

Change management and workflow redesign for electronic medical record adoption in a high-volume public allergy center in Pakistan: a mixed-methods quality improvement study

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Abstract

Background.

The National Allergy Centre (NAC) in Islamabad is the only public-sector allergy immunotherapy facility in Pakistan and sees several hundred patients a day. Before this project it operated entirely on paper, with no appointment or triage system, long queues, fragmented and duplicated records, and clinical staff diverted to manual data entry. Documented public-sector experience of electronic medical record (EMR) implementation in Pakistan and the wider region is scarce. We describe a healthcare-manager-led EMR implementation and the change-management approach used to enable adoption.

Methods.

This single-site, mixed-methods quality improvement study, reported to SQUIRE 2.0, ran over about five months around go-live. A manager-led needs assessment (interviews with staff and patients, observation and record review) identified barriers. The intervention paired Kotter's eight-step change-management model with a concurrent redesign of patient flow. Operational measures (registration time, daily registrations, patients examined, vaccinations given and length of stay) were compared before and after go-live and summarized descriptively; no statistical testing was performed.

Results.

The main barriers were organizational and human rather than technical: no appointment or triage system, fragmented records, a single shared entrance and exit, crowding and staff resistance. The response combined change-management levers (a repeated vision, team and one-to-one engagement, phased training, feedback and recognition) with operational redesign (separate entry and exit points, an added registration counter with dedicated cash counters, a nurse-led triage room, token-based queue management and peak-hour staffing). After go-live, reported registration time fell from about 12 to 8 minutes for new patients and from 5 to 3 minutes for returning patients, approximate length of stay fell from two or three hours to under one hour, and daily patients examined and vaccinations given both rose. Several evidence-based measures, including an appointment system, telehealth and additional hiring, could not be funded.

Conclusions.

In this high-volume public facility, the binding constraints on EMR adoption were organizational, not technological. Pairing a change-management framework with concurrent workflow redesign enabled adoption and improved patient flow, even where preferred technical solutions were unaffordable. The

account offers transferable lessons for comparable public facilities in Pakistan and other low- and middle-income settings.

Background

Electronic medical record (EMR) systems can improve the quality, communication and efficiency of care, although the size of the gains depends on how well a system fits clinical routines [1, 2]. When adoption is treated as a technical exercise rather than an organizational change, deployments often fail, produce unintended consequences, or add to clinician workload [5, 6, 7, 8]. Evidence from low- and middle-income countries (LMICs) is thinner, and what exists points consistently to infrastructural, financial, human and behavioral barriers, with leadership, training and stakeholder engagement as the factors that decide whether adoption holds [9, 10, 11, 12]. Health systems across the region are moving towards digital records, yet documented public-sector implementation experience remains scarce, and Pakistan is under-represented in this literature.

The National Allergy Centre (NAC) opened within the National Institute of Health in Islamabad in 1981 and remains Pakistan's only public-sector facility for allergy diagnosis and immunotherapy. It sees 600 to 700 patients on a typical day and up to about 1,000 in peak seasons. When this project began, the centre still ran entirely on paper. Patients arrived on a first-come, first-served basis, queued for hours, and often left unseen. Returning patients were re-registered as new because their records could not be found, nurses and technicians spent much of the day entering data by hand, and a single door served as both entrance and exit. The result was long waits, crowding and a real risk of error from missing or duplicated records.

Change-management frameworks are widely recommended for this kind of work but documented in practice far less often, particularly in high-volume LMIC facilities [13, 14, 15, 16, 17, 18]. Kotter's eight-step model was chosen here for a specific reason. If the binding constraints on adoption were social and organizational, that is, staff resistance, weak communication, unstructured workflow and a congested layout, rather than the software itself, then a change effort aimed at those constraints should do more to enable adoption than further technical work. Kotter's steps map onto exactly those levers, and the model has been used elsewhere to frame EMR implementation as socio-technical rather than purely technical [13, 17]. Pairing it with a redesign of patient flow followed from the same logic: change management would win staff over, while the redesign would clear the physical and process obstacles the EMR could not overcome on its own.

To our knowledge, this is the first documented account of a public-sector EMR implementation at a national specialty facility in Pakistan; comparable operational data from this setting have not previously been published, and the lessons are relevant to health services managers and policymakers across similar public facilities in the region and other LMICs. The aim of this report is to describe the barriers identified at baseline, the change-management and workflow strategy used, and the operational measures observed before and after go-live, and to draw transferable lessons for comparable facilities.

