



Perceived feasibility and usefulness of mHealth interventions for psychoeducational support among Nigerian women receiving chemotherapy for breast cancer: a focus group study

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Abstract

Background Women diagnosed with breast cancer (BC) receiving chemotherapy have reported various side effects, which adversely affect their psychological state. Evidence suggests that psychoeducational interventions (PEIs) delivered through mobile phones might effectively provide psychoeducational support for this population. However, there is a lack of evidence on Nigerian women's perception of mobile health (mHealth) PEI, which prompted this study.

Method A qualitative study was conducted among women with BC who had completed chemotherapy at two tertiary hospitals in Nigeria. Face-to-face focus group discussions were conducted at the oncology clinics. Data were collected using focus groups until data saturation was reached. Data were analyzed using thematic analysis.

Results In total, 32 women were recruited, with seven focus group discussions conducted. The participants were between 22 and 75 years old and mostly diagnosed with Stage III BC. Four main themes emerged from the data analysis, including experiences of BC diagnosis and treatment phase, patients' needs during chemotherapy, coping with chemotherapy, and perception of mHealth intervention for psychoeducational support. BC diagnosis was devastating, and psychological disturbances were experienced while receiving chemotherapy, but the participants indicated that mHealth intervention was acceptable as it could provide psychological and informational support. The suggested contents include information on chemotherapy, how to deal with the fear of chemotherapy, nutritious diet locally available, and information on exercise.

Conclusion This study has shown that the participants perceived a mHealth PEI is feasible and acceptable in providing psychoeducational support for Nigerian women diagnosed with BC receiving chemotherapy. It is hoped that the unmet needs of this population will be addressed while receiving chemotherapy.

Keywords Breast cancer · Chemotherapy · mHealth · Oncology · Psychoeducation · Qualitative study

Introduction

Breast cancer (BC) has become the most common malignancy worldwide. In 2020, one in eight cancers worldwide were BCs [1, 2]. It is the most prevalent cause of cancer mortality in Africa [3]. Nigeria ranks second in BC incidence in Africa and first in mortality ratio with 124,815 new cases and 78,899 deaths in 2020 [4, 5].

Although chemotherapy remains one of the major treatment modalities for women with BC, various side effects have been found among women diagnosed with BC receiving chemotherapy, which adversely affects their psychological state [6, 7]. Similarly, educational needs have also been reported [8, 9]. However, psychoeducational interventions (PEIs), defined as activities that combine knowledge transfer

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with psychological activities like counselling [10], have been suggested as a means to address this population's psychoeducational needs. A systematic review and meta-analysis of mHealth interventions along the BC trajectory found a medium effect size of PEIs on psychological issues like anxiety, depression, mood, and quality of life [11].

mHealth, defined as "health services delivered through mobile communication devices" [12], has been suggested as a medium to deliver PEIs because mobile phones have become ubiquitous [13]. In 2020, over three billion people worldwide had a smartphone, which is expected to grow by several hundred million years to come [14]. There were 187.9 million mobile connections in Nigeria in January 2021, covering 90% of the total population [15]. Similarly, Nigeria's mobile market is the fastest growing in Africa [16]. A systematic review on the implementation of mHealth projects in Africa revealed that intervention delivered via such mode demonstrated positive health-related outcomes. They are accessible and acceptable as they use low-cost technology and can be adapted to the local context [17]. However, Otu et al. [16] noted that despite growing evidence to support the usage of mHealth in Africa, the uptake remains surprisingly low. In Nigeria, few research-tested mHealth programs have been found in the literature. Olajubu et al. [19] found that postnatal care visits improved with text message reminders. Also, cervical cancer screening uptake improved with text message reminders [20]. But little is known about the usage of mHealth among Nigerian women diagnosed with BC receiving chemotherapy.

Perception of mHealth interventions has been studied in the literature. A meta-ethnographic review of qualitative studies revealed that patients considered mHealth applications (apps) as a useful complementary tool. They increased patient empowerment, facilitated two-way communication with healthcare providers and provided peer support. However, some problems were associated with the usage of the apps, including concerns about the scientific validity of the apps, privacy and security issues, relevance to specific diseases, cultural and user appropriateness [21].

