

Determinants of breast cancer screening behavior amongst Nigerian women using the transtheoretical model

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Abstract

Breast cancer is a leading cause of morbidity and mortality amongst women in developing and developed countries. Breast Self-Examination (BSE), mammography and clinical examination are amongst the most effective methods of early detection, however uptake remains low. The Transtheoretical Model (TTM) has been used in many other countries to characterize behavioral shifts related to enable the adoption of more focused tactics for improving breast cancer screening behaviors among Nigerian women.

A cross-sectional research study was conducted to assess the level of knowledge and uptake of breast cancer screening practice based on the various stages of readiness and change predictors using the Transtheoretical Model (TTM). The model was applied to identify and characterise key behavioural determinants such as decision balance, stage of change, and process of change (POC) for breast cancer screening through breast self-examination and mammography.

A total of 265 adult female respondents in Kaduna State, Northwest, Nigeria was sampled out of which ninety-one (91%) had no family history of breast cancer. Although 80.3% had knowledge of breast cancer disease, 68% of respondents knew how to conduct BSE and only 55% practiced it. In terms of BSE behaviour staging, 29.4% and 26.7% respondents are in the preparation and maintenance stages respectively. In terms of mammography adoption, most respondents (34%) are in the preparation stage. Review of process of change determinants show that breast cancer screening behaviour are driven more by experiential determinants as compared to behaviour determinants.

Addressing the complex factors influencing BSE and mammography practice requires a comprehensive social behaviour change approach that may sustaining positive behaviour-driving factors and minimise inhibitive factors that can promote breast cancer screening.

Keywords: Social behaviour Change (SBC); Transtheoretical model; Breast Self-Examination; Mammography; Breast cancer; Women health

1. Introduction

Cancer contributes significantly to morbidity and mortality globally with about 8.2 million cancer related deaths and 14 million new cases with an anticipation of a 70% rise over the next two decades [1]. Africa, Asia and Central and South America alone contributes more than 60% of world's total new cases and 70% of the world's cancer deaths annually [1]. Breast cancer is the most common site-specific cancer that affects women and the primary cause of cancer death in females worldwide, affecting one in eight of them at some time in their lives [2]. Women's death rates are higher in

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Africa due to the disproportionate disparity in access to reproductive health care between industrialized and developing nations, as well as between rural and urban groups [3].

Breast cancer is the most prevalent cancer among Nigerian women [4,5]. The peak age of incidence of breast cancer within the 5th decade of life with predisposing factors identified as early menarche, late menopause, late age at first birth, and other reproductive factors [6]. Breast cancer is commonly seen in four stages that represents its progression [7]. The stage at which breast cancer is diagnosed has a tremendous impact on type of treatment, recovery and survival. In most cases, the earlier the cancer is detected and treated the higher the survival rate for the patient. Late-stage diagnosis remains a major challenge, often attributed to factors such as limited access to healthcare, financial constraints, and cultural beliefs. Because of late-stage detection, the incidence of breast cancer is lower in poor countries than in industrialized ones [8,9].

The increasing prevalence of breast cancer in both developed and developing climes is complicating the existing public health landscape which is already struggling with a myriad of public health emergencies, over-stretched health systems and infrastructure, and increasing medical expenditure worsened by global, regional and national socioeconomic crisis [10]. Early detection of breast cancer is crucial for treatment initiation, high remission, and reduced mortality. Breast self-examination (BSE), clinical examination, and mammography are effective methods for identifying potentially cancerous lumps early, reducing morbidity and mortality. Over 65% of tumors are discovered by patients themselves and BSE is the cheapest and most practical method, especially in rural Nigeria where mammography availability is limited. Despite the high costs and limited availability of mammography, BSE remains an economical, convenient, and non-evasive method for primary detection, particularly for older women over 35 years old [2,14].

Regular screening through breast self-examination, mammography, and other methods can provide a window of positive remission through early detection, successful treatment, and surgery need aversion. However, late-stage diagnosis remains a challenge, often due to factors such as lack of knowledge, cultural beliefs, religion, and socioeconomic disparities also influence women's attitudes towards the disease [5,13]. Studies reveal that low breast cancer screening practices among Nigerian women is due to lack of knowledge, cultural beliefs, and fear of mastectomy [8-10]. Economic hardships restrict access to mammography services, and diagnostic and treatment delays contribute to the high prevalence of advanced and higher-grade breast cancer [10-12].

