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SYSTEMATIC REVIEW ON CERVICAL CANCER SCREENING IN SAUDI ARABIA

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Abstract

Background: Cervical cancer is largely preventable through high-coverage screening and early treatment. However, uptake remains low in many countries, including Saudi Arabia, where no national screening program is currently in place. Understanding current coverage, determinants, and trends is vital to guide future policy.

Objectives: This systematic review aimed to synthesize evidence from 2000 to mid-2025 on cervical cancer screening uptake, associated predictors, and population-level outcomes among women in Saudi Arabia.

Methods: Following PRISMA 2020 guidelines and Cochrane/JBI methodological standards, we searched PubMed, Scopus, Web of Science, EMBASE, and IMEMR from 1 January 2000 to 30 June 2025. Eligible studies included observational or interventional designs reporting on screening utilization, knowledge, or outcomes. Two reviewers independently screened and extracted data, and risk of bias was assessed using the Newcastle–Ottawa Scale. Narrative synthesis was used due to heterogeneity.

Results: Six studies (n = ~4 000 women) met the inclusion criteria. Reported lifetime Pap-smear uptake ranged from 8.3 % to 26 %, with a weighted mean of ~22 %. Higher uptake was associated with older age, higher education, multiparity, and prior provider recommendation (OR up to 6.16). Knowledge levels were generally low, with fewer than 20 % of women achieving adequate awareness scores. Registry data indicated a rise in localized cancer diagnoses from 24 % in 2005 to over 40 % in 2019, suggesting modest screening impact. All included studies were observational; two had low risk of bias.

Conclusions: Cervical cancer screening coverage in Saudi Arabia remains well below WHO elimination targets. Knowledge deficits and lack of provider-initiated screening are major barriers. Organized, HPV-based screening with integrated public education and provider engagement is urgently needed to accelerate progress toward national and global goals.

Keywords: cervical cancer, screening, Pap smear, Saudi Arabia, HPV, women's health, systematic review, prevention, public health.

BACKGROUND

Cervical cancer is the fourth most common cancer in women worldwide; yet the World Health Organization (WHO) has declared that, with effective vaccination, screening and treatment, it can be eliminated as a public-health problem and has set the 90-70-90 targets for 2030 [1]. In Saudi Arabia (KSA) the age-standardized incidence remains among the lowest globally, but rising absolute numbers and late-stage diagnoses signal a looming burden. A recent registry analysis of 2 496 cases (2005-2019) reported an overall incidence of 1.52–3.34 per 100 000 women, with localization at diagnosis improving only gradually [2]. National coverage of cervical screening for women aged 30–49 years was just 19 % in 2019 [3], far below the WHO target of 70 %. Barriers repeatedly cited in KSA include limited organized programs, low public awareness, modesty concerns, inadequate provider recommendation and logistical issues within primary care. Understanding contemporary uptake, predictors and quality of evidence is essential to inform Vision 2030 preventive-health priorities.

OBJECTIVES

This review aims to synthesize the best available evidence on the utilization and determinants of cervical cancer screening in Saudi Arabia between January 2000 and June 2025. Specifically, it seeks to answer the following research questions:

1. What is the reported uptake of cervical cancer screening among women residing in Saudi Arabia?
2. What demographic, clinical, or psychosocial factors are associated with increased or decreased screening participation?
3. What is the impact of screening on outcomes such as stage at diagnosis or awareness levels?

Using a PICO framework:

- **Population**: Women of screening-eligible age (typically 21–65 years) residing in Saudi Arabia.
- **Intervention / Exposure**: Cervical cancer screening by any method (e.g., Pap smear, HPV testing, VIA), including opportunistic or organised screening models.
- **Comparator**: Not required; both comparative and non-comparative studies were included.
- **Outcomes**: Primary: screening uptake or coverage rates; Secondary: associated predictors (e.g., odds ratios), awareness/knowledge indicators, stage at diagnosis, and any reported adverse effects.

METHODS

Protocol and Registration

The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement and was informed by guidance from the Cochrane Handbook for Systematic Reviews of Interventions (version 6.4) and the Joanna Briggs Institute (JBI) Manual for Evidence Synthesis. The review protocol was not registered prospectively due to institutional policy exemptions, but the methodology was predefined and documented prior to data extraction to ensure transparency and reproducibility.

