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From a Positive Cervical Screening Result to Completed Follow-Up: A Proposed Event-Level Measurement Framework for Saudi and Gulf Services

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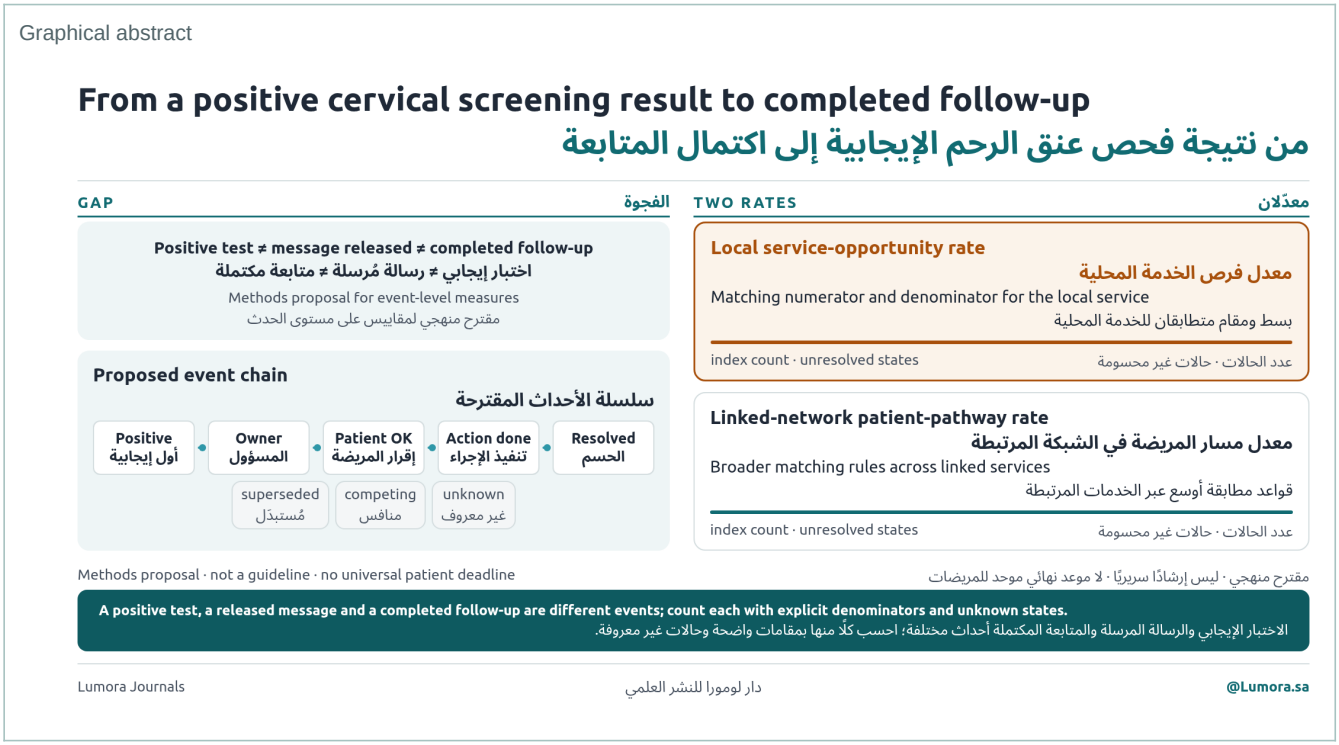
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Abstract

Graphical abstract



Background: The benefit of human papillomavirus (HPV) screening depends on appropriate care after a positive result. Clinical pathways differ by genotype, cytology, prior history, specimen type and programme capacity. A recorded positive test, a released portal message and a completed diagnostic or surveillance episode are not equivalent events. **Methods:** We conducted a targeted, non-systematic narrative review of PubMed-indexed studies, SciSpace discovery leads, and original WHO and ASCCP guidance available through 28 September 2026. We examined clinical branching, follow-up indicators, intervention studies, computable guidelines and Gulf evidence. **Synthesis:** WHO's 2023 monitoring framework and 2026 implementation and genotyping guidance already define important indicators and capacity concepts. Earlier programme and research models also describe care stages. Yet the operational choices required to derive risk-specific denominators, distinguish patient receipt from message release, join referral and procedure records, and classify unknown outcomes across providers remain consequential. **Proposal:** We specify an unvalidated, locally governed event-level framework: a versioned clinical-action rule; one first-valid-positive index episode per person in a versioned reporting cohort; source-timestamped evidence of ownership, patient acknowledgment and performed action; and explicit superseding, competing and unknown states. A local service-opportunity rate and a broader linked-network patient-pathway rate use separately defined matching denominators and numerators. Each rate is paired with its index count and excluded or unresolved states; invalidated or duplicate index results trigger auditable cohort restatement. WHO programme-capacity classification is kept separate from local process measures; no single patient deadline is applied to every positive test. **Conclusion:** This is a methods proposal, not a validated Saudi pathway, clinical guideline or empirical estimate. Local clinicians, patients and data stewards must test feasibility, accuracy, equity and safety before adoption.

