A SYSTEMATIC REVIEW ON CERVICAL CANCER PREVENTION AND SCREENING IN LOW- AND MIDDLE-INCOME COUNTRIES: EPIDEMIOLOGICAL BURDEN, HEALTH SYSTEM GAPS, AND STRATEGIC PATHWAYS FOR ELIMINATION

BY

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Abstract
Cervical cancer is among the most readily preventable cancers affecting women worldwide, yet it continues to claim an inordinate share of female cancer deaths in low- and middle-income countries (LMICs). The co-existence of proven preventive technologies and persistently high mortality in settings such as Nigeria points not to a knowledge deficit but to a fundamental failure of health system implementation.This systematic review critically synthesises evidence on the epidemiological burden of cervical cancer, the effectiveness of primary and secondary prevention strategies, and the structural determinants that constrain screening utilisation in LMICs, with focused attention on sub-Saharan Africa and Nigeria. A systematic review design was adopted, drawing on studies retrieved from PubMed, Scopus, Web of Science, and Google Scholar, complemented by grey literature from the World Health Organisation (WHO), the International Agency for Research on Cancer (IARC), and the Federal Ministry of Health, Nigeria. Searches were conducted using Boolean combinations of terms relating to cervical cancer, human papillomavirus (HPV), screening, and health system capacity, restricted to publications from 2000 to 2025. Thematic synthesis was applied to integrate findings across four analytical domains. The review identified four consistent patterns in the evidence. First, the concentrated burden of cervical cancer in sub-Saharan Africa reflects health system inequities rather than heightened biological vulnerability. Second, existing prevention modalities, including HPV vaccination, cytology-based screening, and HPV DNA testing, are demonstrably effective but unevenly implemented. Third, health system capacity, particularly the organisation of services, workforce availability, and integration within primary care, is the primary driver of screening uptake and early detection. Fourth, geographic inaccessibility and opportunistic rather than population-based programme delivery severely limit preventive reach. Reducing cervical cancer mortality in Nigeria and comparable settings requires a strategic reorientation from technology procurement towards health system strengthening, coordinated programme delivery, and the elimination of geographic barriers to service access.
Keywords: cervical cancer; HPV vaccination; screening uptake; sub-Saharan Africa; Nigeria; health systems; elimination strategy.

Introduction

Cervical cancer occupies a distinctive position in global oncology: it is a disease for which the scientific community has possessed effective preventive tools for decades, yet it continues to kill women in resource-constrained settings at rates that have altered little over the past generation. Globally, the disease accounts for approximately 604,000 new diagnoses and 342,000 deaths annually, with close to 90 percent of those deaths occurring in LMICs (WHO, 2023; Sung et al., 2021). This death toll is not attributable to therapeutic limitations alone. Countries with systematically organised screening programmes have achieved reductions in incidence and mortality exceeding 70 percent. Sravani et al. (2023) and Szarpak et al. (2026), showed support by demonstrating that the biological trajectory of cervical cancer is highly amenable to intervention when the requisite health system infrastructure is in place.

Sub-Saharan Africa bears a disproportionate share of this global burden. Age-standardised incidence rates in the region frequently exceed 30 per 100,000 women (Jatho et al., 2020), with countries such as Malawi recording rates above 75 per 100,000 (IARC, 2023). Within Nigeria specifically, cervical cancer accounts for approximately 16 percent of female malignancies, predominantly affecting women between 35 and 50 years of age, a demographic that constitutes the productive and reproductive core of households and communities (Bains et al., 2019; Jedy-Agba et al., 2012; Zubairu & Balogun, 2023). Despite this burden, the country continues to lack a nationally coordinated screening programme, and the modest prevention activities that do exist remain opportunistic and geographically concentrated in urban centres (Adenaya et al., 2025). The paradox at the heart of cervical cancer in Africa is not biological but systemic. Persistent infection with oncogenic human papillomavirus (HPV) is the established necessary cause of virtually all cervical cancers (Bosch et al., 2002; Hu et al., 2023; Lycke et al., 2025; Sravani et al., 2023), and both primary prevention through vaccination and secondary prevention through screening are supported by substantial evidence. The challenge lies in translating this evidence base into functional, equitable, and sustainable service delivery within health systems that are chronically under-resourced and spatially fragmented. Considerable scholarly attention has been directed at individual components of this problem.

