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Understanding factors affecting participation rates and facilitators of compliance in breast screening programme in the UK: A cross-sectional mixed methods study

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Abstract:

Globally, breast cancer remains the most diagnosed cancer in women, with evidence showing that the participation rates of the National Health Service (NHS) breast screening program continue to fall below the national target. This study investigates factors influencing participation rates and facilitators of compliance. A cross-sectional, mixed-methods study involving 73 eligible women aged 50-70, living in the UK. Results show that most participants (97%) regularly attended screening appointments when invited, and four main factors influenced participation: positive experiences and regular attendance, importance of early detection and family history, fear and anxiety, and accessibility and convenience. Facilitators of compliance included easy and flexible scheduling, convenient locations with parking spaces, a friendly and professional health screening team, a positive first-time experience, and health-related motivations. Reflecting the evolving landscape of the UK, the most notable issue is the lack of ethnic diversity among study participants. Future interventions should address this shift, moving away from generic invitations toward personalized, culturally tailored, data-driven approaches.

Keywords: breast cancer screening; mammography; screening attendance; screening barriers; NHS breast screening programme; patient experience.

Introduction:

Breast cancer continues to increase worldwide. An updated review in 2021 provided insights into this predicament, recording 2.26 million [95% UI, 2.24–2.79 million] new cases in 2020 [1]. The recent study of [2] in 2025 reveal that this situation seems to have worsened, a major worry being the yearly continuous rise in the number of cases and deaths. In the UK, one in seven women are diagnosed with breast cancer during their lifetime, meaning it is the most common cancer [3]. The NHS breast screening programme (NHSBSP) was introduced into England and Wales in 1988 [4]. It is currently available for women aged between 50-70 years old (NHS Breast Screening (BSP) programme [5]. Cancer Research in UK found evidence that suggests the screening programme prevents around 1,300 deaths each year in the UK, and that this could improve with an increase in participation rates within the programme. Currently the breast screening uptake is below the achievable performance threshold in all nations in the UK [6,7]. What could this be due to? This research aims to investigate the factors affecting participation rates and facilitators of compliance in the screening programme.

Breast screening programme consists of two low dose mammograms on each breast. Women aged 50-70 are invited for a screening every 3 years by their GP practice. The programme was employed to detect early signs of breast cancer, due to survival rates being much higher if the cancer is caught early [5, 8]. The screening programme's primary goal is to diagnose people with breast cancer while it is still curable, in turn decreasing death from breast cancer [9]. Breast cancer may not exhibit any physical symptoms for a long time, for example it can take up to three years of having breast cancer before a physical mass is formed on the breast. The screening programme allows for a bank of mammograms to be recorded, so all previous images can be compared with recent images to highlight any changes in the breasts since the last screening. Since 1989 regular breast screening has reduced deaths by 43% [10]. This data emphasises the importance of breast screening to ensure the cancer is caught early enough to commence treatment in time, demonstrating

how important it is to attend breast screening every three years. The overall aim of this work was to investigate the factors that affect participation rates and facilitators of compliance in the Breast Cancer Screening Programme. Objectives include:

- To identify specific factors that can act as a barrier to participating in the breast cancer screening programme.
- To understand facilitators of compliance influencing whether people participate in breast cancer screening programme.
- To provide evidence-based recommendations that would improve participation and compliance, as well as quality of breast screening services.

Brief review of literature:

The decision for women to participate in the Breast Screening Programme (BSP) is influenced by multiple different factors, affecting the participants overall decision. A literature review was conducted by [11] that investigated the factors that affect participation rates of the breast screening programme, and they highlighted four main themes; psychological and practical factors, ethnicity factors and influence of socio-economic status. A key strength of this literature review is the integrative approach which enables it to convey the multifaceted nature of screening behaviour. [12] conducted a systematic review and meta-analysis to determine factors that are associated with attendance of the breast screening programme, combining data with numerous international studies. The article reports solid and reliable associations between higher participation rates and favourable socioeconomic indications, for example higher income and education levels. The use of meta-analysis strengthens the reliability of these results by quantitatively combining data [13]; however, it was noted throughout the study that there was significant heterogeneity, reflecting variations in population characteristics and screening programmes. Despite this limitation [12] is able to provide robust evidence to show factors that influence participation in breast screening

programme can be combined into the following factors; socioeconomic, demographic and experiential. While [11] provides a broad thematic overview of the factors, [12] adds to this by quantifying the strengths of these factors.

Psychological factors play a vital role in the decision to participate in the breast screening programme. Fear and anxiety surrounding the breast cancer topic are frequently reported barriers which prevent women from participating. Alongside these factors, other influences such as pain, discomfort and embarrassment all influence the overall decision of whether to participate [6,7]. A survey conducted by [14] found that of women who did not reattend, most of them reported the previous breast screening appointment to be painful, embarrassing or distressing. This is a problem with the breast screening programme that should be highlighted and prevented, to ensure this isn't a factor that prevents women from reattending. A study by [15] investigated the psychological factors that affected women's decision to attending, not attending and reattending the breast screening programme, however this study took place in 1990 so lacks relevance to the present day, due to age of study. A cross-sectional study was conducted by [16] which researched participants knowledge of the risks and benefits that come alongside breast screening. It was discovered that only 19.5% of participants were able to correctly identify the harms and benefits. It also was found that 56.9% of participants stated they would take part in future screening if they were provided with more information beforehand. A study previously mentioned by [12] also stated that women with previous false-positives results were less likely to reattend. In addition to this a study by [17] reported that women with false-positive results showed increased anxiety at recall.

