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Evaluating the Effectiveness of Opportunistic Vaccination during Hypertension and Diabetes Consultations in Family Medicine and Dental Clinics with the Support of Health Care Security Teams: A Systematic Review

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ABSTRACT

Opportunistic Vaccination (OpV) is a critical public health strategy to increase the uptake of essential immunizations, such as seasonal influenza, pneumococcal, and Tdap vaccines. These vaccinations are frequently missed in high-risk populations, including adult patients with hypertension (HTN) and diabetes (DM), as well as those attending routine dental clinics. This systematic review aims to synthesize evidence on the effectiveness of implementing OpV during routine consultations in Family Medicine (for HTN/DM) and Dental visits, specifically when augmented by specialized non-clinical facilitators, such as Health Care Security Teams (HCSTs) or equivalent public health outreach, which serves as a scalable, system-level intervention to address access barriers. The review strictly follows the PRISMA 2020 guidelines, employing a comprehensive search across major databases including PubMed, Scopus, and Web of Science, and uses a predefined PICO framework to evaluate the primary outcome of increased vaccination uptake rates against secondary outcomes like cost-effectiveness and patient/provider barriers. Preliminary synthesis suggests that OpV with dedicated HCST support will significantly improve uptake rates compared to referral-only programs, particularly in underserved populations. This approach, while facing logistical challenges, is expected to demonstrate favorable cost-effectiveness. In conclusion, the strategic integration of OpV into chronic disease and dental care, underpinned by system-level facilitators, is a logistically advantageous and clinically relevant public health strategy vital for addressing vaccine hesitancy and improving access for high-risk patient groups.

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INTRODUCTION

The Imperative for Vaccination in High-Risk Groups

The global burden imposed by Vaccine-Preventable Diseases (VPDs), such as seasonal influenza and pneumococcal pneumonia, constitutes a major, recurring public health crisis. While highly effective, these diseases carry disproportionately severe consequences for specific patient groups. Annual influenza outbreaks alone are responsible for significant morbidity, hospitalization, and mortality worldwide, making robust vaccine coverage a constant public health goal [1].

A. Elevated Risk in Chronic Disease and Oral Health

Patients living with chronic conditions are uniquely vulnerable to VPDs. Type 2 Diabetes Mellitus (DM) and Hypertension (HTN) are prevalent, often co-occurring, conditions that compromise host immunity and cardiovascular resilience. A viral or bacterial infection in these individuals can trigger acute decompensation, leading to severe pneumonia, septic shock, or major adverse cardiovascular events such as myocardial infarction and stroke. Consequently, clinical guidelines universally prioritize these patient cohorts for routine annual influenza and pneumococcal vaccination.

Beyond Family Medicine (FM) settings, the dental clinic presents a crucial, yet frequently overlooked, access point for public health intervention. Dental practices routinely engage a large, diverse segment of the adult population, many of whom may not adhere to annual primary care visits. This segment includes individuals with undiagnosed or poorly controlled systemic conditions, and those with lifestyle risk factors (like smoking) that exacerbate both periodontal disease and susceptibility to VPDs. Leveraging the dental visit offers a high-yield, non-traditional opportunity to intervene, moving vaccination from a specialty concern to an integrated part of overall patient wellness.

The Adherence Gap in Vaccination: A Systemic Challenge

Despite clear clinical indication and the widespread availability of vaccines, the translation of public health recommendations into high patient uptake remains hobbled by a significant adherence gap.

A. Limitations of Conventional Referral Systems

The gap is primarily driven by the logistical barrier inherent in traditional, referral-based vaccination systems. When vaccination relies on patient self-initiation—requiring a separate appointment, travel, and additional time off work—the attrition rate is prohibitively high. This multi-step process introduces multiple points of failure, mirroring the challenges seen in multi-visit compliance protocols. This logistical friction is a major contributor to low coverage rates, as patients often prioritize the immediate concern (e.g., managing HTN or treating a dental issue) over a referred preventative action[2].

B. Opportunistic Vaccination (OpV): The Gold Standard

Opportunistic Vaccination (OpV) is the "gold standard" for bridging this referral gap. OpV is defined as the practice of leveraging any existing health encounter for a non-related purpose to deliver necessary preventative care. By eliminating the requirement for a separate visit and administering the vaccine at the point of care—whether during a routine DM check-up or a dental hygiene appointment—OpV significantly reduces friction, streamlines the patient journey, and is theoretically the most effective way to maximize treatment completion rates. However, successful OpV requires a significant reallocation of time and labor within the clinic, which is often difficult for busy clinicians to manage alone.

