

INTEGRATION OF PREVENTIVE ONCOLOGY SERVICES INTO INDIA'S PRIMARY HEALTHCARE SYSTEM: A REVIEW OF MODELS, EVIDENCE, AND GAPS

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ABSTRACT

Background: Cancer is now among the leading causes of premature mortality in India, with cervical, breast, and oral cancers together accounting for a substantial share of the national burden [1,2]. Because most cancer deaths in India occur at advanced, largely unpreventable stages, global and national bodies have called for early detection and prevention to be delivered as close to the community as possible, through the primary healthcare system [3,4].

Methodology: A narrative review with a structured, PRISMA-style literature selection process was conducted, searching PubMed, Scopus, Embase, Google Scholar, and grey literature from the Ministry of Health and Family Welfare (MoHFW) and World Health Organization (WHO) for records on preventive oncology integration into Indian primary care published up to 2026. Of 210 records identified, 28 studies, program reports, and policy documents met the eligibility criteria and were retained for synthesis.

Observations: Two major national policy platforms—the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS) and the Ayushman Bharat Health and Wellness Centre (HWC) initiative—now provide the structural backbone for population-based screening of oral, breast, and cervical cancers at the primary-care level. Landmark cluster-randomised trials conducted in Kerala, Mumbai, and rural India demonstrated that community health worker-led visual and HPV-based screening can meaningfully reduce cancer-specific mortality. However, translation of this trial-generated evidence into routine primary care delivery remains uneven, constrained by workforce shortages, weak referral linkages to diagnostic and treatment centres, inconsistent screening coverage across states, and limited follow-up of screen-positive individuals.

Conclusions: India's primary healthcare system now possesses a credible policy and infrastructural foundation for preventive oncology, but realising its population-level impact will require strengthening referral pathways, expanding and retaining a trained frontline workforce, and building robust data systems to track individuals from screening through to treatment completion.

KEYWORDS: Preventive oncology; Primary health care; Cancer screening; India; Ayushman Bharat; Health and Wellness Centres; NPCDCS; Early detection.

1. INTRODUCTION

Cancer has emerged as one of the fastest-growing contributors to the non-communicable disease burden in India, with an estimated incidence that continues to rise alongside the country's demographic and epidemiological transition [1,2]. Oral, breast, and cervical cancers together account for a large proportion of this burden, and each has well-established, low-cost screening modalities—oral visual examination, clinical breast examination, and visual inspection with acetic acid (VIA) or HPV testing—that are feasible to deliver outside tertiary hospitals [4].

Despite this, the great majority of cancers in India continue to present at locally advanced or metastatic stages, when curative treatment is no longer possible and outcomes are poor [2,28]. This late-stage presentation reflects, in large part, the historical concentration of cancer services within tertiary and referral hospitals, with limited integration of prevention and early detection into the primary healthcare platforms that most Indians first encounter [3,4].

Over the past decade, two major policy shifts have sought to close this gap: the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS), and, more recently, the Ayushman Bharat Health and Wellness Centre (HWC) initiative, which has repositioned Sub-Health Centres and Primary Health Centres as sites of comprehensive primary health care inclusive of population-based NCD and cancer screening [6,7,8]. Alongside these policy platforms, a body of India-specific trial evidence, generated through large cluster-randomised studies in Kerala, Mumbai, and rural Maharashtra, has directly demonstrated that primary-care-level screening led by trained non-physician health workers can reduce cancer-specific mortality [10,11,12].

This review synthesises the policy models, delivery mechanisms, and trial evidence underpinning the integration of preventive oncology into India's primary healthcare system, and identifies the principal gaps that continue to limit its population-level impact.

2. METHODOLOGY

This is a narrative review structured around a systematic literature identification and selection process, reported in line with PRISMA principles for transparency of the search and screening pathway (Figure 1), while findings are synthesised descriptively given the heterogeneity of study designs, program reports, and policy documents included.

A search was conducted across PubMed, Scopus, Embase, and Google Scholar, supplemented by grey literature from the Ministry of Health and Family Welfare, the National Health Systems Resource Centre, the World Health Organization, and the ICMR-National Centre for Disease Informatics and Research [5,6,7,8,9]. Search terms combined the concepts of ("preventive oncology" OR "cancer screening" OR "early detection") AND ("primary health care" OR "primary healthcare" OR "Health and Wellness Centre" OR "Ayushman Bharat" OR "NPCDCS") AND ("India"), restricted to records addressing oral, breast, or cervical cancer prevention and screening.