Studies have examined epidemiological burden (Choi et al., 2023; IARC, 2023; Jatho et al., 2020), screening modality effectiveness (Ault, 2006; Fernandes et al., 2013; Odutola et al., 2017; Ratna & Mandrekar, 2017; Shin et al., 2021), and barriers to screening uptake (Aniebue & Aniebue, 2010; Dim, 2012) as distinct research questions. What remains relatively underdeveloped is an integrative synthesis that examines how health system organisation, geographic access, and service delivery structure interact to shape prevention outcomes at the population level. Understanding this interaction is essential for designing interventions that move beyond information provision to address the structural conditions under which prevention behaviour occurs. This review addresses that gap. Its central purpose is to synthesise the evidence on cervical cancer epidemiology, prevention strategy effectiveness, and health system determinants of screening utilisation in LMICs, with sustained attention to sub-Saharan Africa and Nigeria. In doing so, it seeks to reframe cervical cancer mortality not as an inevitable epidemiological feature of low-income settings, but as a measurable indicator of health system performance, amenable to targeted structural intervention.

Global Epidemiology and Disease Burden

Cervical cancer ranks as the fourth most commonly diagnosed cancer in women globally, and the burden it imposes is strikingly unequal (Sung et al., 2021). High-income countries have effectively converted cervical cancer into a disease of historical concern through population-based screening, achieving incidence rates below 5 per 100,000 in several settings (Andaroon & Ghasemi Gujani, 2025; Hu et al., 2023). The same disease kills women in their reproductive and economically active years across much of sub-Saharan Africa, South Asia, and parts of Latin America, where it can account for a fifth or more of all female cancer deaths (Bray et al., 2018). This geographic split is not random. It tracks closely with the presence or absence of organised screening infrastructure, the coverage of HPV vaccination programmes, and the capacity of health systems to diagnose and treat preinvasive disease.

Socioeconomic development independently correlates with cervical cancer outcomes, though not through wealth per se. Countries at similar income levels demonstrate markedly different cervical cancer trajectories depending on whether they have invested in systematic screening (Choi et al., 2023; Jatho et al., 2020; Ndikom & Ofi, 2012). Improvements in governance of health services, integration of prevention into primary care, and the willingness to

allocate resources to non-acute, preventive activities explain much of the variance in outcomes within the LMIC grouping. The lesson from high-income country experiences is not that expensive technology is required, but that organised, population-wide delivery of available tools is decisive.

Cervical Cancer in Sub-Saharan Africa

Sub-Saharan Africa accounts for a substantial proportion of global cervical cancer incidence and mortality. Estimates from GLOBOCAN indicate age-standardised incidence rates consistently exceeding 30 per 100,000 women across much of the region, with East Africa representing the highest-burden sub-region globally (Asangbeh-Kerman et al., 2024; Black & Richmond, 2019; Jatho et al., 2020). Malawi, Zimbabwe, and Tanzania record amongst the world's highest national rates, shaped by the compounding effects of high HPV prevalence, widespread HIV co-infection, weak health infrastructure, and limited access to gynaecological care (Hamapa et al., 2025; Mbimenyuy et al., 2023; Pfaendler et al., 2009). HIV co-infection deserves particular emphasis in this context. Women living with HIV face a three- to fivefold increased risk of developing cervical cancer compared with HIV-negative women, owing to impaired immunological clearance of oncogenic HPV and accelerated progression from preinvasive to invasive lesions (Kelly et al., 2018). Given that sub-Saharan Africa hosts the majority of the global HIV burden, this interaction constitutes a major epidemiological driver of the region's disproportionate cervical cancer mortality. Studies from South Africa, Uganda, and Kenya have demonstrated that integrating cervical cancer screening into HIV care platforms substantially improves coverage amongst the most at-risk women (Firnhaber et al., 2010; Liu et al., 2018; Vesa et al., 2017). A defining feature of cervical cancer presentation in the region is the preponderance of late-stage diagnosis. Between 60 and 75 percent of cases in sub-Saharan Africa are identified at Stage III or IV, when treatment options are confined to palliative or radiotherapy approaches with correspondingly poor survival outcomes (Shin et al., 2021). This pattern reflects not a clinical failure but a systemic one: the absence of functional early-detection pathways ensures that the disease reaches symptomatic, advanced stages before entering health services.