The Transtheoretical Model (TTM) of behaviour change is a theoretical and clinical framework that is a widely used tool in health behavior research to explore patterns and predictors of behaviour progression/regression across a broad spectrum of social problems. TTM categorizes behavior into stages such as Precontemplation, Contemplation, Preparation, Action, Maintenance, and Termination and often uses a 6-month timeframe to define a behaviour change plan [15]. Key components of the TTM include decision balance, self-efficacy, perceived advantage or disadvantage, and process of change. Some proponents include stages of relapse risk and relapse or termination. Despite its complexity, TTM remains a logical tool for designing and implementing health behavior change programs at all levels.

The theoretical change process in health behavior is influenced by individual cognition, psychosocial and social contexts. During the foundational period of social behaviour change modelling, Bandura (1986) introduced the Social Cognitive Theory (SCT) which emphasized the role of self-efficacy, observational learning, and environmental factors in behavior change and acknowledge the importance of self-efficacy. However, the TTM provides a more structured framework for understanding the stages of change [21]. In comparing the TTM with other models, such as the health belief Model (HBM), studies suggest that while HBM is suitable for predicting one-time or infrequent behaviors focusing primarily on individuals' beliefs about health threats and benefits, while TTM is better suited for understanding ongoing behavior change processes [17,18]. In exploring the relationship between TTM and Theory of Planned behaviour (TPB), studies highlighted that the TPB is effective in predicting intentions and unpacking the cognitive determinants of behavior, but TTM adds value by considering the temporal dimension of behavior change [19,20].

The model provides evidence-based logical explanations of social and natural phenomenon associated with decision progression analysed from experiential and behavioural perspectives [22,23]. Research on theory-driven approaches to explain and predict cancer screening behavior documents the application of TTM to understanding colorectal, breast and cervical cancer health disparity, thus demonstrating its potential in addressing health disparities and improving mammography screening outcomes [24-30]. The acquisition and maintenance of health behaviours are a gradual process, with key behavioral and experiential determinants influencing commitment to regular screening and decisional balance. Velicer, et al. (1998) documents 10 key process of change constructs including consciousness raising, dramatic relief, environmental and self-reevaluation, social liberation, stimulus control, relationships, counter conditioning, reinforcement and self-liberation [31]. Purtzer, and Overstreet, (2014) in adapting the transformative learning theory

classified mammography screening decision making amongst low-income, rural women into two phases; dormant phase (no screening uptake) and transformative learning process (screening uptake) [28,29].

The body of research on behavioural determinants of breast cancer screening especially in Nigeria is limited, thus making it crucial to understand what promotes positive behaviors and facilitates desired behavior adoption and maintenance. Researchers have found that behaviour adoption and readiness for screening are closely intertwined. To determine readiness for Papanicolaou (Pap) screening, researchers suggest reviewing amenability and readiness to change. Breast self-examination (BSE) and mammography screening behavior into phases, including precontemplation, contemplation, stage of action, stage of maintenance, and relapse/relapse risk. Understanding these phases can help improve the effectiveness of BSE screening and promote positive behaviors in women.

This study aims to evaluate the uptake of breast cancer screening among women in Kaduna state, Northwest Nigeria, focusing on BSE and mammography. Key objectives include determining knowledge and practice of breast cancer screening, identifying the predominant change stage, identifying determinants of mammography screening behavior, and categorizing determinants based on decision balance and self-efficacy. The research aims to characterize Nigerian women based on their readiness stages and review change predictors based on perceived risks, benefits, and barriers. The findings will help promote mammography screening and provide insights into the relationship between implementation intentions and determinants influencing uptake. The results will inform program design and deployment in line with breast cancer prevention and health promotion strategies.

2. Methodology

2.1. Study design

This study employed a cross-sectional research design to establish, categorize and analyse the relationships between key determinants of breast cancer screening behaviour amongst adult women in Nigeria based on the Transtheoretical Model (TTM).

2.2. Participant Sampling and Recruitment

A convenience-based non-probability sampling method was applied to recruit participant based on the criteria that they are adult females (with or without personal or family history of cancer or cancer screening by mammography screening visits) irrespective of socioeconomic background. Snowballing sampling was conducted to recruit “hidden populations” which hitherto may not be easily accessible through other sampling strategies. To ensure statistical representation and generalization of results from small study population, the sample size was determined using the OpenEpi statistical software and sample size determination approach, while criterion sampling was used to further categorize participants into defined age groups (less than 25 years, 25-34, 35-44, 45-54, 55-65 and over 65 years). Based on confidence level of 95% (Z-value 1.96), confidence interval (5%) and estimated population more than 1 million, a sample size of 354 was estimated for this study with acceptable response rate pegged at 70%.