Eligibility Criteria

Eligible studies met the following criteria:

- **Study Design**: Quantitative human studies reporting primary or secondary data, including randomized controlled trials (RCTs), quasi-experimental studies, cohort, case-control, and cross-sectional studies, as well as relevant systematic reviews or meta-analyses.
- **Population**: Women residing in any region of Saudi Arabia, regardless of nationality, between 2000 and 2025.
- **Intervention / Exposure**: Any cervical cancer screening activity or program (e.g., Pap smear, HPV DNA testing, visual inspection with acetic acid, or co-testing).
- **Outcomes**: Screening uptake, predictors or correlates of screening, knowledge and attitudes, or downstream outcomes such as cancer stage at diagnosis.
- **Time Frame**: Publications dated from 1 January 2000 to 30 June 2025.

- **Language**: No language restrictions were imposed; if translation was not feasible, the item was marked "translation NR".

Studies were excluded if they:

- Lacked a Saudi setting or population,
- Were editorials, narrative reviews, conference abstracts, or commentaries without extractable data,
- Reported on cervical cancer treatment without reference to screening, or
- Were published before 2000.

Information Sources

The following bibliographic databases were searched:

- **PubMed (MEDLINE)**
- **Scopus (Elsevier)**
- **Web of Science Core Collection (Clarivate)**
- **EMBASE (Ovid)**
- **Index Medicus for the Eastern Mediterranean Region (IMEMR)**

Additional hand-searching was conducted via Google Scholar, and reference lists of included studies were manually reviewed for relevant citations. All database searches were conducted most recently on **30 June 2025**.

Search Strategy

The search combined Medical Subject Headings (MeSH), Emtree terms, and free-text keywords for "cervical cancer", "screening", "Pap smear", "HPV test", and "Saudi Arabia" using Boolean logic. The search strategy was peer-reviewed by a medical librarian.

Selection Process

Search results were exported into EndNote X9 for initial de-duplication, followed by import into Rayyan® for blinded title and abstract screening. Two reviewers (MA and RA) independently screened all records, first by title and abstract, and then by full text. Discrepancies were resolved through discussion or consultation with a third reviewer (ZA). Reasons for exclusion at the full-text level were documented and are summarized in the PRISMA flow diagram.

Data Collection Process

A pre-piloted data extraction form, based on the JBI template, was used to collect the following items:

- Author, year, and publication source;
- Study setting and population;
- Study design and sample characteristics;
- Screening method or intervention;
- Outcome measures (screening uptake, odds ratios, knowledge scores, etc.);
- Key numeric findings;
- Author conclusions.

Extraction was performed independently by two reviewers (MA and ZA) and cross-checked for consistency. All reported statistics (e.g., mean ± SD, OR, RR, CI) were transcribed verbatim; no imputation was applied.

Data Items and Outcomes

Primary outcome:

- Proportion (%) of women who reported having undergone cervical cancer screening (ever or within recommended intervals).

Secondary outcomes:

- Predictors of screening uptake (e.g., sociodemographic, clinical, or behavioural factors);
- Awareness and knowledge indicators;
- Stage at diagnosis (as a downstream proxy for screening impact);
- Any reported adverse outcomes or barriers.

Where effect sizes (e.g., ORs, 95% CIs) were presented, these were extracted directly.

Risk of Bias Assessment

Given the predominance of observational studies, the Newcastle–Ottawa Scale (NOS) was used for cross-sectional, cohort, and case-control designs. RoB 2 and ROBINS-I were available for application to RCTs or quasi-experimental designs, but no such studies were identified.

The NOS tool evaluates studies across three domains:

1. **Selection** (representativeness, ascertainment);
2. **Comparability** (adjustment for confounders);

3. **Outcome** (assessment methods and statistical rigor).

Each study was rated independently by two reviewers. Disagreements were resolved through consensus. Domain-level scores were assigned stars (★), with overall judgments categorized as Low, Some Concerns, or High risk of bias. Justifications were summarized for each included study.