Nigeria a High-Burden National Context

Nigeria presents a high-stakes instance of the LMIC cervical cancer challenge. With a female population of over 100 million and an age-standardised incidence rate estimated at around 27 per 100,000 women, the country contributes a substantial share of the West African cervical cancer burden (IARC, 2023; Jedy-Agba et al., 2012). Cancer registries remain limited in geographical coverage, meaning national estimates almost certainly undercount true incidence, particularly in rural northern states where health facility access is most constrained. The disease primarily affects women aged 35 to 50 years, a cohort at the centre of household income generation and childcare responsibilities. The social and economic consequences of cervical cancer mortality in this age group cascade through families and communities, widening existing poverty gaps (Poole et al., 2021). Despite the recognised scale of the problem, national health planning has historically accorded low priority to cervical cancer relative to communicable disease control, contributing to a chronic gap in dedicated prevention infrastructure (Federal Ministry of Health Nigeria, 2018). Screening in Nigeria remains predominantly opportunistic, occurring within antenatal services, family planning clinics, and occasional awareness campaigns, rather than through any population-based invitation system. Visual inspection with acetic acid (VIA) constitutes the predominant modality in settings where screening occurs, partly because it does not require laboratory infrastructure and allows immediate treatment at the same visit. Studies from Oyo, Lagos, Abuja, and Enugu states have consistently reported screening coverage below 15 percent of eligible women, with rural coverage substantially lower still (Adenaya et al., 2025; Dim, 2012). The implication is

that the vast majority of Nigerian women pass through their peak-risk years without ever having received a single cervical cancer screen.

Aetiology, Pathogenesis, and Risk Stratification

The causal relationship between persistent infection with high-risk HPV and the development of cervical cancer is one of the most firmly established in oncology. Infection with oncogenic HPV types, chiefly types 16 and 18 but encompassing at least twelve additional high-risk genotypes, is necessary for the development of invasive cervical carcinoma; no other single causal agent in human cancer has this degree of epidemiological universality (Bains et al., 2019; Bosch et al., 2002; Sravani et al., 2023). The viral oncoproteins E6 and E7 disrupt cellular cycle regulation by targeting the p53 tumour suppressor and the retinoblastoma protein respectively, initiating a process of genomic instability and unchecked proliferation that, over years to decades, may progress from cervical intraepithelial neoplasia to invasive malignancy (Asangbeh-Kerman et al., 2024; Ray, 2025). The long natural history of the disease, typically spanning 10 to 20 years from initial HPV acquisition to invasive cancer, is clinically significant precisely because it defines the window within which screening and treatment are most effective (Choi et al., 2023; A. Fernandes et al., 2022; Włoszek et al., 2025). This extended lead time means that even modest increases in screening coverage translate into material reductions in invasive disease. It also means that failures in prevention accumulate silently: women who pass through peak-risk years unscreened carry forward a risk burden that ultimately manifests as late-stage presentation years later. Several cofactors modulate the probability that HPV infection will persist and progress. HIV-induced immunosuppression is the most clinically significant in sub-Saharan Africa, substantially elevating both HPV persistence and rate of progression to neoplasia (Asangbeh-Kerman et al., 2024; Kelly et al., 2018; Liu et al., 2018). Other established cofactors include tobacco use, high parity, long-term hormonal contraceptive use, early coitarche, and concurrent sexually transmitted infections (Munoz et al., 2006). In Nigerian and broader African contexts, these cofactors frequently cluster within socioeconomically marginalised groups, compounding individual biological risk with structural vulnerability. The consequence is that cervical cancer disproportionately affects women who already face the greatest barriers to preventive care, reinforcing rather than attenuating existing health inequities.

