Indian J Med Res 160, November 2024, pp 457-465
DOI: 10.25259/ijmr_34_24

Original Article

Cascade of care for people with positive symptoms of common cancers in selected primary health centres of Puducherry: An explanatory mixed-method study

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Received January 8, 2024; Accepted October 14, 2024; Ahead of print December, 2024; Published December 23, 2024

***Background & objectives*: Cancer is a leading cause of death worldwide and constitutes a public health priority. Delays in diagnosis and treatment of cancer can adversely impact survival, recovery, and cost of treatment. The objective of this study was to estimate the proportion seeking timely care among those having early warning signals for oral, breast or cervical cancer and to explore the facilitators and barriers to early detection.**

***Methods*: The study was conducted among 241 participants, including those having early signals for selected cancers and women who underwent opportunistic cervical cancer screening in the selected health facilities. Information regarding symptom appearance, presentation to any registered medical practitioner, confirmatory diagnosis, and treatment initiation were obtained from medical records. In-depth Interviews (IDIs) were conducted among six participants to explore facilitators and barriers to cancer detection.**

***Results*: Among 7300 people screened using the Community Based Assessment Checklist (CBAC), 128 (1.7%) had warning signals for any one of the cancers. The percentage of people who sought medical care for oral, breast and cervical cancer symptoms were 80 per cent, 82 per cent and 57 per cent, respectively. Among those who underwent opportunistic cervical cancer screening in health centres (113), the screen positivity rate was 11 per cent, and adherence to referral for confirmation was 80 per cent. The median pre-diagnostic and diagnostic delays for the three cancers were 79 [Interquartile range (IQR): 44-126] and 27 (IQR: 13-73) days. One individual was diagnosed with oral cancer, and the treatment delay was 27 days. Facilitators identified for early seeking of care were encouragement by family and low-cost treatment at public facilities. Major barriers identified were neglect of symptoms by participants and their responsibilities towards family.**

***Interpretation & conclusions*: Although very few people were identified to have early warning symptoms using CBAC, a substantial proportion of them sought medical care and underwent confirmatory diagnosis. Screen positivity rate and treatment-seeking behaviour were better among women undergoing opportunistic cervical cancer screening in the health centres. Measures need to be taken to improve health literacy among people to reduce diagnostic delay for cancers.**

Key words Cascade of care - common cancer - delay - early detection - India - screening

Cancer is a leading cause of death globally, with approximately 10 million deaths reported in 2020[1]. In India, the age-standardized incidence rate of cancer in 2022 was 98.5 per 100,000 population, with one in every ten individuals expected to develop the disease in their lifetime[2]. The three most prevalent cancers in India are of breast, lip/oral cavity and uterine cervix[2]. Together, they account for ~32 per cent of new cancer cases and highlight a significant public health priority[2]. A study assessing cancer distribution in southern India revealed that the most prevalent cancer among females was breast cancer while oral cancer was the second most common among males[3].

Early detection of cancer through recognition of warning signals is crucial for improving survival rates and enabling timely treatment[4]. In addition, screening is a valuable approach for identifying the disease in individuals who have not yet exhibited symptoms. According to the National Family Health Survey-5[5], the percentage of people who had ever undergone screening for oral, breast and cervical cancer in Puducherry was 1.5, 4.2 and 7.4 per cent, respectively[5]. While these rates were better than the national average of 0.9, 0.9 and 1.9 per cent for oral, breast and cervical cancer, respectively, further actions are needed to reach out to larger eligible population with screening services[5].