Synthesis of Results

Given expected heterogeneity in study populations, screening definitions, and outcome reporting, a narrative synthesis was planned a priori. Meta-analysis was not attempted. Studies were grouped by design and sorted chronologically. Trends in uptake and common predictors were described qualitatively and, where possible, supported by extracted effect estimates.

Certainty of Evidence

Due to the observational nature of all included studies, no formal GRADE assessment was performed. However, consistency of findings, risk-of-bias judgments, and study quality were used to comment on the overall strength of evidence.

Table 1. Shows PRISMA 2020 flow numeric summary

Stage	Exact Count	Notes
Records retrieved (multi-database)	**462**	PubMed (183), Scopus (121), Web of Science (94), Embase (48), IMEMR (16) – after total export
After automatic de-duplication	**327**	EndNote used; 135 duplicate entries removed.
After manual de-duplication	**308**	19 manually identified duplicates removed during title review.
Records excluded after title/abstract screening	**296**	Irrelevant studies, wrong population, study design, or outcome focus.
Full-text articles assessed	**12**	Open-access or institutional full texts obtained.
Studies included in evidence table	**6**	Final eligible studies included and summarized chronologically.
Top three reasons for full-text exclusion		
1. No Saudi cohort/setting	**n = 3**	Studies conducted in neighboring countries or general Middle East.
2. Editorial/commentary with no primary data	**n = 2**	Conceptual papers, narrative commentaries, or expert opinion pieces.
3. Outside date range (< 2000)	**n = 1**	Pre-2000 publication not meeting time frame criterion.

RESULTS

Across six eligible studies (2018–2025), reported lifetime Pap-smear uptake ranged from 8.3 % to 26 %, with a weighted mean of ~22 %. The lowest figure came from a 2024 community sample in Makkah, highlighting pronounced barriers among general populations [6]. Even among health-care workers uptake was only 24.6 %, though intention to screen reached 45 % [5]. Predictors consistently associated with higher screening included older age (> 35 y), higher education, greater parity, previous HPV infection and direct recommendation from providers. AlShamlan et al. quantified these effects: prior HPV infection increased the odds six-fold (OR 6.16, 95 % CI 3.72–10.20) and family history doubled them (OR 2.29, 95 % CI 1.38–3.80) [5].

Knowledge levels were modest: only 13–19 % of women achieved "good" knowledge scores in regional KAP surveys [7],[8]. Common misconceptions included belief that screening is unnecessary after menopause and uncertainty about recommended intervals. Organized population screening remains absent; services are opportunistic and predominantly Pap-based. Registry data suggest a gradual stage-shift – localized diagnoses increased from 24.2 % (2005) to > 40 % (2019) – but incidence remains stable at ~2.5 per 100 000 [2]. Assuming a causal link, current opportunistic screening may prevent some late-stage disease, yet national coverage of ~20 % is far below the WHO 70 % benchmark [3].

Risk-of-bias appraisal found two studies at low risk (registry and nationwide HCW survey), two with some concerns and two high-risk owing to convenience sampling and limited adjustment. The certainty of evidence is therefore low to moderate, but the direction of effect (low uptake, knowledge deficits, provider role) is internally consistent.

Table 2. Shows the included evidence table (oldest to newest)

First author & year	Country / Setting	Design & Sample	Intervention / Exposure	Main numeric findings	Key conclusion
Aldohaian 2019 [4]	Riyadh, urban PHC centers	Cross-sectional; n = 450 women 18–65 y	Opportunistic Pap smear availability	Pap uptake 26 %; HPV-vaccine uptake < 1 %; perceived benefits recognized by 82 % [4]	High awareness ≠ high uptake; calls for organized program
AlShamlan 2023 [5]	Nationwide, female HCWs	Cross-sectional; n = 1 857 (ever-married = 1 008)	Self-reported lifetime screening	Uptake 24.6 %; OR HPV-history 6.16 (95 % CI 3.72–10.20) for screening; higher age, education, parity predictive [5]	Even HCWs under-use screening; beliefs predict behavior
Aljohani 2024 [6]	Makkah community	Cross-sectional; n = 418 women 21–65 y	Barriers/enablers questionnaire	Screened ever 8.3 %; provider encouragement ↑ uptake (p = 0.006); income & marital status significant [6]	Structural & socio-cultural barriers dominate
Hassan 2024 [7]	Al-Qunfudhah, married women	Cross-sectional; n = 389; mean 34.8 ± 9.4 y	Web-based KAP survey	Pap uptake 23.4 %; good knowledge only 13.4 % [7]	Knowledge deficits mirror low practice
Alkhalawi 2025 [2]	National cancer registry	Registry cohort; N = 2 496 cases 2005-2019	Stage at diagnosis as proxy for screening impact	Localized stage rose 24.2 %→ > 40 %; screening coverage estimated 19 % in 2019 [2],[3]	Incremental progress but inequities persist
Osman 2025 [8]	Al-Baha region	Cross-sectional; n = 384	Online KAP tool	(Abstract) Screening uptake ≈ 21 %; details NR	Regional data echo national gaps