Keywords: cervical cancer screening; human papillomavirus; abnormal result; diagnostic follow-up; quality measurement; Saudi Arabia; Gulf Cooperation Council.

Introduction

Cervical screening is often counted at the moment a sample is collected. The WHO elimination strategy, however, joins screening to treatment of precancer and management of invasive cancer [1]. A positive HPV test has clinical value only if the person reaches an appropriate next step and the findings are resolved or placed under reliable surveillance. Between these points are laboratory reporting, result review, communication, risk triage, referral, appointment access, attendance, pathology, treatment where indicated, and the return of information to a responsible clinician. Those steps may occur in different organizations. Counting a test as “followed up” because a referral order exists, or counting a portal release as confirmed communication, can make a pathway appear safer than it is.

The clinical decision is not uniform. WHO recommends HPV DNA-based approaches and provides different screen-and-treat and screen-triage-treat strategies according to population and service context [2]. Its 2026 genotyping guideline distinguishes programmes with adequate capacity to retain patients at *every* relevant step from those with a gap at any step; it uses a 60% follow-up-capacity decision boundary for selecting modelled strategies, not a universal patient-level deadline [3]. ASCCP's risk-based system combines current results with history and can recommend colposcopy, treatment or surveillance rather than automatically sending every HPV-positive individual for immediate colposcopy [4,5,6,7,8]. These are distinct frameworks designed for different settings. A Saudi or Gulf service would have to select and approve its own current clinical pathway; a review cannot import an American rule as a national Saudi instruction.

Measurement is also not a blank field. WHO's indicator metadata specify screening positivity and eligible-precancer treatment measures [9]. Its 14 July 2026 implementation guidance supports tracking retention after a positive HPV result, including attendance across indicated triage, treatment and repeat-screening steps; indicator use must follow the applicable programme and clinical pathway [10]. The 2026 genotyping guidance further proposes using attendance at the next visit, later retesting after negative triage, and post-treatment follow-up to judge capacity [3]. Italian HPV programme indicators, the PROSPR screening-process model and its cross-cancer measures, and programme key performance indices precede this review [11,12,13,14]. The question is therefore not whether a cascade has been described before. It is how an organization can turn those high-level indicators into reproducible event definitions without misclassifying clinically appropriate surveillance as a failure or an undocumented loss as success.

Saudi and wider Gulf evidence makes local testing of this question reasonable but does not demonstrate a particular Saudi failure rate. Survey studies address awareness, vaccination, or reported screening participation; they generally do not link positive individual tests to completed triage, pathology and treatment [15,16,17,18]. A regional review describes heterogeneous screening organization across Gulf states [19]. That is a rationale to examine local data flows and acceptability, not proof that any named hospital lacks follow-up. This article critically maps the established clinical and programme literature and proposes a narrow, auditable measurement contract for evaluation in participating services. It claims no newly observed clinical outcomes, validated cut-off, or superiority over existing WHO indicators.

Evidence identification and interpretation

On 28 September 2026 we used four recorded free-text PubMed discovery queries: cervical screening abnormal result follow-up loss to follow-up systematic review; human papillomavirus positive screening result diagnostic follow-up navigation randomized trial; Saudi Arabia cervical cancer screening HPV uptake

barriers 2025; and Gulf Cooperation Council cervical screening HPV 2024. We also checked exact titles and PMIDs for selected trials, guidelines and close prior indicator work; these lookups were not logged as a systematic search set. Two SciSpace semantic questions identified leads about positive-result care measures and event-level data quality since 2023; SciSpace answers served discovery only. A paper entered the cited set only after its bibliographic identity and relevant claim were checked in PubMed, an original publisher report, or an official WHO/ASCCP document. A dated internal ledger retains the four PubMed strings, SciSpace questions, selected PubMed XML and three original WHO PDFs. This purposive search did not generate a deduplicated count of all candidate papers.

This was a purposive critical narrative review, not a systematic review. We did not register a protocol, search every database to exhaustion, keep a complete exclusion log, conduct duplicate screening, formally grade risk of bias, or pool effects. The selected sources answer different questions: official WHO documents specify global programme indicators and strategy options [2,3,9,10]; ASCCP documents illustrate U.S. risk-specific clinical actions [4,5,6,7,8]; the Italian, PROSPR and Cameroon work establishes prior programme process measures [11,12,13,14]; reviews and the Atlas trial examine heterogeneous completion and intervention endpoints [20,21,22,23]; the Atlas decision-support comparison examines case-finding [24]; and Saudi/Gulf surveys supply local context rather than linked outcomes [15,16,17,18,19]. Original WHO texts and the pivotal open-access reviews and cluster trial were inspected; some later clinical, computable and local-context records were checked through PubMed abstracts or official descriptions rather than full reports. Table 1 identifies each evidence role and appraisal tier. Numerical findings are attributed to their original studies and not combined. Clinical transferability depends on full-text appraisal of the pivotal guidance and intervention studies, the local governing pathway and its version date.

