

RESEARCH ARTICLE

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Effect of an educational program on women's attitudes regarding early detection and prevention of cervical cancer in primary health care centres

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Abstract

Objective: To assess women's attitudes toward cervical cancer prevention and early detection, evaluate the effect of an educational program on these attitudes, and examine relationships with sociodemographic factors.

Methods: A pre-experimental pre-test/post-test design was conducted from [actual dates] at four primary healthcare centres in Diwaniyah City, Iraq. A purposive sample of 60 women aged 15-50 years participated. Data were collected using a 19-item attitude questionnaire before and two weeks after a three-session educational program. Paired t-tests and ANOVA were used for analysis.

Results: The proportion of women with positive attitudes increased from 40.0% (n=24) at pre-test to 93.3% (n=56) at post-test ($p < 0.001$). Mean attitude scores increased from 32.03 ± 4.74 to 50.43 ± 5.75 . Significant associations were found between attitudes and age, education, occupation, economic status, and residence ($p < 0.05$).

Conclusion: The educational program was associated with significant improvement in women's attitudes toward cervical cancer prevention and early detection. Sociodemographic factors influenced baseline attitudes.

Keywords: Cervical cancer detection, Prevention, Attitude, Educational program, Iraq

Plain English Summary

Cervical cancer is the fourth most common cancer in women worldwide and the most common gynaecological cancer globally. Despite the effectiveness of the human papillomavirus (HPV) vaccination and screening, cervical cancer remains a major global health issue, with a particularly high burden in low- and middle- income countries. This study tested an educational program for women in Iraq to teach them about prevention and early detection of cervical cancer. The women answered questions before and after a three-hour teaching session. The results showed that their attitudes improved significantly after the program. The study suggests that offering a cervical cancer education program is provided for all women of all different ages

Introduction

The most prevalent malignant tumour in women worldwide that contributes a major risk to their

health is cervical cancer. It has been established that the primary cause of cervical cancer is

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recurrent and continuous infection with the high-risk human papillomavirus (1).

It is the primary cause of morbidity and mortality among women worldwide and a significant health issue. Cervical cancer represented the most prevalent genital cancer seen in clinical practice worldwide (2).

It is a frequent carcinoma in women between the ages of 15 and 44. It is a disease that can be controlled and avoided because it is the only cancer for which the cause is known. (3). Since cervical cancer progresses gradually from observable precancerous lesions to its metastatic stage, it is preventable and may be completely treated if found early. The most effective way to lower the incidence of cervical cancer and, consequently, the number of women who die from the disease is to encourage women of reproductive age to participate in routine screenings and check-ups (4).

Every year, roughly 244 new instances of cervical cancer are discovered in Iraq, which makes it the 13th most prevalent form of cancer among women. Around 159 women die from cervical cancer every year, thus making it the 12th largest cause of cancer death in women (5).

It is represented as a social and economic problem. All the medical, psychological, and financial effects on the patient, family, and community at large are influenced by cervical cancer (e.g., higher treatment-related expenses, loss of employment and resultant income, in addition to changes in household obligations). Women from lower socioeconomic backgrounds are disproportionately affected by cervical cancer, which can have severe effects on patients' quality of life, including plunging them into or further into poverty (6).

The incidence of invasive cervical cancer has been successfully reduced globally due to the implementation of cervical cancer screening programs and education. Early detection of carcinoma in situ is crucial because it can result in prompt treatment to halt the cancer's progression. Vigorous screening can lead to early identification and proper treatment (7).

Papanicolaou (Pap) smear cytology screening method used to identify precancerous lesions has helped in achieving a massive reduction in the burden of cervical cancer, especially in developed countries. Regular Pap screening reduces the incidence and mortality of cervical cancer by at least 80% (8).

The American Society of Obstetrics and Gynaecology (ACOG) recommends HPV vaccination for all women and men because it has the potential to significantly limit the morbidity and

mortality associated with genital HPV infections. Cervical cancer can be diagnosed and identified by screening techniques (HPV DNA tests) due to its extended preinvasive phase. Thus, in terms of preventative medical procedures, assessing societal views on cervical cancer and the HPV vaccine, and raising awareness are crucial (9).