Methods

Study design and reporting

This was a single-site, prospective, mixed-methods quality improvement study, reported in line with the Standards for Quality Improvement Reporting Excellence (SQUIRE 2.0). It combined a qualitative needs assessment to characterize barriers and enablers with operational measures compared before and after go-live. The design is descriptive; measures are reported as observed rather than as the output of a formal statistical design. The project ran about five months around go-live, with roughly two months of observation afterwards.

Setting

The NAC serves patients from across Pakistan and from neighboring countries. Common presentations are allergic rhinitis, bronchial asthma, urticaria, atopic eczema, food allergy and allergic conjunctivitis. At the time of the project, it ran outpatient services Monday to Friday with 6 doctors, 8 nurses and about 40 support staff, three combined registration and cash counters, and no appointment or triage system (Table 1).

Table 1
Characteristics of the study setting at baseline.

Characteristic	National Allergy Centre
Facility type	Public specialty center (allergy diagnosis and immunotherapy); only public-sector allergy facility in Pakistan
Location and host	National Institute of Health, Islamabad; established 1981
Service hours	Outpatient services, Monday to Friday; 24-hour emergency cover
Daily attendance	600 to 700 patients typically; up to about 1,000 in peak seasons
Common presentations	Allergic rhinitis, bronchial asthma, urticaria, atopic eczema, food allergy, allergic conjunctivitis
Staffing	6 doctors, 8 nurses, about 40 support staff
Record system (baseline)	Paper-based; three combined registration and cash counters; no appointment or triage system

Intervention

An EMR product had been chosen, and installation had begun before a healthcare manager joined, but no cross-functional team and no plan linked the software to how the clinic ran. A dedicated implementation team was formed, with a technical side (chief information officer, project manager, operations manager and two software engineers) and an administrative side (the medical

superintendent, an EMR implementation lead and the healthcare manager). The intervention had two parts that ran together (Table 2, Fig. 1). The first was change management following Kotter's model: the vision for the EMR was communicated repeatedly; regular multidisciplinary meetings brought the two teams into one room to settle problems; one-to-one engagement cleared worries that staff would not raise in a group; training began about two months before go-live, with rehearsal on a test database; and feedback loops and visible recognition, including completion certificates, kept staff involved. The second was workflow redesign: separate entrance and exit points replaced the single shared door; a fourth registration counter was added and cash counters were split off from registration; a nurse-led triage room sorted patients by urgency and allergy type before consultation; token-based queue management replaced crowding at the counters; and continuous monitoring let staff be moved to triage and testing during the 10:00 to 14:00 peak. Some measures identified as useful, an online appointment system, extra hiring, and digital options such as electronic check-in and telehealth, could not be put in place because public-sector funding and multi-level approvals were not available.

Table 2
Baseline barriers mapped to the improvement responses adopted.

Barrier	Response adopted	Lever
Staff resistance to change	Repeated vision communication, team meetings, one-to-one engagement, recognition	Change management
Untrained personnel	Phased pre-go-live training; test-database rehearsal; feedback-driven refresher training	Change management
Weak inter-staff communication	Regular multidisciplinary team meetings; structured feedback loops	Change management
Fragmented, duplicated records	EMR record capture and retrieval replacing paper files	Technical
Clinical staff diverted to data entry	EMR registration workflow; task re-allocation to counters	Technical / workflow
Shared entrance and exit bottleneck	Separate dedicated entrance and exit points	Workflow redesign
Counter congestion	Fourth registration counter; separate cash counters	Workflow redesign
No triage; undifferentiated flow	Nurse-led triage room; sorting by urgency and allergy type	Workflow redesign
Crowding and long queues	Token-based queue management; peak-hour dynamic staffing	Workflow redesign
No appointment system; understaffing	Identified but not implemented (funding and approval constraints)	Constrained

Data collection and measures

The needs assessment used semi-structured interviews with staff across roles and with patients, direct observation of workflow, and review of facility records; responses were captured as written notes and short structured surveys, since audio recording was not permitted. The interview and survey guide used for the needs assessment and the post-implementation evaluation was developed specifically for this study and is provided as Additional file 1. Measures were chosen to reflect the bottlenecks found at baseline: daily registrations (total, new and returning); mean registration time per patient (new and returning); patients examined per day; vaccinations given per day; and length of stay. Values came from facility-level operational observation and were recorded by the implementation team during routine work. Several are reported as approximate ranges, as they were recorded. Patient-level data held inside the EMR could not be extracted or analyzed because of data-protection and institutional-security rules, which limits the precision and completeness of the measures.