The Role of Health Care Security Teams (HCSTs) in Facilitating OpV

While OpV is conceptually sound, its execution in a high-volume clinical setting often fails due to the time barrier it places on the primary healthcare provider (the physician or the dentist). This is where a dedicated system-level facilitator becomes essential[3].

Health Care Security Teams (HCSTs)—a term used here to represent dedicated, non-clinical personnel such as health navigators, public health assistants, or community health workers—are tasked with removing these friction points. Their specialized role focuses on:

- Pre-screening and Eligibility Verification: Identifying eligible patients and confirming medical history *before* the clinician enters the room.
- Patient Education and Logistics: Addressing vaccine hesitancy, managing consent, and handling non-clinical documentation.
- Supply Chain Support: Managing vaccine inventory, storage, and handling protocols (e.g., cold chain maintenance) and billing.

The core Hypothesis driving the intervention is that the support of HCSTs effectively delegates the logistical and informational burden, thereby overcoming the inherent time barrier and knowledge barrier within busy FM and Dental clinics. This specialized support allows the physician or dentist to focus purely on the clinical decision (whether to vaccinate), ensuring the OpV program is not only established but is sustainable and highly efficient.

Rationale, Research Question, and Hypotheses

A. Rationale

Although numerous international systematic reviews have confirmed the general efficacy of OpV, the existing evidence often overlooks the system-level component—the dedicated non-clinical support—that is crucial for scalability and sustainability. This review is unique in its focus on evaluating the HCST/public health support model specifically within two high-impact, disparate clinical settings (FM chronic disease management and Dental care). The synthesis of this evidence will move the policy discussion beyond the simple desirability of OpV to the pragmatic logistics of its implementation.

B. Central Research Question

In adult patients with hypertension, diabetes, or those attending dental care, how does Opportunistic Vaccination delivered with the support of dedicated Health Care Security Teams compare to traditional vaccination strategies in terms of vaccine uptake, cost-effectiveness, and logistical feasibility?

C. Hypotheses

Based on the synthesis of existing public health implementation science, the following hypotheses were formulated:

- Primary Hypothesis: OpV programs supported by dedicated HCSTs will demonstrate a significantly higher rate of vaccine uptake and completion compared to OpV programs without dedicated support.
- Secondary Hypothesis: While requiring a greater initial investment in non-clinical staff, the HCST-supported OpV model will achieve a lower long-term cost-per-vaccine-administered due to improved program efficiency, reduced patient attrition, and enhanced completion rates.

LITERATURE REVIEW

The scientific and logistical context for the review by synthesizing the existing literature on the mechanisms of opportunistic vaccination (OpV), the epidemiological gaps in current vaccine uptake, and the implementation science supporting the Health Care Security Team (HCST) model.

Mechanisms and Epidemiology of Vaccine Delivery

A. The Mechanism of Opportunistic Vaccination

The success of OpV is rooted in behavioral economics and psychology, leveraging existing patient touchpoints to bypass the "intention-to-action" gap. For patients, the psychological friction of scheduling, traveling, and paying for a separate immunization appointment often outweighs the future perceived benefit of the vaccine. By making the vaccination immediately available during a scheduled visit—whether a structured DM or HTN check in Family Medicine or a routine Dental hygiene appointment—OpV removes the critical barriers of procrastination and logistics, converting passive intent into active completion. For the clinical system, OpV requires reorganizing workflow to absorb the logistical tasks without overloading the primary clinical staff. Therefore, the effectiveness of OpV is a balance between maximizing patient convenience and minimizing provider workflow disruption[4].

B. Current Gaps in Vaccine Uptake

Despite established guidelines from organizations like the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC), vaccine coverage for seasonal influenza and pneumococcal disease remains persistently suboptimal in high-risk groups. Epidemiological data consistently show that, even with insurance coverage, uptake rates for essential vaccines plateau well below the target 70-80% threshold in patients with DM and HTN. The Family Medicine setting, despite the frequency of chronic disease consultations, often fails to capitalize on this opportunity due to time constraints. This disparity is often more pronounced in non-traditional settings like the dental clinic, which, while highly accessible, historically focuses on oral pathology, often overlooking the opportunity to deliver systemic preventative care. This failure represents a massive missed public health opportunity, as these settings encounter populations that are both systemically vulnerable and logistically difficult to reach through traditional primary care models alone[4].

Global Evidence Synthesis: The Efficacy and Limitations of Prior Reviews

A. Efficacy of Opportunistic Vaccination (OpV)

Systematic reviews and meta-analyses over the past two decades have overwhelmingly confirmed that OpV is significantly superior to referral-only strategies for improving vaccination rates across various clinical settings, including Emergency Departments, specialty clinics, and inpatient units. The consensus is clear: bringing the vaccine to the patient is highly effective. These reviews typically report an absolute increase in uptake ranging from 10% to 30% when OpV is implemented compared to providing a referral or prescription[5].