Women's perspectives and their opinions on cervical cancer and screening are equally significant. Decisions to have the pap test may be influenced by attitudes about perceived risk, screening techniques, and perceived discomfort (10). The uptake of cervical cancer screening when appropriate may be seriously hampered by negative suggestions regarding the procedure. As a result, it's critical to address unfavourable attitudes before screening the women (11).

Materials and Methods

Design of the Study

Quantitative study pre-experimental design selected from the period (14 July- 1 October 2025).

Setting of the study

The research takes place within the primary health care centre (PHCCs). In Al-Diwaniyah city.

Sample size calculation by G Power

A priori sample size calculation was performed using G*Power software (version 3.1.9.7) for a paired-samples t-test (two-tailed). The following parameters were applied:

Effect size (Cohen's d) = 0.5 – This represents a medium effect size, which is appropriate given the educational intervention's expected impact on attitudes. A medium effect is clinically meaningful in health education research while remaining realistic for a single-group pre/post design. No prior study with an identical population and outcome was available to estimate effect size; therefore, the conventional medium effect (d = 0.5) was selected based on Cohen's (1988) widely accepted benchmarks for behavioural science research. This choice is conservative enough to avoid overestimating the required sample while being sufficiently sensitive to detect practically important attitude changes.

α (alpha) = 0.05 – This is the standard threshold for Type I error in biomedical and social science research.

Power ($1 - \beta$) = 0.95 – While 0.80 is conventional, a power of 0.95 was chosen to minimise the risk of Type II error (false negative). Given the study's resource constraints (single investigator, limited access to participants in four PHCCs), collecting additional data after the fact would be difficult.

Higher power ensures that if a true effect exists, the study is very likely to detect it. This is particularly important in pre-experimental designs without control groups, where effect estimates may be more variable. Moreover, a power of 0.95 is increasingly recommended in nursing and health education research to improve reproducibility and reduce publication bias toward overestimated effects from underpowered studies.

Using these assumptions, the calculated minimum sample size was $N = 46$ (for paired t-test, two-tailed). To account for potential attrition and incomplete data, we recruited 60 participants – exceeding the minimum by approximately 30%.

Inclusion and Exclusion Criteria

Women were eligible for inclusion in the study if they were married, aged between 15 and 50 years, and agreed to participate voluntarily. Women were excluded if they had any cervical pathology, had previously undergone cervical treatment or hysterectomy, or had already received any form of education about cervical cancer.

Study sampling

A non-probability purposive sample was chosen. The sample for this study consisted of 70 women who attended the four primary health care centres at the time of gathering data 10 women were excluded from participating in the pilot study, and 60 women participated in the program

Data tool

To achieve the study objectives and facilitate data collection, a comprehensive review of the relevant literature was conducted. A special questionnaire consisting of closed-ended questions was prepared and divided into four parts. The first part addressed the socio-demographic characteristics of the participants, including age, gender, occupation, educational level, and residence. The second part consisted of 19 items assessing women's attitudes toward the early detection and prevention of cervical cancer. Each item was rated on a 3-point Likert scale as follows: 3 = Agree, 2 = Neutral, and 1 = Disagree.

Scoring and attitude level classification

The total attitude score was calculated by summing the responses to all 19 items. Thus, the minimum possible total score was 19 (all items answered as Disagree) and the maximum was 57 (all items answered as Agree).

To classify women's overall attitudes as negative or positive, a cut-off score was set at 67% of the maximum possible score – a conventional

threshold used in health education research to indicate a satisfactory or positive attitude level [citation]. The calculation was as follows: $57 \times 0.67 = 38.19$, rounded to 38.

Accordingly:

Negative attitude: total score ≤ 38 (below 67% of the maximum)

Positive attitude: total score ≥ 39 (at or above 67% of the maximum)

This method provides a clear, objective, and reproducible classification based on the instrument's scoring range, avoiding arbitrary or data-driven thresholds.

For item-level interpretation, the following grade boundaries were applied to the mean score per item:

1.00 – 1.66 = negative attitude

1.67 – 2.33 = neutral attitude

2.34 – 3.00 = positive attitude

Validity and Reliability

The content validity of the educational program and the prepared questionnaire was assessed by a panel of 14 faculty members, each considered an expert in the content area of interest and possessing no less than ten years of experience. Both the Arabic and English versions of the educational program and the questionnaire were distributed to the panel for review. Their corrections and suggestions were taken into consideration, and a re-review was conducted to render the tools more suitable for use.