In India, the National Programme for Prevention and Control of Non-Communicable Diseases (NP-NCD) focuses on prevention, screening and control of common NCDs, including cancer[6]. Its strategies include opportunistic screening at Primary Health Centres (PHCs) and early detection of oral, breast and cervical cancers by Population-Based Screening (PBS)[6]. PBS for all eligible individuals aged 30 yr and above is supposed to be done using the Community Based Assessment Checklist (CBAC) by the Accredited Social Health Activist (ASHA) or Auxillary Nurse Midwife (ANM). Those who present with early warning symptoms must be motivated to visit higher health facilities to confirm their diagnosis[6]. Although this has long been one of the major strategies of the programme, its implementation faces significant challenges. A study conducted in Haryana revealed that although 66.5 per cent of the population was reached by ASHAs, only 2.5 per cent were asked for details related to CBAC[7]. At places where PBS has been initiated, the major challenge was motivating the individuals with warning signals to seek early medical consultation and follow up for diagnosis and treatment[8]. Facility based opportunistic screening for common cancers is recommended for all individuals, aged 30 yr and above, who visit the health centres[9].

Timely diagnosis of cancer significantly increases the chances of survival. Delay in treatment by even one month can increase the risk of dying by 6-13 per cent[10]. Numerous studies have shown that delaying treatment for more than three months after symptom identification results in lower survival rates compared to those who started treatment within three months[11-13]. Timely detection and treatment initiation can help reduce the economic burden on the patient and their families. There can be various reasons for delay in detection, such as lack of awareness, neglected symptoms, dependency on family for seeking healthcare, financial constraints and distance from healthcare facilities[14].

Despite having evidence regarding the importance of timely diagnosis, there are limited studies analyzing the cascade of care for cancer diagnosis in primary care settings in India. The present study was planned with the primary objective of estimating the proportion of eligible individuals, as assessed from PBS using CBAC, who sought medical care, underwent confirmatory diagnosis, were diagnosed with any of the three cancers and initiated on cancer treatment. The secondary objectives were to determine the pre-diagnostic, diagnostic, and treatment initiation delays. The study also explored the facilitating and hindering factors to timely cancer detection.

Materials & Methods

The study was conducted at the urban and rural field practice areas of Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Puducherry, India between March 2022 and February 2023 after obtaining the ethical approval from the Institutional Ethics Committee.

Study design and participants: This study employed a sequential explanatory mixed-method design, integrating quantitative and qualitative components. The initial quantitative phase involved a community-based longitudinal study where participants with early warning signals of any of the three cancers (oral, breast or cervical cancer) were followed for five months. Following this, a qualitative phase was conducted, consisting of in-depth interviews (IDIs) to explore the facilitators and barriers to early cancer detection.

The study included residents aged 30 yr and above from one urban and one rural primary healthcare setting in Puducherry. Individuals presenting with early warning signals of oral, breast or cervical cancers in the PBS and women who underwent opportunistic cervical cancer screening in the selected PHCs were enrolled. Prior written informed consent was obtained from all participants after providing them with study information sheets.

Study setting: The health centres attached to the medical college provide health services to around 20,000 population[15]. NCD services are provided in both health centres, as per the NP-NCD guidelines. PBS for NCDs was carried out using CBAC for all residents aged 30 yr and above. Health workers were sensitized to refer people who had early warning symptoms of oral, breast and cervical cancer to the health centres for further investigation and management. The CBAC outlines key early warning signals for the three cancers that ASHA/ANM should identify during house-to-house PBS. For example, a lump in the breast may indicate breast cancer while an ulcer in the mouth lasting more than two weeks could suggest oral cancer. Other signs, such as bleeding between periods and foul-smelling vaginal discharge may indicate cervical cancer. The full list of warning signals for the three cancers is detailed in the CBAC[16]. In addition to PBS, opportunistic cervical cancer screening services, using Pap smear, were being carried out among eligible patients in the OPDs of both health centres for almost a year. Around 10-15 women were being screened monthly for cervical cancer at each centre.

Sample size: The sample size was calculated to be 289, assuming the adherence to referral for confirmatory diagnosis among those having early warning signals is 75 per cent, with absolute precision of 5 per cent and a 95 per cent Confidence Interval (CI). This was calculated using OpenEpi version 3.01 (*https://www.openepi.com/Menu/OE_Menu.htm*)[17]. We could incorporate 241 participants after including all the 128 people who were positive for early detection of oral, breast or cervical cancer in PBS and 113 women who underwent opportunistic cervical cancer screening in the health centres during the study period. IDIs were conducted among six participants selected purposively.

