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PATIENT FLOW AND OPERATIONAL EFFICIENCY INTERVENTIONS IN PRIMARY HEALTH CARE CENTERS: EFFECTS ON WAITING TIME, SAFETY, AND SATISFACTION; A SYSTEMATIC REVIEW

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Abstract

Background: Primary health care centers (PHCs) face increasing demand, constrained staffing, and complex patient needs, contributing to delays, overcrowded clinics, missed appointments, and compromised patient experience. Interventions targeting patient flow and operational efficiency, such as open, advanced access scheduling, Lean process redesign, targeted reminders, and community-based models, reduce waiting time and improve satisfaction while maintaining safety. **Objective:** To synthesize evidence from original studies on patient flow and operational efficiency interventions in PHC, ambulatory primary care settings and evaluate effects on waiting time, access, safety, and satisfaction. **Methods:** A PRISMA-aligned systematic review was conducted using electronic databases as the full-text source. We included original interventional or quasi-experimental studies in PHC, primary care, ambulatory settings evaluating operational interventions with outcomes related to waiting time, access, safety, satisfaction, experience, or attendance. Ten original studies were included for results synthesis. **Results:** In included studies, open access scheduling reduced short-term appointment wait times but effects on satisfaction were inconsistent. Lean implementation reduced service waiting times and increased satisfaction in an ambulatory setting. Predictive-model–driven reminder strategies improved attendance and reduced no-shows, supporting better clinic capacity utilization. Community paramedicine integrated with primary care showed system-level improvements in flow and safety-related processes in PHC. Interventions that combined demand–capacity matching (scheduling, access redesign) with targeted attendance supports (risk-based reminders) were most consistently associated with improved operational outcomes. **Conclusion:** PHC operational efficiency interventions can reduce waiting time and improve satisfaction or attendance, but effects vary by implementation stability, staffing resilience, and context. Risk-stratified reminders and structured process redesign are supported by consistent findings, while open access scheduling requires safeguards for sustainability and continuity.

Keywords: Primary Care; Patient Flow; Operational Efficiency; Waiting Time; Appointment Access; Satisfaction; Safety; Lean; Reminders; Open Access Scheduling.

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INTRODUCTION

Timely access to PHC is a core dimension of quality and patient-centeredness, yet many systems struggle with long lead times to appointments, high no-show rates, and clinic congestion that worsens staff workload and patient dissatisfaction (Ansell et al. 2017). Operational constraints in PHC, fixed staffing, variable demand, and administrative burden, can create bottlenecks in scheduling, registration, triage, and visit completion. These bottlenecks increase perceived waiting time and reduce satisfaction, which is frequently linked to service quality perceptions in PHC settings (Zhang et al. 2023).

“Advanced access” (also called open access or same-day access) was developed to reduce appointment delays by redesigning schedules to better match supply and demand. Evidence suggests outcomes can vary, and implementation barriers (such as clinician leave, demand surges, and continuity pressures) can limit sustainability (Rose et al. 2011; Mehrotra et al. 2008). In parallel, Lean and process-improvement approaches aim to remove non-value-added steps and reduce waste in clinic workflows, often targeting waiting and handoffs that frustrate patients and staff (Samadbeik et al. 2024).

No-shows and late cancellations are another major operational driver of inefficiency in ambulatory care; missed visits waste capacity and can undermine access for other patients. Evidence shows missed appointments are not only an operational issue but correlate with poorer preventive and chronic care performance, making attendance support relevant to safety and outcomes (Hwang et al. 2015). System-level interventions, such as reminder systems, behavioral “nudges,” and risk-stratified outreach, have been tested to improve attendance and protect appointment capacity (Habibi et al. 2024). Telemedicine is also increasingly used as an operational strategy to reduce waiting and expand capacity, with evidence summarized in recent systematic analyses (Capodici et al. 2025). Given the diversity of operational interventions, PHC leaders need a practical synthesis focused on measurable outcomes: waiting time, access, safety signals, and satisfaction. This systematic review therefore summarizes original intervention evidence from PMC-indexed full texts, with emphasis on PHC-relevant operational change.

METHODS

Design and reporting

This review followed PRISMA principles for systematic identification, eligibility assessment, and synthesis of evidence.

Data source and search strategy

PMC, PubMed, WOS and Scopus were used as the full-text source. Searches combined terms related to primary care, primary health care, patient flow, operational efficiency, and outcomes (waiting time, access, satisfaction, safety, no-show). Example keywords included: primary care, primary health care, patient flow, waiting time, access scheduling, open access, advanced access, Lean, quality improvement, reminder, no-show, satisfaction.

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Eligibility criteria

Inclusion:

Original studies (randomized trials, pragmatic trials, controlled before–after, interrupted time series, QI with evaluative outcomes). PHC, primary care, ambulatory primary-care–linked settings (including community and integrated models influencing PHC flow). Evaluated an operational or patient-flow intervention. Reported at least one outcome: waiting time, access metric, attendance, no-show, satisfaction, experience, or safety-related process, outcome.