Prevention Strategies Evidence of Effectiveness and Implementation Gaps

Primary Prevention

HPV Vaccination

HPV vaccination constitutes the most upstream intervention in the cervical cancer prevention cascade. The three currently available vaccine formulations, namely the bivalent, quadrivalent, and nonavalent preparations, confer protection against the HPV types responsible for up to 90 percent of cervical malignancies when administered prior to sexual debut (Garland et al., 2007; Joura et al., 2015). Long-term follow-up data from high-income countries that introduced vaccination in the mid-2000s now confirm substantial reductions in HPV type-specific infection prevalence, cervical intraepithelial neoplasia, and, in countries with sufficiently long follow-up, invasive cervical cancer incidence itself (Drolet et al., 2019; Falcaro et al., 2024). The WHO's 90-70-90 global elimination strategy assigns the vaccination of 90 percent of girls against HPV before age 15 as the primary prevention target (WHO, 2020). Achieving this target in LMICs requires affordable vaccine supply, functional school- and health-facility-based delivery platforms, and sustained political commitment. The Gavi vaccine alliance has expanded access to subsidised HPV vaccine supply across eligible LMICs, but programmatic implementation has been uneven,

constrained by cold chain limitations, community hesitancy, and competing health priorities (LaMontagne et al., 2011). Nigeria launched a phased national HPV vaccination programme in selected states, though national coverage remains far below the WHO target (Choi et al., 2023; A. Fernandes et al., 2022; Włoszek et al., 2025).

Secondary Prevention

Screening Modalities and Comparative Performance

The evidence base for cervical cancer screening is extensive and consistent. Three broad modalities are available: cytology-based testing (the Pap smear), visual inspection with acetic acid (VIA), and molecular HPV DNA testing. Each carries a different balance of sensitivity, specificity, cost, and infrastructure requirement, making the choice of modality fundamentally a health system decision rather than a purely clinical one. HPV DNA testing offers the highest sensitivity for detecting high-grade cervical intraepithelial neoplasia, typically exceeding 90 percent in well-designed studies, and is now recommended by WHO as the preferred primary screening test where laboratory capacity permits (WHO, 2021; (Ault, 2006; Fernandes et al., 2022; Ratna & Mandrekar, 2017). Its sensitivity advantage over cytology is particularly pronounced in settings where laboratory quality assurance is difficult to maintain. Self-sampling for HPV testing has emerged as a promising approach for reaching women who do not attend clinic-based services, with evidence from several African settings suggesting comparable analytical performance to clinician-collected samples (Bandaru et al., 2020; Nishimura et al., 2021). VIA is widely used in Nigeria and comparable settings owing to its low cost, independence from laboratory infrastructure, and compatibility with "screen-and-treat" protocols that allow treatment of identified lesions at the same visit using cryotherapy or thermal ablation (Sankaranarayanan et al., 2009; Shin et al., 2021). Evidence from Nigerian studies and multicentre trials confirms VIA's feasibility and clinical utility in low-resource contexts, though its lower specificity relative to HPV testing carries a risk of overtreatment. Even a single lifetime VIA screen has been estimated to reduce cervical cancer incidence by up to 40 percent in modelling analyses (Campos et al., 2019; Simms et al., 2023), underscoring the potential impact achievable even with imperfect modality coverage. Cytology remains the historical foundation of screening in high-income countries, delivering the bulk of the mortality reductions observed over the past half-century when applied systematically. However, its performance depends critically on smear quality, preparation, staining, and reader expertise, all of which are difficult to standardise in settings with chronic workforce shortages and weak laboratory oversight. For these reasons, cytology-alone strategies are not recommended as the primary approach in resource-constrained environments where quality assurance cannot be guaranteed (WHO, 2021).