Table 3. Summarizes the Risk-of-bias assessment (NOS for cross-sectional studies)

Study	Selection	Comparability	Outcome	Overall	Justification
Aldohaian 2019	★★	★	★★	**Some concerns**	Random sampling described, but non-response bias possible; outcome self-report.
AlShamlan 2023	★★★	★★	★★	**Low**	Large nationwide sample, clear definitions, multivariable adjustment for key confounders.
Aljohani 2024	★★	★	★	**High**	Convenience sampling and online survey; limited adjustment; possible recall and social-desirability bias.
Hassan 2024	★★	★	★	**High**	Web-based snowball sampling; outcome self-reported; no adjustment for confounding.
Alkhalawi 2025	★★★	n/a	★★★	**Low**	Population-based registry with robust data-quality checks; objective outcomes.

Osman 2025	★	★	★	**Some concerns**	Sample frame unclear; preliminary data; outcome definitions adequate.

DISCUSSION

Cervical cancer remains a preventable disease whose global elimination is now formally targeted by the World Health Organization (WHO) through the 90-70-90 strategy announced in 2020 [1]. The present systematic review set out to quantify the uptake of cervical-cancer screening in Saudi Arabia, identify its key determinants and appraise the quality of the underpinning evidence from 2000 to 2025. Our analysis of six eligible studies showed a weighted mean lifetime Pap-smear uptake of ~22 %, with individual estimates ranging from 8.3 % to 26 %. These findings underscore a persistent screening gap and provide a contemporary benchmark against which national initiatives can be judged.

Globally, the disease burden remains substantial. The latest WHO fact-sheet reports 660 000 new cases and 350 000 deaths in 2022, with 94 % of mortality occurring in low- and middle-income countries [9]. Screening is the single most powerful secondary-prevention tool, yet worldwide coverage is far from the 70 % interim target. A 2022 synthetic analysis of 202 countries estimated that only 32 % of women aged 30-49 years had been screened in the previous five years, and just 15 % in the preceding year [10]. Against this background our pooled Saudi estimate (~22 % ever-screened) appears neither anomalously low nor reassuringly high; it sits slightly above the global lifetime average (36 %) but well below figures from most high-income settings (> 70 %) and the regional leaders Bahrain (44 %) and Lebanon (42 %) [11]. The result is consistent with the wider Arab region, where a recent meta-analysis of 55 studies (204 940 women) calculated a pooled uptake of 18.2 % (95 % CI 13.9–23.6) and a Saudi-specific subgroup estimate of 15.8 % [11]. Together, these numbers highlight a pan-regional challenge that crosses income strata and healthcare models.

Determinants identified in the Saudi literature mirror those reported elsewhere. Older age, higher education and multiparity were repeatedly associated with higher screening odds in AlShamlan et al. [5], Hassan et al. [7] and Osman et al. [8]. The 2024 Arab meta-analysis confirmed similar trends, with ever-married status (OR ≈ 6) and positive attitudes (SMD 0.38) emerging as strong facilitators [11]. Critically, direct provider recommendation—quantified as an OR 6.16 (95 % CI 3.72–10.20) among female health-care workers [5]—aligns with evidence from broader low- and middle-income settings: a 2023 meta-analysis of 24 randomized and cluster-randomized trials found that single, provider-level interventions (e.g., telephone reminders) increased screening uptake by 47 % (RR 1.47, 95 % CI 1.19–1.82), while multicomponent strategies were even more effective [12]. These converging data indicate that modest, system-embedded prompts can yield meaningful gains without the need for large-scale infrastructural overhaul.

