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OPTIMISING ACUTE CARE DELIVERY IN RESOURCE-CONSTRAINED SETTINGS: A SCOPING REVIEW OF INTERVENTIONS, OUTCOMES, AND IMPLEMENTATION REALITIES

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ABSTRACT

Objectives: To synthesise evidence on quality improvement (QI) and audit-based interventions in emergency and acute care in resource-constrained settings, focusing on South Asia and implementation.

Design: Scoping review reported in accordance with PRISMA-ScR.

Data sources: Semantic search of >138 million papers in Semantic Scholar and OpenAlex via Elicit, plus targeted wider LMIC emergency care searches.

Eligibility criteria: South Asian emergency or acute care studies evaluating QI, clinical audit, continuous QI or audit–feedback interventions, reporting process, patient or system outcomes, and published in full.

Data extraction and synthesis: Machine-assisted charting of context, interventions, outcomes, implementation factors and design, then descriptive and thematic synthesis.

Results: Eighty South Asian sources were charted, with about 25 wider-LMIC sources. Process outcomes improved across triage, timeliness, guideline adherence and documentation. Mortality fell where baseline deficits were large; higher-performing systems gained process improvement without mortality benefit. Six themes were iterative cycles, training, checklists/protocols, leadership and team engagement, resource constraints and fragile prehospital/referral systems.

Conclusions: Locally adapted, team-based QI improves emergency care processes; patient-outcome effects depend on baseline deficits, staffing, supply chains and institutional embedding.

Keywords: Quality Improvement; Emergency Care; Low- And Middle-Income Countries; Clinical Audit

1 INTRODUCTION

1.1 Rationale

Emergency and acute care in resource-constrained settings warrants strengthening for three reasons. Poor-quality care now causes more deaths than non-use of services, with millions of deaths annually amenable to better care in low- and middle-income countries (LMICs).[1] Acute conditions impose a heavy, inequitable burden: in 2017, 48.9 million sepsis cases and 11 million sepsis deaths occurred worldwide, about 85% in LMICs.[2] Achievable improvements in trauma care could save nearly two million lives each year, mostly in less developed countries.[3] Emergency care systems could address approaching half of deaths and disability in 59 LMICs, yet remain underdeveloped and understudied.[4] WHO therefore places timely care for the acutely ill and injured within universal health coverage.[5]

Quality improvement (QI) and audit-based strategies—Plan-Do-Study-Act (PDSA) cycles, clinical audit and feedback, checklists, care bundles, pathways and structured training—are the principal means by which frontline teams seek to close the gap between best practice and delivered care. Classic work in seriously ill children attributed much hospital mortality in less-developed countries to inadequate assessment, delayed treatment and failures of basic supportive care rather than to irremediable resource absence,[6] and African scoping work showed measurable emergency care quality alongside a thin interventional evidence base.[7] Evidence remains scattered across domains, single facilities and countries, and has not been consolidated for South Asia.

1.2 Objectives and review questions

This scoping review maps and synthesises evidence on QI and audit-based interventions in emergency and acute care in resource-constrained settings, with a primary South Asian evidence base and a supplementary wider-LMIC frame. The review questions were:

- What QI and audit-based interventions have been implemented and evaluated in emergency and acute care in resource-constrained settings?
- What effects have these interventions had on process outcomes (timeliness, triage accuracy, guideline adherence, documentation), patient outcomes and system outcomes?
- What implementation factors—methods, intervention components, leadership and team structures, resource constraints and prehospital/referral linkages—explain variation in effectiveness and sustainability?

2 MATERIALS AND METHODS

2.1 Protocol and registration

No protocol was published or registered for this review. Reporting follows the PRISMA-ScR checklist.

2.2 Eligibility criteria

Sources were eligible if they met all of the following criteria, judged holistically at abstract screening: (i) *setting*—emergency departments, emergency care units or acute care settings in South Asian countries (Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka); (ii) *intervention*—a quality improvement, clinical audit, continuous quality improvement or audit–feedback intervention; (iii) *design*—randomised controlled trial, quasi-experimental, before-and-after, interrupted time series, cohort, systematic review or meta-analysis (cross-sectional surveys, case reports, case series and purely descriptive studies were excluded); (iv) *outcomes*—quantitative or qualitative measures of patient, process or system outcomes; and (v) *publication status*—full publications (conference abstracts and protocols excluded). Supplementary targeted searches applied analogous criteria to emergency care QI literature from LMICs outside South Asia.

2.3 Information sources

We performed a semantic search across more than 138 million papers using Elicit, which indexes Semantic Scholar and OpenAlex. Supplementary targeted searches identified non-South-Asian LMIC literature on emergency care triage, training, trauma systems and prehospital care.