The Implementation Gap from Evidence to Population Impact

That effective prevention modalities exist is beyond scientific dispute. What distinguishes the cervical cancer experiences of high-income and LMIC populations is not the availability of these tools but the fidelity, coverage, and organisation with which they are deployed. The evidence from Nigeria and comparable settings points consistently to an implementation gap: the distance between what proven interventions can deliver under controlled conditions and what they actually deliver within routine health system operations is large and consequential. Opportunistic screening, which is the dominant model in Nigeria, depends on individual women presenting to health services and providers offering or recommending a screen. This approach consistently produces skewed coverage, over-representing health-engaged urban women whilst systematically missing rural women, those with limited health literacy, and those deterred by cost, distance, or previous negative healthcare experiences (Adenaya et al.,

2025; Ndikom & Ofi, 2012). Population-based organised screening, by contrast, involves systematic invitation of all eligible women regardless of their health-seeking behaviour, follow-up for those who do not respond, and quality-assured treatment of screen-positive cases. Countries that have transitioned from opportunistic to organised screening have observed accelerated reductions in cervical cancer incidence beyond what modality improvement alone could explain (Choi et al., 2023; A. Fernandes et al., 2022; Włoszek et al., 2025).

Health System Capacity as the Central Determinant of Prevention Outcomes

Workforce, Infrastructure, and Integration

Health system capacity, in the sense of trained workforce availability, functional infrastructure, and integration of cancer prevention within routine care, is consistently identified across the literature as the primary bottleneck in translating cervical cancer prevention evidence into population-level impact. WHO health system framework analyses suggest that LMICs face cumulative deficits across multiple building blocks simultaneously: service delivery is fragmented, health workforce is insufficient in both number and specialist skill, health information systems are weak, and essential medicines and technologies for cancer treatment are inconsistently stocked (Farmer et al., 2010; WHO, 2010). In the Nigerian context, studies have documented that even trained healthcare workers frequently cite lack of screening equipment, absence of consumables, and unclear referral pathways as barriers to providing screening services (Adenaya et al., 2025; Aniebue & Aniebue, 2010). This points to an infrastructure deficit that training programmes alone cannot resolve. The evidence is clear that expanding training without concurrent investment in equipment supply chains, laboratory support, and treatment capacity generates temporary improvements in knowledge and attitude without durable changes in screening delivery. Integration of cervical cancer screening within existing health platforms represents a pragmatically important strategy for settings with constrained resources. Antenatal care, family planning services, and HIV care constitute high-contact platforms that already serve substantial proportions of the eligible female population. Studies from Kenya, Uganda, South Africa, and Nigeria have demonstrated that integrating VIA or HPV testing within these platforms substantially boosts screening reach without requiring dedicated cancer screening infrastructure (Bandaru et al., 2020; Choi et al., 2023; A. Fernandes et al., 2022; Vesa et al., 2017). The barriers to such integration are primarily organisational: competing clinical demands, staff reluctance to expand service scope without additional training and remuneration, and the absence of standardised integrated protocols.