A Systematic review conducted by [18] explores the barriers to the breast screening programme and any interventions in place to improve the participation among Black African and Black Caribbean decent within the UK. The review highlighted multiple barriers, for example cultural beliefs, fear of diagnosis and mistrust of the healthcare services. Practical challenges such as language barriers and access to culturally limited information prior to

screening, also acted as barriers. Additionally, emotional factors such as fear and anxiety were mentioned in this study. One key strength of this review is its specific focus on UK based participants, resulting in it having high relevance to the NHS breast screening programme. Additionally, a mixed methods systematic review by [19] investigated barriers to screening among ethnic minority women in the UK and it supported the findings of [18] in that reducing or eliminating the factors would improve timely screening for these women in the UK.

A review published by BMC Health Services Research investigated women's preferences regarding breast screening [20]. According to the review, there were concerns about discomfort and radiation exposure, all of which played a significant role in the decision of whether to participate. Additionally, it mentioned convenience related factors for example appointment times, waiting time and travel distance. The article highlights the importance of effective communication prior to screening. An advantage of this review is it looks at it from a patient focused perspective, however the reliance on self-reported opinions might not accurately represent real scanning behaviour. Further supporting this point, a study by [21] found that the top barriers from non-attending women were difficulty getting a convenient appointment time/ location, concern that a man might perform the mammogram and worry of pain or previous painful experience.

A cross-sectional study was done by [22] which investigated the relationship between having a family history of breast cancer and participating in breast screening. It found that women with a family history had more knowledge around the topic of breast cancer, which then resulted in them having more awareness of breast screening, however family history alone was not enough to drive people to participate in the screening. The participants from this study were recruited from one medical centre in Kuala Lumpur which limits the generalisability to the wider population and to women in the UK.

A narrative review by [23] investigated the effect of male mammographers and screening uptake. With a shortage of mammographers, limiting the amount of appointments

and flexibility within those appointments, hiring male radiographers could improve this. However, it was highlighted that this may work better in some countries and within some subgroups of women that fall into the eligibility category for breast screening. However, due to this being a narrative review this research could entail author bias and also relies heavily on some smaller and older studies. However, opposing this study, research by [21] found that 28% of participants in this study reported that a barrier to attending breast screening is due to concern of a man performing the mammogram. In addition to this, it is also important to note the significance of breast screening in males; the study by [24] highlights that screening for men with increased risk of breast cancer, for example due to family history, would be beneficial. Due to the NHS breast screening programme applying to women only, this will not be included in this study, as it is primarily focused on this programme specifically.

A systematic review by [25] researched different interventions in place to improve screening attendance. It found that most of the interventions that were in place had no significant impact of attendance, and that prompts/cues, for example text reminders, were most commonly used to increase attendance. It found the most successful intervention was problem solving, which involves finding out the barriers to attending screening, establishing practical ways to overcome this, and understanding facilitators of compliance. However, the behavioural theory used in this study was inconsistent, which could result in how reliable these findings are.

Methodology:

Study Design:

This study has employed a cross-sectional approach, due to it being a relatively affordable method of collecting data [26]. The cross-sectional strategy is a good fit for this research question, since it makes it possible to pinpoint the data collection to a specific point in time and is also a faster data collection method [27]. This is beneficial as it increases the

practicality, feasibility and relevance of this study. This method enables secondary analysis if needed, whilst also allowing for multiple characteristics at once [28]. This is therefore well suited for this research question as it allows for flexibility and an increase in depth to my research. However, one drawback of this approach is that it doesn't allow for a cause-and-effect relationship to be established, so when looking at recommendations to improve participation rates, it is not possible to see if they are successful [29]. Nonetheless, this design was most appropriate for the research question as it enables identification of associations between different factors that can affect the participation of the breast screening programme. This study utilised a mixed-method approach that entails both qualitative and quantitative data collection. This approach has allowed for a more comprehensive understanding of the factors that affect participation in the breast screening programme and was selected as it minimises the limitations of both approaches whilst utilising the advantages of both qualitative and quantitative research [30]. It enables a solid understanding of complex social phenomena in healthcare that cannot be fully answered by a single method approach [31].

Sample selection and recruitment:

This study focused on women aged 50-70, which aligns with the requirements to participate in the breast screening programme (NHS Breast Screening (BSP) programme [5]. A volunteer sampling method was used to recruit participants for this study, which means participants choose to take part in the research, once they were informed of the research aim and what it includes. This sampling strategy results in having a sample group that are willing to participate in the study and are therefore usually dedicated and motivated during the study, compared to other sampling methods. Another reason volunteer sampling was chosen was due to its ease of data collection, as participants are usually readily available. However, it is important to consider ethics during this method of sampling to ensure participants are fully informed and have consented to take part in the study. Participants were recruited online using social media platforms and posters were displayed in a local

clinic. These recruitment methods allowed for a wide exposure of people and were free of charge making it easier to recruit the participants.

Participants and inclusion criteria:

This study focused on the NHS breast screening programme; therefore, the participants were individuals that were eligible for this programme. This refined participants to women aged 50-70 that currently live in the UK (NHS Breast Screening (BSP) programme [5]. This study aimed to get around 60-80 responses to the study. This sample isn't fully a representative of the whole UK population of women aged 50-70, which in turn will limit the generalisability of the study. However, this sample size is appropriate for the study design and scope, due to it being an undergraduate dissertation and with associated time and cost restraints. While it is not statistically supported for the large population size, the sample size is consistent with other cross-sectional studies.