“Timely” is an outcome definition, not a fixed biological constant. A 90-day colposcopy measure in one U.S. programme, a 120-day trial endpoint after enrollment, and a one-year surveillance interval for a lower-risk result have different start points and populations [23,25,26,27]. Directly averaging their proportions or transplanting one deadline into another setting would be misleading. We therefore distinguish the source's reported interval from a local service's proposed due date and avoid claiming that a chosen time threshold is clinically validated by this review.

What prior work already establishes

The 2024 intervention meta-analysis by Lopez Varon and colleagues included 28 studies and found heterogeneous definitions of follow-up; multicomponent approaches were more effective on its pooled completion measure than single-component approaches, but its effect estimates span different designs and actions [20]. Martinez-Gutierrez and colleagues found 27 publications on inadequate follow-up in primary and ambulatory care, all from high-income countries, with definitions differing between missed visits and absent subsequent tests in records [21]. Wang and colleagues pooled 33 studies of triage and treatment compliance after positive screening; that synthesis establishes that these stages are already reported separately in many programmes [22]. These reviews support attention to the process, while their variation limits direct transplantation of a single pooled rate to Saudi practice.

The pragmatic Atlas cluster trial randomized 44 U.S. primary-care practices across four cancer-screening pathways. Its EHR reminders plus outreach arms increased completion of recommended follow-up compared with reminders alone or usual care at 120 days after enrollment; cervical cases were a subgroup of a mixed-cancer trial, and the outcome began when people were already overdue [23]. A later

comparison of the trial's two clinical-decision-support implementations found imperfect identification of true overdue cervical cases and differences between systems [24]. Thus even an intervention trial with a positive process effect does not validate a local case-finding query by itself. An accurate invitation mechanism depends on reliable result interpretation, prior history and cross-site ascertainment.

Other evidence shows why a single “attended” field is too coarse. Tiro and colleagues tracked surveillance after HPV-positive non-16/18 results with negative cytology in three U.S. health systems; fewer than half received a follow-up test during the study's defined first surveillance round [25]. Paskett's navigation analysis stratified cervical abnormalities by risk and used distinct 60- and 180-day follow-up windows [28]. Feldman and colleagues studied time to colposcopy *only among results for which colposcopy was indicated*, making eligibility central to their denominator [26]. In an HPV self-sampling implementation study in Uganda, an SMS instruction, a reported receipt, and a follow-up visit were separate observed events [29]. A Kenyan community-testing cohort likewise distinguished HPV-positive, notified, seeking care and treated participants [30]. These findings are not Saudi estimates. They show where data definitions must preserve the sequence and where lost contact may enter. Table 1 locates this proposal beside the most relevant established frameworks.

The clinical action must be versioned before a rate is calculated

A useful denominator begins with an interpreted index result, not with an appointment list. The minimum record should identify a person, a laboratory accession, a specimen type, collection and finalization times, the test platform or result format, cytology or dual-stain findings if available, and relevant prior cervical history. “Positive HPV” without these details can represent different risks and next actions. Under ASCCP's current U.S. framework, positive HPV16/18 results often prompt colposcopy, whereas other positives may require triage or surveillance depending on associated findings and history [4,5,6,7,8]. WHO offers alternatives according to follow-up and treatment capacity [2,3]. For each observation period, a local clinical authority must approve exactly one governing protocol, its version, applicability dates, action routes and due intervals, including pregnancy, immunosuppression, symptoms, prior treatment, and invalid results. If no locally approved rule applies or relevant history is unavailable, the action is “undetermined”; it cannot be called overdue or clinically complete by a borrowed U.S. or WHO interval. The system stores the contemporaneous rule version rather than silently recalculating old cases whenever guidance changes. WHO programme options and ASCCP examples inform clinical deliberation but do not themselves establish a Saudi deadline.

The positive-test cohort and the “next action due” cohort are related but not identical. Every valid positive result belongs in a result register. Some trigger immediate triage; some trigger referral for colposcopy or treatment; some are assigned repeat testing at a later interval. The proposed audit maps each to the action its governing rule required at that time. An absent immediate colposcopy after a surveillance-eligible result is not automatically a failure. Conversely, a colposcopy booking should not close an episode if the procedure did not occur or if a biopsy result later required further treatment. This mapping requires clinician adjudication of edge cases and a field for “rule cannot be applied from available data,” not a forced binary classification.