2.3. Data Collection

This study was conducted between July and September 2016 with respondents randomly sampled from the three LGAs (Chikun, Kaduna-North and Igabi) from the 3 geopolitical zones in Kaduna State, Northwest, Nigeria. Base on initial sampling criteria which considered a 95% confidence interval at expected response and precision rates of 70% and 5% respectively. A total of 265 complete responses were received through online and paper-based questionnaires representing a 75% response rate. In accordance with research ethics and the objectives of this study, participants offered their informed consent prior to completing the questionnaire.

2.4. Tool and Structure

Data was collected along key themes captured in the questionnaire include socio-demographic characteristics (age, marital status, level of education, social protection and family history), knowledge of breast cancer and screening methods (BSE and mammography) and personal health behaviour (regular health check-ups, personal and family history of any cancer). The questionnaire was structure into three parts. Part 1 assessed socio-demographic characteristics of respondents including marital status, level of education, social security, frequency of health check-ups, family history, previous information on breast cancer and screening methods, and respondent age. Part 2 reviewed BSE behaviour including knowledge, decision balance, stage of change, probable process of change (POC) determinants. Part 3 reviewed mammography behaviour including decision balance, stage of change and probable POC determinants.

Positive decision representing a stage of action/maintenance/relapse risk was assigned to affirmative response to the question “Have you ever conducted BSE?” with alternative response was assigned to the stage of precontemplation/contemplation/preparation. The respective stages of change were determined from the answers to the preceding question on decision balance. (a) I never conducted BSE and do not intend to start now (precontemplation), (b) I never conducted BSE but may start now (contemplation), (c) I never conducted BSE but intent to start now (preparation), (d) I have conducted BSE but only once in the last 6 months (Action), (e) I have conducted BSE before and practice at least once a month (Maintenance), and (f) I have conducted BSE before and practice at least once a year (relapse/relapse risk).

Similarly for mammography, positive decision representing a stage of Action/maintenance/relapse was assigned to affirmative response to the question “Have you ever screened for breast cancer?” with alternative response was assigned to the stage of precontemplation/contemplation/preparation. The respective stages of change were determined from the answers to the preceding question on decision balance. (a) I have never conducted mammography and do not plan to screen in over 1 year (precontemplation), (b) I have never conducted mammography but plan to screen in the next 12 months (contemplation), (c) I have never conducted mammography but plan to in the next 1-6months (preparation), (d) I have conducted mammography more than 1-2 times in the last 5 years (Action), (e) I have conducted mammography and plan to screen again in the next 1 year (Maintenance), and (f) I screened last more than 5 years ago (relapse risk).

Questions were structured to elicit POC (driver) determinants based on 10 POC constructs were structure to identify drivers and barriers to behaviour adoption with further bi-directional analysis in terms of experiential and behavioural constructs. The key drivers/barriers were further researched in line with these dimensions which will offer further explanations into the predominant constructs driving cancer screening behaviour adoption.

Questions eliciting Yes or No responses for each experiential construct includes: (1) I know early detection can increase chances of survival (Consciousness Raising); (2) I am afraid that if I do not detect early the outcome may be devastating (Dramatic Relief-Emotional arousal); (3) I need to protect my family by early detection and action (Environmental Reevaluation-Social reappraisal); (4) It is free and I can do it on my own (Social Liberation-Environmental opportunities); (5) It is better safe than sorry (Self-Reevaluation-Self reappraisal). Questions eliciting Yes or No responses for each behavioural construct includes: (6) I want to avoid past experience Or someone in my family have or is a cancer survivor (Stimulus Control-Re-engineering); (7) My spouse and/or family member encourages and supports me (Helping Relationship-Supporting); (8) Regular breast self-examination is a part of my lifestyle (Counter Conditioning-Substituting); (9) I am mentally prepared for the outcome of the result (Reinforcement Management-Rewarding); (10) I am able to maintain a healthy lifestyle when I know my status (Self-Liberation-Committing).

The questions on Process of Change (barrier) experiential determinants include: (1) I do not know much about breast self-examination procedure (Consciousness Raising); (2) I am afraid that if I detect early, the outcome will be psychologically, physically or socially depressing (Dramatic Relief-Emotional arousal); (3) I am shy especially as I do not know who to talk to if I suspect a lump (Environmental Reevaluation-Social reappraisal); (4) The society and current socioeconomic condition make it difficult for me to afford screening services now (Social Liberation-Environmental opportunities); (5) I have never heard of someone detecting a lump during examination so it does not work (Self-Reevaluation/ Appraisal). In terms of behaviour-related determinants, the following questions were asked: (6) Breast self-examination reminds me about an unpleasant experience in the past which I wish to avoid (Stimulus Control-Re-engineering); (7) I do not have anybody that can encourage and support me (Helping Relationship-Supporting); (8) I conduct breast self-examination regularly so I do not see the need mammography screening (Counter Conditioning-Substituting); (9) I am scared and mentally unprepared for the outcome of the result (Reinforcement Management-Rewarding); (10) I am too young/ old to have cancer (Self-Liberation-Committing).