Various factors have been found to influence the perception of mHealth interventions. One of such is technological literacy. Some elderly patients receiving treatment for hypertension and heart failure were frustrated as they could not use the apps due to their low level of digital literacy [22, 23]. Furthermore, poor eyesight was another barrier to the usage of the apps among aged patients with chronic diseases, as they could not see their phones clearly [24]. Cost of the technology was another factor as some patients in rural South Africa could not afford airtime to purchase mobile data as their area had no access to Wi-Fi [25]. Although the mobile phone has been referred to as the most advanced infrastructural development in Africa, with rural populations being able to access mobile technology than roads and water [26],

issues of electricity and Internet still affect the acceptability of mHealth.

Furthermore, some cultural factors have been identified to influence the acceptability of mHealth interventions, including language issues, security and confidentiality issues, the competence of the staff in delivering the intervention, cultural attitudes, beliefs, and values [27]. Nigeria is a country with many cultural heritages [28] that can influence the perception of mHealth. As the culture is mainly patriarchal, women need to consult their husbands and family leaders before making health decisions [29]. Similarly, the culture is deeply communal, as the extended family usually rallies around any member that needs medical support [29]. These cultural factors might raise privacy and confidentiality concerns with mHealth usage. Furthermore, Nigeria is a deeply religious community, as some prefer to seek spiritual solutions to their medical conditions [29]. This might also affect the acceptability of mHealth.

The usage of mHealth in addressing the psychoeducational needs of women with BC receiving chemotherapy is becoming prominent [30–33]. Previous studies suggest that mHealth interventions might help address certain psychological concerns like self-efficacy, symptom distress, quality of life, anxiety, and depression [34–38]. However, none of the studies was conducted in Nigeria and Africa.

Although it has been observed that mHealth will be integrated into the care of oncology patients in Nigeria during the COVID-19 pandemic [39], the evidence to guide this integration is lacking. Similarly, the need for culturally appropriate, research-tested mHealth interventions in this population has been documented [33]. This highlights the need for a qualitative study to understand the perception of women diagnosed with BC receiving chemotherapy on the usage of mHealth interventions and the cultural elements that should be included in the intervention.

Hence, this study aims to explore (1) the psychological and educational needs of Nigerian women receiving chemotherapy, (2) the acceptability of using mHealth intervention in addressing psychological and educational needs, (3) the facilitators and barriers, and (4) the cultural elements that should be included in the mHealth PEI.

Method

Design and sampling

A qualitative study was conducted among women with BC who had completed chemotherapy at two tertiary hospitals in Nigeria. Face-to-face focus group discussions were conducted at the oncology clinics. A focus group discussion was considered appropriate as it allows diverse insights among participants where the facilitator takes a peripheral role to

guide the discussion [40, 41]. Purposive sampling technique was used to select 32 women diagnosed with BC receiving chemotherapy from the oncology clinics of two University Teaching hospitals in Nigeria. In total, 32 women of different age groups, professions, and stages of BC who had completed chemotherapy were purposively selected to capture experiences from these groups. A total of seven focus group discussions were conducted until data saturation was reached.

The inclusion criteria were women aged 18 years and above, diagnosed with BC and completed chemotherapy within the past three months; attending the oncology clinic; could speak English and/or Yoruba; and consented to join the study. Participants were excluded if they were cognitively impaired.

The participants were residing in Lagos and other neighboring towns. Lagos is the most populous nation in Africa as of 2021 [42], with an estimated population of 15,387,639 as of 2022 [43]. Tertiary institutions which are referral centers that render advanced oncology nursing services were selected. As referral centers, patients patronize the centers from the Lagos metropolis and neighboring towns. Similarly, a survey conducted at one of the participating institutions revealed that more than half of the patients patronizing the facility come from distances longer than 10 km [44]. Similarly, the survey revealed that about 44.4% of the patients resided outside the Lagos metropolis, thus increasing mobile phone usage among patients [44]. Getting to the institutions is also stressful for the patients, as a study revealed that an average commuter in Lagos spends 2.21 h per day getting to work due to traffic congestion [45].