Records were included if they (a) reported original trial or program-implementation data, or a national/state policy or operational framework, (b) were set in, or directly applicable to, the Indian primary healthcare system, and (c) addressed at least one of oral, breast, or cervical cancer prevention, screening, or early detection. Records were excluded if they were editorials or commentaries without original data, described cancer-control programs outside India without applicability to the Indian primary-care context, or were duplicate descriptions of the same program or policy. Of 210 records identified, 170 remained after de-duplication; 110 were excluded at title/abstract screening, and a further 32 were excluded after full-text assessment, leaving 28 studies, program reports, and policy documents in the final synthesis (Figure 1).

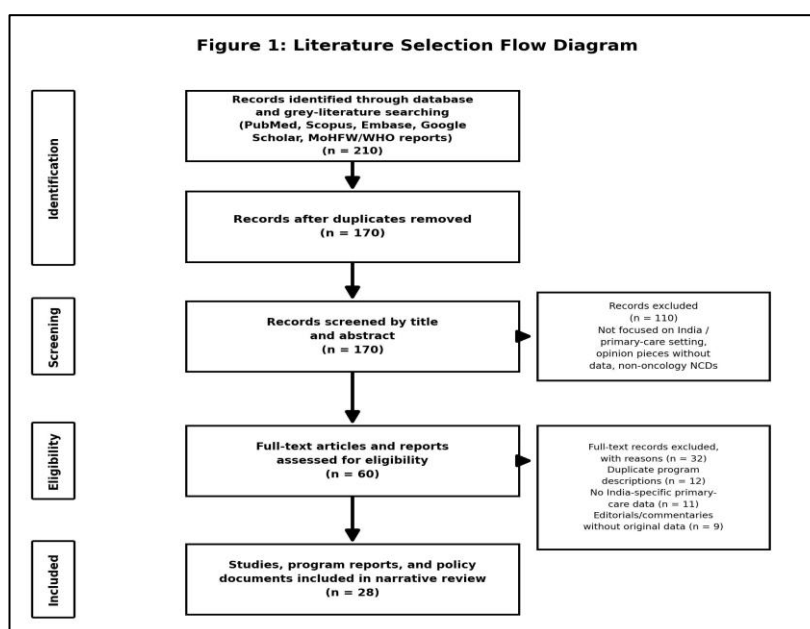


Figure 1: Literature Selection Flow Diagram

3. Policy Models for Integrating Preventive Oncology into Primary Care

3.1 The National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS)

Launched in 2010 and operationalised through detailed guidelines in 2013, NPCDCS was the first national platform to formally position cancer prevention and opportunistic screening for oral, breast, and cervical cancer within the district health system, using NCD clinics at Community Health Centres and District Hospitals as the principal delivery points [6]. While NPCDCS established the administrative and clinical framework for cancer control, its screening delivery model remained largely facility-based and opportunistic, reaching individuals who presented to health facilities for unrelated complaints rather than proactively covering a defined population [4,6].

3.2 Ayushman Bharat – Health and Wellness Centres

The Ayushman Bharat Health and Wellness Centre initiative, launched in 2018, represents a structural shift from opportunistic, facility-based screening to population-based screening delivered proactively through upgraded Sub-Health Centres and Primary Health Centres [7]. Each HWC is anchored by a Community Health Officer (a mid-level health provider, typically a trained nurse or Ayurveda physician), supported by ANMs and ASHA workers, and is mandated to screen the entire eligible population within its catchment area for oral, breast, and cervical cancer as part of an expanded package of comprehensive primary health care [7,8,9].

Under this model, ASHA workers conduct house-to-house line-listing and risk assessment, the Community Health Officer or ANM performs the screening test itself (oral visual examination, clinical breast examination, and VIA or HPV-based testing), and screen-positive individuals are referred along a structured pathway to the Primary Health Centre and, where

required, to higher centres for confirmatory diagnosis and treatment [8,9]. This pathway is summarised schematically in Figure 2.