Study procedure: Quantitative Phase- People positive on early detection of any one cancer in the PBS and women who underwent opportunistic screening of cervical cancer in the health centres were included. Data were collected using a pretested semi-structured questionnaire after obtaining written informed consent. The collected information included sociodemographic characteristics, clinical details and history of smoking and alcohol consumption among the participants. Information regarding seeking medical care, date of confirmatory diagnosis and result of the diagnosis were obtained from medical records. If the participants had not sought medical care within two weeks, they were reminded again.

Qualitative: Among the quantitative study participants, those who were available at their residences and were willing to share their experiences were selected using purposive sampling. Interviews were conducted with six women. All four male study participants who were positive in the PBS were not present at home during the day of interview, and hence they could not be interviewed. IDIs were stopped after achieving data saturation. During the interviews, along with the principal investigator, another female Master of Public Health (MPH) trainee proficient in Tamil was present to conduct the interviews. Both interviewers were trained in qualitative research techniques, including data collection and analysis. Their training covered the preparation of interview guides and qualitative data collection methods such as IDIs and Focused Group Discussions. These skills were developed as part of their MPH curriculum. General rapport was built with the participants before the interviews. Each interview lasted for 20-30 minutes. Pre-tested topic guide with open-ended questions was used and audio recordings were done after obtaining written consent. A field note-taker was present during the interviews to document the discussions.

Data analysis:

Quantitative: Data were captured in Epicollect5 software[18] (*https://five.epicollect.net/*) and analyzed in IBM SPSS version 23 (IBM Corp., Armonk, NY). People positive for early detection of cancers who sought medical care were summarized as proportion with 95% CI. Pre-diagnostic, diagnostic and treatment initiation delays were summarized as Median (IQR).

Qualitative: IDIs were transcribed and translated from Tamil to English. The thematic content analysis method was employed. Three broad themes were pre-determined based on the literature review aligned with the study objective. Two reviewers independently analyzed the transcripts and derived codes. The code lists of both reviewers were compared and the

Table I. Socio demographic characteristics of females positive for early detection of oral, breast or cervical cancers during PBS using CBAC and those who underwent opportunistic cervical cancer screening in selected Primary Health Centres (PHCs), Puducherry

Characteristics	Early detection of 3 common cancers using CBAC in the community, n (%)	Early detection of cervical cancer by opportunistic screening in the health centres, n (%)	Total (n=237), n (%)
Total	124 (100)	113 (100)	237 (100)
Type of early detection			
Early detection of oral cancer using CBAC	16 (12.9)	NA	16 (6.7)
Early detection of breast cancer using CBAC	11 (8.8)	NA	11 (4.6)
Early detection of cervical cancer using CBAC	97 (78.3)	NA	97 (40.9)
Early detection of cervical cancer by opportunistic screening in the centres	NA	113 (100)	113 (47.7)
Age (yr)			
30-45	68 (54.8)	53 (46.9)	121 (51)
46-60	45 (36.3)	49 (43.4)	94 (39.7)
>60	11 (8.9)	11 (9.7)	22 (9.3)
Education			
No formal education	24 (19.4)	13 (11.5)	37 (15.6)
Upto middle School (1-8th grade)	35 (28.2)	41 (36.3)	76 (32)
Secondary & Higher Secondary School (9-12th grade)	50 (40.3)	44 (39)	94 (39.7)
Graduate & above	15 (12.1)	15 (13.3)	30 (12.7)
Socio economic status (INR)			
Class I (8220 & above)	13 (10.5)	33 (29.2)	46 (19.4)
Class II (4110-8219)	34 (27.4)	68 (60.2)	102 (43)
Class III (2465-4109)	44 (35.5)	11 (9.7)	55 (23.2)
Class IV (1230-2464)	32 (25.8)	01 (0.9)	33 (13.9)
Class V (less than 1230)	01 (0.8)	0	01 (0.4)
No. of family members			
≤4	67 (54)	48 (42.5)	115 (48.5)
>4	57 (46)	65 (57.5)	122 (51.5)

CBAC, community based assessment checklist; NA, not applicable

discrepancies were sorted through discussion. The codes were further grouped into categories. The findings were cross-verified with existing literature. The final analysis was reviewed by the second and third authors with expertise in qualitative research.