Chemotherapy is administered on an outpatient basis in the institutions. Patients are only admitted if complications require close monitoring and management. As communal life is predominant in Nigeria [29], women's immediate and extended family members have to participate in their care at home after the chemotherapy sessions.

Data collection procedure

The second, third, and fourth authors, female registered nurses with bachelor's degrees, conducted the interview. They were working at the participating institutions, but they did not have a therapeutic relationship with the participants. The principal investigator trained them before the data collection. An information sheet including detailed information about the study was provided to all participants, after which they were required to sign a written consent form. Demographic data were collected with a self-designed demographic datasheet.

As evidence suggests that focus group participants should be homogenous with respect to at least one characteristic [46], our participants for each focus group were homogenous

with respect to age and social and economic backgrounds. This was done to allow for dense interactions and lively discussions [46].

The interview was conducted in a private, quiet room in the oncology clinic. One of the interviewers moderated the discussion as a facilitator, while the other acted as an observer to handle logistics, take careful notes, and monitor recording equipment [47]. The facilitator utilized a semi-structured interview guide developed by the research team, which comprised open-ended questions based on literature review findings. Some of the questions asked include how they felt when they were diagnosed, how they coped with the diagnosis and treatment, their needs while receiving chemotherapy, their experience with health professionals, and their perception of the mHealth app. The participants were seated in a circle. Each interview lasted around 60 to 90 min. All the interviews were audio-recorded.

Some measures were taken to ensure rigor during data collection and data analysis. Open-ended questions were utilized to ensure credibility. Dependability and transferability were ensured through audit trails. To ensure the validity of the qualitative findings and the generated themes, two authors (the first and fifth authors) reviewed participants' quotes and interpretations to confirm congruence and validate the findings [47, 48].

Data analysis

Data were analyzed using the QSR NVIVO 12 software program. Verbatim transcription was conducted while listening to the recording. Thematic analysis method was used for data analysis [49, 50]. This method has six phases: familiarizing with the data, generating initial codes, searching for themes, reviewing themes, defining and naming the themes, and producing the report. The consolidated criteria for reporting qualitative research guidelines (COREQ) were adhered to in reporting this study (see Supplementary material).

Results

Demographics

In total, 32 women who had recently completed BC chemotherapy were interviewed. The majority were between the ages 41 and 50 (34.4%). Most were married (62.5%), Christian (75%), had tertiary level education (68.8%), and monthly household income of USD120 (34.4%) and were diagnosed with stage III BC (34.4%). Most of the participants had no previous formal mHealth experience before the study, but they had been using their phones to search for health information. Socio-demographic data are presented in Table 1.

Table 1 Sociodemographic data of the participants ($N=32$)

Variable	Frequency	Percent	
Age, mean (SD) $48 \pm (12.78)$			
Marital status	Single	5	15.6
	Married	21	62.5
	Separated	1	6.7
	Widowed	4	12.5
	Divorced	1	3.1
Ethnicity	Yoruba	16	50.0
	Igbo	12	37.5
	Hausa	1	3.1
	Edo	1	3.1
	Urhobo	1	3.1
	Igala	1	3.1
	Religion	Christianity	24
	Islam	7	21.9
	Catholic	1	3.1
Level of education	No formal Education	2	6.3
	Primary	2	6.3
	Secondary	5	15.6
	Diploma	1	3.1
	Tertiary	22	68.8
Stage of breast cancer	Stage 1	7	21.9
	Stage 2	5	15.6
	Stage 3	11	34.4
	Stage 4	4	12.5
	I don't know	5	15.6
Monthly household income	Less than 20,000NGN (50USD)	8	25.0
	21,000–50,000NGN (120USD)	11	34.4
	51,000–100,000NGN (245USD)	6	18.8
	101,000–150,000NGN (370USD)	2	6.3
	Above 150,000NGN	5	15.6

Themes

Four major themes emerged, including experiences of BC diagnosis and treatment phase, patients' needs during

chemotherapy, coping with chemotherapy, and perception of mHealth intervention for psychoeducational support. These themes are further elaborated into various subthemes (see Table 2).