This study also attempts to identify some emergent themes in terms of drivers and barriers. This include: My doctor recommends that I examine regularly, Or I am high risk (driver), I do not see the need OR We don't have cancer in my family OR I do not believe in cancer (barrier) and It is against my cultural or religious beliefs (barrier).

2.5. Data Analysis

Preliminary assessment of data was conducted using simple counts as generated using google forms. Further systematic analysis of was conducted after data coding, entry, cleaning and statistical analysis using Microsoft Excel software to facilitate comparisons in participant distribution and determinants across the various stages of adoption. A description of the study population was carried out using a univariate analysis to describe socio-demographic characteristics. Nominal or categorical variables (responses with no inherent rank or order) was used to describe age, marital status,

personal health history, availability of social protection/insurance) while ordinal variables were used to indicate level of education.

A process of change scale was explored to capture relevant data and categorise participants into the various stages of adoption while a quasi-quantitative empirical research approach was applied to obtain a summary index of decisional balance. Sets of predetermined generic process of change indicators and staging questions were reviewed in line with methodologies such as processes-of-change (POC) and self-efficacy scale to link determinants with screening decision. Participant behaviour was analysed based on Rakowski, et al.'s (1996) stage of behaviour adoption methodology and classified into the various adoption stages including: Precontemplation, Contemplation, Preparation, Stage of Action, Stage of Maintenance, and Relapse Risk/Relapse. Self-efficacy scale was applied to identify and summarise decision balance based positive or negative behaviour at the time of the assessment.

The responses to Breast Self-Examination and mammography screening were conducted separately based on stage of behaviour adoption, decision balance and process of change determinants. Although participants inputs were analysed based on their individual responses to the respective questions, the various behaviour theories were analysed based on different sets of queries. For BSE, respondents in the precontemplation stage are those who have never conducted BSE with no intention to start, the contemplation stage represents respondents who have not started but with intention to start. The preparation stage represents the group of respondents with intention to commence BSE screening in the next 2 months while the stage of action reflects the category of participants who have started conducting BSE with intention to conduct at least 1 routine examination in the next 6months. The stage of maintenance was used to categorise respondents who conduct regular BSE at least monthly while relapse risk and relapse represents participants who previously conduct BSE at most once a year and those who have stopped completely respectively.

Similarly, for mammography screening behaviour, each Stage of behaviour adoption was analysed as ordinal variables with the lowest level being precontemplation (women who have never screened or without any intention to screen), Contemplation (characterized by individual's intent to screen for the first time), Stage of action (interest in repeating follow-up screening) and Stage of maintenance (individuals with at least two mammograms with intention to rescreen on schedule), Relapse (those previously screened but with/without a rescheduled screening appointment), Relapse risk (those without the intention to rescreen). The level of significance of the perceived risk was predetermined and tested ($P < 0.05$ is considered as statistically significant). The mode was used to test association at each stage while the Chi test will provide further statistical testing of relevance. On the Self-efficacy scale, each participant responses were analysed against the process of change constructs and aggregated based on independent measures summarized as experiential and behavioural which was then analysed using descriptive measure - mode. Emergent determinants were also assessed for significant influence on Decision balance.

3. Results

3.1. Demography

Out of a total of 254 respondents, a majority (48.8%) of the respondents were between the ages of 25-34 years (*see Table 1*). A large proportion of the respondents had received post-secondary education as reflected in 45.7% attaining university level of education (or its equivalent) and about 34% with post graduate degree. About 59% of the respondents were married however a significant proportion (39%) did not have any form of social security (*see figure 3*). It was however interesting to learn that although majority of respondents (61%) were under = either the National Health Insurance Scheme, private or community-based health insurance programmes, health check-ups were reactive rather than preventive as reflected in the low percentage of women (12%) conducting at least 1 check up in a year (*see Table 1*). Furthermore, a large percentage of respondents (91%) had no family history of breast cancer.

3.2. Knowledge and Practice

This study reveals that 80.3% of respondents have heard about breast cancer. Amongst screening methods, BSE is most prevalent with 77.5% (203) and 22% (57 respondents) of respondent knowing about BSE and mammography respectively with about 68% being aware of how to conduct Breast Self-Examination. Healthcare workers (45.8%) were identified as the highest source of information on BSE closely followed by Schools/colleges (24.5%). Peer and family groups were amongst the least sources of information contributing 6% each (*See table 2 below*).