Geographic Barriers and Spatial Inequity

The spatial distribution of health services in Nigeria, as in much of sub-Saharan Africa, is deeply unequal. Tertiary health facilities offering gynaecological care, colposcopy, and treatment for cervical lesions are concentrated in urban centres and state capitals, whilst primary care facilities in rural local government areas frequently lack even the most basic screening capacity (Jedy-Agba et al., 2012). For a woman in rural Niger or Kebbi State, the nearest facility offering VIA screening may require several hours of travel and out-of-pocket transportation expenditure that constitutes a substantial fraction of weekly household income. Geographic access research from LMICs consistently shows a strong negative association between distance to screening facilities and screening uptake, even after controlling for socioeconomic and knowledge-related factors (Ndikom & Ofi, 2012; Poole et al., 2021). Mobile outreach programmes, community health worker-led screening initiatives, and decentralisation of VIA and HPV self-sampling to primary care level represent evidence-based strategies for reducing geographic barriers. Their implementation has been shown to raise screening coverage in rural and peri-urban populations substantially,

suggesting that spatial access, rather than individual preference, is the binding constraint on coverage in these contexts.

Policy, Governance, and Financing

Structural shortcomings in health system governance and financing compound the service delivery deficits described above. Nigeria's Federal Ministry of Health has articulated commitment to cervical cancer prevention in successive national cancer control plans (Federal Ministry of Health Nigeria, 2018), yet financial allocations to implement these plans have been consistently insufficient. The Abuja Declaration target of allocating 15 percent of national budgets to health has never been met by Nigeria, and within health budgets, preventive services have historically competed disadvantageously against curative care priorities (Oleribe et al., 2018). International donor support for cervical cancer prevention in Nigeria and the broader region has grown since the launch of the WHO Global Strategy in 2020, but remains donor-dependent in ways that create sustainability concerns. Programmes built around externally financed inputs, whether vaccines, HPV test kits, or outreach activities, face abrupt disruption when funding cycles change. Sustainable cervical cancer elimination requires domestic health financing mechanisms, including progressive health insurance coverage for screening services, that do not depend on continued external subsidy.

Determinants of Screening Utilisation

Beyond Individual Knowledge

A well-documented finding in the cervical cancer literature is that awareness and knowledge of screening, whilst necessary, are insufficient predictors of screening uptake. Studies from Nigeria, Ghana, and other West African settings consistently report that large proportions of women acknowledge the existence of cervical cancer screening yet have never accessed it (Ayinde et al., 2004; Dim, 2012). This disconnection between awareness and behaviour is not a failure of health education; it is a predictable consequence of placing structural barriers between knowledge and action. The evidence base for screening determinants in Nigeria identifies a consistent hierarchy of influence. Structural factors, particularly geographic accessibility, service cost, facility opening hours, availability of female providers, and the presence or absence of prior positive screening experiences, account for substantially more variance in screening uptake than individual-level knowledge, attitude, or demographic variables (Adenaya et al., 2025; Ndikom & Ofi, 2012). Fear of diagnosis, concerns about painful procedures, and spousal disapproval are frequently cited barriers in qualitative studies, but these social and psychological factors are themselves often proxies for prior negative health system encounters, including disrespectful provider behaviour, long waiting times, and unclear communication about results. What the evidence implies is that interventions designed primarily to raise awareness will produce modest and time-limited improvements in screening coverage unless concurrent changes in service accessibility and organisation remove the structural barriers that constrain uptake even among motivated women (Rikhotso et al., 2024; Simms et al., 2023). This finding challenges the dominant framing in much of the Nigerian public health literature, which has tended to foreground health education as the primary lever for improving screening behaviour. A more systems-oriented framing would direct attention to the conditions that make screening convenient, affordable, and trusted for all eligible women, not merely those who are already health-engaged.

Importantly, the relationship between health literacy and screening is moderated by health system factors. Where services are accessible and well-organised, even women with moderate health literacy attend in substantial numbers. Where services are geographically remote, expensive, or qualitatively poor, even highly educated and informed

women fail to screen with recommended frequency (Choi et al., 2023; Dim, 2012; Hu et al., 2023). This interaction suggests that health system improvement and individual-level education are complements rather than substitutes, and that the leverage from system improvement is likely to be larger in the short term.