Exclusion:

Editorials, purely descriptive studies without an evaluated intervention. Non-PHC settings without relevance to primary care flow (unless the intervention was explicitly transferable to PHC operations and measured comparable outcomes). Non-PMC full text.

Study selection

Titles, abstracts were screened for relevance, followed by full-text eligibility assessment in PMC. Ten original studies were included for results synthesis.

Data extraction

From each included original study, we extracted: Setting, country, design, participants, volume, intervention components, comparator, usual care. Outcomes: waiting, access metrics (third next available), waiting time, attendance, no-show, satisfaction, and any safety, process indicators.

Risk of bias

Given heterogeneous designs, risk of bias was assessed qualitatively by design features (randomization, allocation, baseline comparability, objective outcome measurement, missing data, and time-related confounding for before–after studies). Findings were interpreted cautiously when designs were uncontrolled.

Synthesis approach

A narrative synthesis was performed due to intervention and outcome heterogeneity. Results are summarized by intervention type: scheduling, access redesign, reminder and attendance interventions, workflow, process redesign, and community-integrated service models affecting PHC flow.

RESULTS

Overview of included studies

The 10 included original studies evaluated operational interventions in primary care, PHC-linked ambulatory settings, including open access scheduling, reminder, outreach strategies (phone, text, risk-based targeting), Lean, process redesign, behavioral nudges, and community paramedicine integration.

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Table 1: Characteristics of included original studies

Study (year)	Setting	Design	Intervention	Comparator	Key outcomes reported
Mehrotra et al. (2008)	6 primary care practices (Boston, USA)	Case series	Open access scheduling implementation	Pre–post	3rd next available appointment wait, no show, patient, staff ratings of availability
Sampson et al. (2008)	General practice (UK)	Observational evaluation	Same day appointment system component	Usual scheduling	Patient satisfaction and access measures
Naidoo et al. (2016)	Rural outpatient clinic, hospital ambulatory services (South Africa)	Pre–post	Lean process changes	Baseline	Patient waiting time, staff satisfaction
Shah et al. (2016)	Hospital based primary care clinic (USA)	RCT	Targeted reminder phone calls for high risk no show patients	Automated reminder only	No show rate, reimbursement, efficiency measures
Lin et al. (2016)	Pediatric primary care clinic (USA)	RCT	Text message reminders	Usual reminder process	Appointment adherence, no show
Hammoudeh et al. (2021)	Ambulatory outpatient pharmacy (Jordan)	Pre–post QI	Lean management redesign	Baseline	Waiting time, patient satisfaction, staff satisfaction
Ulloa Pérez et al. (2022)	Primary care & mental health visits (USA)	Pragmatic randomized QI	2 vs 1 targeted text reminders for high risk visits	Single reminder	No show, same day cancellations
Teo et al. (2023)	Primary care (VA system, USA)	Pragmatic trial	Behavioral economics “nudge” messages	Standard messaging	Missed appointments, cancellations
Tarabichi et al. (2023)	Primary care ambulatory system (USA)	Randomized QI	Predictive model–driven live reminders for at risk patients	Standard care	No show and composite missed visit outcomes
Elden et al. (2025)	Primary health care (Sweden)	Mixed methods evaluation	Community paramedicine integrated with PHC	Usual services	Patient flow, safety, process indicators, service utilization

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Table 2: Main findings on waiting time, access, safety, and satisfaction, experience

Intervention type	Study	Main operational effect	Satisfaction, experience	Safety, process signals
Open, advanced access scheduling	Mehrotra et al. (2008)	Short term improvement in appointment access: mean 3rd next available wait reduced (21→8 days for short visits, 39→14 days for long visits), but later increased over follow up	No significant improvement in patient, staff ratings of availability in that evaluation	Implementation vulnerable to provider leave, demand instability (continuity risk noted)
Attendance focused outreach (phone)	Shah et al. (2016)	Targeted live calls to high risk patients reduced no shows (reported as statistically significant in trial)	Supports perceived access by freeing capacity	Reduce fragmented care associated with missed visits
Attendance focused outreach (text reminders)	Ulloa Pérez et al. (2022)	In high risk primary care visits, additional text reduced no shows by 7% (RR 0.93) and same day cancellations by 6% (RR 0.94)	Not primary endpoint	Improves efficiency by reducing wasted slots
Predictive model–driven live reminders	Tarabichi et al. (2023)	Reduced missed appointments (missed appointments 27.1% vs 30.7%, and composite no show outcomes 32.8% vs 36.2%)	Not primary endpoint	Targeting reduce disparities in access, use
Workflow, process redesign (Lean)	Naidoo et al. (2016)	Reduced waiting time in rural ambulatory setting after Lean changes	Improved staff satisfaction reported	Process reliability and reduced delays can support safer operations
Workflow, process redesign (Lean)	Hammoudeh et al. (2021)	Waiting time decreased substantially (22.3→8.1 min for <3 meds, 31.8→16.1 min for ≥3 meds)	Patient satisfaction increased (62%→69%) and staff reported improved work experience	Reduced congestion and improved workflow coordination
Behavioral “nudge” messaging	Teo et al. (2023)	Nudge based messaging associated with improved attendance behaviors (missed visit outcomes targeted)	Not primary endpoint	Efficient cancellations improve capacity use
Text message reminders (pediatric primary care)	Lin et al. (2016)	Increased appointment adherence vs control	Not primary endpoint	Fewer missed visits reduces care gaps
Integrated community paramedicine + PHC	Elden et al. (2025)	Improved PHC system flow through alternative care pathways and coordination	Patient, clinical team experience explored	Reported attention to patient safety processes in integrated model
Same day appointments in general practice	Sampson et al. (2008)	Improved rapid access to appointments (service level effect)	Mixed satisfaction impacts depending on continuity and expectations	Potential continuity trade offs must be managed