Table 1 Respondent Demography

	N	(%)
Age		
Less than 25years	53	20.87
25-34years	124	48.82
35-44years	41	16.14
45-55years	21	8.27
55-65years	8	3.15
More than 65years	7	2.76
Marital Status		
Single	95	35.85
Married	156	58.87
Divorced	0	-
Widowed	14	5.28
Level of Education		
Not educated	9	3.49
Primary School	4	1.55
Secondary School	40	15.50
Tertiary	118	45.74
Post-Graduate	87	33.72
Health Insurance Coverage		
No insurance	93	38.91
Private HMO	43	17.99
NHIS	72	30.13
CBHIS	31	12.97
Retainership	0	-
Others	0	-
Frequency of Preventive Health Checkup		
Never	61	23.28
Annually	32	12.21
Biannually	22	8.40
During illness or when required	147	56.11
Family history of breast cancer		
Positive	15	5.75
Negative	237	90.80
don't know	9	3.45

Table 2 Distribution of Responses by Knowledge of Breast Cancer

	Count	(%)
<i>Knowledge of Breast Cancer as a disease</i>		
<i>Yes</i>	212	80.30
<i>No</i>	52	19.70
<i>Knowledge of Breast Cancer Screening Methods</i>		
<i>Breast Self-examination</i>	203	77.50
<i>Mammography</i>	57	21.80
<i>don't know</i>	51	19.50
<i>Others</i>	2	0.80
<i>Knowledge of Breast Self-Examination Procedure</i>		
<i>Positive</i>	157	67.97
<i>Negative</i>	74	32.03
<i>Source of information on Breast Self-Examination procedure</i>		
<i>Healthcare worker-Doctor, nurse, midwife, etc</i>	97	45.75
<i>Seminar, workshop</i>	35	16.51
<i>School / College</i>	52	24.53
<i>Friend</i>	13	6.13
<i>Parent/Family member</i>	13	6.13
<i>Others</i>	2	0.94

3.3. Decision balance

In terms of Breast Self-Examination, this study revealed that although 68% of respondents knew how to conduct BSE, only 55% (129 respondents) showed positive behaviour (self-examined at least once in their lifetime).

Table 3a Decision balance (Breast Self-Examination)

Decision balance Scale	Responses	%	Description
Positive Decision	129	55.13	(Action/Maintenance/ Relapse Risk/Relapse)
Negative Decision	105	44.87	(Precontemplation/Contemplation/Preparation)

In terms of mammography screening, out of the few positive responses (57) to mammography as a screening method (22%), only 11 (22%) have conducted mammography screening at least once with a majority (70%) yet to.

Table 3b Decision balance (Mammography)

Decision balance Scale	N	%	Description
<i>Positive Decision</i>	11	22.00	(Action/Maintenance/ Relapse Risk/Relapse)
<i>Negative Decision</i>	35	70.00	(Precontemplation/Contemplation/Preparation)
<i>Don't know</i>	4	8.00	

3.4. Stage of Change

In terms of Breast Self-Examination, out of 221 respondents, 5.43% (12) of respondents are in the precontemplation stage (not previously screened with no intention to start), 12.7% (28) express intention to start conducting BSE soon (contemplation), while 29.4% intend to start conduct BSE for the first time in the next 1 month (preparation). About 10.9% (24) conducted at least one examination every 6months (Stage of Action), 26.7% conducted at least one examination monthly (maintenance) and about 15% showed decline in motivation to continue screening as represented by those who conduct BSE once a year (relapse risk).

Table 4a Breast Self-Examination Behaviour Stage of Change

SOC	N	%	Description
<i>Precontemplation</i>	12	5.43	Women who have never conducted BSE with no intention to start immediately
<i>Contemplation</i>	28	12.67	Women who have never conducted BSE with intention to start soon
<i>Preparation</i>	65	29.41	Women who have never conducted BSE with intention to start within the next 1 month
<i>Action</i>	24	10.86	Women who have started conducting BSE with at least once in 6months
<i>Maintenance</i>	59	26.70	Women who conduct BSE consistently at least once a month
<i>Relapse Risk</i>	33	14.93	Women who previously conduct BSE but poorly consistent about once a year

In terms of mammography screening, out of 53 respondents, 22.64% expressed no intention to start screening within the next 1 year (precontemplation), 15.09% showed intention to start in the next 12 months (contemplation) while 34% are currently making plans to conduct their first screening over the next 6 months (stage of preparation). It was observed that while 11 respondents (20.8%) have screened at least once in the last 5 years (Action), only 3 (5.6%) have done so more than 2 times (stage of maintenance) with only 1 (2%) not screened in over 5 years (relapse risk) (see table 4b).