2.4 Search

The semantic search used the concept query: “Quality improvement/audit-based interventions in emergency care in South Asia—what’s been tried, what improved outcomes.” The single retrieval pass returned the 1000 most relevant records for screening (searched August 2026).

2.5 Selection of sources of evidence

Records were screened by abstract against the eligibility criteria; all screened-in sources underwent data extraction.

2.6 Data charting process and data items

Data charting was machine-assisted: a large language model extracted structured data using prespecified instructions, and the research team checked charted data against sources. Data items comprised context, intervention, outcomes, results, implementation factors and study design.

2.7 Synthesis of results

We used descriptive numerical synthesis to summarise source characteristics and intervention effects by clinical domain, and thematic analysis to identify cross-cutting implementation patterns. No meta-analysis was attempted given heterogeneity.

2.8 Critical appraisal

Formal critical appraisal of individual sources was not undertaken (optional under PRISMA-ScR); the design hierarchy is described and the strength of inference from each design class is considered throughout.

3 RESULTS

3.1 Selection of sources of evidence

The semantic search identified 1000 records. After abstract screening, 454 records were excluded and 546 sources underwent data extraction. Eighty South Asian sources were charted in depth, and approximately 25 wider-LMIC sources were included for contextual synthesis—approximately 105 sources in total (figure 1).

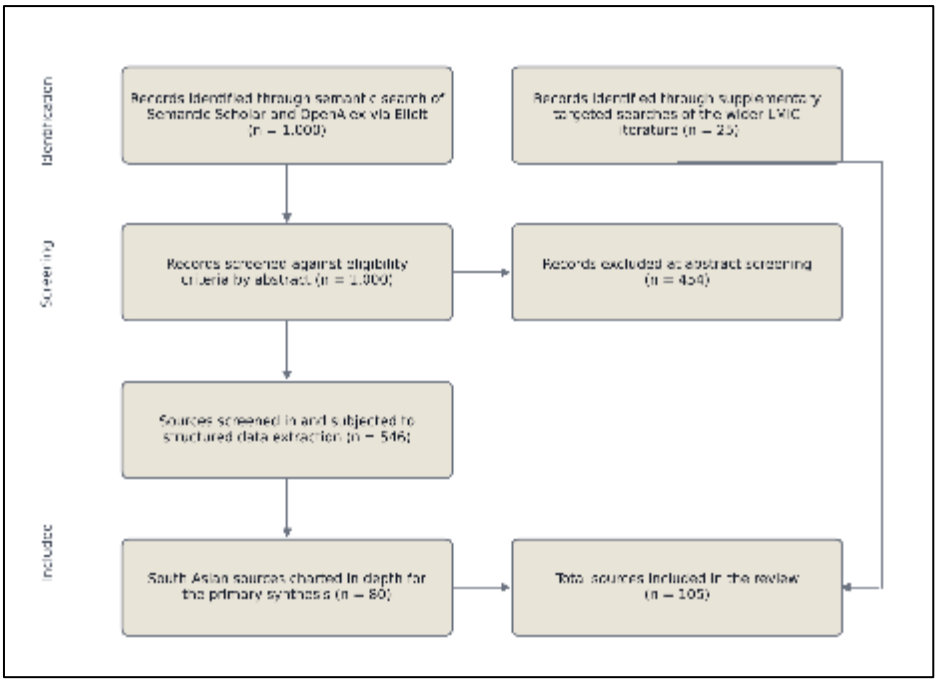

Figure 1: PRISMA-ScR flow diagram of the selection of sources of evidence.

3.2 Characteristics of sources of evidence

The 80 charted South Asian sources span India (approximately 40 studies), Pakistan (approximately 15), Nepal, Sri Lanka, Bangladesh and Bhutan, within an eligibility frame extending to Afghanistan and Maldives. Facility types range from primary health centres to quaternary academic centres and a Level 1 trauma centre; clinical domains include ED operations, triage, sepsis, cardiovascular emergencies, trauma, respiratory illness, stroke, neonatal and obstetric care, training, documentation and infection control, and prehospital and referral systems (table 1).

Designs are predominantly uncontrolled before–after studies or single-arm PDSA projects. The stronger tier comprises a stepped-wedge cluster randomised trial of neonatal resuscitation QI in Nepal,[8] cluster randomised trials of

emergency obstetric skills training in Pakistan[9] and onsite nurse mentoring in Karnataka,[10] the ACS QUIK stepped-wedge trial in Kerala,[11] and controlled interrupted time-series analyses of trauma QI in urban India.[12, 13] Quasi-experimental plausibility studies in maternal and neonatal care[14, 15] and a Kerala interrupted time-series study of acute heart failure[16] occupy an intermediate tier; the remainder rely on historical controls, so secular trends threaten internal validity.

Table 1: Condensed summary of included evidence by clinical domain (representative studies).