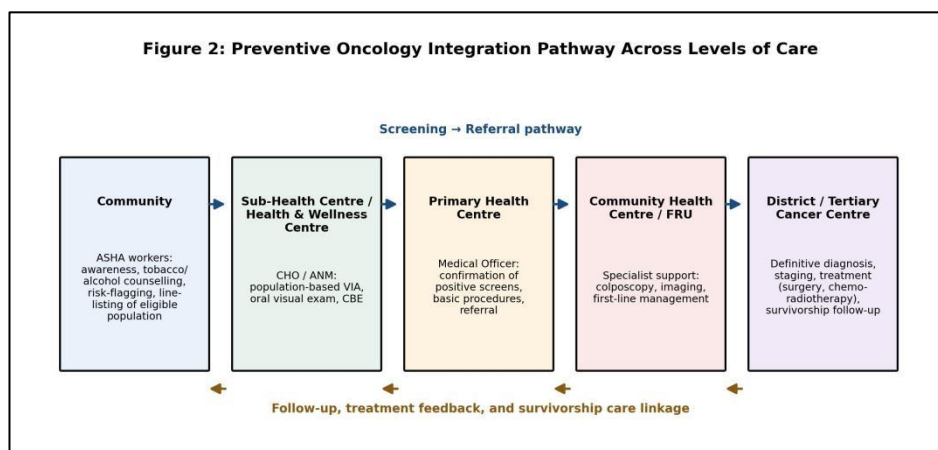


Figure 2: Preventive Oncology Integration Pathway Across Levels of Care

3.3 Complementary Community-Based and Task-Shifted Models

Beyond the two flagship national programs, several state-level and research-driven models have tested community-based, task-shifted approaches to cancer screening, including ASHA-led house-to-house VIA referral programs, camp-based oral and breast screening drives, and mobile-van-based cervical screening in hard-to-reach districts. These models share a common design principle demonstrated in the trial literature: screening tasks that do not require a physician can be safely and effectively shifted to trained non-physician health workers, provided referral and follow-up systems are in place [10,11,12].

Table 1: Comparison of Major National Programs and Policies for Preventive Oncology Integration in India

Program / Policy	Year Launched	Target Cancers	Primary Delivery Level	Workforce Cadre	Screening Approach
NPCDCS	2010 (guidelines 2013)	Oral, breast, cervical	CHC / District NCD clinic	Medical Officer, staff nurse	Opportunistic, facility-based
Ayushman Bharat – HWC	2018	Oral, breast, cervical	Sub-Health Centre / PHC	Community Health Officer, ANM, ASHA	Population-based, proactive house-to-house
State community screening pilots	Variable (2010–present)	Oral, cervical (mainly)	Community / camp-based	ASHA, trained volunteers	Camp- and mobile-van-based
National Health Policy 2017 framework	2017	All major NCDs incl. cancer	System-wide (policy)	All cadres (integrated)	Policy and financing framework

4. Evidence Base for Primary-Care-Level Cancer Screening

4.1 Cervical Cancer Screening

The largest body of India-specific trial evidence concerns cervical cancer. A cluster-randomised trial in rural India demonstrated that a single round of HPV DNA testing performed by trained health workers, followed by appropriate referral, significantly reduced the incidence of advanced cervical cancer and cervical cancer mortality compared with no screening [11]. VIA-based screening, delivered by trained nurses and paramedical workers, has similarly been shown to be a feasible, low-cost alternative in settings without laboratory infrastructure for HPV testing [13,14]. The global push toward cervical cancer elimination has further reinforced the centrality of primary-care-based screening and HPV vaccination as complementary strategies [26].

4.2 Oral Cancer Screening

India carries one of the highest global burdens of oral cancer, driven substantially by smokeless tobacco and areca nut use [16]. A landmark cluster-randomised controlled trial in Kerala demonstrated that repeated visual oral examination performed by trained health workers, when directed at high-risk individuals (users of tobacco or alcohol), significantly reduced oral cancer mortality in that subgroup [10]. This trial provided the principal evidentiary basis for including simple visual oral examination as a core screening test within both NPCDCS and the HWC screening package [6,17]. Tobacco

control policy, anchored in India's ratification of the WHO Framework Convention on Tobacco Control, is now recognised as a necessary complement to clinical screening for sustained reduction in oral cancer incidence [18,19].

4.3 Breast Cancer Screening

Evidence for breast cancer screening in the Indian primary-care context is comparatively less mature than for cervical or oral cancer. The Mumbai cluster-randomised trial evaluated clinical breast examination delivered by trained primary health workers alongside cervical screening, and demonstrated the operational feasibility of combining breast and cervical screening within a single community health worker visit, generating interim evidence on downstaging of breast cancer at diagnosis [12]. In the absence of a national mammography screening program at the primary-care level, clinical breast examination remains the recommended entry-level screening modality in current guidelines [4,7].