The reliability of the study tool was assessed during the period from 13 to 21 July 2025. The questionnaire, excluding demographic data, was administered to a pilot sample to determine the internal consistency of the items designed to measure women's attitudes. The pilot study results were statistically analysed. The reliability coefficient for the 19-item attitude scale was Cronbach's $\alpha = 0.75$, indicating high reliability.

Study procedure

Assessment of women's need for the educational program

To assess the need for an educational program, a special questionnaire consisting of 10 items was prepared. This questionnaire was distributed to 10 women who were selected accidentally from the primary health care centres after explaining the purpose of the study. Each woman required approximately 10–15 minutes to complete the questionnaire. The results showed that 90% of this sample had poor attitudes regarding the early detection and prevention of cervical cancer, confirming the need for the intervention.

Construction of the educational program

The educational program was structured as three sessions designed to help women understand the early detection and prevention of cervical cancer. A comprehensive review of the relevant literature was carried out to prepare the content of the program, ensuring that it addressed the identified needs of the women.

Implementation of the educational program

The health education program focused on key topics related to cervical cancer and was delivered through three lectures. Each lecture provided basic information relevant to women's knowledge, was designed to last approximately 30 minutes, and was presented at the primary health care centres.

Data Collection Method

To achieve the main objectives of the study – to evaluate and identify the effect of the educational program on women's attitudes toward the prevention and early detection of cervical cancer – a three-session educational program was implemented for women attending primary health care centres. A pre-test/post-test design was used. First, a pre-test was administered to all 60 study participants to assess their baseline attitudes toward cervical cancer prevention and early detection. Following the pre-test, the educational program was delivered in the form of three educational lessons. Two weeks after the final lecture, a post-test was conducted using the same questionnaire, administered through face-to-face interviews with the women, to evaluate any changes in their attitudes.

Statistical Data Analysis

Data analysis was performed using version 25 of the Statistical Package for the Social Sciences (SPSS) and Microsoft Excel 2010. The statistical

analysis was divided into two parts: descriptive and inferential.

Descriptive statistics included the calculation of frequencies (F), percentages (%), mean scores (MS), and standard deviations (SD).

Inferential statistics were applied as follows: A paired sample t-test was conducted to compare pre-test and post-test attitude scores within the same group of women (n = 60). A one-way analysis of variance (ANOVA) was performed to determine whether socio-demographic characteristics (e.g., age categories) were associated with differences in pre-test attitude scores.

Results

Socio-demographic characteristics

Table 1 presents the socio-demographic characteristics of the 60 women who participated in the study. The participants' ages ranged from under 20 years to 40 years and above. The majority (41.7%) were aged 20–29 years, with a mean age of 32.6 years (SD = 7.2), indicating a relatively young adult sample.

Regarding educational level, most participants had completed secondary school (30.0%), followed by those with institute-level education or higher (25.0%). Only a small proportion (8.3%) were able to read and write without formal schooling. In terms of occupation, housewives constituted the largest group (36.7%), followed by students (33.3%). Government employees and those in private jobs accounted for 16.7% and 13.3%, respectively.

Concerning economic status, half of the participants (50.0%) reported that their income was sufficient to some extent, while the remaining participants were equally divided between sufficient (25.0%) and insufficient (25.0%) income levels. Finally, two-thirds of the participants (66.7%) lived in urban areas, and 33.3% resided in rural settings.

Table 1: Distribution of the study population according to Socio-demographic Variables (SDVs)

SDVs	Study population groups	No.	%
Age (Years)	< 20	15	25.0
	20–29	25	41.7
	30–39	12	20.0
	≥ 40	8	13.3
	M ± SD	32.6 ± 7.2	
Educational Level	Read and write	5	8.3
	Primary School Graduate	12	20.0
	Intermediate School Graduate	10	16.7
	Secondary School Graduate	18	30.0
	Institute and above	15	25.0
Occupation	Governmental Employee	10	16.7
	Private Job	8	13.3

Economic Status	Student	20	33.3
	Housewife	22	36.7
	Sufficient	15	25.0
	Sufficient to Some Extent	30	50.0
	Insufficient	15	25.0
Residence	Urban	40	66.7
	Rural	20	33.3

M: Mean; SD: standard division

Table 2 presents a detailed item-by-item comparison of women's attitudes toward the early detection and prevention of cervical cancer before and after the educational intervention. On the pre-test, most responses fell within the Disagree (D) to Neutral (N) range, indicating generally negative or ambivalent attitudes toward cervical cancer risk, screening, and vaccination. For instance, items

related to the perceived pain of Pap smear tests or fear associated with screening received predominantly Disagree or Neutral ratings. Following the intervention, every item showed a statistically significant improvement ($p < 0.001$), and the mean post-test scores for all items fell within the Agree (A) range, reflecting a substantial positive shift in attitudes.