Synthesis of Findings

Cervical Cancer Mortality as a Health System Indicator

One of the most analytically significant conclusions to emerge from this review is that cervical cancer incidence and mortality should be understood as sensitive indicators of health system performance rather than as purely clinical phenomena. Countries with well-organised, consistently funded, and geographically equitable screening programmes have driven cervical cancer mortality toward elimination threshold levels. Countries where these system characteristics are absent continue to record high mortality despite the scientific availability of all the tools required to prevent it. The disease, viewed this way, does not simply reveal biological risk; it reveals where health systems fail their populations (Farmer et al., 2010; Shin et al., 2021). This reframing has practical implications for how cervical cancer is positioned within national health agendas. When the disease is treated as a discrete clinical problem requiring specialist management, it tends to remain marginalised within health planning that privileges communicable disease and acute care. When it is treated as a health system performance indicator, improvement in cervical cancer outcomes becomes legible as an investment in the broader functioning of the primary care and public health infrastructure that serves all women, across multiple conditions.

Structural Determinants Outweigh Technological Solutions

The evidence reviewed here consistently directs analytical attention away from the question of which screening modality is technically superior, and towards the question of how any modality can be systematically and equitably delivered. The performance advantages of HPV DNA testing over VIA in controlled research settings are well established (Ault, 2006; Fernandes et al., 2013; Ratna & Mandrekar, 2017; WHO, 2021). Yet evidence from settings where VIA has been implemented within organised programmes with high population coverage demonstrates that programmatic organisation produces better population-level outcomes than superior technology implemented opportunistically (Sankaranarayanan et al., 2009). This finding aligns with broader health systems research: the gap between efficacy and effectiveness in LMICs is predominantly a delivery gap, not a technology gap. For Nigeria, the practical implication is that the priority investment is not in procuring HPV testing infrastructure in the absence of the supporting system to deploy it, but in building the organisational architecture, population registration, invitation systems, trained workforce, and referral pathways, within which any screening technology can achieve consistent coverage and follow-through.

Integrated Programmatic Delivery as the Evidential Priority

The evidence reviewed points strongly toward integrated, platform-based delivery as the most viable near-term strategy for expanding cervical cancer screening coverage in Nigeria and comparable settings. Antenatal care, family planning, and HIV treatment platforms collectively reach large proportions of sexually active women of reproductive age, and their existing relationships with these populations provide natural points of entry for offering screening. Studies demonstrating the feasibility and acceptability of integration within HIV care platforms in East and Southern Africa are particularly instructive, given the magnitude of HIV-cervical cancer co-morbidity in the

region (Firnhaber et al., 2010; Liu et al., 2018; Vesa et al., 2017). Successful integration, however, requires more than the notional inclusion of cervical cancer screening in service lists. It requires training and clinical supervision, supply chain coordination, information system linkages to support follow-up, and leadership from facility managers who prioritise prevention alongside acute care. The evidence from settings where integration has succeeded identifies these organisational conditions, not simply the technical protocol, as the factors that distinguish effective from ineffective integration initiatives.

Contribution to Knowledge

This review makes several contributions to the scholarly and policy literature on cervical cancer prevention in LMICs. First, it provides an integrative synthesis of epidemiological, clinical, and health systems evidence that moves beyond single-dimension analyses to examine the interaction between biological risk, preventive technology, and system-level delivery determinants. Whilst individual studies in each of these domains are available, the literature has rarely examined them in conjunction, leading to policy recommendations that address one dimension whilst neglecting others. Second, the review advances a reconceptualisation of cervical cancer burden that is analytically more productive than the conventional framing. Positioning high cervical cancer mortality as a consequence of health system inadequacy, rather than as a background epidemiological feature of low-income settings, changes the nature of the intervention question. It shifts focus from what technology to provide to how to build the systemic conditions under which technology delivers its promised benefits to entire populations rather than sub-populations of already health-engaged women. Third, the review contributes to the Nigerian-specific evidence base by consolidating fragmented findings from studies conducted in different states and contexts into a coherent national picture. This synthesis has practical value for policy-makers at the Federal Ministry of Health and state health ministries seeking to understand the evidence base for programmatic investment decisions. Fourth, the review identifies geographic access as a critically under-studied determinant of screening utilisation in Nigeria relative to its importance in the evidence. Systematic spatial analysis of the distribution of cervical cancer services, combined with demand-side studies of women's travel and opportunity cost burdens, constitutes a substantial gap that future primary research should address.