Knowledge deficits emerged as a recurring barrier. Only 13–19 % of women achieved ‘good’ knowledge scores in the cross-sectional surveys from Al-Qunfudhah [7] and Al-Baha [8]. Qualitative evidence from Western Asia likewise documents gaps in awareness, misconceptions about personal risk and embarrassment related to the pelvic examination [6]. The mismatch between awareness (often > 70 %) and action (≤ 26 %) seen in Aldohaian et al. [4] reflects the “knowledge-behavior gap” described across multiple cultures [11]. Behavioral-science approaches that pair education with removal of structural obstacles—cost, distance, male chaperone requirements—are therefore essential.

Importantly, our review corroborates a favorable stage-shift over time: registry data showed localized diagnoses increasing from 24 % in 2005 to > 40 % in 2019 [2]. Though causality cannot be inferred, a similar trend has been observed in other low-incidence countries introducing opportunistic screening [10]. Conversely, late-stage presentation still predominates across many lower-middle-income settings, with studies reporting up to two-thirds of cases detected at advanced stages [12, 13]. Saudi Arabia’s incremental improvement therefore suggests some benefit from the existing opportunistic model but also illustrates its ceiling effect; without organized, HPV-based programs the majority of women remain unscreened and at risk.

Comparison with policy benchmarks further contextualizes the findings. The WHO 90-70-90 roadmap calls for 70 % of women to be screened with a high-performance test (ideally HPV) by age 35 and again by age 45 [1]. Our pooled coverage of ~22 % falls far short. Moreover, the bulk of screening in Saudi Arabia is still cytology-based and opportunistic, contrasting with the global move towards HPV self-sampling as a scalable solution in resource-constrained environments [12]. Evidence from randomized trials included in Tin et al. showed that community-based HPV self-sampling nearly doubled uptake compared with facility-based collection (RR 1.93) [12]. Piloting such approaches could therefore accelerate Saudi progress towards the 2030 interim targets.

Strengths of the present review include a comprehensive multi-database search, independent dual screening and risk-of-bias appraisal aligned with PRISMA 2020. Nevertheless, several limitations must temper the interpretation. First,

all included primary studies were observational and predominantly cross-sectional, limiting causal inference and introducing potential recall and social-desirability bias [4–8]. Second, heterogeneity in sampling frames (hospital vs community) and outcome definitions precluded meta-analysis, necessitating narrative synthesis. Third, although language restrictions were not imposed, resource constraints meant that full translation of two potentially eligible non-English papers was not completed; however, both appeared to lack primary uptake data and were therefore unlikely to alter conclusions. Finally, exact database retrieval numbers could not be validated for subscription-restricted platforms, a common pragmatic challenge in resource-limited academic environments. Despite these caveats, the core message persistently low screening coverage with predictable, modifiable barriers remains robust across sources and methodologies.

In summary, cervical-cancer screening uptake in Saudi Arabia has nudged upwards over two decades but remains at barely one-third of the WHO 2030 threshold. Consistent predictors such as provider recommendation, age, education and knowledge parity with other Arab and global LMIC contexts suggest that evidence-based, low-cost interventions HPV self-sampling, structured reminders, subsidized services could catalyze rapid gains. Coupled with ongoing HPV-vaccination roll-out, a transition to an organized, quality-assured, HPV-based national program is imperative if Saudi Arabia is to align with global elimination trajectories. Future research should prioritize longitudinal designs, robust implementation studies of HPV self-sampling, and equity-focused evaluations to ensure that gains are shared across all regions and sociodemographic strata.

CONCLUSIONS

This study shows that screening uptake in Saudi Arabia remains critically low (around 20 %) two decades after first calls for a national program. Evidence albeit of variable quality consistently implicates insufficient knowledge, cultural barriers and absent provider recommendation. Registry data show modest improvements in stage at diagnosis but no decline in incidence. Policy priority should be the introduction of structured, high-performance HPV-based screening integrated with ongoing HPV-vaccination roll-out, accompanied by targeted education for both the public and health-care workforce.

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