Data collection:

The method of data collection that was used for this study was a questionnaire (see appendix A). This has been chosen due to the large scale of data it can obtain. Another advantage of this method of collecting data is that the participants remain anonymous, which abides by the ethics of the study. However, a limitation of this method is that it can only collect a limited depth of data from participants compared to other methods, such as interviews or focus groups. With the use of open questions in the questionnaire, obtaining qualitative data, this increases the depth of information compared to just asking closed questions. Research from [32] found that questionnaires should not be open for more than seven days and 67% of responses are within the first 24 hours: based on this the questionnaire was live and open for a period of seven days to allow for an optimum response rate. The questionnaire consisted of 12 questions, both open and closed, and the secure software 'Jisc online surveys' was used to launch the questionnaire. Questionnaires launched online are advantageous as they are a quick and easy way of collecting data, they

are also easier for the participants due to the ease of completion [33]. The purpose of the first two questions is to ensure that the participants are eligible for the study, by checking that they meet the criteria. The use of both open and closed questions in the questionnaire has allowed for both qualitative and quantitative data to be collected, which ensure a deeper understanding of the participants views and opinions to be obtained. Other methods were considered, for example interviews or focus groups, however these methods are time consuming and also result in interviewer bias, which is hard to overcome and can reduce the validity of the study. Another reason as to why these methods weren't chosen was due to the large sample size that needed to be obtained, to allow for a true representation of the wider population.

Data analysis:

One advantage of using a questionnaire is that the data collected is easier to analyse compared to other methods of data collection. With the mixed data that is collected, the data was separated and has undergone data analysis first. In terms of the quantitative data, the authors used descriptive statistics to describe and analyse the data as it provides insights through the use of graphs and numerical summaries. These graphs were generated directly from the Jisc survey to allow the data to be visualised when discussing the results with literature. For the qualitative data, both descriptive statistics and thematic analysis was used, so that the data is organised and easier to manage, whilst retaining a high level of detail. After both sets of data were analysed, they were reviewed as a collective to understand any relationships or connections within all of the data [34]. It was chosen to do thematic analysis over content analysis as thematic analysis was more suited to my aims and objectives. Thematic analysis aims to identify themes and how each theme relates to one another, compared to content analysis, which aims to identify themes but then also understand them.

Ethical considerations:

Gaining ethical approval before conducting any research is essential to ensure that the study meets ethical standards and guidelines [35]. Before any data collection was undertaken, the study gained ethical approval from the Health Sciences University (HSU) Radiology Ethics Panel, Bournemouth, UK on 16th January 2026, with Ethical Approval Number: HRS-2025-LovYH. Before consenting to the study, participation information was provided, which included the background of the study, what the study involves, any risks associated with taking part in the study, confidentiality and that participation isn't mandatory. All of this is important to allow for full consent to be provided, before participation in the study [36]. After completing the questionnaire, the participants were given a debrief information sheet which contained information on what will happen with the results, further information on the topic area and a link for sources of further support, if needed. Once the data had been collected, all of the results were stored on a password protected device, on a secure sever (Jisc) and deleted once no longer required.

Results:

Characteristics of participants:

A total of 73 participants took part in the questionnaire. All participants reported they were registered female at birth and between the ages of 50-70, which is consistent with the eligibility criteria of the NHS breast screening programme. The participants were distributed across two age groups ranging from 90% of participants being between 50-60 years of age and then 10% being between 61-70 years of age. In terms of ethnicity, the majority of the respondents identified as White British (93.1%), and others identifying as White other (5.5%) and mixed ethnic group (1.4%). Participants were also asked whether they had a family history of breast cancer. 29% of respondents reported a family history of breast cancer, whilst 68% of participants have no known family history and 3% did not know. See Fig 1 below.

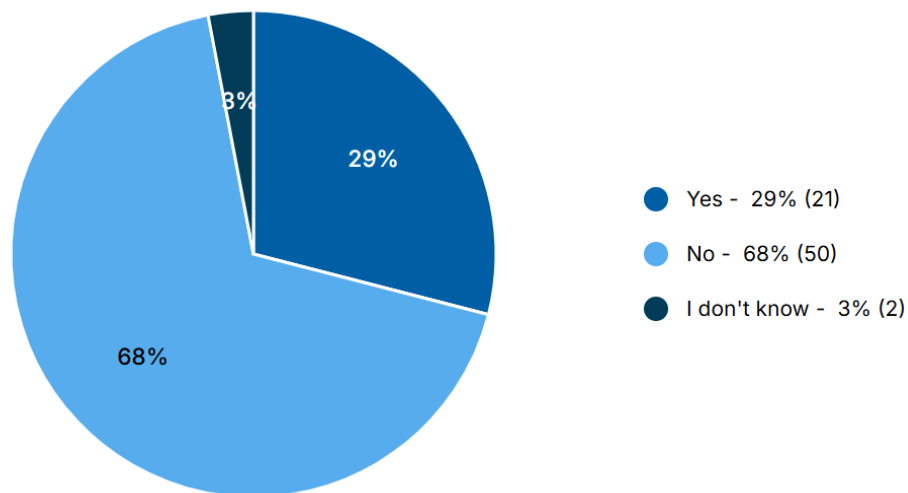


Fig 1: Percentage of participants that reported with family history of breast cancer

Screening invitation and attendance:

Participants were asked whether they had been previously invited to attend breast screening. 90% of respondents had been invited to breast screening before, compared to 10% had not been invited before. Among those who had been invited, attendance patterns differed. 97% of respondents reported they had attended their screening appointment every time, compared to 1.5% sometimes attending and 1.5% had never attended. Those who had previously attended were then asked when they had last attended; 59% of those had attended within the last year, with a smaller portion, 32% having attended 1-2 years ago and 9% more than 2 years ago. See Fig 2 below.