Table 2 Themes and subthemes generated from the interviews

Themes	Subthemes
Experiences of breast cancer diagnosis and treatment phase	<ul style="list-style-type: none"> • Emotional turmoil with breast cancer diagnosis • Different experiences with the first cycle of chemotherapy • Psychological disturbances during chemotherapy
Patients' needs during chemotherapy	<ul style="list-style-type: none"> • Need for information from reliable sources • Need for psychological support and reassurance
Coping with chemotherapy	<ul style="list-style-type: none"> • Resources available for coping • Strategies adopted for illness adjustment
Perception of mHealth intervention for psychoeducational support	<ul style="list-style-type: none"> • Suggestions for the design of mHealth intervention • Incorporation of cultural elements • Facilitators for using mHealth intervention • Perceived barriers to using mHealth intervention • Acceptability and feasibility of the usage of mHealth intervention

Experiences of BC diagnosis and treatment phase

The participants perceived diagnosis with BC as highly challenging. On receiving the diagnosis, some were confused, scared, and shocked. Participants' experiences in this regard are further discussed under three subthemes.

i. *Emotional turmoil with breast cancer diagnosis*

Receiving the diagnosis was psychologically burdensome and shocking for the women. All of them were emotionally challenged after they received the diagnosis. It was clear that none of them was prepared for such an occurrence.

“I felt that the whole world was coming to an end. I cried and cried. I said, ‘God why, me....’” (P5, 59 years, civil servant).

“It was the saddest day of my life. It was even on my birthday. When people called telling me happy birthday, I told them it was a sad birthday.” (P1, 37 years, administrative officer).

ii. *Different experiences with the first cycle of chemotherapy*

Many women felt that the first cycle of chemotherapy they had was more challenging than the other cycles they received:

“The first chemo...My God, I almost ran mad. I was on admission. In fact, I could not stand. I thought I was gone. They said I passed out. I was hearing them from afar.” (P13, 47 years, civil servant).

“My first dose of chemo was not easy. It was easy to take it, but it was challenging to battle the side effects at home. It was as if another demon from hell was coming to dominate this body....” (P8, 38 years, tailor).

However, some participants opined that the first chemotherapy cycle was not challenging for them:

“The first chemo did not trouble me much. I was eating as I like; I witnessed a little discomfort the first and second day.” (P25, 65 years, trader).

iii. *Psychological disturbances during chemotherapy*

Psychological concerns reported by the women include fear, anger, confusion, and insomnia:

“My sister, you see, chemo will confuse you. When I started chemo, I weighed 138 kg. 1st Chemo took 13 kg!” (P9, 40 years, unemployed).

“...even to sleep on my bed, I become scared. Because it is as though once it is 12 midnight something strange was coming to possess my body...” (P8, 38 years, tailor).

“Sometimes I will be shouting at my children; I became very irritable and aggressive.” (P20, 36 years, fashion designer).

Patients' needs during chemotherapy

While receiving chemotherapy, the needs of the women were majorly informational and psychological. Many of them got confusing information online and from friends and relatives. These needs were further elaborated in two subthemes.

i. *Need for information from reliable sources*

The participants' responses suggested that they did not have enough information before and during chemotherapy. They wished they had more information about diet, exercise, and the mode of action of the chemotherapy:

“I didn't know they would cut off my breast after the injection; they didn't explain very well to me. Even for the chemotherapy, they did not explain well...” (P10, 29 years, student).

“The major informational need I had was on nutrition. Like when I want to go to the market, what should I buy and what should I not buy...” (P13, 47 years, civil servant).

Although many of them resorted to seeking information online, some were scared as the information they got was misleading, confusing, and inconsistent. While some found the information helpful, many found the information unreliable, which made them feel uncertain about their prognosis:

“Google will take you where you don't want to go. When I google, I was confused as I didn't see anybody to put me through...” (P8, 38 years, tailor).

“When I got the diagnosis, I said I would not go for chemotherapy. So, I tried different supplements. But they were not successful, so I went back to the hospital. But by then, I was between life and death.” (P9, 40 years, unemployed).

ii. *Need for psychological support and reassurance*

Although many of them reported that they had attended health talks on coping with the demands of chemotherapy before the commencement of their chemotherapy sessions, they felt they needed personal counselling sessions:

“Except for the weekly health talk, there was really no personal counselling. They just did a general health talk.” (P6, 63 years, retired).