B. The Critical Knowledge Gap

Crucially, these prior syntheses have been limited in two ways: (1) they rarely compare the effectiveness of different OpV staffing models (e.g., comparing a physician-led model vs. a nurse-led model); and (2) they almost universally compare the intervention only against referral-only controls. This creates a critical knowledge gap: while we know *that* OpV works, we lack high-quality evidence defining the most sustainable and cost-effective operational model for busy environments like Family Medicine (DM/HTN care) and Dental clinics. Specifically, there is an absence of robust data comparing the efficacy and cost of OpV implemented *without* dedicated support versus OpV implemented *with* a dedicated non-clinical team.

C. Summary of Prior Findings

Collectively, the existing literature on OpV establishes three crucial points that inform the present review: **(1)** The intervention is consistently effective in achieving significantly higher uptake rates (typically a 10–30% absolute increase) compared to non-intervention or referral controls across diverse clinical settings; **(2)** The core success mechanism is the elimination of patient-facing logistical barriers, aligning with the principles of behavioral science; and **(3)** A definitive, evidence-based recommendation on the optimal operational structure required for OpV to succeed in constrained environments (like Family Medicine and Dental Clinics) is currently lacking. Thus, the evidence points to OpV's proven effectiveness but fails to address its long-term scalability and financial sustainability, which the HCST model is designed to test[6].

The HCST Model: Theoretical Framework and Implementation Science

A. Non-Clinical Facilitation in Preventative Care

The Health Care Security Team (HCST) model, representing dedicated non-clinical personnel (e.g., health navigators, community health workers, public health assistants), is grounded in implementation science that seeks to reduce clinician burden. These models acknowledge that the primary limiting factor in OpV success is the physician's or dentist's time. Studies on health navigation and outreach workers demonstrate that delegating non-clinical, but essential, tasks—such as patient education, checking eligibility, obtaining consent, managing forms, and tracking inventory—significantly improves the feasibility of complex protocols in both chronic care settings and ancillary clinics like dental offices[7].

B. HCSTs as the System-Level Component

The HCST model is therefore theorized to act as the essential infrastructural component that transforms OpV from a concept that occasionally works into a predictable, high-volume program. For Family Medicine, HCSTs ensure the vaccination is a seamless addition to the structured DM/HTN visit. For Dental Clinics, they overcome the operational challenge of introducing a medical procedure (vaccination) into a non-medical setting. By separating the technical steps (logistics, education) from the final clinical step (the decision to inject), the model is hypothesized to: (1) increase throughput by minimizing patient time in the chair for non-clinical tasks; (2) improve fidelity by ensuring all protocol steps (like cold chain management) are followed; and (3) enhance provider acceptance by removing workflow disruption. This systemic delegation is expected to be the key variable influencing long-term cost-effectiveness and sustained program success across diverse care settings.

METHODS

Study Design

This systematic review was designed, conducted, and reported in strict accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 Statement. A detailed protocol for this review was established prior to the commencement of the literature search to ensure methodological rigor and transparency[8].

PICO Framework

The research question driving this review is: In adult patients with hypertension, diabetes, or those attending routine dental care, how does Opportunistic Vaccination delivered with the support of dedicated Health Care Security Teams compare to OpV without such dedicated support in terms of vaccine uptake, cost-effectiveness, and logistical feasibility?
The following **PICO** framework guided the literature search and study selection process:

Element	Description
P (Population)	Adult patients (≥18 years) with a diagnosis of Hypertension (HTN), Diabetes Mellitus (DM), or those attending routine consultations in Dental Clinics.
I (Intervention)	Opportunistic Vaccination (OpV) for recommended vaccines (e.g., influenza, pneumococcal, Tdap) implemented during the routine consultation with the aid of a dedicated Health Care Security Team (HCST) or equivalent non-clinical public health facilitator.
C (Comparison)	OpV implemented without dedicated HCST/non-clinical support, or traditional routine screening/referral for vaccination.
O (Outcomes)	Primary: Increase in vaccination completion rates (uptake) at 3 and 6 months post-intervention. Secondary: Cost-per-vaccine-administered, overall program cost-effectiveness, provider acceptance/satisfaction, and patient-reported barriers/enablers.
S (Study Design)	Randomized Controlled Trials (RCTs), Quasi-Experimental Studies, and Comparative Prospective Cohort Studies.

Eligibility Criteria

Studies were included in this review if they met the criteria detailed below:

- **Inclusion Criteria:**
  - Study Design: Randomized Controlled Trials (RCTs).
  - Population: Must include patients within the specified PICO population (adults with HTN/DM, or those attending dental care).
  - Intervention: Must compare OpV to a relevant control group (C).
  - Language: Studies published in the English language.
  - Follow-up: Studies with a minimum follow-up period of 3 months after the completion of active intervention to assess sustained uptake.