Domain	Representative studies	Settings/ countries	Designs	Headline quantitative findings
Triage and patient flow	[17–23]	Rural maternity hospital, Delhi paediatric ED, tertiary EDs (India); Patan Hospital (Nepal); teaching hospital (Sri Lanka)	Before–after (PDSA/PDCA), audit cycles, Kaizen redesign	Correct obstetric triage 49%→>95% and triage wait 40→<10 min; appropriate paediatric care 16–17%→63%; treatment initiation 30→10 min and mortality 26.2%→20.9% (p=0.021); triage accuracy 48.7%→65.3%; registration time 50–60→10–12 min
Sepsis and time-critical emergencies	[24–28]	Tertiary EDs (New Delhi, Lahore, Karachi, Peshawar); subdistrict hospitals (rural Bangladesh)	Before–after (PDSA), audit–feedback	Door-to-antibiotic time 155→78 min; cultures before antibiotics 0%→67.7%; hour-1 bundle compliance 0%→57.7%; antibiotics <1 h in 85% and time-to-antibiotic 35 min (Bangladesh); 1-h antibiotic adherence 40%→75%
Cardiovascular emergencies	[11, 16, 29–31]	63 hospitals, Kerala (India); tertiary hospitals (India, Karachi)	Stepped-wedge cluster RCT, interrupted time series, before–after, quasi-experimental	ACS QUIK: no reduction in 30-day composite (5.3% vs 6.4%; adjusted OR 0.98, 95% CI 0.80–1.21); heart failure guideline therapy 28.1%→41.3%; door-to-balloon 88→71.7 min, ≤90-min compliance ∼46%→97%
Trauma	[12, 13, 32–34]	Tertiary urban hospitals and Level 1 trauma centres (India); tertiary ED (Nepal)	Controlled interrupted time series, quasi-experimental, prospective cohort	In-hospital mortality 32%→24% (OR 0.57, 95% CI 0.41–0.79) and 30-day mortality 39%→26%; 90-day EQ-5D decline −4.07 (95% CI −7.00 to −1.15); paediatric 72-h survival 86%→94.5%; trauma checklist documentation gains (e.g., motor exam 5.9%→59.8%)
Respiratory and other medical	[35–39]	AIIMS Delhi (India); rural district hospital (Nepal); tertiary and district hospitals (Pakistan); four EDs (Karachi)	Before–after (PDSA), rapid-cycle QI, quasi-experimental, audit	Nebulisation time 46.5→15 min; COPD corticosteroids 14%→>60% (Nepal) and 54%→88% (Pakistan); heat emergency diagnosis 3.0%→7.5%; hypertensive emergency NICE adherence 20%→80%, time to BP control 5.2→2.1 h
Stroke	[40, 41]	Three referral hospitals (Bhutan); tertiary hospital (Sri Lanka)	Hybrid type II effectiveness–implementation; before–after audit	Quality indicator adherence 30%→57%; swallow screen 10%→85%; rehabilitation 42%→94%; tPA 0%→7%; unadjusted mortality 29%→9%

				(adjusted OR 0.65); CT completion 75→52 min
Neonatal and obstetric emergency care	[8, 15, 42–50]	Public hospitals (Nepal); SNCUs and NICU (India); postpartum wards (New Delhi, Sri Lanka); 60 hospitals, Telangana/Andhra Pradesh	Stepped-wedge cluster RCT, before–after (PDSA), quasi-experimental plausibility	Intrapartum-related mortality 11.0→8.0 per 1000 (adjusted OR 0.79, 95% CI 0.69–0.92); neonatal treatment <30 min 20%→76%, SNCU mortality 33%→15%; transport hypothermia 64%→16%; crash caesarean decision-to-delivery 13 min; Safe Care Saving Lives: no effect on stillbirth or neonatal mortality
Training and capacity building	[9, 51–54]	District hospitals (Pakistan); tertiary hospitals (Karachi, four Indian centres); subdistrict hospital (West Bengal); national programme (Nepal)	Cluster RCT, before–after, mixed methods, quasi-experimental	Structured ABC management 63.7% vs 37.1% (OR 2.98, 95% CI 1.78–4.99); simulation knowledge +19%; Primary Emergency Care knowledge +35.9% with 7.2% decay; subdistrict mortality 2.46%→1.23%
Documentation, guideline adherence and infection control	[55–61]	Tertiary EDs and wards (Pakistan, Sri Lanka, Bhutan, South India)	Before–after audit, closed-loop audit, PDSA	Consultation-time documentation 51.8%→94.2%; resuscitation-decision documentation 10%→44.7% and unsuccessful CPR 77.5%→36.8%; VTE prophylaxis 54%→89%; oxygen prescribing 20%→82%; hand hygiene 63.8%→80.5%
Prehospital and referral systems	[34, 62–66]	Level 1 trauma centre (Mumbai); AIIMS Delhi ambulances; rural municipalities (Nepal); Puducherry network (India); rural Bangladesh	Prospective cohort, before–after, quasi-experimental	Trauma notification 0%→11%, ED deaths RR 0.11; fracture immobilisation 51.4% vs 17.1%; referred-child survival 86.6%→97.6%; good referral letters 0.7%→18%; decision-to-facility time 90→80 min