“I think one thing is missing, counselling. How can people come here crying and still go out of the hospital sad? There must be time for counseling.” (P4, 62 years, retired).

Coping with chemotherapy

Although the participants perceived chemotherapy as highly challenging, coping resources were available, and some coping strategies were adopted for adjustment. This is further elaborated in two subthemes.

I. *Resources available for coping*

Coping resources identified by the participants can be categorized into family members, friends, BC survivors, health professionals, and the church:

“My aunt was a huge support to me. She is 80 now. She is a BC survivor. I concluded that if she could survive it over 20 years ago when technology was not this advanced...what am I afraid of...” (P13, 47 years, civil servant).

“My children all rallied around me. They have been giving much money, running into millions of naira.” (P19, 62 years, trader).

“I just want to thank the nurses and the doctors here. They are very hardworking. Thank you for your love and care. The love, attention, care and support were beneficial.” (P25, 65 years, trader).

“My whole church was aware. Because of my financial state, I could not pay the hospital bills here, so my whole church was supportive in terms of praying and raising money for me, especially the church women.” (P8, 38 years, tailor).

Furthermore, many of them found smartphones to be a major source of support while receiving chemotherapy:

“Smartphone is like my doctor, consultant, and dietician. The phone is a teacher and even more than a doctor. Before you see a doctor, the phone has helped you to get an answer.”

(P8, 38 years, tailor).

“My phone was my top companion. Apart from God and my phone... Anything I don’t understand, I will just press it there and get the answer.” (P10, 29 years, student).

II. *Strategies adopted for adjusting to the illness*

The strategies adopted for coping include positive thinking, prayer, online information and exercise:

“Determination, courage, being positive in everything, that was what pushed me through....”

(P10, 29 years, student).

“With prayers, I was able to cope. And I believed God was able to support...” (P26, 47 years, businesswoman).

“The exercise helps me eat more. Sometimes, bad thoughts will enter during the night, and sleep will become an issue. After these exercises, I also find it easier to fall asleep.” (P17, 65 years, retired).

“I didn’t know what to eat or what to do. I now went to check online. The kind of food I should be taking. I was like, whao! Is that the secret? That was how I pushed through.”

(P8, 38 years, tailor).

Perception of mHealth intervention for psychoeducational support

The participants offered various suggestions that should guide the design of such an intervention. Their thoughts are captured in the following five subthemes:

i. *Suggestions for the design of mHealth intervention*

The participants suggested that mHealth intervention could be delivered through a mobile application (app). The contents should include what to expect during chemotherapy, how chemotherapy works, how to manage the side effects of chemotherapy, and information on diet:

“First thing is information about chemo. Many are afraid of chemo. But if they can put out the information, it will take the fear away. Also, there should be info about how chemo works and how to manage the side effects” (P15, 44 years, businesswoman).

“They should give information about the first stage of chemo, the second stage. They should break it down” (P16, 22 years, unemployed).

“What can I eat and what things I need to run away from. The app should also have information about exercise” (P17, 65 years, retired).

The intervention features suggested by the participants include the availability of offline features, involvement of BC survivors, privacy, timely response from nurses, and user-friendliness:

“If it is possible, they can do it in such a way that participants can access some messages or functions offline. Also, the app should be user-friendly, and nurses must also respond on time. There should also be feedback.” (P4, 62 years, retired).

“You have to bring survivors in. If a nurse is a survivor, that can be fine. It takes a survivor to relate with what we are passing through.” (P8, 38 years, tailor).

“Privacy is paramount. An app like Facebook is not allowed. An app like WhatsApp looks good. It should be confidential to avoid stigma.” (P20, 36 years, fashion designer).