Self-collected HPV screening makes the issue concrete. The 2025 Enduring Consensus recommendations distinguish HPV16/18 from other genotype groups and, for several positive groups, recommend clinician-collected triage; some groups have a repeat-testing route [8]. These recommendations are not a blanket Gulf protocol. They demonstrate why a “positive result → colposcopy” indicator can misstate appropriate

care and why specimen source must be retained. Dual-stain and extended-genotyping guidance add further branching [6,7]. A local data model should be able to show the recommended route and the route actually taken without declaring one correct before governance decides which clinical guideline applies.

The primary audit unit is one **index episode per person per fixed enrollment period**: the first valid final HPV-positive screening result at a participating site. The person count and episode count are therefore identical in this primary cohort. Co-collected specimens from the same encounter form one accession bundle, with a single clinically interpreted index; a corrected result for that accession is a versioned amendment, not another index. A repeat positive while an episode remains open is linked to it. If it changes the recommended route, the earlier action is dated “superseded,” the replacement action inherits the episode, and elapsed time from the original result remains visible. A new positive after documented closure can begin a new episode for a later cohort; any second episode in the same period is reported separately, not silently added to the primary denominator. Cross-provider results require a privacy-preserving patient key and adjudication of whether accessions are duplicates, repeat tests or distinct encounters. The enrollment window, source data and reporting cutoff are frozen for each published cohort version. If a corrected accession changes the index from positive to negative or later adjudication resolves a cross-provider duplicate, the case is not treated as a clinical competing event: the first-valid-positive index is re-evaluated and **N_0 and all derived denominators are version-restated**, with old and new counts, reason, event date, adjudicator and report version retained. A later valid positive in the same enrollment window may become the person's index; otherwise the invalidated entry leaves that versioned positive cohort. No prior published snapshot is silently overwritten. These are proposed counting rules for pilot testing, not verified properties of a Saudi registry.

Table 1. Evidence roles, appraisal tier and remaining implementation choices

Evidence role and setting	What was checked and supplied	Remaining implementation choice
WHO indicators and strategy [1,2,3,9,10]	Original global documents: screening, eligible treatment, retention and follow-up capacity.	Bind each required step and horizon to local events.
ASCCP guidance [4,5,6,7,8]	U.S. risk/specimen actions; official recommendations and bibliographic records.	Approve a governing local protocol before action assignment.
Italian/PROSPR/Cameroon [11,12,13,14]	Prior process and programme measures; bibliographic records and accessible reports.	Specify episode keys, linkage and evidence provenance.
Reviews and Atlas trial [20,21,22,23]	Open pivotal reports: heterogeneous completion and trial endpoints, mostly outside the Gulf.	Validate applicability and avoid pooling unlike clocks.
Atlas decision support [24]	U.S. case-finding comparison checked through PubMed record.	Validate local eligibility, precision and recall.
Saudi/Gulf context [15,16,17,18,19]	Survey/review records: awareness and uptake, not linked follow-up.	Test local data linkage and patient acceptability.

Table 1 note: “Checked” does not mean that every cited full report underwent clinical appraisal. The 2025 Atlas comparison and several local studies were assessed primarily from abstracts. WHO's roughly 60% capacity boundary concerns modelled programme strategy at every relevant step, not an individual deadline or acceptable facility target; the WHO treatment target uses a separate disease-eligible denominator [1,3]. ASCCP guidance is U.S.-specific. The final column is an unvalidated local proposal, not an observed Gulf deficiency.

A proposed event-level contract

The proposed contract is a sequence of events with provenance. The laboratory posts a final result; a named clinician or team acknowledges it; a communication channel reaches the patient or records failed contact; a rule identifies the next action; an order or referral is accepted by a service; a test or visit is performed; results and pathology become available; and a clinician documents a disposition. The contract does not assume that every person passes through every event. A screen-and-treat pathway, a triage-negative repeat-testing route and a direct colposcopy route have different legitimate branches. Table 2 defines a minimum common record that can be mapped to those branches.

Table 2. Proposed event record for an HPV-positive follow-up episode

Field or event	Minimum auditable content	Why a binary status alone is insufficient
Index result	Patient key, accession, specimen, final category, amendment/duplicate status, timestamp, source [2,3,8].	An order or invalidated positive is not a valid index.
Action rule	Approved version, relevant history, route and due date [3,4,5,6,7,8].	HPV positivity has several appropriate routes.
Review/owner	Acknowledgment, named service, acceptance and escalation [23,24,31,32].	EHR routing does not prove ownership.
Communication	Channel, language, attempts, direct patient contact and acknowledgment evidence [17,29,30].	Dispatch, proxy contact, receipt and comprehension differ.
Service	Order, accepted referral, offered slot, performed action [21,23,28].	Booking does not prove attendance.
Resolution	Triage/pathology, decision, indicated treatment, surveillance [3,9,10,12,13].	An attended visit may create another obligation.
Exceptions	Dated death, accepted responsibility transfer, informed decline, supersession, unknown status.	Competing states and missing records are not completion.