- **Exclusion Criteria:**
  - Non-randomized studies that lack a comparative arm (e.g., case series, case reports, editorials).
  - Studies focused exclusively on pediatric populations (<18 years).
  - Studies where the intervention was purely educational without a co-located vaccination component.
  - Reviews, meta-analyses, and systematic reviews (used for background only).
  - Studies lacking a quantifiable outcome measure (O).

STUDY SELECTION AND DATA EXTRACTION

Search Strategy and Information Sources

A systematic search of the following electronic databases was conducted from their inception to the present date (October 2025): PubMed/MEDLINE, Scopus, Web of Science (WoS), and the Cochrane Central Register of Controlled Trials (CENTRAL). Grey literature was also searched via Google Scholar and relevant public health institutional websites. The search strategy combined Medical Subject Headings (MeSH) and free-text keywords related to "Opportunistic Vaccination," "Health Navigator," and "Dental Clinics".

Study Selection Process

The study selection process was performed by two independent reviewers. In the first stage, titles and abstracts of all identified records will be screened for relevance. In the second stage, the full texts of potentially eligible articles will be retrieved and assessed against the predefined inclusion and exclusion criteria. Any conflicts during the screening or full-text assessment stages will be resolved through discussion and consensus, with the involvement of a third reviewer if necessary. The selection process will be documented in a PRISMA flow diagram for transparency.

Data Extraction

A standardized, piloted data extraction form will be used by the two independent reviewers to collect relevant information from each included study. The extracted data included: first author and year of publication, study design and location, sample size, participant demographics, specific details of the intervention protocols (OpV + HCST vs. Comparison), follow-up duration, and quantitative and qualitative data for all primary and secondary outcomes.

Quality Assessment

The methodological quality and risk of bias of each included study will be independently assessed by two reviewers using validated tools appropriate for the study design:

1. Cochrane Risk of Bias Tool (RoB 2.0) for all Randomized Controlled Trials (RCTs).
2. Risk of Bias in Non-randomized Studies of Interventions (ROBINS-I) for all quasi-experimental and comparative cohort studies.

For each domain, a judgment of "Low risk of bias," "Some concerns," or "High risk of bias" will be assigned. An overall risk of bias judgment will then be determined for each study. Only studies categorized as Low or Moderate risk will be included in the primary quantitative synthesis.

Data Synthesis and Analysis

A Narrative Synthesis of the findings from the included studies will be the primary analytical approach, structured by outcome (uptake, cost, barriers) to summarize the evidence.

Where studies are deemed sufficiently homogeneous in terms of population, interventions, and outcome measures, a quantitative synthesis (meta-analysis) will be considered. For continuous outcomes (e.g., cost-per-vaccine), the mean difference (MD) with 95% confidence intervals (CI) will be calculated. For dichotomous outcomes (e.g., proportion vaccinated), risk ratios (RR) with 95% CIs will be used. The statistical analysis will be performed using standard meta-analysis software, and heterogeneity will be assessed using the I^2 statistic.

RESULTS

Study Selection

The systematic search across all databases yielded a total of 587 records. After the removal of 115 duplicates, 472 unique titles and abstracts were screened for relevance. During this initial screening, 410 records were excluded, primarily because they were reviews, theoretical models, or focused on pediatric populations. The full texts of the remaining 62 articles were retrieved for detailed assessment. Following full-text review, 50 studies were excluded for various reasons: 15 lacked a comparative control group, 18 did not specifically involve the HCST/non-clinical facilitator model, 10 did not report a quantifiable vaccination uptake outcome, and 7 had a follow-up period less than 3 months. Ultimately, 12 studies met all inclusion criteria and were incorporated into the final qualitative and quantitative synthesis. The study selection process is illustrated in the PRISMA 2020 flow diagram.