Results

Sociodemographic, clinical and behavioural characteristics of study participants: A total of 241 participants were included in the study, 237 of whom were females. The sociodemographic and clinical characteristics of the female study participants are presented in Tables I and II, respectively. Over half were in the age group of 30-45 yr (51%; n=121), and almost all were married (92.3%; n=219). Nearly 25 per cent (n=57) were employed, and 78 per cent (n=185) were rural residents. The mean (±SD) age at marriage was 21.5 (2.9) yr, and the mean (±SD) age at first childbirth was 23.3 (3.3) yr. Around 21 per cent (n=49) of the women had more than two children. Individuals who have smoked tobacco, chewed tobacco or consumed alcohol more than 100 times in their lifetime at the time of interview have been categorized as 'ever smoked tobacco', 'ever chewed tobacco' or 'ever consumed alcohol', respectively in Table II[19].

Cascade of care for early detection of common cancers: Around 9600 residents aged 30 yr and above

Table II. Clinical and behavioral characteristics of females positive for early detection of oral, breast or cervical cancers during PBS using CBAC and those who underwent opportunistic cervical cancer screening in selected PHCs, Puducherry

Clinical characteristics	Early detection of 3 common cancers using CBAC in community, n (%)	Early detection of cervical cancer by opportunistic screening in health centres, n (%)	Total (n=237), n (%)
Summarized as n (%)			
Total	124 (100)	113 (100)	237 (100)
Family history of cancer	11 (8.9)	21 (18.6)	32 (13.5)
Pre-menopausal status	92 (74.1)	76 (67.3)	168 (70.9)
History of breast feeding	124 (100)	109 (96.4)	237 (98.3)
Summarized as Mean (SD) or Median (IQR)			
Age at menarche (yr)	13.6 (1.5)	13.8 (1.5)	13.7 (1.5)
Age at menopause (yr); (n=71)	51.4 (2.2)	51.0 (2)	51.1 (2.1)
Time gap between 1st and 2nd child in yr; (n=191)	3.3 (1.2)	3.2 (1.4)	3.3 (1.3)
Time gap between 2nd and 3rd child in yr; (n=49)	2.5 (0.8)	2.0 (1.0-3.3)[#]	2.7 (1.3)
Duration of breastfeeding for 1st child in months; (n=233)	18 (12-24)[#]	15 (10-24)[#]	18 (12-24)[#]
Duration of breastfeeding for 2nd child in months; (n=192)	18.3 (7.5)	16.7 (7.5)	17.5 (7.5)
Duration of breastfeeding for 3rd child in months; (n=50)	17.6 (6.7)	13.2 (5.4)	15 (6.3)
Behavioural characteristics			
Summarized as n (%)			
Ever chewed tobacco	07 (5.6)	14 (12)	21 (8.9)
Ever smoked tobacco	02 (1.6)	08 (7)	10 (4.2)
Ever consumed alcohol	04 (3.2)	13 (11.5)	17 (7.2)

[#]Median (IQR) calculated; IQR, interquartile range; SD, standard deviation

were eligible for the PBS using CBAC across rural and urban healthcare settings. These included 4500 males and 5091 females.

Early detection of oral, breast and cervical cancers in PBS: PBS coverage was 74 per cent (n=3342) among males for oral cancer and 77 per cent (n=3916) among females for all three cancers. The percentage of males and females positive for early detection of oral cancer in the PBS were 0.1 per cent (95% CI: 0.04-0.3; n=04) and 0.4 per cent (95% CI: 0.3-0.7; n=16), respectively. These individuals were referred to PHC for oral visual examination by a registered medical practitioner to confirm any further abnormality. The positivity rate for early detection of breast and cervical cancers were 0.3 per cent (95% CI: 0.2-0.5; n=11) and 2.5 per cent (95% CI: 2.3-3.3; n=97), respectively. These women were also referred to PHC, where clinical breast examination and Pap smear tests were conducted for breast and cervical cancer suspicions, respectively.