Table 2 note: This is a proposed feasibility schema, not a validated standard or a description of existing Gulf systems. The Saudi survey [17] motivates language and acceptability testing; it does not validate a message-receipt field. Direct acknowledgment does not prove comprehension. A corrected or deduplicated index is a versioned cohort restatement, not a clinical exception. Other citations support branching and process distinctions, not these exact fields. Local governance must approve timestamps, exceptions and privacy controls.

An implementation should preserve **events** before deriving mutually exclusive states. Each event needs a source system, source timestamp, ingestion timestamp, author or verifier, action-rule version, and evidence type. For communication, “dispatched” means a portal or SMS system released a message; “proxy contact” means someone other than the patient was reached under an authorized process; “patient acknowledged” requires documented direct conversation or an authenticated patient action. None proves comprehension, which is a distinct patient-confirmed or teach-back observation requiring local acceptability testing. An accepted electronic referral is not attendance; attendance is not a completed procedure; a procedure without available pathology and signed plan is not diagnostic disposition. External care counts as performed only when a clinically equivalent record is verified by the responsible service; unverified patient report remains a separate lead for reconciliation.

At each dated reporting cutoff, the data extract should assign one current state per **required action** by a declared precedence: verified completion of that action **with an on-time or late attribute**, documented supersession by a newly approved action, a documented competing event before its due date, not yet due, due but unresolved, or action undetermined. **Event chronology governs that precedence.** Performance of an obsolete action only after documented clinical supersession remains in the event log for safety review but does not count as timely completion of the superseded obligation, even if it precedes that obligation's former due date. Conversely, valid completion before a later supersession remains a historical completion in the dated snapshot. When same-day records cannot establish order, the sequence requires adjudication rather than an assumed success. A later-imported document retains its true event date but generates a versioned correction to the earlier report; historical snapshots and the size of the correction remain accessible. Death, transfer of responsibility and informed decline are not coded as successful action. A transfer supported only by a referral order is still unresolved; a verified transfer accepted by another service is separately reported. For surveillance, signing the surveillance plan can resolve the current decision yet the episode remains under follow-up until the required repeat test is performed or the pathway formally ends. Clinical closure therefore requires a signed disposition plus completion of actions still due under the approved plan, or a documented clinician-approved competing disposition; it does not follow merely from a sent message or booked visit. These proposed precedence rules must undergo clinical and patient review because they are not established by the cited studies.

Every event should have a recorded source and timestamp type. Laboratory finalization is the earliest reliable time at which a report can be acted upon, but it may not be the same as sample collection, EHR import or clinician review. The patient-communication interval can begin at finalization; an appointment interval can begin only when the recommended action is known; an abnormal biopsy response interval begins when pathology becomes available. Using one screening date for all these clocks merges laboratory delay, clinical inattention, patient contact, scheduling and pathology turnaround into an uninterpretable total. The recorded time zone, amendments, corrections and import delays matter when facilities exchange data. We propose retaining both the source-system time and the receiving-system ingestion time; a late data feed should not be misread as a late patient action.

A “closed episode” needs a clinical definition. For a result warranting colposcopy, completion of the procedure is one process endpoint, but biopsy availability and a documented disposition are subsequent endpoints. For a triage-negative pathway requiring repeat testing, the relevant endpoint is the appropriately timed repeat test and subsequent review, not an unnecessary invasive procedure. For detected precancer requiring treatment, the treatment episode has its own indication, delivery and post-treatment follow-up. WHO's treatment-rate denominator is people with lesions eligible for treatment, not all HPV-positive people [9]. An event contract must preserve that distinction or it can inflate both apparent under-treatment and apparent success. A programme may publish a simple summary measure, but it should retain component measures behind it so clinicians can find the failing handoff.

Denominators, clocks and uncertainty

Let $\mathbf{N_0}$ be the count of first valid positive index episodes, one per person, in the frozen enrollment period and current **report version**. Later death, transfer, decline or unknown outcome does not change cohort eligibility; an invalidated index or adjudicated duplicate instead triggers the visible N_0 restatement described above. For each clinically approved action *a*, the **originating-service opportunity denominator D_a(local)** contains index episodes assigned that action and due by the report cutoff. An action is excluded for

documented death, informed decline, accepted responsibility transfer to another service, or clinician-approved supersession only if that event occurred **before both the action's due date and a valid local completion**. A referral order alone is not accepted transfer. **C_a(local)** is the subset of D_a(local) with verified clinically equivalent performance at the originating service by the due date and before any supersession. These two counts form the local service-opportunity rate C_a(local)/D_a(local). Verified performance at an outside provider is recorded but never put in this local numerator. Every excluded or unresolved action remains visible against N_0 with its event source and timing.