Table 2: Summary of Major Cluster-Randomised Screening Trials Underpinning Primary-Care Cancer Screening in India

Trial (Location)	Design	Sample Size	Intervention	Comparator	Key Reported Outcome
Sankaranarayanan et al., Kerala oral cancer trial	Cluster-RCT	N ≈ 191,000 (13 clusters)	Visual oral examination by trained health workers, 3 rounds	No screening (usual care)	Significant reduction in oral cancer mortality among tobacco/alcohol users
Sankaranarayanan et al., rural India HPV trial	Cluster-RCT	N ≈ 131,000 (52 clusters)	Single round HPV DNA testing with referral	VIA, cytology, or no screening arms	Significant reduction in advanced cervical cancer and cervical cancer mortality
Mittra et al., Mumbai cluster trial	Cluster-RCT	N ≈ 150,000 (20 clusters)	Combined clinical breast examination and VIA/cytology by primary health workers	No screening (usual care)	Feasibility of combined screening; interim downstaging trends reported

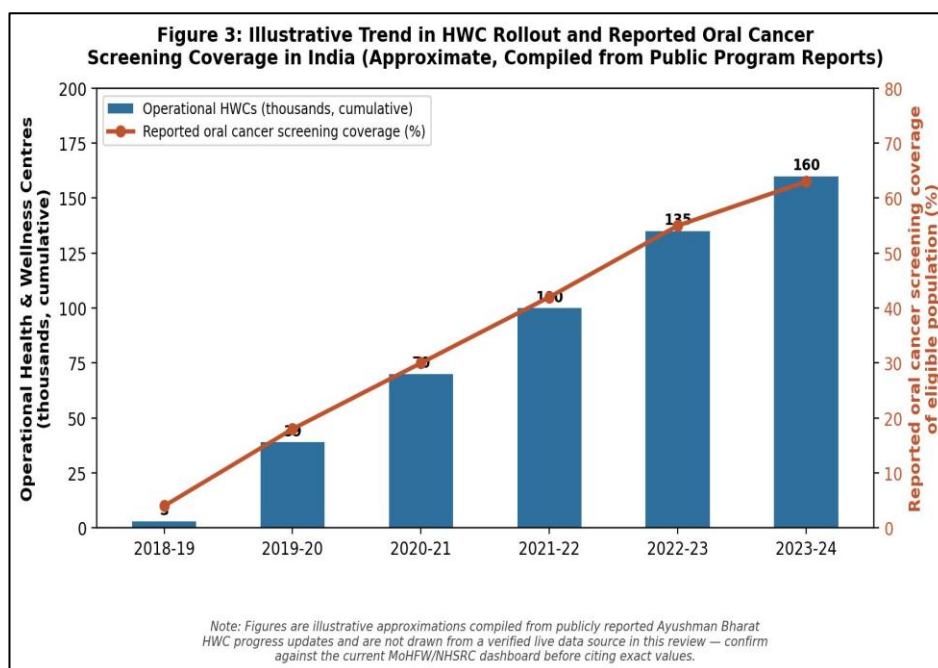


Figure 3: Illustrative Trend in HWC Rollout and Reported Oral Cancer Screening Coverage in India

5. Workforce and Service-Delivery Roles

The success of population-based screening under the HWC model depends on a task-shifted, multi-cadre workforce. ASHA workers undertake community mobilisation, health education, and line-listing of the eligible population; ANMs and Community Health Officers perform the screening tests themselves and provide first-level counselling; and Medical Officers at the Primary Health Centre confirm screen-positive cases and initiate referral [7,8,20]. Economic evaluations of community health worker-based delivery models in India indicate that this task-shifted approach is substantially more cost-effective than physician-led, facility-based screening, provided adequate training, supervision, and incentive structures are maintained [20].

Table 3: Cadre-Wise Roles in Preventive Oncology Service Delivery at the Primary-Care Level

Cadre	Primary Location	Core Preventive-Oncology Role	Training Requirement
ASHA (Accredited Social Health Activist)	Community / household	Awareness generation, tobacco/alcohol counselling, line-listing of eligible population, follow-up tracing	Short structured training modules under NPCDCS/HWC
ANM (Auxiliary Nurse Midwife)	Sub-Health Centre / HWC	VIA, oral visual examination, clinical breast examination, basic documentation	In-service NCD/cancer screening training
Community Health Officer (CHO)	Health & Wellness Centre	Population-based screening delivery, risk stratification, referral initiation, HWC-level record-keeping	Certificate course in community health (mid-level provider)
Medical Officer	Primary Health Centre	Confirmation of screen-positive cases, basic procedures (e.g., cryotherapy), onward referral	MBBS with NCD/cancer screening orientation