3.3 Results of individual sources and synthesis of results

3.3.1 Triage and patient flow

A validated obstetric triage index in rural central India increased correct triage from 49% to over 95% within eight months, while median triage wait fell from 40 to under 10 minutes.[17] A Delhi paediatric ED using the South African Triage Scale raised appropriate care from 16–17% to 63% over 20 months,[18] and Manchester Triage System introduction reduced treatment-initiation time from 30 to 10 minutes (p=0.001) and mortality from 26.2% to 20.9% (p=0.021).[19] Patan Hospital audits improved correct triage from 48.7% to 65.3% and under-triage from 2.7% to 1.3%;[20] Dhulikhel qualitative evaluation suggested better sorting with limited quantitative data.[67] Sri Lankan Kaizen redesign cut patient movement by over 70% and registration time from 50–60 to 10–12 minutes;[22] Health-QUEST reduced triage, pain-assessment, review and disposition times across ten Indian EDs.[21] Two PDCA cycles in South India raised ED stays under two hours from 21% to 30%.[23]

3.3.2 Sepsis and time-critical medical emergencies

In a high-volume New Delhi tertiary ED, three PDSA cycles reduced median door-to-antibiotic time from 155 to 78 minutes, raised pre-antibiotic cultures from 0% to 67.7% and increased antibiotics within 60 minutes from 8% to 36.6%; crude 24-hour mortality fell, with transfer bias acknowledged.[24] A Lahore sepsis bundle sustained hour-1 compliance from 0% to 57.7% and appropriate prescribing from 26.7% to 48.1% (p=0.013), without significant

mortality, intensive care or length-of-stay change.[25] Rural Bangladeshi subdistrict hospitals achieved near-universal assessment (99%), one-hour antibiotics in 85% and a 35-minute median time-to-antibiotic.[26] Peshawar audit–feedback improved one-hour antibiotic adherence from 40% to 75%,[27] and Karachi order sets cut order-entry and dispensing times by more than two-thirds ($p<0.001$).[28]

3.3.3 Cardiovascular emergencies

ACS QUIK enrolled 21,374 patients with acute myocardial infarction across 63 Kerala hospitals; audit–feedback, checklists and patient education increased medication use and reperfusion but did not reduce the 30-day composite of death, reinfarction, stroke or major bleeding (5.3% vs 6.4%; adjusted OR 0.98, 95% CI 0.80–1.21).[11] Process evaluation reported high uptake, with time, staffing and patient volume the main barriers.[29] A Karachi myocardial infarction pathway improved quality-of-life scores versus controls ($p<0.001$).[31] A private Indian CODE STEMI pathway reduced door-to-balloon time from 88 to 71.7 minutes and raised ≤90-minute compliance from about 46% to 97%.[30] Kerala interrupted time-series analysis increased guideline-directed heart-failure discharge therapy from 28.1% to 41.3% (adjusted OR 1.70, 95% CI 1.17–2.48) without changing length of stay or inpatient mortality.[16]

3.3.4 Trauma

Across four tertiary urban Indian hospitals, controlled interrupted time-series analysis found an audit-filter trauma QI programme associated with lower in-hospital mortality (32% to 24%; OR 0.57, 95% CI 0.41–0.79) and lower 30-day mortality (39% to 26%; −0.15, 95% CI −0.19 to −0.11), with a new trauma centre and COVID-19 acknowledged as confounders.[12] A companion analysis found lower 90-day EQ-5D in the intervention arm (−4.07, 95% CI −7.00 to −1.15), consistent with a survivorship effect.[13] WHO Trauma Care Checklist training in Nepal improved gross motor documentation (5.9% to 59.8%) and clinician knowledge, though the 90% target was not met.[32] A Northern Indian Paediatric Trauma Resuscitation Module improved 72-hour survival from 86% to 94.5% ($p=0.048$), eliminated first-hour mortality ($p=0.042$) and raised early specialist review.[33] Mumbai mobile-phone notification improved notification from 0% to 11% ($p<0.001$) with more trauma call-outs (RR 1.30) and fewer ED deaths (RR 0.11), though in-hospital mortality was unchanged.[34]