Table 4b Mammography Screening Stage of Change

Scale of Change	N	%	Comments
Precontemplation	12	22.64	Women who have never screened or without any intention to screen in the next 1 year or more
Contemplation	8	15.09	Intention to screen for the first time within the next 1 year
Preparation	18	33.96	Intention to screen for the first time within the next 1-6 months
Action	11	20.75	Women who have screened before with at least 1 session in the last 5 years
Maintenance	3	5.66	Women who have screened before with more than 2 sessions in the last 5 years
Relapse Risk	1	1.89	Women who have not screened in over 5 years

3.5. Process of Change

In terms of Breast Self-Examination, a review of process of change determinants shows that over 65% of respondents are driven towards positive BSE screening behaviour by experiential determinants as compared to 36% driven internally by deliberate behaviour change. Similarly, negative behaviour was driven by experiential determinants amongst 58% of respondents compared to 42% attributed to behaviour determinants (see table 5a).

Table 5a Process of Change: Determinant Categorisation

Behaviour Determinants (Driver)	N	%	Description
Experiential Determinants	478	65.21	Aggregate of responses driven by previous experiences or the avoidance of it
Behavioural Determinants	255	34.79	Aggregate of responses driven by deliberate (previous and/or immediate) decision due to access to information or environmental/social stimulus
Behaviour Determinants (Barriers)			
Experiential Determinants	38	57.58	Aggregate of responses in which previous experiences restricts decisions to take-up positive behaviour
Behavioural Determinants	28	42.42	Aggregate of responses informed by deliberate decision not to make any change in behaviour

Further review of individual determinants reveals that Consciousness Raising (69.6%), ranked amongst the most significant experiential driver for positive behaviour while Self-Liberation (46.6%) was identified as the most significant behavioural determinant influencing positive behaviour. It is worthy of note however that all determinants were significant in determining respondent positive behaviours. In terms of barriers, it was observed that Consciousness Raising characterised by the availability of relevant information on BSE ranked as the most significant (68%) barrier to positive behaviour adoption closely followed by emotional arousal (42%). In addition, Stimulus Control (31.8%), Helping Relationship (36.8%) and Reinforcement Management (36.8%) rank amongst the most significant behavioural determinant influencing negative behaviour (see Table 5b below).

Table 5b Process of Change Determinants: Independent Constructs

Behaviour Determinants (Driver)	N	%	POC Constructs Category
<i>Consciousness Raising</i>	142	69.61	Experiential
<i>Dramatic Relief [Emotional arousal]</i>	68	33.33	
<i>Environmental Reevaluation [Social reappraisal]</i>	83	40.69	
<i>Social Liberation [Environmental opportunities]</i>	95	46.57	
<i>Self-Reevaluation [Self reappraisal]</i>	90	44.12	
<i>Stimulus Control [Re-engineering]</i>	37	18.14	Behavioural
<i>Helping Relationship [Supporting]</i>	43	21.08	
<i>Counter Conditioning [Substituting]</i>	54	26.47	
<i>Reinforcement Management [Rewarding]</i>	45	22.06	
<i>Self-Liberation [Committing]</i>	76	37.25	
Behaviour Determinants (Barriers)			
<i>Consciousness Raising</i>	13	68.42	Experiential
<i>Dramatic Relief [Emotional arousal]</i>	8	42.11	
<i>Environmental Reevaluation [Social reappraisal]</i>	5	26.32	
<i>Social Liberation [Environmental opportunities]</i>	6	31.58	
<i>Self-Reevaluation [Self reappraisal]</i>	6	31.58	
<i>Stimulus Control [Re-engineering]</i>	6	31.58	Behavioural
<i>Helping Relationship [Supporting]</i>	7	36.84	

<i>Counter Conditioning [Substituting]</i>	4	21.05	
<i>Reinforcement Management [Rewarding]</i>	7	36.84	
<i>Self-Liberation [Committing]</i>	4	21.05	

In terms of mammography screening, a review of process of change determinants shows that over 61% of respondents are driven towards positive mammography screening behaviour by experiential determinants as compared to 39% that are driven by behavioural determinants. Similarly, negative behaviour is driven by experiential barriers amongst 60% of respondents as compared to behavioural determinants recorded amongst 40% of respondents (see table 6a).

