, a demographic information sheet, and translated instruments. Expert reviewers assessed each item on four scopes using a dichotomous response scale: "clear = 1" or "not clear = 0." The four scopes were (a) item consistency to content area, (b) item wording clarity, (c) perceived item difficulty, and (d) whether (and why) they thought the item should be included in a revised version of the test. A few adjustments were performed as suggested. The content validity index (CVI) obtained from the validation procedure was 0.975, which is considered relevant. Another two experts from medicine and biomedicine performed the face validity after the overall validation procedure.

Stage 3: Reliability procedure

The finalised version of the questionnaire was distributed among 18 respondents that attended the Breast Cancer Webinar 2022 held via Zoom platform on November 27, 2022, to determine the reliability or internal consistency of the items. The Cronbach's alpha value obtained from the pilot study was 0.89, which was strongly reliable.

Data analysis

IBM Statistical Package for Social Science (SPSS) version 28.0 was used for the data analysis. A descriptive analysis was performed to present the results with no missing data found. The data were interpreted as frequency and percentage for categorical variables, while median and interquartile range was used for numerical variables. Sensitivity analysis was not performed since this instrument was developed for the purpose of screening not for a diagnostic purpose.

RESULTS

Socio-demographic data of the respondents

Table I shows the sociodemographic data of the respondents. The majority of the respondents were female (82.8%), Malay (93.8%), married (90.6%), from IIUM (96.9%), and currently pursuing their degree (84.4%). The respondents reported having family members with various types of cancer (29.7%), specifically breast cancer (14.1%).

Table I: Sociodemographic data of the respondents (n=64)

Variable		n (%)
Age[#]	20-30 years old	56 (87.5)
	≥31 years old	8 (12.5)
Gender	Male	11 (17.2)
	Female	53 (82.8)
Race	Malay	60 (93.8)
	Non-Malay	4 (6.3)
Marital status	Non-married	58 (90.6)
	Married	6 (9.4)
Number of children	0	58 (90.6)
	≥1	6 (9.4)
Family breast cancer	No	55 (85.9)
	Yes	9 (14.1)
Family history of breast cancer	No	55 (85.9)
	Yes	9 (14.1)
Highest educational level	Malaysian Certificate of Education (SPM)	1 (1.6)
	Diploma	2 (3.1)
	Degree	54 (84.4)
	Master	1 (1.6)
	PhD	6 (9.4)
Current workplace	Non-IIUM Staff	2 (3.1)
	IIUM Staff	62 (96.9)
Kulliyyah	Kulliyyah of Nursing	61 (95.3)
	Non-Kulliyyah of Nursing	3 (4.7)
Healthcare professional	No	56 (87.5)
	Yes	8 (12.5)
Type of profession	Administrative clerk	1 (1.6)
	Lecturer	6 (9.4)
	Nurse	1 (1.6)
	Student	55 (85.9)
	Teacher	1 (1.6)

[#] Median for age (numerical) is 22.00 (3) and number of children is 0.00 (0).

Knowledge regarding breast cancer risk factors

Table II shows the most common risk factors for breast cancer recognised by the respondents, which are increased age (98.4%), late detection of breast cancer that causes death (95.3%), and the fact that breast cancer is not a type of contagious disease (87.5%). The respondents know that smoking and alcohol consumption increase the risk of breast cancer (85.9%), breastfeeding decreases its risk (84.4%), and breast cancer is an inherited disease (84.4%). It is detrimental to know that approximately 80% of respondents answered that breast cancer has no cure, and a few respondents understood that breast cancer is a contagious disease (12.5%). Nevertheless, the respondents knew that a high level of oestrogen hormone and obesity increase the risk of breast cancer.