3.3.5 Respiratory emergencies and other medical conditions

An AIIMS Delhi PDSA initiative reduced median nebulisation time in red-triaged patients from 46.5 to 15 minutes.[35] Rural Nepal COPD care increased corticosteroid prescribing from 14% to over 60%, maintained over 12 months;[36] a six-week rapid-cycle Pakistani intervention improved corticosteroids (54% to 88%), appropriate antibiotics (62% to 90%) and discharge planning (40% to 82%), all $p<0.05$.[37] Heat emergency education across four Karachi EDs improved diagnosis from 3.0% to 7.5% and temperature monitoring from 0.9% to 13% (both $p<0.001$).[38] For hypertensive emergencies, training and protocols improved NICE adherence from 20% to 80% ($p<0.001$) and reduced median time to blood pressure control from 5.2 to 2.1 hours ($p=0.003$).[39]

3.3.6 Stroke

Bhutan's BRAINS initiative trained non-neurologist physicians and established stroke units at three referral hospitals: quality indicator adherence rose from 30% to 57%, swallowing screening from 10% to 85%, rehabilitation within 72 hours from 42% to 94% and thrombolysis from 0% to 7% ($p=0.02$); unadjusted in-hospital mortality fell from 29% to 9% (adjusted OR 0.65, 95% CI 0.50–0.85), though baseline severity was unadjusted.[40] In Sri Lanka, FAST and ROSIER reduced median CT completion from 75 to 52 minutes, brought onset documentation to 100% and eliminated inappropriate pre-CT aspirin and antihypertensive use.[41]

3.3.7 Neonatal and obstetric emergency care

The Nepal stepped-wedge cluster RCT (89,014 mother–infant pairs) reduced intrapartum-related mortality from 11.0 to 8.0 per 1000 births (adjusted OR 0.79, 95% CI 0.69–0.92; $p=0.002$), although 28-day neonatal mortality did not reach significance;[8] companion data confirmed faster airway clearance and ventilation initiation.[42] Remote training with PDSA improved equipment preparation (9.6% to 43.7%) and early ventilation (0% to 18%).[43] An Eastern Indian SNCU initiative increased treatment within 30 minutes (20% to 76%) and reduced mortality (33% to 15%).[44] Transport QI reduced neonatal hypothermia from 64% to 16%.[45] Obstetric projects achieved a 13-minute median decision-to-delivery interval,[46] timely postpartum-haemorrhage care,[47] and improved complication identification, although Delhi gains eroded with high-acuity referrals.[48] A secondary-hospital PDSA improved early breastfeeding.[68] At scale, Care Around Birth improved oxytocin administration and neonatal resuscitation,[49] Vriddhi showed similar process gains,[69] and ASSIST achieved 90–99% adherence in eight of nine elements with lower perinatal mortality but uncertain attribution.[50] By contrast, Safe Care, Saving Lives was null across 60 hospitals because of weak leadership and unit activation,[15] and Karnataka training improved knowledge and OSCE performance but not complication management amid staffing and supply constraints.[14]

3.3.8 Training and capacity-building interventions

A five-day emergency maternal, neonatal and child health skills training cluster RCT in Pakistan found trained doctors managed 63.7% of life-threatening emergencies with a structured ABC approach versus 37.1% in controls (OR 2.98,

95% CI 1.78–4.99).[9] A one-year Karachi emergency medicine certification programme improved clinical metrics with a mortality trend (relative risk 0.587, p<0.001) across more than 125,000 patient contacts.[51] Simulation-based paediatric training at four Indian academic hospitals raised knowledge by 19% and procedural skills by 16–20% (p<0.01), sustained at six months;[52] Nepal Primary Emergency Care training improved knowledge by 35.9% (p=0.001) with 7.2% decay and peer-to-peer spillover;[53] and a West Bengal subdistrict paediatric emergency initiative improved the national quality score by 15%, reduced referrals from 9.43% to 6.61% and reduced mortality from 2.46% to 1.23%.[54] Other interventions spanned social emergency medicine, stroke caregiver education, medical emergency teams, ophthalmic equipment audit, anaemia-in-pregnancy care, paediatric falls prevention, congenital heart surgery collaboration and ED violence prevention.[70–77]

3.3.9 Documentation, guideline adherence and infection control

Educational interventions with visual reminders raised Pakistani ED consultation-time documentation from 51.8% to 94.2% (p<0.001).[55] A single Sri Lankan educational session raised resuscitation-decision documentation from 10% to 44.7% (p=0.0006) while unsuccessful CPR attempts fell from 77.5% to 36.8% (p=0.0003).[56, 78] Structured education improved venous thromboembolism prophylaxis from 54% to 89%;[57] training with visual cues improved WHO phlebotomy guideline adherence;[58] and a 12-week PDSA initiative in Bhutan raised oxygen prescribing from 20% to 82% among doctors and 22% to 83% among nurses.[59] Ten South Indian paediatric audit cycles cut antibiotic use from 80% to 20% and mean drugs per prescription from 4.4 to 1.5 (both p<0.01), with partial regression at re-audit.[60] Five PDSA cycles using the WHO multimodal strategy raised hand hygiene from 63.8% to 80.5% in a South Indian coronary care unit.[61] A nurse-prompted PICU rounding checklist was associated with reduced length of stay (4.5 to 4.1 days; p=0.05) and mortality (19% to 11.4%; p<0.05).[79]