They also reported on the suitability of nurses for delivering such interventions:

“I believe nurses should be able to help us with the application. Maybe because we spend more time with them, so they answer our questions more....”

ii. *Incorporation of cultural elements*

Some cultural elements identified during the discussion are the inclusion of food available in the local context and the availability of translation features into the three major local Nigerian languages and information on how to balance spirituality and orthodox medicine:

“There are many fruits and vegetables that they mention online that we don’t have around here. So, if an app with local content can be built, it will go a very long way.” (P7, 50 years, civil servant):

“There should be room for translation- Yoruba, Igbo and Hausa. Over 20 years ago, my sister-in-law died of BC. I saw her breast decaying, and she did not go to the hospital but was praying. People should come to the hospital. This is a cultural issue.” (P4, 62 years, retired).

iii. *Facilitators for using mHealth intervention*

Facilitators for the usage of mHealth intervention include the availability of smartphones, regular internet subscriptions, and literacy. Almost all of them had a smartphone, and they have been using it to seek information online:

“I am a regular user of my phone, so there will not be any barrier. I speak English well, and I subscribe well to the internet.” (P1, 37 years, administrative officer).

“If there is an app that can bridge the communication between patients and nurses, it will encourage the patients that at least somebody is going through the journey with them.” (P3, 46 years, educator).

iv. *Perceived barriers to using mHealth intervention*

The participants identified three major barriers: illiteracy, non-expertise in using the app, and the cost of downloading the app. The two illiterate participants suggested that their children could teach them how to use the app:

“If it does not have you paying a subscription fee to be part, that will be very fine. For me, I won’t download the app if it is not free. I prefer to be using my chrome and going on Google.” (P32, 56 years, civil servant):
 “I have it, but I am not literate. For the application, my children can tell me how to go about it.” (P14, 75 years, retired).

v. *Acceptability and feasibility of the usage of mHealth intervention*

All the participants opined that the intervention was feasible and would be acceptable. Also, they declared that they were willing to be part of the intervention when it is launched:

“This is a welcome development. We will not have to be rushing to the hospital every time for complaints that can be easily handled on the phone” (P30, 44 years, businesswoman).

For me, if such an app had existed before I started chemotherapy, I would have surely used it....” (P4, 62 years, retired).

“This intervention will go a long way. I don’t think there will be many barriers, so far, the app is beneficial, people will use it.” (P15, 44 years, businesswoman).

Discussion

This study was conducted to understand the perception of Nigerian women on the feasibility of using mHealth interventions to provide psychoeducational support while receiving chemotherapy. We found that many of our participants found diagnosis with BC and usage of chemotherapy to be psychologically burdensome. The psychological burden found among participants in our study was similar to the experiences of Nigerian women from a previous study [9]. Most participants verbalized that the first cycle was more burdensome for them psychologically than the subsequent cycles. This was supported by a study that found a significant increase in anxiety among this population after their first cycle of chemotherapy [51]. This calls for psychological support for this population when receiving chemotherapy.

We found inadequate psychological preparation before chemotherapy. This might have contributed to the emotional turmoil associated with the treatment. Inadequate preparation before chemotherapy was also found in a study among Zambian women receiving chemotherapy for BC [52]. This highlights the need for adequate psychological preparation before and during chemotherapy. Furthermore, inadequate information was also found among our participants before the commencement of chemotherapy. Diet, exercise, mode of action of chemotherapy, managing side effects, and dealing with the fear of chemotherapy were areas of need. These areas are similar to the information needs found in this population’s findings from previous studies [53, 54]. Inadequate information before chemotherapy was also found in previous studies conducted in Nigeria [9] and Ghana [55], where the women receiving chemotherapy did not know much about

the treatment. This highlights the need to provide PEIs to this group of people to address their unmet psychological and informational needs.

To fill the knowledge gap found among our respondents, many sought information from online sources using their mobile phones. Various studies have reported that online information-seeking behavior is typical among women diagnosed with BC [56, 57]. Many of them have unanswered questions and sometimes find information from health professionals within 15–20 min of clinic consultation overwhelming and not very clear [58]. This highlights the need to deliver simplified online health information.

Some coping resources were utilized to deal with the chemotherapy's side effects and psychological issues, including support from family members, which was also reported in another study [59]. Also, many of them found support from BC survivors helpful. This aligned with a study conducted in Thailand where women receiving chemotherapy for BC found support from those who had completed the treatment [60]. Furthermore, many of the participants reported that the church was beneficial. Religious coping was also reported by a study among African American women [61].