Table II: Knowledge regarding risk factors of breast cancer (n = 64)

No.	Items	Answer	Frequency (n)	Percentage (%)
1.	Breast cancer risk increases with age	Yes	63	98.4
		No	1	1.6
2.	Breast cancer is inherited disease	Yes	54	84.4
		No	10	15.6
3.	A high-fat diet is a risk factor for breast cancer	Yes	47	73.4
		No	17	26.6
4.	Smoking is a risk factor for breast cancer	Yes	55	85.9
		No	9	14.1
5.	Alcohol consumption increases the risk for breast cancer	Yes	55	85.9
		No	9	14.1
6.	Pregnancy at age of more than 30 years old increases the risk for breast cancer	Yes	48	75
		No	16	25
7.	Early menarche below 11 years old increases the risk for breast cancer	Yes	35	54.7
		No	29	45.3
8.	Late menopause is a risk factor for breast cancer	Yes	35	54.7
		No	29	45.3
9.	Stress increases the risk for breast cancer	Yes	49	76.6
		No	15	23.4
10.	Obesity is one of the risk factors for breast cancer	Yes	50	78.1
		No	14	21.9
11.	Women who have never conceive (*nulliparous*) is at risk for breast cancer	Yes	43	67.2
		No	21	32.8
12.	The use of contraceptive pills increases the risk for breast cancer	Yes	44	68.8
		No	20	31.3
13.	Breastfeeding decreases the risk for breast cancer	Yes	54	84.4
		No	10	15.6
14.	A high level of estrogen hormone increases the risk for breast cancer	Yes	50	78.1
		No	14	21.9
15.	Breast cancer is one type of contagious disease	Yes	8	12.5
		No	56	87.5
16.	Breast cancer has no cure	Yes	13	20.3
		No	51	79.7
17.	Late detection of breast cancer can cause death	Yes	61	95.3
		No	3	4.7

CONTINUE

The median score of knowledge about the risk factors of breast cancer was 13.00 (3), which was equivalent to the 50th percentile score of 13.00. The minimum score for this part was 7.00, and the maximum score was 16.00. Although the average level of knowledge about breast cancer among the respondents was moderate, based on the cutoff, it is not safe to assume all members of the community in Kuantan possessed a moderate level of knowledge about breast cancer risk factors. This is due to the fact that some respondents obtained a score below the 50th percentile, which was considered a poor level of knowledge.

Knowledge regarding breast cancer signs and symptoms

Table III highlights the most common signs and symptoms of breast cancer recognised by the respondents. Having lumps in one or both breasts and under armpits is recognised as a sign of breast cancer (93.8%). The respondents also correctly answered that breast skin ulceration, swelling, and enlargement of the breasts are signs and symptoms of breast cancer (92.2%). The median of the total score for knowledge of breast cancer signs and symptoms in this study is 9.00 (2). Thus, the knowledge level of the signs and symptoms of breast cancer among this study population is moderate; however, the minimum score obtained was 3.00.

Table III: Knowledge regarding sign and symptoms of breast cancer (n = 64)

No.	Items	Variables	Frequency (n)	Percentage (%)
1.	A lump at the area of the breast is a sign of breast cancer	Yes	56	87.5
		No	8	12.5
2.	A nipple discharge indicates the sign of breast cancer	Yes	52	81.3
		No	12	18.8
3.	Pain and soreness in the breast are signs and symptoms of breast cancer	Yes	53	82.8
		No	11	17.2
4.	Changes in the size of one or both breasts indicate a sign of breast cancer	Yes	53	82.8
		No	11	17.2
5.	Breast skin ulceration is one of the breast cancer signs	Yes	59	92.2
		No	5	7.8
6.	A breast cancer patient usually experiences weight loss	Yes	50	78.1
		No	14	21.9

CONTINUE

Table III: Knowledge regarding sign and symptoms of breast cancer (n = 64). (CONT.)

No.	Items	Variables	Frequency (n)	Percentage (%)
7.	Changes in the shape of one or both breasts indicate a sign of breast cancer	Yes	60	93.8
		No	4	6.3
8.	An inverted nipple in one or both breasts is a sign of breast cancer	Yes	44	68.8
		No	20	31.3
9.	Breast cancer will cause swelling and enlargement of the breast	Yes	59	92.2
		No	5	7.8
10.	Lumps under the armpit is a sign of breast cancer	Yes	60	93.8
		No	4	6.3
11.	*Peau d'orange* skin at the breast area is a sign of breast cancer	Yes	57	89.1
		No	7	10.9

Awareness on breast cancer and its screening method (breast self-examination)

The total score for awareness of breast cancer and its screening method (breast self-examination) was 100. The minimum score obtained was 41.00, while the maximum score was 100.00. The median total score in the awareness domain was 77.00 (20).