Analysis

Quantitative measures were compared descriptively before and after go-live (Table 3, Fig. 2). Given the small number of aggregates, approximate data points, no statistical testing was performed and no run chart was constructed. Because the workflow redesign ran at the same time as the EMR rollout, the design cannot separate the effect of the EMR from that of the redesign, nor from seasonal change in attendance; observed change is reported as association, not effect. Qualitative material from interview notes and surveys was summarized thematically to identify barriers and enablers; it was not formally coded by independent reviewers.

Ethics and consent

The work was carried out as a service-improvement and quality improvement project within the facility, with permission from the organization's administration. Participants gave consent before interviews and surveys, and no identifiable patient-level clinical data were extracted or reported. The ethics determination and reference number are stated in the Declarations.

Use of generative artificial intelligence

A large language model (Claude, Anthropic) was used to assist with drafting, language editing and formatting of this manuscript. It was not used to generate or analyze the study data. All content was reviewed, verified and approved by the authors, who take full responsibility for the integrity and accuracy of the work.

Results

Barriers identified at baseline

The needs assessment found barriers that were mostly organizational, behavioral and infrastructural rather than technical.

- **No appointment or triage system.** First-come, first-served care meant long waits, early-morning crowding and no structured route for follow-up, consistent with evidence that queue-only models lengthen ambulatory waits [27].
- **Fragmented paper records.** Records were often mislaid, duplicated or incomplete; returning patients were re-registered as new, and gaps in histories opened the door to error.
- **Clinical staff pulled into data entry.** Nurses and technicians spent much of their time on manual data entry instead of clinical work, a recognized driver of documentation burden and burnout [24, 25, 26].
- **Staff resistance to change.** Many staff, long used to paper, expected the new system to be slower, harder to learn or more impersonal, a common reaction during EMR transitions [23, 28, 30].
- **Untrained staff and heavy load.** Staff did not know the system, and steady high attendance made both training and go-live hard to schedule.
- **One door for entry and exit.** A single shared door created a physical bottleneck that made the crowding worse.

Implementation

Training started about two months before go-live, and a subset of staff rehearsed on a test database. Instructor shortages, capacity limits and staff being pulled back to clinical duties stretched the schedule, so refresher sessions were needed close to go-live. Team meetings were frequent early and tapered as competence grew. Monitoring continued for about two months after go-live.

Process and outcome measures

Over the two-month window after go-live, the facility recorded gains across the chosen measures (Table 3, Fig. 2). Reported registration time per patient fell from about 12 to 8 minutes for new patients and from about 5 to 3 minutes for returning ones. Approximate length of stay dropped from two or three hours to under one. Daily patients examined rose from an estimated 150 to 250 towards close to all registered patients, and vaccinations given rose from about 100 to 150 up to 130 to 180 per day, with a modest rise in daily registrations. Staff and patient feedback during monitoring described more accurate and complete records, better coordination and a smoother visit.

Table 3
Process and outcome measures before and after EMR implementation (facility-level, approximate).

Measure	Before	After
Patients registered per day (total)	200 to 300	250 to 300
New patients	70 to 90	100 to 120
Returning patients	130 to 160	150 to 200
Registration time, new patients	about 12 min	about 8 min
Registration time, returning patients	about 5 min	about 3 min
Patients examined per day	150 to 250	close to all registered
Vaccinations given per day	100 to 150	130 to 180
Length of stay	2 to 3 hours	under 1 hour

Contextual factors, unintended consequences and missing data

Two contextual points shaped the result. The strongest lever for regulating flow, an online appointment system, along with extra hiring and telehealth, could not be funded, so the team relied on lower-cost workflow fixes instead. And EMRs do not remove documentation burden on their own; they can add to it where usability is poor [25]. The gains here came with a redesign that moved routine data entry off clinical staff and should be read in that light. On missing data: the measures are facility-level, and several are approximate ranges, patient-level EMR data could not be extracted, and the post-implementation window was short, so sustainability was not assessed.

Discussion

At a high-volume public allergy center in Pakistan, the main constraints on EMR adoption were organizational and human, not technological. Software selection and installation were largely done before the change effort started; what was missing was a cross-functional coalition, a plan tying the system to clinic workflow, staff engagement, and a layout that could absorb the new process. A manager-led approach that joined a recognized change-management framework to a parallel workflow redesign enabled adoption, and it was accompanied by shorter registration times, a shorter stay and higher throughput.