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In studies, two clusters of interventions showed the most consistent operational benefit: (1) attendance optimization using targeted reminders and risk stratification (Shah et al. 2016; Ulloa-Pérez et al. 2022; Tarabichi et al. 2023), and (2) process redesign (Lean) targeting bottlenecks and queueing delays (Naidoo et al. 2016; Hammoudeh et al. 2021). Open access scheduling improved appointment lead time early but demonstrated sustainability challenges and inconsistent satisfaction gains (Mehrotra et al. 2008). In models extending beyond the clinic walls, such as community paramedicine integrated with PHC, system-level effects on flow and safety-related processes were reported, suggesting value where appropriate governance and coordination exist (Elden et al. 2025).

DISCUSSION

This review found that operational efficiency interventions can improve PHC access and flow, but outcomes differ based on implementation fidelity, demand–capacity balance, and whether interventions address both supply (workflow, staffing, scheduling design) and demand, attendance (no-show prevention, appropriate triage pathways).

System-level evidence supports that a range of interventions can reduce primary care appointment wait times, but heterogeneity and context are substantial (Ansell et al. 2017). Open, advanced access scheduling is designed to reduce delays, and systematic review evidence indicates variable effects in settings (Rose et al. 2011). In the included case-series, open access reduced the third next available appointment wait substantially in the short term but did not achieve same-day access and showed rebound increases over longer follow-up, emphasizing sustainability challenges (Mehrotra et al. 2008). These findings align with broader concerns that advanced access requires operational resilience, stable staffing, controlled demand, and protected continuity, to avoid regression.

Telemedicine also increasingly functions as an operational “capacity extender.” Evidence synthesis suggests telemedicine can reduce outpatient waiting times in certain configurations, but the magnitude and generalizability depend on case-mix and implementation model (Capodici et al. 2025). For PHC, telemedicine most impactful when used to offload low-acuity follow-up, medication reviews, or triage functions, thereby preserving in-person capacity.

Missed appointments represent “hidden waste” that directly erodes capacity and increases waiting time for others. Observational evidence links missed appointments with poorer preventive and chronic care performance, raising both quality and safety implications (Hwang et al. 2015). The included randomized and pragmatic studies suggest that targeted reminder strategies can modestly but meaningfully reduce no-shows at scale, translating into improved operational efficiency (Shah et al. 2016; Ulloa-Pérez et al. 2022; Tarabichi et al. 2023). Importantly, the trials that used risk stratification or predictive models focus resources where they are most likely to yield benefit, a principle consistent with the broader literature on reducing no-shows and optimizing access systems (Habibi et al. 2024). Quality improvement in general practice settings has also

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shown that structured programs can reduce missed appointments, supporting the feasibility of operational change in real-world primary care (Margham et al. 2020).

Lean and related process-redesign methods aim to reduce unnecessary steps, smooth queues, and improve standard work. While not all Lean studies in “pure PHC centers” are available as accessible trials, the included evidence from ambulatory environments shows large reductions in waiting time and improvements in satisfaction (Naidoo et al. 2016; Hammoudeh et al. 2021). From a safety perspective, reduced congestion and clearer workflows lower error risk by decreasing interruptions, rushed care, and handoff confusion, mechanisms commonly discussed in broader patient-flow evidence (Samadbeik et al. 2024). However, safety outcomes were infrequently measured directly in the included PHC-centered intervention studies, representing an evidence gap.

CONCLUSION

Operational and patient-flow interventions in PHC and primary-care–linked ambulatory settings can improve access and reduce wasted capacity. The most consistent benefits were seen with targeted reminder strategies and predictive-model–guided outreach that reduced missed appointments, as well as workflow redesign approaches that reduced waiting and improved satisfaction. Open access scheduling can reduce appointment waits rapidly but not sustain gains without demand–capacity controls and staffing resilience. Future PHC studies should measure safety outcomes explicitly and compare combined intervention bundles against usual care.

Abbreviations

ED: Emergency department

PHC: Primary health care

PHC center: Primary health care center

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

QI: Quality improvement

RCT: Randomized controlled trial

RR: Relative risk

VA: Veterans Affairs

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