Practice of breast self-examination

The total score for the practice of breast self-examination was 100. The minimum score obtained was 25.00, while the maximum score was 100.00. The median total score of the awareness domain was 64.00 (36).

Prevalence of the VR approach in breast cancer awareness

Almost all the respondents agreed that utilising the VR approach as part of the awareness programme could be effective, particularly in improving their knowledge and awareness about the disease (92.2 to 93.8%). 95.3% of the respondents reported the content on breast cancer was delivered more precisely through VR, and they enjoyed the session. Despite all the positive effects of the VR approach, a few of them experienced cybersickness symptoms after wearing the VR headset, such as nausea and headache (23.4%), and 10.9% reported that they are not sure whether they are actually comfortable using the VR headset, as shown in Table IV.

Table IV: Prevalence of VR approach in breast cancer awareness program (n=64)

No.	Items	Frequency (%)		
		Yes	No	Not Sure
1.	Have you ever used a VR headset before participating in this breast cancer awareness program?	27 (42.2)	36 (56.3)	1 (1.6)
2.	Do you feel comfortable when using the VR headset?	51 (79.7)	6 (9.4)	7 (10.9)
3.	Do you experience any cybersickness symptoms after wearing the VR headset such as nausea and headache?	15 (23.4)	44 (68.8)	5 (7.8)
4.	Do you understand the content of the breast cancer awareness program using the VR approach?	60 (93.8)	1 (1.6)	3 (4.7)
5.	Does the information on breast cancer given by the VR approach is clear and precise?	61 (95.3)	1 (1.6)	2 (3.1)
6.	Does the content in the VR approach help you to understand about breast cancer better?	59 (92.2)	-	5 (7.8)
7.	Does the content of the VR approach increase your awareness about breast cancer?	59 (92.2)	-	5 (7.8)
8.	Do you feel enjoy during this activity?	61 (95.3)	1 (1.6)	2 (3.1)

DISCUSSION

Sociodemographic background of the respondents

The median age of the respondents was 22.00 (3), with the majority of respondents aged 20 –30 years old (87.5%), similar to previous studies conducted in Bangladesh and the Republic of Congo (35,36). The event took place after the Breast Cancer Awareness (Hybrid) 2023 Outreach Event at the Kulliyyah of Nursing, IIUM Kuantan, on May 12 and 13, 2023. The event attracted students and staff to use virtual reality (VR) technology. The majority of the respondents were single (90.6%), aligned with a study conducted in the Republic of Congo that reported most of their respondents were not married

(52.76%), widowed, or divorced (8.18%) (36). 82.8% of our respondents were female, contradicting previous studies that mostly involved childbearing-aged women (35,36). On the other hand, only a small percentage of our respondents reported having a family history of breast cancer, similar to a previous study (36).

Knowledge regarding breast cancer risk factors

The median score for knowledge regarding breast cancer risk factors among our respondents was 13.00 (3). More than half of them recognised that early menarche increases the risk of breast cancer. This is contradictory with previous studies that reported that more than half of women in Bangladesh, Omani female teachers, and Jordanian women do not recognise early menarche as one of the risk factors for breast cancer (3,37,38). These studies also highlighted the failure of their respondents to recognise obesity as a risk of breast cancer, which contradicted the findings in this study (3,37,38). This could be explained by the fact that the majority of our respondents are students and staff in the nursing or healthcare field. Therefore, they are more exposed to women's health, including breast cancer (15).

Furthermore, our respondents also agreed that early detection could save lives, which is consistent with a study conducted in Oman, where they reported that most of the female teachers possessed significant knowledge of breast cancer, including its risk factors. A study found that good knowledge of breast cancer and early detection can lead to successful treatment (3).