3.3.10 Prehospital and referral system interventions

The Mumbai notification study improved trauma call-outs and reduced ED deaths without changing in-hospital mortality, with uptake reaching only 11% of eligible patients.[34] New Delhi ambulance crew training improved confidence from 35–40% to 75–80%, but compliance gains regressed post-intervention.[62] A rural Nepal community health responder programme improved fracture immobilisation to 51.4% versus 17.1% in controls (p<0.001).[63] A Puducherry communication network improved referred-child survival from 86.6% to 97.6%,[64] and a referral education module improved good referral letters from 0.7% to 18% (p=0.001) while reducing arrivals in physiological decompensation.[65] Community-based obstetric mobilisation in rural Bangladesh reduced decision-to-facility time from 90 to 80 minutes and facility-arrival time from 135 to 110 minutes, but not facility treatment time.[66, 80]

3.3.11 Thematic synthesis

Six themes emerged, each with parallels in the wider LMIC literature.

3.3.11.1 Theme 1: PDSA cycles as the dominant methodology.

Iterative PDSA/PDCA cycles underpinned most studies [17, 18, 20, 21, 23-25, 30, 35, 36, 42-45, 48, 61]; iteration enabled gains beyond single-shot interventions,[18] while two-cycle audits gave short-term documentation and adherence gains with uncertain durability.[27, 39, 41, 55-58, 78] Multimodal iterative learning also underpinned Papua New Guinea triage rollout during COVID-19.[81]

3.3.11.2 Theme 2: Training as the core—but insufficient—component.

Education was universal and improved knowledge and self-efficacy,[9, 32, 52, 53, 63] but translation was inconsistent when structural constraints persisted.[14, 53] Education combined with structural change more reliably changed practice.[9, 24] Wider LMIC evidence concurs: Basic Emergency Care improved knowledge and confidence,[82] reinforced by mentorship[83] and mobile adjuncts,[84] with mortality benefit in Lilongwe only when embedded in system change.[85]

3.3.11.3 Theme 3: Checklists, protocols and standardised order sets as levers.

Checklists, protocols and order sets improved processes,[28, 30, 46, 79] but ACS QUIK showed they may not move hard outcomes where baseline quality is already high.[11, 16, 29] This strengthens calls for implementation evidence in LMICs.[86] Validated triage tools remained implementable in Ghana,[87] Afghanistan, Haiti and Sierra Leone,[88] and Papua New Guinea,[89, 90] amid regional standardisation.[91]

3.3.11.4 Theme 4: Leadership, team engagement and local ownership.

Leadership support and multidisciplinary engagement were the leading facilitators.[8, 15, 18, 23, 24, 40, 49, 51] Failed engagement explains the Safe Care, Saving Lives null result,[15] whereas ward-level ownership supported the Delhi postpartum success.[48] Ministerial support helped BRAINS despite 55% attrition,[40] while Nepal trauma checklist work identified transformational leadership as missing.[32] Sustainability tracked leadership stability and

turnover.[35, 40, 50, 92] African analyses identify governance, workforce stabilisation and institutionalised quality structures as binding constraints.[93]

3.3.11.5 Theme 5: Resource constraints as driver and barrier.

Resource constraints motivated cost-neutral education, posters, checklists and redesign,[39, 55, 57, 59, 60, 80] but capped gains where drugs, equipment and nursing were unavailable.[14, 50] Task shifting helped: Bangladeshi paramedics enabled 85% one-hour antibiotics,[26] and Nepali nurses and midwives led resuscitation.[8] Rural Uganda showed process gains without predicted mortality reductions.[94]

3.3.11.6 Theme 6: Prehospital and referral systems.

ED-level gains are vulnerable before hospital arrival. Notification,[34] ambulance training,[62] community responders,[63] referral networks[64, 65] and community mobilisation[66] were feasible but regressed without supervision. Kampala lay first-responder training was feasible,[95] Eastern Uganda scaled training through transport infrastructure,[96] and a 'super-responder' phenomenon occurred across three African countries.[97] Ghanaian and Mexican cases show injury care needs coordinated prehospital-to-definitive organisation,[98] consistent with essential trauma care frameworks.[99]

4 DISCUSSION

4.1 Summary of evidence

Across 80 South Asian evaluations and wider LMIC evidence, QI and audit interventions consistently improve adherence, documentation, timeliness and knowledge, but patient outcomes are variable. Three mechanisms are apparent. First, baseline context: ACS QUIK[11] and Kerala heart failure[16] had relatively high baseline quality, whereas larger mortality reductions occurred where performance was poor.[18, 40, 44, 54] Second, readiness: Karnataka improved knowledge but not complication management amid staffing and supply constraints,[14] and Safe Care, Saving Lives failed through leadership and capacity gaps.[15] Third, trauma QI reduced mortality but worsened 90-day EQ-5D among survivors,[13] indicating the need to assess functional outcomes.