These findings sit with a steady message in the implementation literature: EMR adoption is a business-process and cultural change with an information-technology component, and success turns on leadership, communication, training and stakeholder engagement [5, 6, 13, 16, 18]. A close precedent is a case study of a large hospital that used Kotter's model and concluded that EMR implementation is not a

pure information-technology project but a socio-technical one that demands specific leadership competencies [17]. The way organizational, financial and behavioral barriers outweighed technical one's echoes LMIC studies from Ethiopia, urban-slum clinics and multi-country reviews [9, 10, 11, 12], as does the prominence of staff resistance and documentation burden [23, 24, 25, 26, 28, 30].

Implications for practice and policy

For managers running EMR adoption in similar facilities, a few priorities transfer: convene a cross-functional implementation team early and give it a mandate; treat the EMR as a change programme and use a structured model to sequence urgency, coalition, vision, communication and consolidation; redesign patient flow in parallel rather than laying software over a congested process; and keep training, feedback and recognition going through go-live and beyond. The account also shows a constraint particular to public-sector settings: even where a manager identifies evidence-based solutions, procurement, hiring and multi-level approvals can put them out of reach, so the team substituted low-cost workflow changes for the appointment system it could not fund [9, 10]. For policymakers, digitizing a public facility takes more than buying software; budget lines and quicker approvals for the complementary inputs, appointment systems, staffing and connectivity, are what let the expected benefits appear at scale. These lessons are transferable to comparable public facilities across Pakistan and other LMICs.

Strengths and limitations

The main strength of this study is that it documents a real, framework-guided implementation in a setting that is rarely written up, a high-volume public specialty facility in Pakistan, with a manager's account of the barriers met and the levers used, and operational measures tracked across go-live. The limitations are substantial. This is a single-site, uncontrolled before-and-after study, so change cannot be attributed causally to the EMR as opposed to the parallel workflow redesign, seasonal swings in attendance, or wider trends. The measures are facility-level and approximate, several are ranges, and none were tested statistically; no run chart was used, and no numeric target was set in advance. Detailed EMR data could not be extracted because of security rules. The observation window was short, about two months, too short to judge whether the gains held, and the qualitative material was captured as notes and surveys rather than recorded and formally coded. Findings should therefore be read as transferable lessons and hypotheses for evaluation, not as measures of effect. Later work should track measures over time, analyze patient-level data where governance allows, add validated user-acceptance and satisfaction measures, and, where possible, compare across sites.

Conclusions

Putting an EMR into a high-volume, resource-constrained public facility is mainly a job of leading organizational change, not installing technology. Pairing Kotter's change-management model with a parallel redesign of patient flow enabled adoption and was accompanied by faster registration, a shorter stay and higher throughput, even where the preferred technical fixes were unaffordable. The approach is

low-cost and should transfer to comparable public facilities in Pakistan and other LMICs. To confirm and extend these gains, later work should track measures over time, analyze patient-level data where governance allows, add validated user-acceptance measures, and compare across sites.

Abbreviations

EMR: electronic medical record; NAC: National Allergy Centre; NIH: National Institute of Health; LMIC: low- and middle-income country; QI: quality improvement; SQUIRE: Standards for Quality Improvement Reporting Excellence; ICMJE: International Committee of Medical Journal Editors.

Declarations

Ethics approval and consent to participate. This work was a quality improvement and service-evaluation initiative rather than a research study, and was conducted and authorized as such by the Transformation and Excellence, Center for Health at the National Institute of Health, Islamabad, the institutional body responsible for the electronic medical record implementation, which confirmed its authorization in writing (letter dated 17 April 2023). In accordance with the local institutional arrangements at the time, this quality improvement and service-evaluation activity was undertaken with institutional authorization and was not submitted for separate research ethics committee review, as it was not classified as human-subjects research. It was conducted in accordance with the ethical principles of the Declaration of Helsinki. All reported data are aggregate, non-identifiable, facility-level operational metrics, and no identifiable patient-level clinical data were extracted or reported. Informed consent to participate was obtained from all participants (staff and patients) before the interviews and surveys.

Consent for publication. Not applicable; the manuscript contains no data or details relating to any individual person.

Availability of data and materials. The datasets generated and/or analyzed during the current study are not publicly available because of institutional data-protection and security restrictions on the facility's records, but non-identifiable operational summaries are available from the corresponding author on reasonable request and with institutional permission.