6. Gaps in Integration

Despite a credible policy architecture and a supportive trial evidence base, several gaps continue to constrain the population-level impact of preventive oncology integration in India. Referral linkages between the HWC and higher centres remain inconsistent, with screen-positive individuals frequently lost to follow-up before confirmatory diagnosis is completed [21,23]. Diagnostic and treatment capacity at the district and tertiary level remains geographically concentrated, so even where screening successfully identifies disease, timely definitive management is not always accessible [23,24]. Health information systems linking screening, referral, diagnosis, and treatment records across levels of care remain fragmented, limiting the ability of program managers to track individuals longitudinally or to measure real-world screening-to-treatment outcomes [21,27].

Workforce gaps persist in the form of vacant CHO and ANM positions in remote and high-burden districts, variable quality of in-service training, and high frontline staff attrition [20,27]. Screening coverage also varies substantially across states, reflecting differences in HWC operationalisation timelines, health system capacity, and community health literacy [8,22]. Finally, as a system built substantially on task-shifted delivery, sustained quality assurance and supportive supervision of non-physician screeners remain essential but inconsistently implemented safeguards [4,20].

Table 4: Key Gaps in Preventive Oncology Integration and Potential Strategies

Identified Gap	Underlying Driver	Potential Strategy
Loss to follow-up after screen-positive result	Weak referral tracking, transport/financial barriers, limited patient navigation	Dedicated patient navigators/tracking registers linked to the HWC digital platform
Limited diagnostic and treatment capacity beyond primary care	Geographic concentration of colposcopy, biopsy, and cancer treatment services	Hub-and-spoke linkage of HWCs to designated district cancer care centres
Fragmented data systems across levels of care	Non-interoperable registers and portals between HWC, PHC, and tertiary centres	Unified digital cancer screening registry integrated with the national NCD portal
Workforce shortages and attrition	Vacant CHO/ANM posts, inconsistent training refreshers, high turnover in remote areas	Structured career pathways, regular refresher training, and retention incentives for rural postings
Uneven screening coverage across states	Variable pace of HWC operationalisation and community health literacy	Targeted scale-up in low-coverage districts with community-tailored awareness campaigns

7. DISCUSSION

Taken together, the evidence indicates that India has moved from a facility-centred, opportunistic model of cancer control under NPCDCS toward a proactive, population-based model under the Ayushman Bharat HWC platform, underpinned by robust India-generated trial evidence for oral, cervical, and, to a lesser extent, breast cancer screening [6,7,10,11,12]. This represents a substantial policy achievement relative to many other low- and middle-income countries, where preventive oncology remains largely confined to tertiary centres [3,25].

However, the persistence of late-stage presentation despite this infrastructure suggests that screening coverage alone is insufficient; the full value of primary-care-based screening is only realised when it is tightly coupled to functioning referral, diagnostic, and treatment pathways [23,24]. Strengthening the “middle” of the pathway—confirmatory diagnosis, treatment initiation, and follow-up—therefore appears to be at least as important as further expanding screening coverage itself [21,24].

8. Limitations

This review has several limitations. As a narrative rather than systematic review, formal risk-of-bias assessment and meta-analytic pooling of trial results were not undertaken. The evidence base for breast cancer screening at the primary-care level remains comparatively limited relative to cervical and oral cancer, restricting the strength of conclusions in that domain [12]. Program coverage and rollout figures cited from grey literature sources are subject to rapid change and should be verified against current official dashboards before being relied upon for policy or publication purposes. Finally, this review focused on oral, breast, and cervical cancer, the three cancers explicitly prioritised for primary-care screening in current Indian guidelines, and did not address integration models for other malignancies [4].

9. CONCLUSION

India's Primary healthcare system now has both the policy architecture, through NPCDCS and the Ayushman Bharat Health and Wellness Centres, and the trial-generated clinical evidence needed to deliver meaningful preventive oncology services at the population level [6,7,10,11,12]. Realising the full mortality benefit demonstrated in trial settings will depend on closing persistent gaps in referral linkage, diagnostic and treatment capacity, workforce retention, and data integration across levels of care [21,23,27]. Continued investment in these connective elements of the system, rather than in screening coverage alone, represents the most promising path toward reducing India's preventable cancer mortality burden.

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