4.2 Comparison with the wider LMIC literature

The pattern generalises. Mortality reductions in Lilongwe, Malawi,[85] and Nepal[8] share structured training, system redesign and ongoing QI governance. Triage evaluations across Ghana,[87] Afghanistan, Haiti and Sierra Leone,[88] and Papua New Guinea[81, 89, 90] confirm implementability in constrained EDs, mirroring South Asian gains.[17-20] WHO/IATSIC trauma QI evidence[100, 101] corroborates the Indian trauma findings,[12, 33] and Malawian injury epidemiology confirms preventable injury death.[102] ETAT preparedness assessments[103] and mHealth-supported pathways[104] extend structured assessment into primary care, much as the Bangladeshi sepsis programme did.[26] Conversely, rural Uganda's process gains without mortality change[94] mirror Lahore[25] and Kerala,[11, 16] suggesting a general process–outcome disconnect in constrained systems.

4.3 Implications for practice, policy and research

For tertiary EDs, PDSA sepsis and time-to-treatment programmes are best supported.[24, 25, 27, 35] Cardiac pathways gain most where baseline delays are long.[28, 30] District hospitals require combined training, structural change and team formation rather than training alone.[8, 14, 15, 26, 54] Prehospital and referral interventions remain feasible but fragile without support.[34, 62, 63] Policy should institutionalise QI through governance, consistent with WHO emergency care and trauma guidance and the high-quality health systems agenda.[1, 5, 7, 101] Scalable models include Karnataka nurse mentoring,[10] neonatal unit programmes,[105] and perinatal QI in Nepal.[106] Research should adopt stepped-wedge or controlled interrupted time-series designs,[86, 107] longer follow-up and functional outcomes.

4.4 Limitations of the review

The primary search used Semantic Scholar/OpenAlex through Elicit rather than multiple bibliographic databases, so non-indexed and non-English studies may be missed. Machine-assisted charting may retain extraction errors despite review. Most designs were uncontrolled before–after studies, leaving findings vulnerable to secular trends, Hawthorne effects and regression to the mean; several were COVID-affected.[12, 24] Heterogeneity precluded meta-analysis, and the wider LMIC search was targeted rather than exhaustive.

5 CONCLUSION

QI and audit interventions produce robust process gains in resource-constrained emergency care and can reduce mortality when baseline deficits are large and training is combined with structural change, teams and leadership.

Benefits remain uncertain where baseline performance is high or staffing and supply chains are unaddressed, and are fragile without institutional embedding. The field should move from isolated projects to governed programmes evaluated with controlled designs, longer follow-up and functional outcomes.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

The authors declare no conflicts of interest regarding this manuscript.

Data availability statement

All data analysed were extracted from published sources cited in the reference list; the charting dataset is available from the corresponding author on reasonable request.

REFERENCES

[1] Kruk ME, Gage AD, Arsenault C, et al. High-quality health systems in the Sustainable Development Goals era: time for a revolution. Lancet Glob Health 2018;6:e1196–252. doi:10.1016/S2214-109X(18)30386-3

[2] Rudd KE, Johnson SC, Agesa KM, et al. Global, regional, and national sepsis incidence and mortality, 1990–2017: analysis for the Global Burden of Disease Study. Lancet 2020;395:200–11. doi:10.1016/S0140-6736(19)32989-7

[3] Mock C, Joshipura M, Arreola-Risa C, et al. An estimate of the number of lives that could be saved through improvements in trauma care globally. World J Surg 2012;36:959–63. doi:10.1007/s00268-012-1459-6

[4] Obermeyer Z, Abujaber S, Makar M, et al. Emergency care in 59 low- and middle-income countries: a systematic review. Bull World Health Organ 2015;93:577–86G. doi:10.2471/BLT.14.148338

[5] World Health Organization. Emergency care systems for universal health coverage: ensuring timely care for the acutely ill and injured. Geneva: World Health Organization; 2019.