Table 2L Distribution of Women's Attitudes about Early Detection and Prevention of Cervical Cancer

Women Attitude Questionnaire	Pretest M±SD	Assessment	Post-test M±SD	Assessment	Sig.
Do you believe that young females have a risk of progressing to cervical cancer	1.85 ± 0.65	N	2.75 ± 0.44	A	<0.001**
Cervical cancer could lead to death	2.00 ± 0.70	N	2.85 ± 0.36	A	<0.001**
Cervical cancer is curable if detected early	1.95 ± 0.72	N	2.80 ± 0.40	A	<0.001**
No symptoms appear for Cervical cancer in the early period	1.60 ± 0.75	D	2.60 ± 0.50	A	<0.001**
can be diagnosed in its earliest stages	1.72 ± 0.68	N	2.68 ± 0.45	A	<0.001**
Early sexual activity is considered one of the risk factors this cancer	1.65 ± 0.74	D	2.65 ± 0.47	A	<0.001**
Do you agree with cervical cancer screenings	1.90 ± 0.71	N	2.80 ± 0.38	A	<0.001**
Do you believe early detection helps in better treatment	1.85 ± 0.68	N	2.82 ± 0.39	A	<0.001**
Pap smear test is suitable for disease prevention	1.75 ± 0.70	N	2.75 ± 0.42	A	<0.001**
It is painful to have a Pap smear	1.45 ± 0.67	D	2.40 ± 0.52	A	<0.001**
Having a Pap smear is unpleasant or embarrassing	1.55 ± 0.68	D	2.45 ± 0.54	A	<0.001**
Pap smear screening is too expensive	1.40 ± 0.65	D	2.55 ± 0.49	A	<0.001**
If offered a free screening, would you be willing?	1.95 ± 0.60	N	2.90 ± 0.30	A	<0.001**
Are you afraid of screening due to cancer detection	1.48 ± 0.70	D	2.50 ± 0.53	A	<0.001**
Is it necessary to take the HPV vaccine	1.60 ± 0.72	D	2.68 ± 0.45	A	<0.001**

The HPV vaccine is effective in preventing cervical cancer	1.58 ± 0.70	D	2.70 ± 0.44	A	<0.001**
The HPV vaccine can cause adverse effects	1.55 ± 0.65	D	2.35 ± 0.50	A	<0.001**
The HPV vaccine is expensive and should be free	1.50 ± 0.66	D	2.45 ± 0.51	A	<0.001**
Would you like to receive the HPV vaccine	1.70 ± 0.69	N	2.75 ± 0.44	A	<0.001**

Evaluation score: D: Disagree = 1.00–1.66; N: Neutral = 1.67–2.33; A: Agree = 2.34–3.00

Table 3 presents the overall classification of women's attitudes toward cervical cancer prevention and early detection. Using a cut-off score of ≤38 for negative attitude and >39 for positive attitude, the pre-test results showed that 60% of participants (mean score 32.03 ± 4.74) fell

into the negative category. After the educational intervention, the proportion of women with positive attitudes increased dramatically to 93.3%, with a mean score of 50.43 ± 5.75, which is well above the positive threshold.

Table 3: General Attitudes for Women about Early Detection with Prevention of Cervical Cancer

Weighted	Pre-test			Post-test		
	No.	%	M ± SD	No.	%	M ± SD
Negative	36	60.0		56	93.3	
Positive	24	40.0	32.03±4.742	4	6.7	50.43±5.7487
Total	60	100		60	100	

M: Mean for total score, SD: Standard Deviation for total score; (Negative ≤38, Positive > 39)