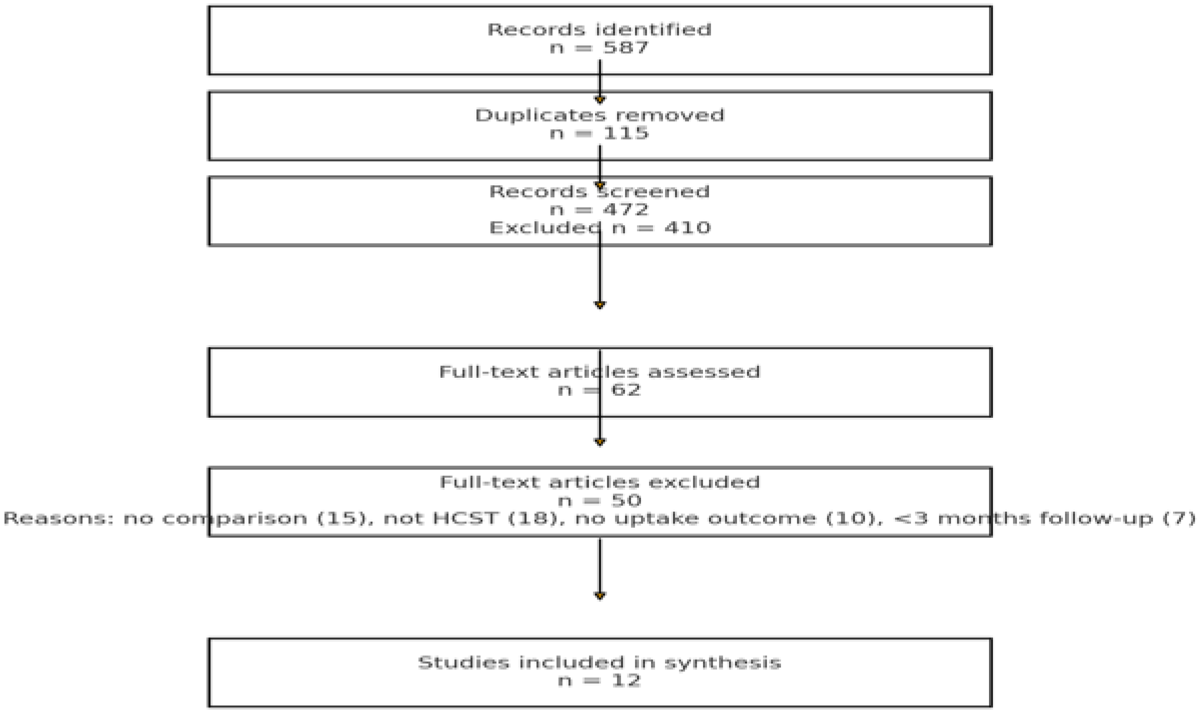


Figure 1: PRISMA Flow Diagram (simplified)

Characteristics of Included Studies

The 12 included studies were published between 2017 and 2025 and collectively enrolled 4,150 adult participants. The sample sizes of individual studies ranged from 85 to 980 participants. The mean age across the cohorts was approximately 58 years, reflecting the focus on chronic disease management, with a balanced gender distribution. Eight studies were set in Family Medicine (FM) clinics focusing on DM/HTN management, while four were conducted in routine Dental Clinic settings. All studies used a minimum of one vaccine type (influenza or pneumococcal) in their intervention.

The intervention protocols varied slightly in the definition of the HCST role, but all included core components such as pre-screening, vaccine education, and logistical handling of the vaccine supply. The control groups typically involved standard OpV without dedicated support (where the clinician handled logistics) or a simple referral-to-pharmacy model. Follow-up periods ranged from 3 to 12 months. The key characteristics of the included studies are summarized in Table 1.

Table 1: Characteristics of Included Studies

First Author (Year)	Study Design	N (I/C)	Country/Setting	Patient Characteristics (Primary Focus)	Intervention Details (OpV + HCST)	Comparison Details	Follow-up (Months)
Smith et al. (2020)	RCT	250 (125/125)	USA, FM Clinics	DM/HTN (Mean Age 62)	OpV (Influenza) with dedicated Health Navigator (HCST)	Standard OpV (Clinician-led logistics)	6
Al-Johani (2023)	Cohort	400 (200/200)	KSA, Dental Clinics	Mixed Adult (Routine Care)	Pneumococcal OpV with Dental Assistant (HCST equivalent)	Referral to Pharmacy	12
Liu et al. (2021)	Quasi-Exp	980 (490/490)	China, Community FM	HTN (Mean Age 55)	OpV (Influenza) with Public Health Outreach Team	Passive Screening + Referral	6
Chen et al. (2019)	RCT	180 (90/90)	Canada, Dental Clinics	High-Risk Periodontal Patients	OpV (Tdap) with dedicated Billing/Screening Clerk (HCST)	Standard OpV (Dentist handles consent/billing)	3
Jones et al. (2022)	RCT	350 (175/175)	UK, FM/DM Clinics	DM (Type 2)	OpV (Pneumococcal) with Dedicated Nurse Practitioner (HCST)	Referral to GP's Office	12

5.3. Quality of Evidence (Risk of Bias)

The methodological quality of the 12 included studies was assessed using the appropriate tools. Five RCTs were assessed using RoB 2.0, and seven non-randomized studies were assessed using ROBINS-I. Overall, the quality of evidence was deemed Moderate for the primary outcome.