Competing interests. The authors declare that they have no competing interests.

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Authors' contributions. PA contributed the electronic medical record implementation project as health manager, carried out the needs assessment, data collection, and the change-management and workflow interventions, and drafted the manuscript. SA contributed to writing and critically revising the manuscript and provided additional content. SM provided senior supervision and oversight of the work. All authors read and approved the final manuscript.

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Note: add a DOI to each reference where available (BMC style) and verify every citation before submission. The list uses BMC Vancouver style with sequential numbering matching the square-bracket in-text citations.

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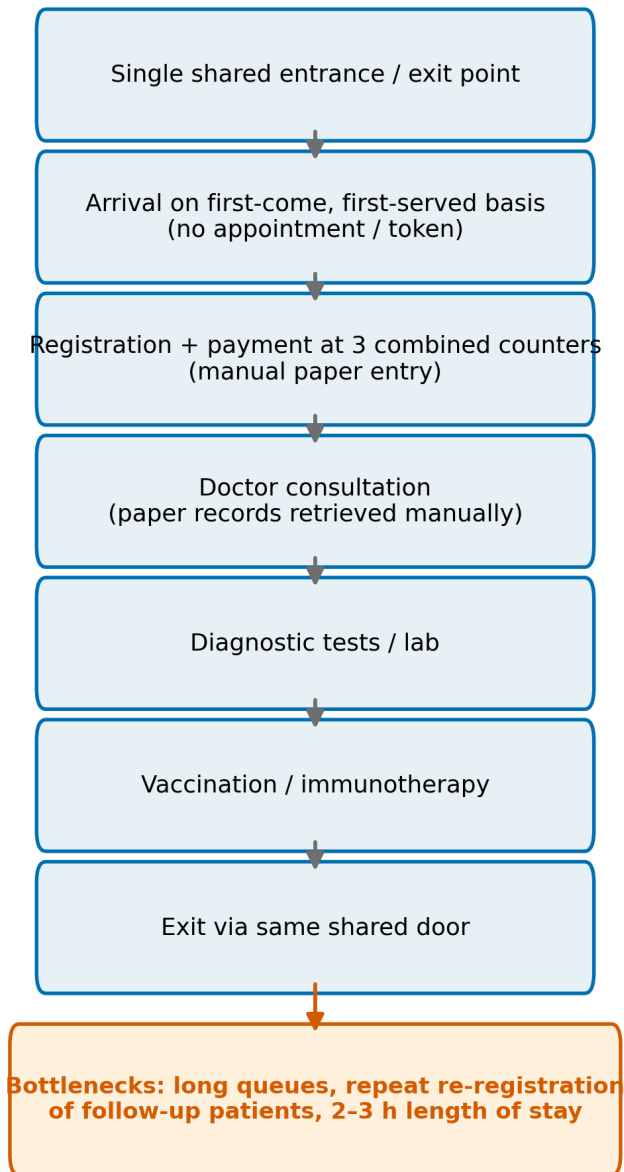
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Figures