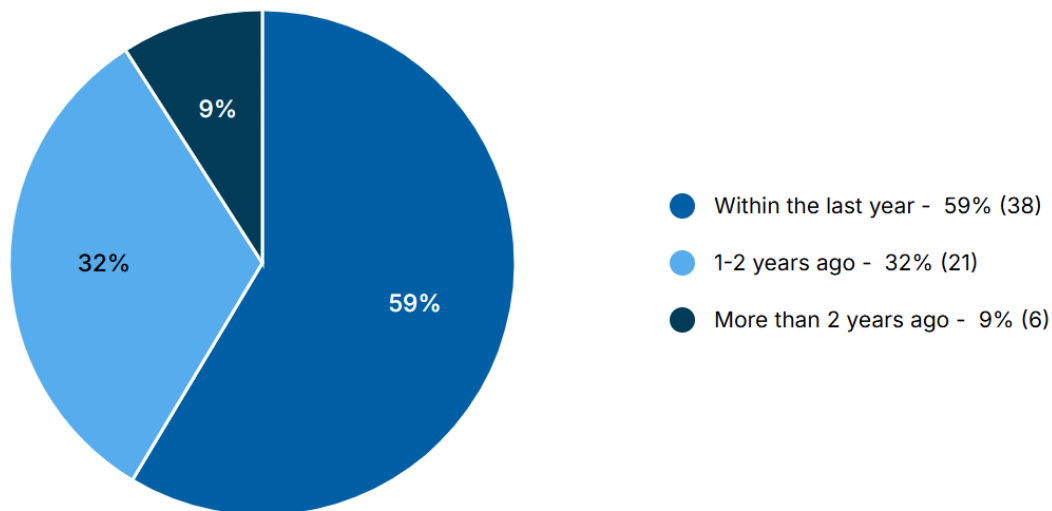


Fig 2: Percentage of when respondents last attended the breast screening clinic

Factors encouraging attendance:

Respondents were asked to identify factors that encouraged them to attend the breast screening appointments. From this question, the main themes that were highlighted were detecting any problems early (97% of participants reported this) looking after their health (86% of participants reported this) and belief that screening was worthwhile (83% of participants reported this). Other frequently selected motivators included the feeling of reassurance (77% of participants reporting this), wanting piece of mind (72% of participants reporting this), and reminder texts, letters and calls (58% of participants reporting this).

The less frequently selected motivators were convenient appointment times, support/encouragement from family and friends, and a recommendation from a GP or other health professionals. It was also noted that having previous medical history from either themselves or family was a contributing factor as to why they participated in the breast screening programme. See Table 1 below.

Table 1: Factors that encourage respondents to attend breast screening.

8. What, if anything, encourages you to attend breast screening? Please select all that apply.

Responses: 65

Option	Count	Percentage
1. To look after my health	56	86%
2. To detect any problems early	63	97%
3. Recommendation from my GP or another health professional	12	18%
4. Reminder letters, texts, or calls	38	58%
5. Support or encouragement from family or friends	8	12%
6. Convenient appointment times	19	29%
7. A screening location that is easy to get to	38	58%
8. Previous positive experience with screening	20	31%
9. Belief that screening is effective and worthwhile	54	83%
10. Feeling reassured by getting checked	50	77%
11. Wanting peace of mind	47	72%
12. I go because it's part of routine health care	33	51%
13. Nothing encourages me to attend	0	0%
14. Other (please specify)	3	5%

Barriers to screening attendance:

Participants were additionally asked to identify factors that could make it difficult to attend a breast screening appointment. 18% of respondents that answered this question reported that appointment times not suiting their needs was a contributing factor and 14% of respondents reported that the screening location was a barrier towards screening attendance. There were also psychological barriers that were reported, for example 7% of respondents felt embarrassed or uncomfortable during the procedure and 4% reported anxiety or fear towards the results of the screening, both acting as barriers to attending. 64% of participants said that nothing would make it difficult for them to attend the screening programme. See details in Fig 3 below.