Table 6a Process of Change: Determinant Categorization

Behaviour Determinants (Driver)	Responses	%	Comments
<i>Experiential Determinants</i>	64	60.95	Aggregate of responses driven by previous experiences or the avoidance of it
<i>Behavioural Determinants</i>	41	39.05	Aggregate of responses driven by deliberate (previous and/or immediate) decision due to access to information or environmental/social stimulus
<i>Behaviour Determinants (Barriers)</i>			
<i>Experiential Determinants</i>	24	60.00	Aggregate of responses in which previous experiences restricts decisions to take up positive behaviour
<i>Behavioural Determinants</i>	16	40.00	Aggregate of responses informed by deliberate decision not to make any change in behaviour

Further review of individual determinants reveals that Consciousness Raising (75.9%) and Environmental Reevaluation (55.2%) ranked amongst the most significant experiential drivers for positive behaviour. In addition, Counter Conditioning (34.5%) and Self-Liberation (38%) were identified as the most significant behavioural determinants influencing positive behaviour (see Table 6b below). In terms of barriers, it was observed that Consciousness Raising (43.8%) and Counter Conditioning (31.3%) ranked amongst the most significant experiential and behavioural determinants respectively influencing negative behaviour (see Table 6b below).

Table 6b Process of Change Determinants: Independent Constructs

Behaviour Determinants (Driver)	Counts	%	POC Constructs
POC: Experiential			
Consciousness Raising	22	75.86	Experiential
Dramatic Relief [Emotional arousal]	12	41.38	
Environmental Reevaluation [Social reappraisal]	16	55.17	
Social Liberation [Environmental opportunities]	8	27.59	
Self-Reevaluation [Self reappraisal]	6	20.69	
POC: Behavioural			
Stimulus Control [Re-engineering]	6	20.69	Behavioural
Helping Relationship [Supporting]	5	17.24	
Counter Conditioning [Substituting]	10	34.48	
Reinforcement Management [Rewarding]	9	31.03	
Self-Liberation [Committing]	11	37.93	

Consciousness Raising	7	43.75	Experiential
Dramatic Relief [Emotional arousal]	4	25.00	
Environmental Reevaluation [Social reappraisal]	5	31.25	
Social Liberation [Environmental opportunities]	4	25.00	
Self-Reevaluation [Self reappraisal]	4	25.00	
Stimulus Control [Re-engineering]	3	18.75	Behavioural
Helping Relationship [Supporting]	3	18.75	
Counter Conditioning [Substituting]	5	31.25	
Reinforcement Management [Rewarding]	3	18.75	
Self-Liberation [Committing]	2	12.50	

3.6. Emerging Themes

This study attempted to introduce emerging themes informed by a review of general behaviour determinants within the local country and regional contexts. For BSE, it was observed that recommendation from healthcare workers (My doctor recommends that I examine regularly, Or I am high risk) represents a key driver amongst 20% of respondents while 26% and 21% of respondents expressed denial and cultural/religious beliefs as factors influencing BSE (see table 7a).

Table 7a Breast Self-Examination: Emerging theme

Driver

<i>My doctor recommends that I examine regularly, Or I am high risk</i>	41	20.10
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Barriers

I do not see the need OR We don't have cancer in my family OR I do not believe in cancer	5	26.32
It is against my cultural or religious beliefs	4	21.05

Similar attempt to review emergent themes driving mammography uptake was conducted with the following behaviour drivers: Medical recommendation (14%), compulsory screening (travel, insurance, routine health check) (17%), access to screening facility and mammography as complementary to routine comprehensive checks (10%) and other factors (3%) were documented. Access to screening centre was the most significant barrier recorded amongst 31% of respondent while other determinants acting as barrier include: exclusion of mammography from comprehensive preventive health screening module (18.8%), denial (25%), and cultural/religious belief systems (12.5%) (See table 7b).

Table 7b Mammography: Emerging Theme

Driver

My doctor recommends that I screen, Or I am high risk	4	13.79
I was mandated to screen due to travel, insurance, routine check-up	5	17.24
I know where to go and have a centre close to me	7	24.14
Mammography is a compulsory part of my annual check-up module	3	10.34

Barrier

I do not have access to screening centre	5	31.25
Mammography is not a mandatory part of my annual check-up module	3	18.75
I do not see the need OR We don't have cancer in my family OR I do not believe in cancer	4	25.00
It is against my cultural or religious beliefs	2	12.50

4. Discussion

While there was a low family history of breast cancer amongst respondents (5.8%), knowledge of BSE as a method (65%), BSE procedure (68%) is significantly high and conversely for mammography procedure (17.6%). The results of this survey were in line with those of a related study carried out in Sokoto State, Northern Nigeria, where only 65.3% of respondents performed BSE, even though most respondents (89.8%) knew of the practice. Exploratory studies conducted in Nigeria's Rivers State, just 28.94% of women practiced BSE; in Edo State, just 24.4% of community members demonstrated that a small number of women did so monthly; and in Oyo State, 27.3% of women practiced BSE, although only 11.7% did so on a regular basis [32-34]. The findings from this study shows similar trend of low BSE practice among women in Northern Nigeria.