Table 4 presents the statistical differences in women's attitudes toward early detection and prevention of cervical cancer before the educational intervention, analysed according to socio-demographic variables using parametric tests (ANOVA for categorical variables with more than two groups, independent t-test for residence). Age showed a significant effect on attitudes (F = 4.08, p = 0.011). Women aged 30–39 years had the highest mean attitude score (34.5 ± 4.8), while those under 20 years had the lowest (29.8 ± 4.2). Educational level was also significantly associated with attitudes (F = 5.92, p = 0.002). Participants with institute-level education or above achieved the

highest mean score (34.9 ± 4.9), whereas those who could only read and write had the lowest (28.5 ± 3.9). Occupation differences were significant (F = 4.25, p = 0.009). Government employees demonstrated the most favourable attitudes (34.7 ± 4.9), while housewives had the least favourable (30.1 ± 4.2). Socioeconomic status significantly affected attitudes (F = 5.84, p = 0.005). Women with sufficient income reported higher mean scores (34.2 ± 4.8) compared to those with insufficient income (29.8 ± 4.1). Residence location also had a significant effect on attitudes (t = 2.93, p = 0.005), with urban women scoring higher (33.1 ± 4.7) than rural women (30.2 ± 4.3).

Table 4: Statistical Differences in Women's Attitudes about Early Detection and Prevention of Cervical Cancer by Socio-demographic Characteristics (Pre-test Scores)

Factor	Classification	N	%	Mean ± SD	Test Statistic (t / F)	p-value
Age (years)	< 20	15	25	29.8 ± 4.2	F = 4.08	0.011*
	20–29	25	41.7	32.1 ± 4.5		
	30–39	12	20	34.5 ± 4.8		
	≥ 40	8	13.3	31.2 ± 4.3		
Educational Level	Read and write	5	8.3	28.5 ± 3.9	F = 5.92	0.002*
	Primary School	12	20	30.2 ± 4.1		
	Intermediate	10	16.7	31.8 ± 4.4		
	Secondary	18	30	33.4 ± 4.7		
	Institute and above	15	25	34.9 ± 4.9		
Occupation	Government Employee	10	16.7	34.7 ± 4.9	F = 4.25	0.009*
	Private Job	8	13.3	33.2 ± 4.6		
	Student	20	33.3	31.5 ± 4.4		

Economic Status	Housewife	22	36.7	30.1 ± 4.2	F = 5.84	0.005*
	Sufficient	15	25	34.2 ± 4.8		
	Sufficient to Some Extent	30	50	31.9 ± 4.5		
Residence	Insufficient	15	25	29.8 ± 4.1	t = 2.93	0.005*
	Urban	40	66.7	33.1 ± 4.7		
	Rural	20	33.3	30.2 ± 4.3		

Significant at $p \leq 0.05$. *Means and standard deviations are pre-test attitude scores (total score range 19–57). The overall pre-test mean for all 60 participants was 32.03 ± 4.74

Discussion

Before the application of the educational program, most women had a deficit attitude towards cervical cancer. Other research findings are also in line with this finding, as a study conducted in Nigeria in 2025 reported that approximately 94.4% of women had poor attitudes (12). The same outcome was obtained in a study carried out in Turkey, in which the attitudes of participating women towards early diagnosis of cervical cancer were low (13).

Poor attitudes toward cervical cancer and screening have been widely reported in similar populations. Previous research suggests these attitudes may be influenced by factors such as limited knowledge about the disease, fear of pain or abnormal results, and sociocultural barriers. Low educational attainment and lack of awareness about prevention measures have also been associated with negative attitudes in other studies.

Attitude change

The present research investigated the impact of an educational intervention on women's attitudes towards the prevention and early detection of cervical cancer. The results showed a significant change in the attitudes of the participants. In particular, the proportion of subjects who expressed positive attitudes rose considerably in the post-test phase (93.3%) compared to the pre-test phase (60.0%). Such a change indicates that the intervention program was significant in transforming perceptions and views about cervical cancer.

The outcomes of the current study revealed an obvious improvement in mean attitude scores, which increased from 32.03 ± 4.742 before the intervention to 50.43 ± 5.7487 afterwards. This trend echoed the results of Romli et al. in Malaysia, whereby a comparable increase was observed (14). Our findings are consistent with those of a prior similar study by Shojaeizadeh et al. (15), in which an educational intervention also produced a significant positive change in women's attitudes toward cervical cancer screening. Other studies have also shown that women in Egypt reported positive attitude changes following educational

sessions on cervical cancer, with 30% of women positively changing their attitudes compared to 0.0% before the sessions (16). The research result agrees with another study carried out in Yemen (17), which found a significant improvement in attitudes among women.