All our respondents perceived that a mHealth PEI would be suitable to meet their psychological and educational needs while receiving chemotherapy. This is in line with a study where the participants perceived a mobile app as effective for providing psychoeducational support [33]. Various factors could have been responsible for the acceptance of mHealth. One is the literacy level of the participants [22, 23]. Many of our respondents were literate, as 66.8% had tertiary education, and just 6.3% had no formal education. Statistics from the Nigeria Demographic and Health Survey (NDHS) revealed that half of the women in Nigeria have a secondary school education or more [62]. Statistics further revealed that Lagos state, where this study was conducted, has the highest percentage of women with secondary education or more (68%) [63]. Similarly, in a recent study conducted in southwest Nigeria among women diagnosed with BC who had undergone a mastectomy, 72% of the women had a tertiary level of education [64]. Since our study captured the experiences of women with a high level of education, this might influence their perception of the feasibility and usefulness of mHealth as they might experience fewer challenges in using mobile devices. This might be responsible for their positive attitude towards mHealth. It is worthy of note that the literacy rate of women in some geopolitical zones in Nigeria is not as high as that of our study setting. Statistics revealed that the female literacy rate in Northwest, Nigeria was 29%, and the Northeast was 31.8% [63], this could affect their perception of the mHealth PEI. More research is needed to explore the acceptance and usefulness of mHealth among

Nigerian women with lower levels of education and socioeconomic status.

Furthermore, age of the participants could have influenced their perception of mHealth PEI. Higher digital health literacy has been found among younger women who had completed breast cancer treatment [65]. As the mean age of our respondents was 48, this could have been responsible for their perceived feasibility of the intervention. Literature also reveals that older adults are less likely to embrace digital health [66]. The senior technology acceptance model (STAM) and the unified theory of acceptance and use of technology (UTAUT) have found that age is a moderator of usability of technology [66, 67]. Wildenbos et al. [68] also noted that barriers like hearing or visual loss, poor motivation, semantic fluency, poor self-confidence, and grip strength among the elderly could affect mHealth usage. These factors should be taken into consideration when designing mHealth interventions that could be used by older adults. However, two of the respondents in our study were 75 years of age, and they had no formal education; they suggested that their children could help them with the app usage. This was similar to a study conducted among Chinese women where the participants recommended that their family members could be allowed to join the intervention so that they could help with interpretation [33]. However, it is important that privacy and confidentiality issues be upheld as the participants in our study declared that their privacy must be respected and confidentiality must be assured to avoid stigma. Participants from a previous study on the effect of PEI among women diagnosed with BC receiving chemotherapy also noted that some participants were not comfortable discussing sensitive issues due to the stigma associated with BC in that culture [33].

Another factor that could affect mHealth usage is the socioeconomic status. Some of our participants opined that they would not be able to download and use any application that has a cost attached to it. Close to two-thirds of our respondents had a monthly household income of less than 120USD per month. Statistics have revealed that as of 2022, 88.4million people in Nigeria live in extreme poverty, and 12.9% of the global population living in extreme poverty were found in Nigeria [69]. mHealth usage in Nigeria will be more feasible if it could be rendered free of charge or at a low cost as a significant relationship has been found between digital health literacy and socioeconomic status [70].

Culture is another major factor that influences the acceptability of mHealth PEI. As Nigeria is a culturally sensitive community [28], cultural issues must be considered when designing mHealth interventions for Nigerian women. Although English is the official language of instruction in Nigeria [71], participants in our study suggested that the content of the apps should be translated into three major local languages in Nigeria: Yoruba, Igbo, and Hausa. Translation

into local languages is important for healthcare delivery as language barrier between patients and health workers could negatively affect the quality of health care [72]. Similarly, the participants requested that the app should contain information about locally available diets. It is important to pay attention to the diet of women diagnosed with BC receiving chemotherapy as Custódio et al. [73] reported a significant reduction in the intake of macro and micronutrients while receiving chemotherapy. Similarly, Pedersini et al. [74] reported changes in eating habit during chemotherapy. This was in line with our study as some of participants could not tolerate certain kinds of food while receiving chemotherapy, and some complained that some of the food suggestions they got on the internet were not available within their local environment. This highlights the need for education on locally available diet for this population. This was similar to the finding among Asian women receiving chemotherapy for BC, where the inclusion of culturally appropriate recipes in the mHealth PEI was recommended [75].