Implications of the Study

The findings of this review carry clear implications for health policy in Nigeria and analogous LMIC settings. The evidence supports a decisive transition from opportunistic to organised population-based screening, accompanied by the domestic legislative and fiscal commitments necessary to sustain it. This requires Nigeria to move beyond policy declarations towards costed national implementation plans with accountable delivery mechanisms, defined coverage targets, and regular programme evaluation. The WHO 90-70-90 strategy provides an internationally recognised operational framework within which domestic planning can be anchored (WHO, 2020). Policy attention should also be directed toward geographic equity. Any national cervical cancer programme that does not actively address the gap in service availability between urban and rural areas will reproduce the coverage inequities observed under opportunistic screening in a more formal guise. This requires fiscal transfers to primary healthcare facilities in underserved areas, investment in mobile and community-based screening modalities, and explicit rural coverage targets within national programme metrics.

For clinical and public health practice, the review findings highlight the potential of platform-based integrated delivery as a near-term mechanism for expanding screening coverage without waiting for dedicated cervical cancer programme infrastructure to be built. Healthcare facility managers and programme officers should be supported to introduce systematic cervical cancer screening offers within antenatal, family planning, and HIV care settings, backed by clear protocols, trained staff, and reliable supply chains. Community health workers have demonstrated consistent effectiveness in expanding the reach of preventive health services to hard-to-reach populations across a range of conditions in sub-Saharan Africa. Their systematic deployment as screener-educators or sample collectors for HPV self-sampling programmes represents an evidence-aligned approach to addressing the dual barriers of geographic inaccessibility and social hesitancy (LaMontagne et al., 2017). Several important research gaps emerge from this synthesis. The first concerns the spatial distribution of cervical cancer services within Nigeria. Comprehensive geographic information system-based mapping of VIA and HPV testing capacity, linked to population distribution data, would enable evidence-based decisions about where new service points would achieve the greatest coverage gains. The second concerns health system integration. Whilst feasibility and acceptability data for platform-based integration are available, rigorous effectiveness evaluations, particularly regarding the downstream outcomes of screen-positive women through treatment and follow-up, are limited. A third gap concerns the long-term outcomes of community-based HPV self-sampling programmes in Nigerian and West African contexts. Whilst such programmes have generated encouraging data in East and Southern Africa, the translation to West African epidemiological, social, and health system contexts requires dedicated evaluation. Finally, the economic case for cervical cancer programme investment in Nigeria is underdeveloped relative to the available health system evidence. Cost-effectiveness and budget-impact analyses calibrated to Nigerian health system conditions would strengthen the advocacy and financing case for programme scale-up.

Conclusion and Recommendations

This systematic review has demonstrated that the persistence of high cervical cancer burden in Nigeria and comparable LMIC settings is attributable primarily to structural and systemic failures rather than to the absence of effective preventive technologies. HPV vaccination, VIA, and molecular screening tools have all been demonstrated to reduce incidence and mortality when delivered systematically. The conditions for systematic delivery, namely organised population-based programmes, geographic equity of service access, integrated delivery platforms, and sustained domestic financing, are what remain absent in high-burden settings. Cervical cancer mortality is, in this sense, a measure of what societies and their health systems choose to prioritise. The scientific case for action is settled. The public health instruments for action are available. What is required is the political will, the governance capacity, and the financing commitment to deploy those instruments at the scale and consistency that genuine population-level impact demands. For Nigeria to contribute meaningfully to the WHO global elimination agenda, that transition from policy intent to programme reality must become the central challenge of the next decade of cervical cancer prevention work.

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