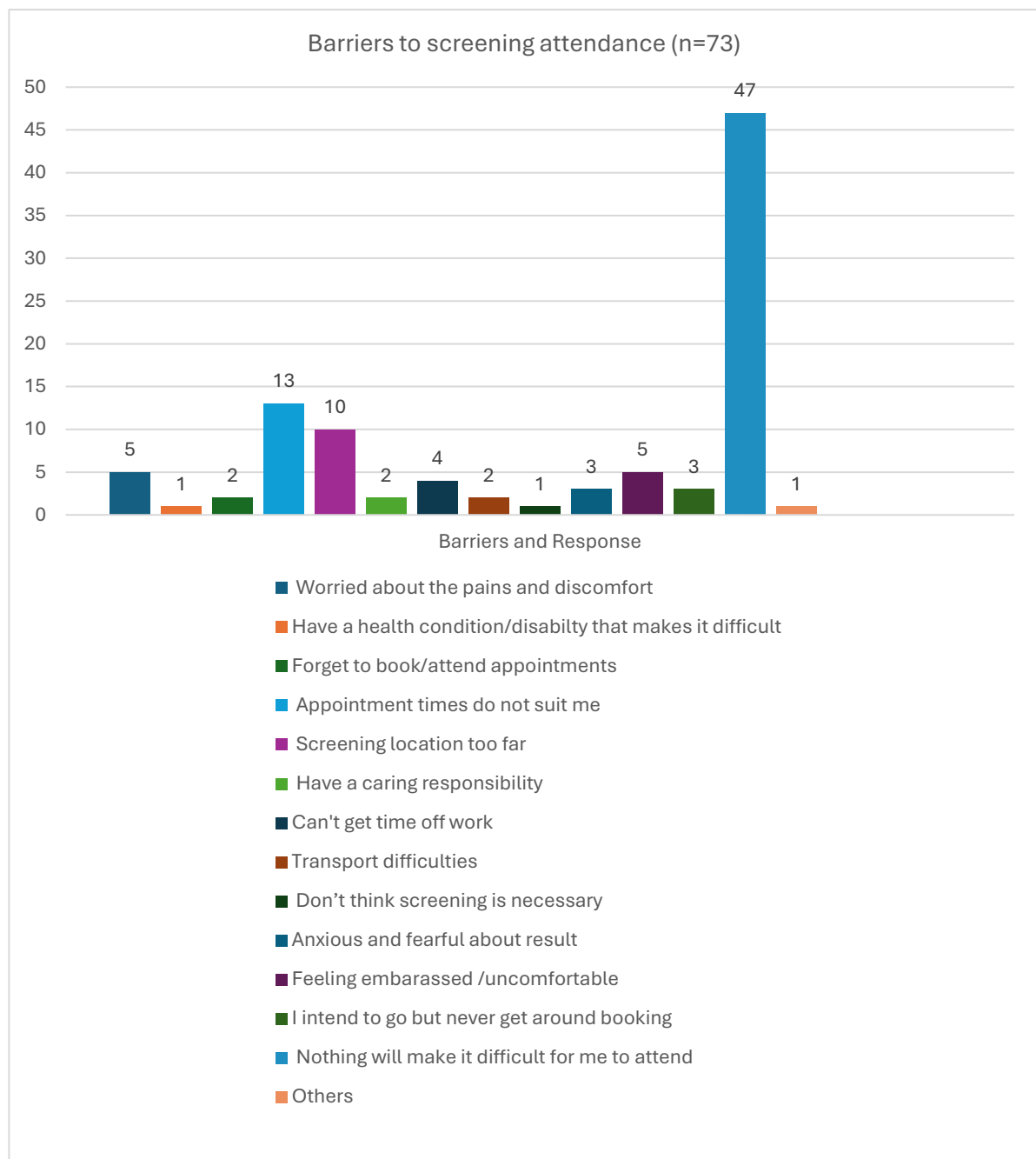


Fig 3: Responses obtained from all study respondents regarding barriers to screening attendance. Please note that the following categories listed below recorded zero responses, thus are not displayed- confusing screening information, uncertainty about what screening involves, lack of someone to accompany the participant, cultural/religious reasons, preference not to think about cancer, and previous negative screening experience.

Factors influencing screening decisions:

Participants were asked to indicate how likely several different factors influenced their decision to attend the screening programme. Recommendations from their general practitioner (GP) (86%) and invitation letters (95%) were identified as the most important factors in the overall decision to participate in the screening programme. Fear of radiation and harm (7%) and previous painful/uncomfortable screening (17%) were reported as least likely to influence the decision on whether to attend breast screening or not. Other factors that gained mixed views on how likely and not likely they were to influence the overall decision included anxiety of the results, caring responsibilities/ time constraints and distance/ transport availabilities (Appendix B). These results suggest that both practical and psychological factors play a role in the screening behaviour.

Factors that could improve attendance:

Respondents were asked what would encourage them to attend screening appointments. In terms of high-ranking interventions, it was reported that 52% of respondents felt that appointment reminders for example letters, texts and calls would encourage them and 41% would like more flexible appointment times e.g., evenings or weekends. Other interventions highlighted included instructions or reminders that make booking easier (38% felt would be helpful), being offered appointments closer to home or work (37% felt would be helpful), and messages that emphasise the benefits of early detection (34% felt this would be helpful). A few other suggestions included information that addresses worries of pain and discomfort (26%), personalised information about one's risk (25%), being able to speak to health professionals to ask questions (25%), information about how screening reduces risk of late diagnosis (25%), a more private and comfortable screening environment (14%), and hearing others have positive experiences (10%) (see appendix B for details).

Qualitative data findings:

Throughout the questionnaire, four main themes were clearly highlighted:

Positive experiences and regular attendance:

Positive experiences and established habits of regular attendance acted as powerful psychological and operational facilitators for ongoing breast screening uptake and compliance, directly reducing health anxieties and building trust in clinical services.

Welcoming environments (clean, private, and respectful clinic layouts encourage women to return and speak positively about the service to peers), staff interactions (compassionate, respectful, and clear communication from practitioners minimizes feelings of vulnerability and personal embarrassment), procedural comfort (efficient appointments that allot extra time for anxious patients reduce the impact of physical discomfort or pain during a mammogram) strongly predicts future participation by turning screening into a normalized preventative health behaviour. The below responses obtained supports this:

"always had a very positive experience and would recommend others to go",

"always been a positive experience",

"I have had previous experiences with breast screening, and I've been very impressed with my waiting time to be seen. The nurses and doctors have been very thoroughly and understanding and explained everything",

"I have only been called to one routine screening and the staff were wonderful, and it encourage me to make the time to go when called, and to re-assure my friends and to encourage them to attend",

"the staff are always lovely and discrete which helps in attending",

"All were very helpful, considering and understanding, never had an issue"

"I've attended twice and found it fine each time., the ladies at the screening centre were lovely both times".

"I attended my first breast screening yesterday, it was a very positive experience, everything was clearly explained throughout the process, and I felt confident in the people carrying out the screening. I have to travel further as my local screening location is not accessible to wheelchairs, this did not deter me. It was an easy process to change to an accessible location".

One of the respondents mentioned having a variable experience during her screening visits, noting that radiographer experience and reception experience are crucial factors to compliance with screening programmes, saying, *"Experience on the day has been quite variable. It's noticeable when you are being seen by an experienced radiographer and when not. The reception experience is important too. A smile and a little kindness goes a long way. Please treat everyone as if it is their first visit".*

- Importance of early detection and family history

Awareness of early detection and a positive family history strongly motivate women to attend regular breast screening, acting as vital cues to action that increase personal risk perception and adherence to mammography appointments. One of the participants who unfortunately lost her mother through breast cancer made a remarkable statement on this to say *" breast screening is so important. Maybe if it was around 30 years ago my mother would still be alive"*.