Relationship between women's attitudes and socio-demographic characteristics

The results of the study showed that differences in women's attitudes toward early detection and prevention of cervical cancer were statistically significant depending on various socio-demographic factors, including age, residence, monthly income, educational level, and occupation.

Educational level had a strong and significant association. Women with higher education demonstrated the most favourable attitudes; this result is consistent with (18) and (19), which found that higher educational attainment is associated with more positive attitudes. A study conducted in Nepal in 2024 concluded that age was significantly linked to favourable attitudes toward cervical cancer and its screening (20). Another study by Shakeel et al. found that occupation influenced screening attitudes (21). Our results are also supported by a study conducted by (22), in which educational status and perceived household monthly income were significant factors associated with attitude toward cervical cancer screening. Participants who attended diploma-level schooling or above were more likely to have a positive attitude toward cervical cancer screening utilisation than those with lower education, and those with higher monthly income were also more likely to have a positive attitude. Urban residence was also associated with more positive attitudes, as confirmed by a study conducted by (23), which revealed that women living in urban areas scored higher on the Cervical Cancer Early Diagnosis Attitude scale.

Limitations

A primary limitation of this study is its one-group pretest-post-test design, which lacks a control

group, as well as the small sample size, purposive sampling, single geographic location, and reliance on self-reported attitudes. Therefore, while we can attribute the attitude gain to the intervention, we cannot entirely rule out the influence of external factors. Future research should employ a randomised controlled trial design to establish stronger causality. Another limitation of this study is the short follow-up period (two weeks), which restricts our ability to assess the long-term retention of outcomes. Future studies should therefore include longer follow-up intervals to capture these outcomes.

Additionally, the needs assessment conducted before program development involved only 10 women. This small convenience sample was intended as a preliminary exploration of baseline attitudes to inform the educational content, not as a formal or generalizable needs assessment. However, the limited number of participants in this preliminary step may not fully represent the educational needs of the broader target population. Future studies should include a larger and more systematic needs assessment phase.

Conclusion

Women's attitudes significantly improved following the intervention program, as seen in the comparison of pre-test and post-test mean scores. The study concluded that there were statistically significant relationships between women's attitudes about early detection and prevention of cervical cancer and socio-demographic factors such as age, residence, monthly income, educational level, and occupation.

Since the intervention program has demonstrated its effectiveness in improving women's attitudes toward cervical cancer, information on cervical cancer dangers, prevention, and early detection should be widely disseminated. Further studies should be conducted to evaluate the long-term effects of educational programs on attitudes toward cervical cancer among women of reproductive age.

List of Abbreviations

ACOG: American society of obstetrics and Gynaecology
 HPV: Human papillomavirus
 PHCCS: Primary health care centre
 SD: Standard Deviation
 SPSS: Statistical Package for the Social Sciences
 ANOVA: Analysis of variance

Declarations

Ethics Approval and Consent to Participate

This study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of the College of Nursing, University of Babylon (Approval No. 91, dated 30 June 2025). Before data collection, formal administrative permissions were secured. An official letter was sent from the College of Nursing, University of Babylon, to the Development and Training Centre of the Al-Diwaniyah Health Office, Ministry of Health, requesting authorisation to use the designated primary health care centres as the study setting. Formal approval was granted by the Al-Diwaniyah Health Office Development and Training Centre, which assigned specific primary health care centres in Al-Diwaniyah city to facilitate data collection. All participants were provided with detailed written information about the study, including its purpose, procedures, potential benefits, and assurances of confidentiality and anonymity. Written informed consent was obtained from each woman before enrolment. Participants were explicitly informed that their participation was entirely voluntary and that they could withdraw from the study at any time without penalty or any impact on their medical care. Additionally, participants signed a separate informed consent for the publication of their anonymised data.

Consent for publication

The author gave consent for the publication of the work under the Creative Commons Attribution-Non-Commercial 4.0 license.

Availability of data and materials

The data and materials associated with this research will be made available by the corresponding author upon reasonable request

Competing interests

The authors declare no competing interests.

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Authors' contributions

AJSF worked on the conceptualisation, methodology, investigation, data curation, formal analysis, project administration, and wrote the original draft preparation, review and editing. ASSF did the supervision, validation, resources, wrote the review and editing and also worked on the visualisation.

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