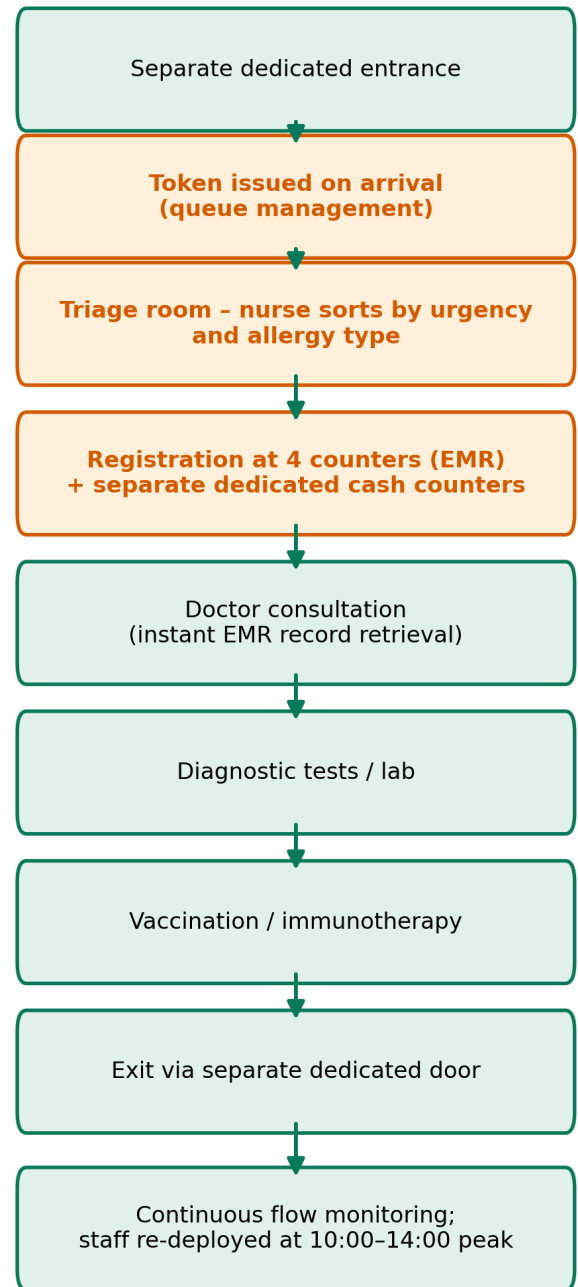
BEFORE

Manual, paper-based; single entry/exit; first-come, first-served



AFTER

EMR-enabled; separate entry/exit; triage + token flow



New / redesigned element

Figure 1

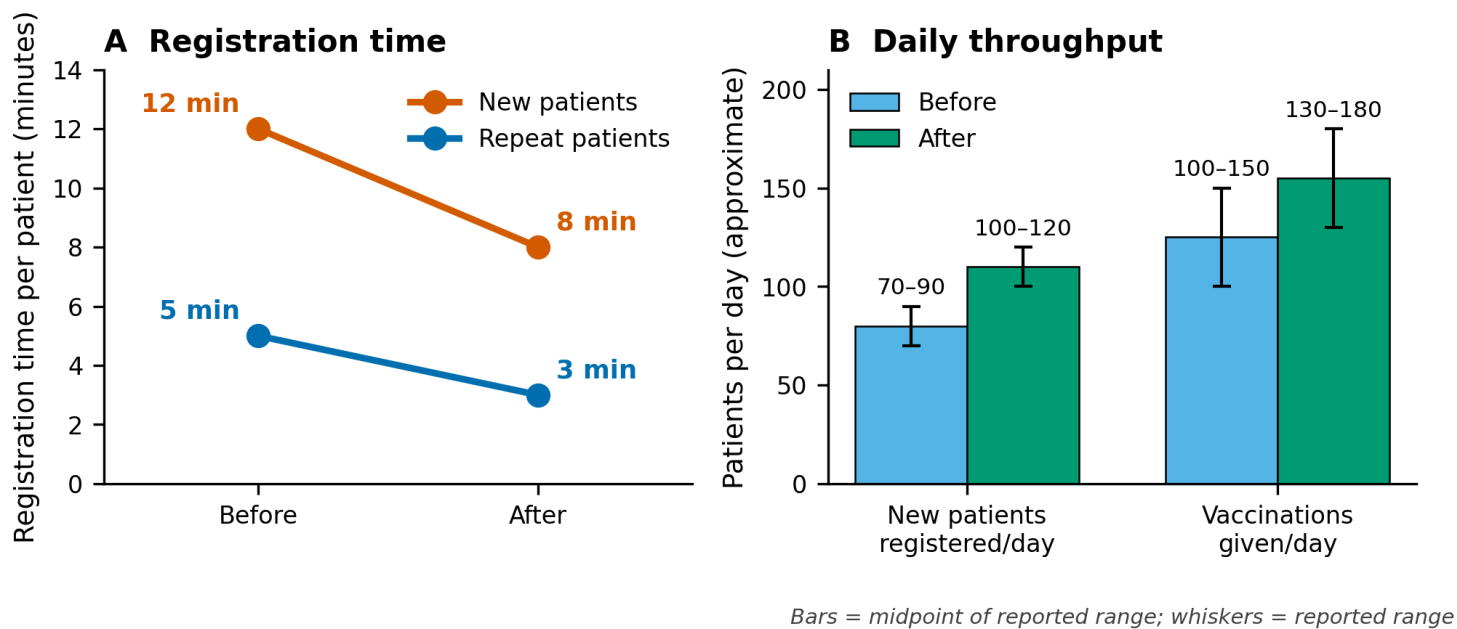


Figure 2

Supplementary Files

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- [SQUIRE2.0checklistBMC.docx](#)