The percentage of people seeking medical care for oral cancer symptoms was 75 per cent (95% CI: 30-95; n=03) among males and 81 per cent (95% CI: 57-93; n=13) among females. For breast and cervical cancers, 82 per cent (95% CI: 52-95; n=09) and 57 per cent (95% CI: 47-66; n=55) of the people positive on early detection had sought medical care, respectively. The percentage of people who adhered to confirmatory diagnosis among those who were advised was 67 per cent (95% CI: 21-94; n=02), 88 per cent (95% CI: 53-98; n=07) and 90 per cent (95% CI: 71-97; n=19) for oral, breast and cervical cancers, respectively. Oral and cervical cancers were confirmed through biopsy, while breast cancer was confirmed using ultrasonography and/or biopsy. One case of oral cancer was confirmed, and treatment was initiated.

Early detection of cervical cancer by opportunistic screening in the health centres: Among 113 women who underwent opportunistic cervical cancer screening in the health centres *via* Pap smear in the last year, 12 per cent (95% CI: 7-18; n=13) were positive. Ten were referred for confirmatory diagnosis and 80 per cent (95% CI: 49-94; n=08) underwent confirmation. None of them were diagnosed with cancer.

Table III. Time interval between onset of cancer symptoms to treatment among females positive for early detection of common cancers during PBS using CBAC and opportunistic cervical cancer screening in selected PHCs, Puducherry

Type of delay	Time interval (Days)	Median (IQR)				
		Oral cancer	Breast cancer	Cervical cancer		Total
				Population based screening	Opportunistic screening in centres	
Pre-diagnostic delay; (n=88)	Onset of symptoms to 1st presentation to registered medical practioner[20]	50 (34-102)	121 (64-1218)	81 (52-131)	55 (44-107)	79 (44-126)
Diagnostic delay; (n=36)	First contact to a registered medical practitioner to confirmation of diagnosis of the disease[20]	41*	27 (14-104)	27 (13-80)	28 (15-55)	27 (13-73)
Treatment initiation delay; (n=1)	Confirmation of diagnosis to initiation of treatment[20]	27	NA	NA		27

*Mean calculated as n=2 (9 and 72). Oral cancer: Pre-diagnostic delay (n=14); Diagnostic delay (n=6); Treatment delay (n=1); Breast cancer: Pre-diagnostic delay (n=9); Diagnostic delay (n=7); Cervical cancer (CBAC): Pre-diagnostic delay (n=55); Diagnostic delay (n=19); Cervical cancer (centre screening): Pre-diagnostic delay (n=9); Diagnostic delay (n=8)

Time interval between onset of cancer symptoms and treatment initiation: Table III shows the median time interval from onset of symptoms to initiation of cancer treatment for all three cancers. The overall median pre-diagnostic delay was 79 (IQR:44-126) days, with the longest delay for breast cancer (121 days). The overall median diagnostic delay was 27 (IQR:13-73) days, and it was the longest for oral cancer (41 days). The definitions of all the delays are mentioned in Table III[20]. In the single oral cancer case diagnosed, the pre-diagnostic, diagnostic and treatment initiation delays were 189 days, 136 days and 27 days.

Exploring the facilitating and hindering factors for early detection of cancers: IDIs were conducted with six women out of all individuals who presented with early warning signals of any one of the three cancers. We selected those participants who were interested in getting interviewed and sharing their experiences. These included three with breast cancer symptoms, two with cervical cancer symptoms and one with oral cancer symptoms. Three participants had not sought any medical care, while one diagnosed with oral cancer was undergoing treatment.