Define separately a **linked-network patient-pathway denominator D_a(network)** on the same N_0 and due-action rules, but **do not exclude an accepted transfer merely because another service took responsibility**. The network's prespecified capture boundary must identify receiving services and permit verification of clinically equivalent outside care. Pre-due death, informed decline or approved supersession excludes only if it precedes a valid completion anywhere within that defined capture boundary. **C_a(network)** is the D_a(network) subset with verified performance by the due date at the originating or receiving service and before any supersession; a transfer order or acceptance by itself is not completion. Thus a transfer accepted on day 10 followed by a verified receiving-service action on day 20 for a day-30 due date is excluded from D_a(local)/C_a(local) but is in both D_a(network) and C_a(network). An unverified external outcome remains unresolved in the network denominator, not a success; if linkage and coverage cannot support this measure, it should not be published as a comparable rate. Each rate needs its own numerator, denominator, transfer count, unresolved count and coverage statement rather than mixing scopes.

Event order overrides a static final-state label. A valid originating-service action on day 10 followed by death on day 20 before a day-30 due date remains in both local D_a and C_a, with death separately recorded; the same principle applies to later transfer, decline or supersession. An action first performed on day 40 after a day-30 deadline remains in the due denominator but is **late**, outside the on-time numerator, even though its current state is now “completed.” If supersession occurred on day 20 and the obsolete action was performed on day 25, that performance is logged for safety review but is not a completion of the superseded obligation. Those with no approved rule remain in N_0 as “action undetermined” and outside action-specific denominators; future surveillance dates remain “not yet due.” The whole-cohort state distribution, due-action denominators, pre-due competing counts and unresolved counts must appear together so attrition remains visible.

A superseding result changes the current obligation, not the historical index. For example, a person whose initial positive result led to surveillance and whose later triage result legitimately required colposcopy would contribute **one** person to N_0, a dated superseded surveillance obligation, and one current colposcopy obligation with its own approved due date. If the original surveillance action was already due before supersession, that overdue status remains in the historical snapshot; if it was completed before supersession, its completed history remains. A corrected result on the same accession is recorded as an amendment, not a second episode; if correction invalidates the positive index, cohort eligibility is explicitly restated rather than treated as post-index attrition. Informed decline remains visible rather than being treated as attendance. If death or accepted transfer occurs *after* an action was due, the earlier due-date status is retained and the later event is reported separately.

Conditional stage summaries then distinguish direct patient acknowledgment among N_0, owner acceptance among episodes requiring transfer of responsibility, performed triage or colposcopy only among due and rule-assigned actions under a declared local or network scope, and treatment only among people with a

verified treatment indication. WHO's 2026 genotyping guidance uses an approximate 60% follow-up-capacity boundary at **every relevant programme step** to choose among modelled strategies; its threshold is not exact and is neither an individual deadline nor an acceptable local performance target [3]. WHO implementation retention indicators have their own specified populations and reporting horizons [10]. Before comparing either proposed action measure with WHO, a site must map the WHO step, eligible population and horizon to the local event and report any mismatch. The global strategy's 90% treatment target applies to women identified with cervical disease, not all HPV-positive results [1]. None of these programme denominators is silently substituted for D_a(local) or D_a(network).

These are descriptive statuses at a reporting cutoff. Time-to-event work would require a separate prespecified event origin, censoring plan and competing-risk estimand rather than treating transfer or death as ordinary random censoring. Result finalization, clinician acknowledgment, patient receipt, referral acceptance and action due date are different clocks. A common clock from finalization can expose total delay; stage clocks help assign a bottleneck. The local protocol sets route-specific due windows before outcomes are observed. Unknown outside-network status remains unknown, not coded as completed. Table 3 states the proposed denominators and clocks for pilot testing.

Table 3. Proposed denominator and clock rules to be tested locally

Measure	Proposed numerator and denominator	Clock and explicit alternative states
Review [23,24]	Acknowledged results / N_0 index episodes.	Finalization to clinician acknowledgment; show feed failure.
Communication [29,30]	Direct patient acknowledgment / N_0 index episodes.	Finalization to acknowledgment; show dispatch, proxy and unknown separately.
Next action, originating service [3,4,5,6,7,8]	C_a(local) / D_a(local) for each rule-assigned action.	Due-date clock; accepted responsibility transfer before local completion is a visible competing state.
Next action, linked network [3,4,5,6,7,8]	C_a(network) / D_a(network) for the same action and cohort version.	Retain transfers in denominator; verify receiving-service performance, show unknown outcomes.
Disposition [9,12,26]	Signed clinical decision / performed diagnostic actions.	Procedure/pathology to decision; show missing pathology.
Treatment [9,10]	Delivered / adjudicated treatment-eligible people.	Indication to delivery; show decline and alternative plans.
WHO retention [3,10]	Attendance / WHO step-eligible population.	Preserve each WHO horizon; report non-equivalence to both proposed action rates.