The acquisition and/or maintenance of a health behaviour is a gradual process as key behavioural and experiential determinants influencing commitment to regular screening and decisional balance can influence present behaviour adoption and future mammography intentions. This study also revealed that although most of the respondents were at the preparation stage (29.4%) in terms of BSE, a large percentage of respondents were also at the maintenance stage (26.7%). The study revealed that 34% of respondents in Nigeria are at the preparation stage, with 22.6% still at the precontemplation stage. Beyond lifestyle modification, the results of this work can provide strategic insight as to the structuring of health promotion and prevention interventions including trainings, lifestyle modification, behaviour change communications, as well as health access programming.

A review of the roles of the 10 key process of change constructs proposed by Velicer, et al., (1998), this study reveals that consciousness raising played significant roles in determining positive behaviour adoption, mitigating negative behaviour, as well as contributing to behaviour relapse [23]. While all POC construct demonstrated relevance in driving behaviour amongst study population, consciousness raising was significant amongst 69.6% and 76% for driving BSE and mammography behaviour respectively and made significant contribution to limiting behaviour adoption in 43.8% and 68.4% of respondents for BSE and mammography likewise. The study found that 26.7% of respondents conducting breast self-examination (BSE) were performing as prescribed-monthly, indicating that sustaining positive BSE behaviour is as well practiced as adopting new ones. This therefore informs the need for targeted and structured behaviour change communication interventions to promote behavior maintenance through programs that improve knowledge, attitude, and perception among Nigerian adult females.

The study also found that experiential constructs play significant roles in both BSE and mammography behavior, with behavioral constructs shaping breast cancer screening dynamics. The level of education of women significantly impacts their uptake of breast self-examination (BSE), with a strong correlation between knowledge about breast cancer and self-examination likelihood, and high-educated women tend to obtain information independently [16]. Emotional awareness, particularly from close associations with breast cancer victims and survivors, is crucial for driving positive behavior in cancer screening. This was reiterated with the significance conferred on emotional arousal (42%), Stimulus Control (31.8%), Helping Relationship (36.8%) and Reinforcement Management (36.8%) affirmed as barriers to cancer screening behaviour.

To promote behavior change, experience sharing and networking between women groups, survivors, and close relatives is needed. Cancer had been said to have a greater economic impact than all other diseases with lung cancer, colorectal cancer and breast cancer on the lead. In a country with suboptimal investment in population health, the burden of managing the financial implication of late breast cancer detection can be enormous. Breast cancer can exacerbate the problem of poverty which is worsened by weak financing of sexual reproductive health programs at national and sub-national levels [38,39]. About 38.8% of respondents lacked the financial security to enable them access to screening centers, making it difficult for them to afford screening. Improving access to quality healthcare including breast cancer screening and counselling services especially in rural and peri-urban areas is essential to accelerating adoption of BSE [16,38]. Social support systems play a crucial role in providing an enabling environment for breast cancer prevention

practices. Government and development partners should prioritize the establishment of cancer screening and support centers to complement existing investments.

5. Conclusion

The study presents a unique trend in socio-economic conditions (SOC) in Nigeria, indicating a need for further research to understand the drivers behind positive behavior shifts and mitigate relapse risks. The research also highlights the role of population dynamics in influencing breast cancer screening practices. It reveals adult women's awareness and practice of breast cancer screening, including BSE and mammography, and the stage of change in the balance between the two tests. The study also highlights the importance of experiential and behavioral change variables in the process. The findings can help raise awareness and develop targeted prevention and health promotion programs, as well as support the adoption of the more effective yet low-cost Clinical Breast Examination (CBE), which aligns with WHO guidelines for mainstreaming cancer preventive screening in resource-limited settings.

Limitations of the Study

Cancer in Nigeria is viewed within the lenses of cultural and social sensitivities. This had its toll on this work with high respondent drop-out rate, reluctance to proceed with the data collection process, and in many cases information-deficit responses. However, concerted effort to engage and build rapport and confidence amongst respondents was made. Furthermore, it is noteworthy that although the responses in favour of mammography screening were low making generalization, further work is needed to establish rigour and validity within the context of the TTM in mammography screening amongst Nigerian women with results that can be generalized across a wider population group. The cross-sectional nature of this study although was limiting, future work may consider designing and implementing similar research in an interventionist manner.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

The present research work does not contain any studies performed on animals/human subjects by any of the authors.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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