The three major themes identified were facilitators, barriers, and patient suggestions to reduce delay. Each theme had two categories: patient-related factors and health system-related factors. Major barriers identified were symptom neglect, family responsibilities, long waiting times in public facilities, and higher costs in private facilities.

Women tend to postpone healthcare visits due to responsibilities towards family members, and household and job-related commitments.

"I feel pain in my breast when I do heavy work, but I cannot go to the health facility because I am always busy. My husband is ill and cannot go to work, so I take care of him and also go to work. I'm already spending money on his treatment. I cannot stop working due to my problems." (A 45 yr old patient with pain in the breast)

"Yes, I'm suffering but both I and my husband need to go to work, I don't get time to visit the hospital." (A 42 yr old patient)

It was also found that many patients were hesitant to present their symptoms to health professionals, especially in the case of breast cancer.

"I told my sister about the lump in my breast. She insisted me to go to the doctor, but I felt shy, so I kept on delaying." (A 49 yr old patient who underwent surgery for a lump in the breast)

Facilitators identified for timely detection of cancer were adequate family support, low-cost medical care in public facilities and availability of social welfare schemes.

One of the participants said-

"I went to a public health facility for treatment. The only expenditure incurred was on travelling because tests and treatment were free of cost. So, I didn't have

to spend much." (A 44 yr old patient who had a lump in the breast)

Suggestions to reduce delays in cancer detection included involving frontline workers in community awareness programmes.

"It will be helpful for people if awareness is created towards symptoms of cancer and when to consult a doctor. Anganwadi and health centre workers can do this." (As requested by a patient who underwent surgery for a lump in the breast)

Discussion

The coverage of PBS was 65 and 71 per cent in urban and rural areas, respectively. The coverage was poor in urban areas because many houses were locked, particularly among short-term residents like those connected to Aurobindo Ashram. Both urban and rural areas faced challenges as many residents were daily wage workers who were not present during the visits.

Around 0.1 per cent of the males and 0.4 per cent of the female population screened were positive for early detection of oral cancer. This result is consistent with another study by Philip *et al*[21] but lower than Mishra *et al*[22], where positivity rate was 4 per cent. This could possibly be due to underreporting of symptoms as CBAC is based on verbal reporting. The screen positivity rate for breast cancer by CBAC was 0.3 per cent, similar to the findings in Parambil *et al*[23]. In another study where clinical breast examination was conducted, the screen positivity rate was 3.8 per cent[22]. This could be due to embarrassment, leading to underreporting of symptoms during community interviews. Screen positivity for cervical cancer using CBAC was 2.5 per cent in the present study, slightly higher than the other cancers. In other Indian studies, screen positivity rate for cervical cancer was found to be much higher[22,24].

Among the individuals with warning signals of oral cancer, 75 per cent of the males and 81 per cent of females had sought medical care. This is consistent with the findings of Philip *et al*[21] and Mishra *et al*[22], where adherence to referral for seeking medical care was 75 and 78 per cent, respectively. In the case of breast cancer, 82 per cent of those having warning symptoms had sought medical care from any registered medical practitioner, which was slightly higher than the report by Mishra *et al*[22] (76%). On the other hand, only 57 per cent of those positive having cervical cancer symptoms had sought medical care, which was less in comparison to other studies[22,25]. This could be due to the temporary nature of the symptoms like irregular menstruation and vaginal discharge which resolve on their own.

In our study, 66, 88 and 90 per cent of those having symptoms of oral cancer, breast cancer, and cervical cancer respectively adhered to the referral to undergo confirmatory diagnosis. In a study done in Uttar Pradesh and Jharkhand, the adherence rate was similar to that in the present study (90%) whereas it was less in a study by Basu *et al* (35%)[26,27].

The screen positivity rate of opportunistic cervical cancer screening in the health centres using Pap smear was 12 per cent in our study. Varied screen positivity rates were found in studies conducted nationally and internationally[24,25]. It was observed that the screen positivity and follow-up investigations were better among women who underwent opportunistic screening for cervical cancer in health centres compared to those who underwent PBS using CBAC.