Knowledge regarding breast cancer signs and symptoms

About 93.8% of our respondents were able to recognise that changes in the shape of one or both breasts and lumps under the armpit are signs of breast cancer. Meanwhile, 82.8% of our respondents agreed that changes in the size of one or both breasts indicate a sign of breast cancer. Similarly, a study conducted in Oman reported that 82.0% of Omani female teachers knew changes in the size of their breasts were one of the signs and symptoms of breast cancer (3). Additionally, more than half of the Congolese women were able to identify changes in the breast shape and changes in the breast size as signs of breast cancer (36). Furthermore, a study conducted in Qatar found that 54% of Qatari women recognised the presence of a lump or thickening under the armpit as a sign of breast cancer (10) Although this finding is similar to our current study, which shows more than half of the respondents were able to recognise this sign, the proportion is lower compared to the current study.

In contrast, a study in Bangladesh found that 85.3% of the study population did not know that any change in breast size or shape was one of the signs and symptoms of breast cancer (37). This contradictory finding might be due to the sociodemographic factor, where the majority of the respondents in Bangladesh were living in rural areas and received secondary education. In this current study, our respondents were mostly undergraduate students, and the campus is located in an urban area. Perhaps living areas and literacy status do have an influence on the knowledge level of breast cancer among women in Bangladesh (37).

Awareness on breast cancer and breast self-examination

The median score obtained for the awareness domain was 77.00 which is considered to have good awareness (15). Our findings were comparable to a study among Jordanian women, particularly those who are working, with more than half of them showing a good to excellent level of awareness regarding the curability of breast cancer and that early detection improves the chance of survival (38). On the other hand, a study conducted among women in Qatar revealed contradictory findings to ours. Most of the women in Qatar have low awareness of the signs and symptoms, risk factors, and the current screening programme, despite the availability of free health care services and the national awareness campaign held in 2020 on breast cancer (10). Although more than half of the respondents said they knew about the warning signs of breast cancer, the results of their awareness level for specific signs did not correspond.

Practice of breast-self examination

Our study found that the respondents' practice of breast self-examination was 64.00 (36), which is considered moderate. For instance, a hospital-based cross-sectional study conducted in Bangladesh showed that participants who knew about BSE did not even practice BSE regularly (37). On the other hand, low levels of practice for early detection of breast cancer could be due to the absence of any breast cancer symptoms in them (39). Hence, they hardly practice BSE, knowing that there would be no changes to their breasts and having fewer chances of getting breast cancer (37,39).

Prevalence of VR approach in breast cancer awareness

Prior to this current study, more than half of the respondents claimed that they had never used a VR headset similarly like a study in Kampala (13). A small proportion of the respondents reported experiencing cybersickness symptoms, such as nausea and headaches, after wearing the headset. This finding is like a study conducted among cancer-associated chronic pain patients in Canada. The study reported that the main negative effects of VR intervention for pain management were cybersickness, which is a type of motion sickness induced by VR (22).

The majority of the current study respondents claimed that they understood the content of the VR; the information about breast cancer given through VR is clear and precise, and it also helped them understand breast cancer better. Similarly, the respondent also reported that VR enhance the delivery content of topics for the learners and able to simulate their interest

which supported by previous findings (13,14). Almost 95.3% of the respondents reported that they found the VR approach enjoyable which also reported in earlier studies (25,40). This is consistent with the positive response among the cancer patients with chronic pain who felt fascinated with the VR approach for providing relaxation by distracting them from pain (18,22).

Most of the respondents believed VR technology would be an effective means to provide information on breast cancer to the public. Studies conducted were among nursing students and healthcare professionals with the aim of exploring the learners' views of using virtual reality in healthcare (13,15). The nursing students claimed the VR approach was an effective intervention since its novelty, simplicity, and enjoyment provided cancer awareness information. In fact, the VR intervention would benefit people with visual learning styles the most, making it easier to retain the information.

Limitation of the current study

Some limitations were encountered, such as lack of generalisability, as it was only a preliminary finding conducted in a single university setting in Kuantan, and a larger scale study is recommended for future examination.

CONCLUSION

To conclude, this study revealed that the majority of the respondents possessed an above-satisfactory level of knowledge of breast cancer risk factors as well as its signs and symptoms. Additionally, the level of awareness about breast cancer and its screening method, breast self-examination, is considered good. Meanwhile, the level of practice of breast self-examination by the respondent was moderate. Furthermore, the findings of these results showed that the VR approach to breast cancer awareness programmes is an innovative idea for applying technology to create public awareness about breast cancer.

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