Another cultural issue brought to the fore in this study was the need to balance spirituality and orthodox medicine. A systematic review by Osuchukwu et al. [76] noted that religion was one of the major factors that significantly factors that influence treatment-seeking behavior and illness experiences of West African women diagnosed with breast cancer. Similarly, a previous study conducted among this population in Nigeria found that their religious institutions helped them cope with the demands of chemotherapy [9]. This was similar to the experiences of our participants that benefited from support from their churches.

However, some participants observed that some people still do not believe in orthodox medicine for treating BC and some resort to seeking spiritual intervention instead of presenting to the hospital on time. This was also similar to a case report of three cancer cases in southeast Nigeria where the concerned patients resorted to first consulting religious organizations and eventually presented late to the facility when complications had already occurred [77]. Our respondents opined that there while it is important to seek spiritual support, it should be combined with chemotherapy. They affirmed that this could not be overemphasized in a mHealth PEI. Similarly, other suggested features by the participants like privacy, timely response from nurses, and user-friendliness could be considered when designing future interventions.

Our respondents also agreed that nurses would be suitable to deliver the PEI. This supports a systematic review that reported that nurses are suitable providers of PEIs as their interventions have been found to improve health outcomes among cancer patients [78]. The suggested contents to be included in the intervention include management of side effects, information on the mode of action of chemotherapy, locally available diet, dealing with psychological concerns, and exercise. These are similar to the

suggested components of previous mHealth interventions used among this population [30–33, 36]. However, areas that were covered by other interventions in previous studies which were not suggested by the participants, such as self-esteem, body image, sleep management, self-care, and discussion forum [27, 79], could be considered when designing further interventions.

Conclusion

This study has highlighted the perceived feasibility and acceptability of mHealth PEI in supporting Nigerian women diagnosed with BC receiving chemotherapy. The suggested features, including management of side effects, information on the mode of action of chemotherapy, dealing with psychological concerns, and exercise, could be considered for further interventions. Similarly, cultural factors such as translation into the main Nigerian languages, locally available diet, privacy, confidentiality, anonymity, and balance between spirituality and orthodox medicine should also be considered.

Relevance to clinical practice

This study will provide evidence on the factors to be considered when designing mHealth PEI for this population. It is hoped that this will help integrate mHealth into the care of women receiving chemotherapy for BC, thus addressing their psychological and educational needs; hence, improving their experiences while undergoing treatment.

Author contribution Oluwadamilare Akingbade: conceptualization, methodology, data collection, data analysis; writing, original draft preparation; writing, review, and editing; and approval of the manuscript for publication. Victoria Adediran: data collection; ethics approval from study setting; review; and approval of the manuscript for publication. Elizabeth Somoye: data collection; ethics approval from study setting; review; and approval of the manuscript for publication. Adetutu Sefinat Alade: data collection; ethics approval from study setting; review; and approval of the manuscript for publication. Ka Ming Chow: conceptualization; methodology; initial draft preparation; writing, review and editing; validation of formal analysis; supervision; and approval of manuscript for publication.

Data availability All data generated or analyzed during this study are included in this published article.

Code availability Not applicable.

Declarations

Ethics approval This study was conducted in line with the principles of the Declaration of Helsinki. Ethical approval was obtained from

the Survey and Behavioral Ethics Committee of the Chinese University of Hong Kong (SBRE-20–776) and from the Research and Ethics Committee of the Lagos State University Teaching Hospital, Nigeria (LREC/06/10/1660), and Lagos University Teaching Hospital (ADM/DCST/HREC/APP/4420).

Consent to participate The participants received a research information sheet to help them understand key information about the research and the provided consent form. Verbal and written consent informed consent was obtained from each participant included in the study.

Consent for publication Not applicable.

Conflict of interest The authors declare no competing interests.

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