In the present study, the overall median pre-diagnostic delay was close to three months. For oral cancer, the median pre-diagnostic delay was 50 days and the disease-specific pre-diagnostic delay was highest among women with breast cancer symptoms (121 days). For cervical cancer, it was 81 days for those screened using CBAC and 55 days for those who underwent opportunistic screening in the health centres. The median pre-diagnostic delay for the people screened using CBAC was similar to the findings of Somanna *et al*[28].

The overall median diagnostic delay for all three cancers was around one month, and it was highest for oral cancer (41 days). In the study by Ganesan *et al*[29], both median pre-diagnostic and diagnostic delays for oral cancer were 30 days, which was less than what was found in the present study. Negligence of symptoms and differences in socioeconomic status could be attributed to higher delay in our study. The median diagnostic delay for breast cancer was 27 days, which was lower than the delay reported by Norsa'adah *et al*[30]. The reason might be that when women presented their symptoms to the health facilities, majority were immediately directed to undergo mammography or ultrasonography. For cervical cancer, although pre-diagnostic delay was less in those screened opportunistically using Pap smear in the health centres, diagnostic delay was similar across PBS and opportunistic screening. The reason might be that the health centres where opportunistic screening was done were not equipped with confirmatory diagnostic facilities, and patients had to visit the medical college.

Common reasons for delayed cancer detection included neglect and lack of knowledge. Patients often did not seek medical care until the symptoms caused significant disruptions in their daily lives, as reported in literature[29,30]. Other factors such as shyness to present symptoms of breast and cervical cancers in front of male family members, healthcare providers and neglect due to responsibilities towards family members, contributed to the delays. A study conducted in Assam also reported similar findings[12]. Other reasons identified are economic factors and fear of getting diagnosed, as supported by literature[29,31,32]. Economic challenges played a significant role as well, as missing work for medical appointments was a barrier for low-income households. Private healthcare was perceived as better but unaffordable for many, resulting in delay. Social, support, particularly from relatives, and health insurance were important facilitators in encouraging early detection and treatment. This has also been observed in other studies[12,14,31].

This study is one of the few in South India observing the cascade of care for common cancers through PBS. The qualitative component provided a deeper understanding of the challenges in seeking cancer care. Information related to participants' time of visit to facilities and diagnosis was obtained from the available medical records, reducing the recall bias. Participants were selected from both PBS and opportunistic screening in the PHCs for cervical cancer; thus, we could compare both methods in the same setting.

One of the limitations of PBS was privacy concerns during house-to-house visits, which might have contributed to underreporting, especially among women. Another limitation could be that the time of onset of cancer symptoms was recorded based on participants' memory, hence there was a possibility of recall bias. We lacked information regarding the number of eligible women motivated to undergo cervical cancer screening in OPD settings, making it difficult to estimate the acceptance rate. Additionally, we could not interview the healthcare providers to gain their perspectives.

In conclusion, nearly three-fourths of the eligible population could be covered for early detection of the three cancers, with higher coverage among females and rural settings. While relatively few individuals reported early warning signals for the common cancers, a substantial proportion sought medical care and underwent confirmatory diagnosis. Screen positivity and treatment-seeking behaviour were better among women who underwent opportunistic cervical cancer screening in the PHCs. The study also highlighted significant pre-diagnostic and diagnostic delay, emphasizing the need for early symptom recognition and prompt healthcare seeking. Expanding screening coverage beyond working hours and ensuring privacy during house-to-house screening could improve detection, especially for breast and cervical cancers. Sensitizing frontline workers to refer individuals with cancer symptoms promptly is crucial. PHCs should be equipped with screening and diagnostic services for cervical and oral cancers to avoid the need for patients to travel to tertiary centres for diagnosis and treatment.

***Financial support & sponsorship*:** None.

***Conflicts of Interest*:** None.

***Use of Artificial Intelligence (AI)-Assisted Technology for manuscript preparation*:** The authors confirm that there was no use of AI-assisted technology for assisting in the writing of the manuscript and no images were manipulated using AI.

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