Table 3 note: N_0 is the versioned first-valid-positive person/episode count. A pre-due competing event excludes an action only when it preceded valid completion within that measure's stated scope. Local C_a counts originating-service performance; it never includes external performance after accepted transfer. Network C_a can count verified receiving-service or outside-provider care because its matched D_a retains transfers; unverified status stays unresolved. A valid completed-on-time action remains in its D_a and C_a despite a later competing event, while a late action stays outside on-time C_a. An invalidated index restates N_0 and both denominators through an audit trail. All exclusions and unknown states remain visible. These author-proposed rates supplement, but do not redefine, WHO indicators [3,9,10]. Freeze the clinical rule and reporting period before calculation. Do not multiply stage rates into joint completion or infer a universal 90-day deadline.

Denominator construction deserves a blinded chart-audit sample. The 2025 clinical-decision-support comparison found that a substantial fraction of algorithmically flagged cervical cases were not true overdue cases on review [24]. A draft measure should therefore test both precision (flagged episodes truly eligible)

and recall (eligible episodes found), not only whether a dashboard populates. A sample should deliberately include HPV16/18, non-16/18 positives, self-collected specimens, surveillance cases, prior treatment, and results with fragmented history. Two trained clinical reviewers should independently classify action eligibility and disposition, resolve disagreements with a prespecified adjudicator, and report agreement with its uncertainty. We do not set an invented acceptable agreement threshold. The clinical team must choose a criterion appropriate to the intended use and correct the rule/data mapping before any public comparison.

Feasibility, equity and governance in a Gulf setting

A Saudi or Gulf feasibility pilot would first map actual data custodians. Laboratory results may live in one system, cytology in another, referrals in scheduling software, and colposcopy pathology in a specialist record. Programme reports should state which providers and sectors are covered, whether outside results are accessible, and how patient identifiers link records. WHO's 2026 implementation guidance places retention beside adoption, uptake and sustainability, and recommends planning tools and indicators [10]. The proposed event contract is a way to test those indicators at facility level, not a substitute for programme leadership. It should be implemented only after local clinicians select the applicable screening protocol and define which steps are feasible in that pathway.

Communication should be tested with patients rather than optimized solely for administrative completion. Saudi focus-group research found knowledge and cultural concerns around cervical cancer and HPV [17]. A 2025 Saudi online survey and a 2026 Riyadh survey report awareness and screening behavior, but their sampling and self-report cannot identify the proportion of HPV-positive patients who received appropriate follow-up [15,18]. A GCC cross-sectional survey similarly describes prevention knowledge and Pap testing, not longitudinal linkage after a positive result [16]. These studies justify language-sensitive, privacy-conscious contact design and patient input. They do not justify assuming that all Gulf patients prefer one channel or that a message marked delivered was understood.

Equity auditing should keep denominators visible across age, geography, facility, language or access variables where collection is lawful and clinically appropriate. Small cells should be suppressed before any external report to protect privacy. Comparing services requires attention to case mix, action rule and out-of-network ascertainment; a clinic receiving more high-risk referrals or more uncertain histories may appear to perform worse under a crude rate. Fragmented data can also vary systematically by region or care sector. In a U.S. cohort, Tiro and colleagues found site variation in surveillance and differential testing by patient characteristics [25]; this cannot be assumed to have the same direction locally, but it shows why one aggregate percentage is insufficient. Patient participation in designing communication and follow-up explanations is also necessary to distinguish a person who declines after informed discussion from someone who never received the result.

A minimal pilot could begin with one laboratory and one linked primary/specialist network, using retrospective de-identified episodes to test ascertainment before any automated outreach. The team would freeze a clinical-rule version, sample records, compare extraction with chart adjudication, reconcile event timestamps across systems, and quantify unknown states by facility and pathway. Estonian EHR work shows that evaluating adherence from routine records is feasible in a defined setting, but it does not validate the proposed Gulf event fields [33]. Only after local ascertainment is tested should prospective prompts or navigation be considered, with explicit ownership for correcting incorrect alerts. Atlas's trial supports outreach as a studied intervention in its U.S. networks [23]; it does not prove the same design will work in a Gulf network. Danish registry-based GP reminders, navigation studies, and low-resource SMS

projects offer mechanisms worth adapting, but their follow-up definitions, baseline services and patient populations differ [28,29,34,35]. A local evaluation would need to measure harms too: false reassurance from a closed status, unnecessary colposcopy, duplicated contact, privacy breaches, and the workload created by inaccurate flags. Table 4 sets out questions for a first validation study.