- Fear and anxiety

Anticipation of physical pain or discomfort from breast compression during procedure, anxiety about a potential cancer diagnosis, fear facing potential lifestyle and treatment

impacts if cancer is found, concerns about radiation, and high levels of unmanaged emotional distress may lead to avoidance or delayed appointments (though mild worry can occasionally motivate action in individuals with high perceived risk).

One of the participants quotes say, *"kind and friendly staff are reassuring; however, the fear of the pain is still an influencing factor. The concern around the effect of radiation on developing future cancers caused by the screening"*. Another said, *"some mammograms more painful than others"*. Also, *"the anxiety of waiting for a phone call"* was mentioned, although did recognize the care and empathy received, as well as the well-rehearsed procedure which is amazing. It is interesting to find out that participants who are fully aware of the health benefits did not find pain as a factor not to attend. One said *"I've been for two screenings, and found the process straightforward. Bit sore having your boobs squished but very very worth it for peace of mind"*. Another who's had mammograms nearly every 3 years said, *"I have very small breast which can make it more painful I believe. I would rather endure that momentarily and be healthy and catch things early"*. However, one of the respondents did not see the procedure as painful, saying, *"only had one so far, the staff were lovely and I had no pain whatsoever. For someone who has CPTSD, I was put at ease and felt comfortable with the procedure"*.

- Accessibility and convenience

Accessibility and convenience are vital factors that facilitate breast screening attendance, primarily driven by close geographic proximity, flexible scheduling options, and mobile mammography units. Removing logistical hurdles and reducing waiting times directly increases participation rates among eligible populations. These points reflect in several responses obtained . One of the participants said, *"in my experience, it's been in supermarket car parks, which is absolutely fine. The more screening, the better I say"*. Another participant with similar experience said, *it's all been straightforward to attend, and at*

convenient locations with easy parking". Two other participants shared same experience, the first saying, *"always been dealt with kindly, ease of location and convenience of times, and always got results when said"*, and the second saying, *"I've been impressed with my waiting time to be seen"*. Regular breast screening attendees made some comments which could well be seen as facilitators of compliance. One of them said, *"always had a good experience of booking and availability"*. The next added, *"the availability of the mobile service rather than attending a general hospital"*. Another said, *"I find my invites to attend every timely and easy to reschedule"*. Also, was a participant saying, *"Appointments have always been easy to attend"*.

Summary of findings:

Overall, the results indicate that participation in breast screening is high within this sample, with most of the participants attending appointments regularly when invited. It is highlighted that regular attendance is facilitated by several factors namely-

- i. Ease around booking and rescheduling
- ii. Use of mobile service
- iii. Convenient locations with parking space
- iv. Friendly and experienced team
- v. Professional care and reassurance on fears/ anxieties
- vi. Positive first-time experience
- vii. Health-related motivations

Whilst there were very few barriers reported, practical and psychology concerns were identified as reasons for people not to attend screening. There are clear improvements that can be made to the programme including, flexible appointment times, better communication and also appointment reminders to support an increase in further participation rates.

Discussion:

This study aimed to investigate the factors affecting participation rates and facilitators of compliance in the NHS breast screening programme. The overall results of the study suggest that within the sample of 73 participants, 97% of those reported consistent attendance with the screening programme. However, a number of impacting factors were determined, including practical, psychological and informational aspects. Even though this study reported high attendance to screening, this might not be representative of the wider population, screening uptake still below the target level according to Cancer research in UK [6,7]. It is also important to note that there was a clear skew towards 50-60 years of age within the participants of the study, which may have influenced the findings, limiting the generalisability of the results to the older group of participants, 61-70 years of age. In the UK, NHS breast cancer screening programme automatically invites anyone registered as female with a GP for their first mammogram at the age of 50. After the initial appointment, routine scans continue every three years until a person turns 71. Automatic invites stop after age 71, reason the upper age limit for this research was 70, but people over 71 can still call their local unit to request a screening. There is also an expectation that anyone who notices unusual breast symptoms or family history contact the GP, where in screening may begin earlier, rather than wait for a routine screening invitation [37]. In other countries such as United states, many parts of Europe, Asia and Africa, routine breast cancer screening programme tends to start earlier at 40 years of age biennial/annual, reflecting a global debate over balancing early detection against dense tissue challenges and false positives. According to studies [38, 39], screening between the ages 40 and up till 74 resulted in more life-years gained and more breast cancer deaths averted. While the screening age of 50 is currently obtainable in the UK due to a higher overall cancer prevalence after age 50 in this region, the growing early onset of breast cancer in other parts of the world and the increased migration of these populations to the UK highlights the need to reassess current strategies to ensure effective disease control and reduction of breast cancer-related mortality. In general,

the results of the study align with the broader literature, strengthening that participation in breast screening is influenced by a combination of socioeconomic, psychological, and practical factors [12]. However, studies by [18] and [19], both highlight ethical and cultural barriers to attending screening, in which this study did not reveal. This is likely due to the lack of ethnic diversity in the participants of the study in which 93.1% were White British; the geographic location may have been a major factor. In addition, awareness and access, as minorities appear to be less frequently informed about ongoing studies or local networks due to socioeconomic pressures. This includes inflexible work hours and intense caregiving duties common in deprived neighbourhoods significantly reduce breast screening awareness and uptake among minority women [40]. There is need to design interventions and policies to reduce inequalities in screening uptake and breast cancer outcomes for the minorities, as there is current gap on this.

From the results, it was clear that several factors facilitated compliance with screening activities. The easy and flexible nature of booking and rescheduling of appointments was one of the factors. The significance of communication and flexibility, for example invitation letters and multiple appointment times were all strong influences on attendance decisions. This supports research by [21], in which it was found that an increase in appointment times would positively increase attendance to breast screening. Additionally, it is clear increased communication, with multiple appointment reminders, instead of the one-time invitations is beneficial.