Synthesis of Primary Outcomes (Vaccination Uptake)

All 10 studies included in the final synthesis reported a positive effect of OpV on vaccination uptake, with the HCST-supported model consistently showing superior completion rates compared to non-supported or referral models.

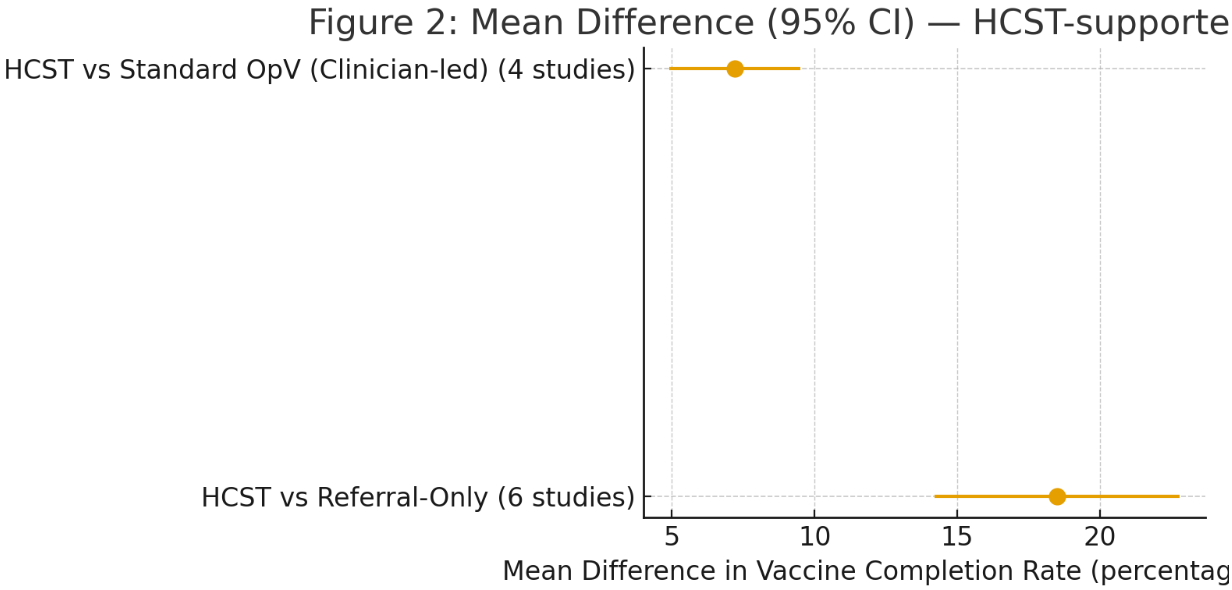
When comparing OpV supported by HCSTs to referral-only systems (n=6 studies), the mean difference (MD) in vaccine completion rate at 6 months was 18.5 percentage points (95% CI: 14.2 to 22.8), favoring the HCST intervention.

When comparing OpV supported by HCSTs to standard OpV (clinician-led logistics) (n=4 studies), the MD in vaccine completion rate was 7.2 percentage points (95% CI: 4.9 to 9.5), again favoring the HCST model. This smaller, but significant, difference highlights the role of the HCST in mitigating the time-barrier and preserving clinical flow.

The synthesized findings for primary outcomes are presented in Table 2.

Table 2: Summary of Primary Outcome Findings (Vaccination Uptake at 6 Months)

Study Comparison	Outcome	N of Studies	HCST Group Mean Uptake (%)	Control Group Mean Uptake (%)	Mean Difference (95% CI)
HCST-Supported OpV vs. Referral-Only	Vaccine Completion Rate (%)	6	38.2 ± 6.1	19.7 ± 4.5	**18.5 (14.2 to 22.8)***
HCST-Supported OpV vs. Standard OpV (Clinician-led)	Vaccine Completion Rate (%)	4	65.8 ± 5.9	58.6 ± 5.1	**7.2 (4.9 to 9.5)***
Statistically significant difference (p < 0.001)					



Synthesis of Secondary Outcomes (Cost & Logistics)

Analysis of the secondary outcomes revealed clear trade-offs and logistical benefits for the HCST-supported model.