Table 4. Validation questions before a service uses the proposed contract

Domain	Test in a local pilot	A finding that requires repair before scale-up
Eligibility [3,4,5,6,7,8,24]	Independently adjudicate stratified cases.	Wrong triage, colposcopy or surveillance route.
Capture [12,13,24,31,32]	Compare extraction with accession and chart lists.	Missed cases or false overdue flags.
Linkage [3,9,10]	Reconcile result, import, referral and pathology times.	Impossible sequences or interface artefacts.
Communication [17,29,30]	Audit dispatch, receipt and comprehension.	Dispatch coded as confirmed receipt.
Missingness [21,25]	Stratify unknown, external, transfer and not-yet-due.	Data loss coded as success or nonadherence.
Equity [15,16,17,18]	Co-design messages; audit access and capture by group.	Aggregate rate hides unequal opportunity.

Table 4 note: This author-proposed checklist is not a trial or pass/fail standard. Cited studies motivate the audit; they do not validate it. Local investigators must set sampling, agreement criteria, lawful access and performance thresholds. No patient data underlie this review.

Limits of the proposal and research agenda

A complete event log can still miss the clinical meaning of a decision. An attended colposcopy may be inadequate, a biopsy may be interpreted differently after review, and a treatment can be inappropriate despite being delivered. Conversely, an individually documented alternative to a standard pathway may be medically sound. The proposed contract is a process audit and must be paired with clinical adjudication, pathology quality and patient outcomes. It should not be marketed as a validated safety score. Its sensitivity to missing history, referral interfaces and undocumented outside care may also limit comparability across sites.

The strongest prior art limits any claim of conceptual novelty. WHO has indicators, a follow-up-capacity rule and implementation guidance [3,9,10]. Italian HPV indicators, PROSPR and programme studies have long described sequential screening metrics [11,12,13,14]. A U.S. computable-guideline initiative and its 2026 update address translation of complex cervical rules; the latter reports a six-month cervical clinical pilot [31,32]. The present article contributes a deliberately small *unvalidated* operational proposal: a versioned local action assignment tied to a traceable index; separate evidence of ownership, patient acknowledgment and performed action; local and linked-network due-action rates with matched scope; auditable cohort restatement; and explicit unknown and competing states. Earlier work may incorporate some of these elements. A local pilot should compare this additional record burden and its validity against existing WHO and local reporting rather than presume improvement.

Future research should specify its estimand before selecting an intervention. A descriptive study could estimate the stage-specific proportion completed after a valid positive result; a cluster trial could compare

an outreach system with usual care among correctly identified overdue patients; a qualitative study could examine why communication fails; and an economic evaluation could account for staff time, avoidable procedures and referral capacity. Each requires different data and ethics arrangements. The initial pilot should publish the actual rule version, denominators, missingness, chart-review performance, and the precise time origin for every interval. If the system cannot identify who required which action, an intervention effect cannot be interpreted confidently. If an intervention increases visit attendance but not diagnostic resolution, the distinction should remain visible.

This review has limitations of its own. The search was targeted and non-systematic, so an unlocated study may alter the assessment of novelty or effectiveness. PubMed abstracts and accessible full texts vary in the detail available for interpretation; no independent human clinical panel completed full-text appraisal. Sources from the United States, Europe and sub-Saharan Africa are used to define transferable questions, not to estimate Gulf performance. The Saudi/Gulf studies cited largely assess knowledge, uptake or prevalence rather than the event-level follow-up proposed here. We have neither patient-level local data nor a verified national policy map, so cannot estimate a local gap, assert that a workflow currently exists, or claim ethical approval for a study. Clinical pathways and WHO recommendations can change; the version date must be checked again before implementation or submission.

Conclusion

An HPV-positive result begins a sequence whose appropriate end differs by clinical risk and programme strategy. WHO and other programmes provide clinical and monitoring guidance, but local clinical-action rules and their version dates must be established before operational application. A Saudi or Gulf implementation study can add value by testing whether that architecture can be represented faithfully in linked local records: who owned the result, whether the patient received it, which next action was actually required, whether it occurred on time and under whose responsibility, and whether the episode reached a documented disposition. Keeping valid pre-event completions, late actions, transfers and amended indexes in a versioned audit trail makes the proposed local and network denominators testable rather than automatically trustworthy. The event-level contract is a starting hypothesis; its accuracy, feasibility, patient acceptability and effect on care remain to be demonstrated under human clinical and data governance.

Declarations

Ethics: Ethical approval and informed consent were not required because this review uses only published literature and no new participant data were collected.

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Competing interests: The authors declare no competing interests.

Data availability: No clinical dataset underlies this review; the PubMed queries are reported in the text.

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