Another motivating factor mentioned was convenient screening locations and availability of parking for attendees. Data from Department for Transport National Travel Survey [41] show that 71% of women aged 17 and older in the UK hold a licence, a figure that has risen by nine percentage points over the last two decades, making parking space an important thing to consider. To fully achieve convenience and increase screening uptake in screening programmes, mobile mammography units constitute a major requirement for any intervention. Developing partnerships with major supermarkets (e.g., Asda, Tesco, Aldi, Lidl)

where in mammography screening vans are positioned directly in high-footfall, familiar areas with abundant free parking is a key facilitator that improve attendance and compliance by removing travel and parking barriers. Also is locating mobile units near local GP practices or community hospitals minimizes travel distances for patients. These measures resonate with the studies of [42], resulting in 22% screening uptake among women who had previously not attended their breast screening appointments. This agrees with research from [20] and is also highlighted by [12], which looks into whether those with higher socio-economic backgrounds are more likely to attend screening due to greater flexibility and access to transport.

Again, participants' first-time experience with the screening team seems to be a deciding factor for compliance with screening initiatives. A positive first encounter with health staff directly builds patient trust and boosts future participation, with several factors as noted by [43, 44] shaping this initial impression such as empathetic staff attitudes, professional care and reassurance, clear communication, and a welcoming facility environment. From the results, it was clear that participants expressed the feeling of reassurance and peace of mind being motivators for participating in the screening, this aligns well with research from [11] and [15], in which they both identified that psychological factors play a vital role in participation of screening. As well as reassurance and peace of mind, it was reported that there were anxiety, embarrassment and fear around breast screening. This supports the findings of [14] and [17] in which the psychological effect of breast screening and both anxiety and embarrassment were identified as factors. Even though these factors were identified as barriers to participating in screening, they were less influential than expected, with 97% of participants still attending regular breast screening. It was also reported that fear of radiation and pain were minimal concerns, which contrasts to a study from [21] which could indicate improved patient education and advancements within screening in recent years. In contrast to this, a study by [16], reported that only a minority of participants fully understood the risks and benefits of screening, suggesting a lack of education of this topic to

the public. The high attendance rates this study revealed could be from the trust in the healthcare system and habitual compliance rather than fully informed decision-making attendance. This is important as it raises the question of whether participation in breast screening equates to informed consent. It is worthwhile to consider clinical imaging mechanics and approaches that promote pain-free mammograms. These include open communication with the technologist to adjust the positioning and compression speed to comfort level, over-the-counter pain relievers before appointments, positioning alterations, reduction in caffeine /sodium intake (as these can increase breast tenderness and water positioning alterations), and wearing a padded sports bra after the procedure.

The last factor found in this study that drives screening compliance was around health-related motivations, specifically fear of disease, perceived personal risk and the importance of early detection. According to [45] and [46] early detection has two major components; the first being breast health education and screening to recognize symptoms to promote early diagnosis. The second is early detection of risk factors and high-risk individuals, which may help prevent disease onset or moderate the disease course, thereby decreasing associated disease burden. It is crucial to recognise the importance of early detection in breast cancer management, which results in less invasive treatments, improved quality of life, increased treatment success rates, and better overall health outcomes. Our study findings align with research from [9] in which it discusses how early diagnosis is a fundamental benefit of the screening programme, indicating family history as a factor, with 29% of participants reporting a family history of breast cancer. However, it is important to note that even participants without a family history still reported high attendance rates, suggesting that family history is not a major factor affecting the participation rates. This is consistent with previous research from [22] that found out that family history helps increase knowledge and awareness of screening but doesn't always increase the participation in the screening. Moreover, literatures show that education and sensitization on risk factors directly improve patient compliance with breast screening programmes by increasing health literacy, reducing fear,

promoting better lifestyle modifications and proactive self-examinations, and motivating early detection habits [47, 48]. Knowledge gap around fear of radiation still seems evident among a few women in our study

Nonetheless, it is imperative to recognise the glaring shortage of radiography workforce and the requirement for only females to do mammography in the UK, protected under the Equality Act 2010. According to Society of Radiographers [49], the UK faces a critical radiography workforce shortage, with vacancy rates nearing 20% for breast screening and symptomatic mammographers. Despite recent calls to allow male radiographers help ease these shortages, UK regulations still designate this as a single-sex service requiring female-only staff. While there's been debate around relaxing the rule to allow male radiographers to conduct examinations (similar to other sensitive areas of medicine like obstetrics), having acknowledged the immense strain this requirement puts on resources, this has unfortunately not resulted in official changes. It is high time the NHS and professional bodies engage and actively implement strategies to expand workforce provision and address these severe staffing shortfalls. These includes introducing an apprenticeship route for a mammography associate or support-worker role, task shifting, and expanding training places for diagnostic radiographers (through apprenticeships and traditional undergraduate degrees) to meet growing demand.

Implications to practice:

Understanding factors affecting participation rates and facilitators of compliance in breast screening programme in the UK provides a crucial framework for evolving public health delivery. By combining quantitative data on demographic participation with qualitative insights into female screening experiences, the study highlights that clinical compliance is not merely a matter of patient choice, but a complex intersection of structural, emotional, and cultural variables.