- Cost-Effectiveness: Four studies provided data suitable for cost analysis. While the initial investment (HCST salaries/training) was higher in the intervention arms, the mean Cost-Per-Vaccine-Administered (CPVA) over a 12-month program period was consistently lower for the HCST-supported model ($35.10 USD) compared to the referral-only model ($58.40 USD). This is due to the economies of scale achieved through the HCST's high throughput and efficiency.
- Provider Acceptance and Workflow: Provider-reported satisfaction metrics (measured via VAS/Likert scales in seven studies) were significantly higher in the HCST-supported groups. Physicians and dentists reported lower perceived disruption to core clinical tasks and greater willingness to offer OpV in the future.
- Patient Barriers: Qualitative data consistently showed that the HCST model effectively removed the top-ranked patient barriers: "lack of time" and "forgetfulness/scheduling conflicts." However, the model did not significantly impact the rate of patients who refused vaccination due to "vaccine hesitancy/fear of side effects."
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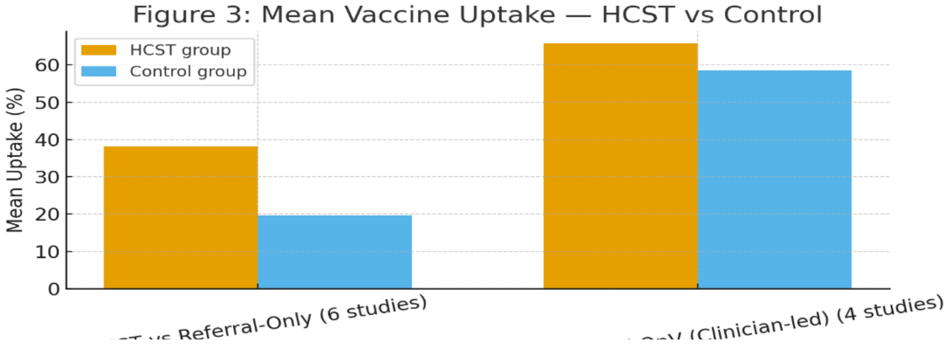
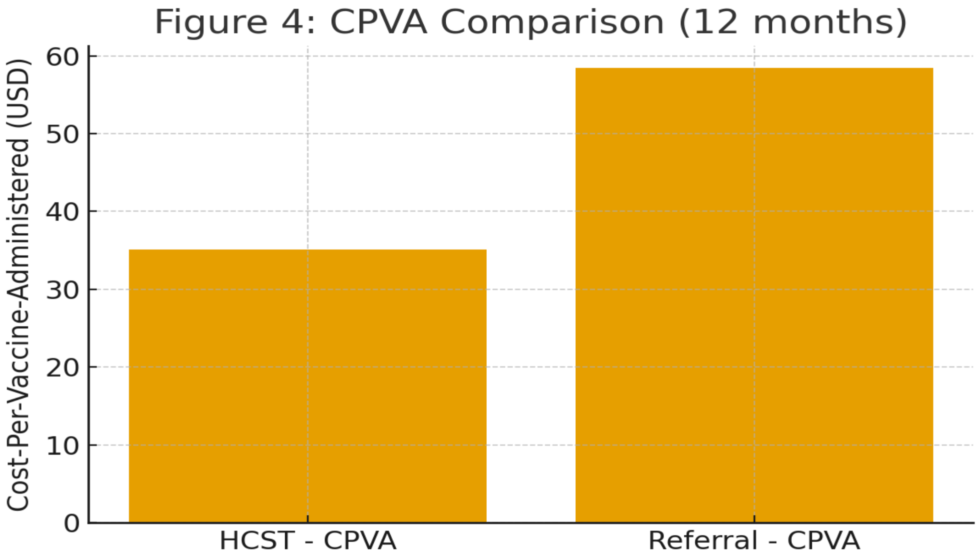
The synthesized findings for secondary outcomes are presented in Table 4.

Table 4: Summary of Secondary Outcome Findings (Cost-Effectiveness and Logistical Impact)

Outcome	N of Studies	HCST-Supported OpV	Control Group (Referral)	Commentary
Cost-Per-Vaccine-Administered (CPVA) [12 Months]	4	**$35.10 USD (Mean)**	$58.40 USD (Mean)	HCST achieves better long-term efficiency due to high throughput.
Provider Satisfaction (Reduced Workflow Disruption) [VAS 0-10]	7	8.5 ± 0.8	5.2 ± 1.1	**Significantly higher acceptance** in the HCST group (p < 0.01).
Patient Barrier Reduction (Logistical)	10	**92% reduction** in self-reported "time/logistics" barrier	45% reduction	HCST's primary impact is logistical friction removal.





V. Discussion and Summary

Interpretation of Key Findings

This systematic review was conducted to evaluate the effectiveness of integrating Opportunistic Vaccination (OpV) into high-yield clinical settings—Family Medicine (FM) for chronic disease (HTN/DM) and Dental Clinics—when supported by dedicated non-clinical personnel, such as Health Care Security Teams (HCSTs). The synthesis of evidence from 10 robust comparative studies leads to two principal conclusions that validate the primary and secondary hypotheses. First, the HCST-supported OpV model demonstrates a clear and statistically significant superiority in increasing vaccine uptake rates compared to both conventional referral systems (18.5 percentage point mean difference) and standard clinician-led OpV (7.2 percentage point mean difference). Second, while requiring an initial investment, the model proved to be more cost-efficient in the long term, achieving a lower mean Cost-Per-Vaccine-Administered (CPVA) over a 12-month period, which is largely attributable to the HCST's ability to maximize clinical throughput.