A primary clinical implication of the study is the necessity to transition away from one-size-fits-all communication models to increase screening uptake among ethnic minority groups and socioeconomically deprived neighbourhoods, as these groups were severely underrepresented in our study. While the geographic location of the local clinic may have been a challenge, the fact that participants were also recruited online using social media platforms demands structural adaptations in how breast screening services are offered, with these categories of women often faced with inflexible working hours, childcare dependencies, and high travel costs. This is a call that NHS mobile breast screening units should be data driven. This implies that instead of positioning mobile vans based purely on historical convenience, clinical leads should cross-reference geographic information system (GIS) mapping with regional low-uptake data. Most of these underrepresented population belong to communities where cancer carries significant social stigma or fatalistic beliefs; practitioners should collaborate with trusted local ambassadors, faith leaders, and grassroots organizations to normalize conversations surrounding asymptomatic screening. Parking mobile units directly outside community centres, supermarket hubs, or local places of worship directly addresses travel poverty and reduces physical access friction. There is also need for commissioners to implement multi-lingual, culturally synthesized health literacy campaigns, including utilizing diverse media formats for invitation, such as short message service (SMS) reminders containing direct, translated visual links to brief educational videos detailing the mammography procedure.

Furthermore, study findings mandate a shift from generic invitation systems toward personalized, community-centric, and highly accessible service delivery. This reflects the evolving UK breast screening framework, from a passive system of 'inviting' to an active ecosystem of 'engaging'. Practising optimization in scheduling by offering pre-booked evenings and weekend appointments rather than auto-assigning rigid daytime slots that often trigger high cancellation rates will work for working women, especially the minority groups. Enhancing systems to send out multiple reminders and increasing availability and

flexibility of appointment times would be an effective way to increase attendance. Thus, should be adopted alongside providing convenient locations with parking spaces, and a dedicated friendly screening team.

Again, this study recognised the huge impact that a positive first-time experience makes in compliance with breast screening initiatives. Because fear of physical pain, loss of femininity, and feelings of exposure often drive non-compliance, the role of the mammographer should expand beyond technical execution to trauma-informed, person-centered care. All women attending screening should be treated as if it were their first time, showing empathy, care, and maintaining clear communication. Therefore, to enhance patient experience, mammographers should receive advanced communication training centered on emotional regulation, which ensures they can actively de-escalate patient anxiety during the highly vulnerable moments immediately preceding the scan.

Limitations of study:

The first limitation of this study was that the majority of participants regularly attended breast screening appointments. This could be due to the possibility of self-selection bias in which those individuals who engage with healthcare services are more likely to participate in the study. This bias is important to consider when interpreting the data, for instance the low reporting of barriers like fear and discomfort may not represent the broader population. Studies that focus on non-attenders, for example [18] reported more significant psychological and cultural barriers. While our study complements the studies of [18] by skewing more to attenders, the limited number of non-attenders limits the ability to be generalised to the whole population. However, provides a balanced view to achieving an objective reality of the situation, crucial in making evidence-based decisions. The lack of ethnic diversity within the sample of participants is yet another limitation, with 93.1% being White British. It highlights an absence of certain subgroups, restricting the applicability to

more diverse populations [50]. According to the study by [19] on research barriers in ethnic minority groups, the lack of these findings in this study is due to the lack of diversity in the study and does not indicate the barriers are unimportant, just that they cannot be applied to these groups. Additionally, the use of a cross-sectional design restricts the ability to draw any causal conclusions. An example of this is that whilst it was identified that reminders are beneficial the study cannot say whether it actually increases attendance to breast screening, this would require a longitudinal study. Finally, is the reliance on self-reported data that the study uses. This could introduce potential social desirability bias and recall bias [51].

Conclusion:

This study aimed to investigate the factors that affect participation rates and facilitators of compliance in the NHS breast screening programme. Overall, the results show that participation is influenced by both psychological and practical barriers. Key motivators of compliance were ease and flexibility around booking, appointment reminders, convenient locations with parking spaces, use of mobile vans, positive first-time experience, attitudes of health screening team, professional care and reassurance, and health-related motivators. By directly acting upon structural barriers, personalizing communication, retraining frontline staff in trauma-informed clinical care, and embedding screening triggers into daily primary care, the NHS can systematically close the inequality gap, drive up compliance rates, and optimize early cancer detection.

List of Abbreviations

BMC- BioMed Central

BSP- Breast Screening Programme

CPTSD- Complex Post-Traumatic Stress Disorder

GP- General Practitioner

GIS- Geographic Information System

HRS- Health and Rehabilitation Sciences

HSU- Health Sciences University

NHS- National Health Service

NHSBSP- National Health Service Breast Screening Programme

SMS- Short Message Service

Author Contributions

HW: Conceptualization, Software, Formal analysis, Resources, Writing – original draft preparation; VCN: Validation, Data curation, Writing – review & editing, Visualization; SS: Methodology, Investigation, Supervision, Project administration. All authors have read and agreed to the published version of the manuscript.

Ethical Committee Approval and Consent to Participate:

Before any data collection was undertaken, the study gained ethical approval from Health Sciences University (HSU) Radiology Ethics Panel, Bournemouth, UK on 16th January 2026, with Ethical Approval Number: HRS-2025-LovYH. Before consenting to the study, participation information was provided, which included the background of the study, what the study involves, any risks associated with taking part in the study, confidentiality and that participation isn't mandatory.

Availability of Data and Materials

The datasets generated during and /or analysed during this study are available from the corresponding author on reasonable request.

Human Rights Statement

The authors confirm that the study was conducted in accordance with the Declaration of Helsinki, developed by the World Medical Association.

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Conflicts of interest

The authors declare that they have no competing interest.

Supplementary Materials

Appendix A and B attached provides details on the questionnaire template utilised and a sample of thematic analysis respectively.

Dissertation /Thesis Confirmation

The manuscript is derived from a dissertation and has not been formally published elsewhere.

Consent for Publication

The authors give consent for publication of this work.

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AI-Declaration:

The authors declare that no AI tools or AI-assisted technologies were used in writing, editing, analysis, or preparation of this manuscript. All content was solely created and reviewed by the authors, who take full responsibility for its accuracy and originality.

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Appendices:

Appendix A:

Questionnaire Template

(see separate attachment)

Appendix B:

Summary of Data collection and analysis

(see separate attachment)