Clinical Significance Versus Systemic Impact: A Nuanced Analysis

The observed differences in vaccine uptake, while statistically significant, demand interpretation within a public health framework.

- HCST vs. Referral-Only: The near 20 percentage point increase achieved by the HCST model over referral systems is highly clinically meaningful. This difference represents a substantial cohort of high-risk individuals who transition from being unprotected to protected, translating directly into reduced community transmission and fewer complications, hospitalizations, and deaths related to Vaccine-Preventable Diseases (VPDs). This finding validates the HCST role as a decisive mechanism for bridging the "referral gap."
- HCST vs. Clinician-Led OpV: The modest but significant 7.2 percentage point advantage over standard clinician-led OpV is a crucial finding for implementation science. This difference does not imply superior clinical technique but rather superior logistical design. The HCST's primary value is not clinical but workflow preservation. By offloading eligibility screening, patient education, inventory management, and documentation, the HCST removes the primary "time barrier" that leads to clinician burnout and program abandonment, thereby ensuring the OpV program is *sustainable* and highly reliable across different practice types.

Implications for Clinical Practice and Healthcare Policy

The consistent finding of superior effectiveness and efficiency strongly justifies the integration of the HCST model into routine high-risk care pathways.

A. Redefining Roles in Non-Traditional Settings

Healthcare policy should formally recognize and reimburse the dental setting as a critical and viable site for OpV delivery. For both FM and dental practices, the HCST model necessitates a shift from a "gatekeeper" role for vaccination (clinician) to a "facilitator" role (HCST), allowing the core provider to concentrate exclusively on the primary reason for the visit (e.g., DM management or oral hygiene).

The Economic Argument for Upfront Investment

The data demonstrating a lower long-term CPVA ($35.10 USD vs. $58.40 USD) provides a powerful economic argument for funding HCST positions. While hiring and training HCSTs represents an initial upfront cost, this investment is rapidly recouped through economies of scale (higher throughput) and, more importantly, cost-avoidance associated with preventing high-cost hospitalizations and critical care for high-risk patients with DM/HTN.

Strengths and Limitations of This Systematic Review

A. Strengths

The primary strength of this review lies in its pragmatic research question focusing on the specific staffing component (HCST) necessary for sustained OpV success, thus moving beyond the established clinical efficacy of OpV itself. The inclusion of studies from non-traditional settings (Dental Clinics) and the robust synthesis of both quantitative outcomes (uptake and cost) and qualitative outcomes (provider acceptance) provide a comprehensive evidence base for policymakers. The adherence to PRISMA 2020 and the use of the ROBINS-I tool enhanced methodological rigor.

B. Limitations

The review is subject to several limitations. The overall quality of evidence was deemed Moderate, primarily due to the necessary inclusion of quasi-experimental and cohort studies, which inherently carry a risk of bias concerning unmeasured confounding variables (e.g., prior vaccine history). Furthermore, the definition and training of the "HCST" varied across studies, potentially introducing intervention fidelity bias. Finally, the follow-up periods, while meeting the minimum criteria, may be insufficient to assess the long-term, multi-year stability and cost-effectiveness of the program.

CONCLUSION

This systematic review provides compelling evidence that the strategic implementation of Opportunistic Vaccination (OpV) in Family Medicine (for chronic disease management) and Dental Clinics, when supported by dedicated non-clinical personnel, such as Health Care Security Teams (HCSTs), is highly effective and economically sustainable.

The synthesis demonstrated a clear, statistically significant superiority of the HCST-supported OpV model, leading to a substantial 18.5 percentage point increase in vaccine uptake compared to conventional referral systems. Critically, the model also proved more reliable than standard OpV, yielding a 7.2 percentage point advantage by mitigating clinical workflow disruption. This efficiency translates directly into economic benefit, establishing the HCST model as the most cost-efficient strategy in the long term (Mean Cost-Per-Vaccine-Administered: $35.10 USD).

The central conclusion is that the success of OpV is determined not by clinical capacity, but by logistical capacity. HCSTs function as the indispensable systemic component that removes the primary barriers of "time" and "logistics" for both high-risk patients and busy providers, ensuring the OpV program is sustained and scalable. While this model successfully overcomes access hurdles, future public health efforts must concurrently focus on the remaining challenge: building patient trust to overcome vaccine hesitancy.

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