[6] Nolan T, Angos P, Cunha AJ, et al. Quality of hospital care for seriously ill children in less-developed countries. Lancet 2001;357:106–10. doi:10.1016/S0140-6736(00)03542-X

[7] Pickering AE, Malherbe P, Nambuba J, et al. Clinical emergency care quality indicators in Africa: a scoping review and data summary. BMJ Open 2023;13:e069494. doi:10.1136/bmjopen-2022-069494

[8] Kc A, Ewald U, Basnet O, et al. Effect of a scaled-up neonatal resuscitation quality improvement package on intrapartum-related mortality in Nepal: a stepped-wedge cluster randomized controlled trial. PLoS Med 2019. doi:10.1371/journal.pmed.1002900

[9] Nisar YB, Hafeez A, Zafar S, et al. Impact of essential surgical skills with an emphasis on emergency maternal, neonatal and child health training on the practice of doctors: a cluster randomised controlled trial in Pakistan. Resuscitation 2011. doi:10.1016/j.resuscitation.2011.02.046

[10] Jayanna K, Bradley J, Mony P, et al. Effectiveness of onsite nurse mentoring in improving quality of institutional births in the primary health centres of high priority districts of Karnataka, South India: a cluster randomized trial. PLoS One 2016. doi:10.1371/journal.pone.0161957

[11] Huffman MD, Mohanan P, Devarajan R, et al. Effect of a quality improvement intervention on clinical outcomes in patients in India with acute myocardial infarction: the ACS QUIK randomized clinical trial. JAMA 2018. doi:10.1001/jama.2017.21906

[12] Berg J, David S, Bakhshi G, et al. Effects of trauma quality improvement program implementation on mortality: a multi-center controlled interrupted time-series study. medRxiv 2024 [preprint]. doi:10.1101/2024.05.27.24307748

[13] Kapitan E, Berg J, David S, et al. The effect of trauma quality improvement programme implementation on quality of life among trauma patients in urban India. medRxiv 2024 [preprint]. doi:10.1101/2024.09.28.24314529

[14] Varghese B, Krishnamurthy J, Correia B, et al. Limited effectiveness of a skills and drills intervention to improve emergency obstetric and newborn care in Karnataka, India: a proof-of-concept study. Glob Health Sci Pract 2016. doi:10.9745/GHSP-D-16-00143

[15] Zamboni K, Singh S, Tyagi M, et al. Effect of collaborative quality improvement on stillbirths, neonatal mortality and newborn care practices in hospitals of Telangana and Andhra Pradesh, India: evidence from a quasi-experimental mixed-methods study. Implement Sci 2021. doi:10.1186/s13012-020-01058-z

[16] Agarwal A, Mohanan P, Kondal D, et al. Effect of a quality improvement intervention for acute heart failure in South India: an interrupted time series study. Int J Cardiol 2020. doi:10.1016/j.ijcard.2020.12.048

[17] Ranade M, Jain S, Shivkumar PV, et al. Quality improvement initiative: improving obstetric triaging practices in a rural maternal hospital in central India. BMJ Open Qual 2024;13(Suppl 1):e001870. doi:10.1136/bmjoq-2022-001870

[18] Joshi N, Wadhwani R, Nagpal J, et al. Implementing a triage tool to improve appropriateness of care for children coming to the emergency department in a small hospital in India. BMJ Open Quality 2020. doi:10.1136/bmjoq-2020-000935

[19] Singh S, Awasthi S. Effect of in-situation versus Manchester Triage System–based initial case management on hospital-based mortality: a before and after study. Indian J Pediatr 2022. doi:10.1007/s12098-022-04092-5

[20] Adhikari S, Rijal S. Quality improvement of triage accuracy in the emergency department. J Gen Pract Emerg Med Nepal 2020. doi:10.59284/jgpeman88

[21] Kumar S, Vikneswaran G, Suryavamshi J, et al. Using space technology approach to improve quality in emergency departments in India: a quality improvement program. Int J Qual Health Care 2025. doi:10.1093/intqhc/mzae116

[22] Mayuran N, Sasikumar T, Barthelot M. Optimizing patient flow by minimizing the patients' movements in the Accident and Emergency Unit: a case study from Teaching Hospital Batticaloa. Sri Lankan J Med Adm 2025. doi:10.4038/sljma.v26i1.5523

[23] Goenka A, Mundkur SC, Nayak SS, et al. Improving the emergency services using quality improvement project and Donabedian model in a quaternary teaching hospital in South India. BMJ Open Quality 2024;13:e002246. doi:10.1136/bmjoq-2022-002246

[24] Malhotra C, Kumar A, Sahu A, et al. Strengthening sepsis care at a tertiary care teaching hospital in New Delhi, India. BMJ Open Quality 2021. doi:10.1136/bmjoq-2020-001335

[25] Zia I, Zaidi S. Promoting antibiotic stewardship and implementation of sepsis pathway in the emergency department: a quality improvement initiative. Cureus 2023. doi:10.7759/cureus.49275

[26] Rahman AE, Iqbal A, Hoque DE, et al. Managing neonatal and early childhood syndromic sepsis in sub-district hospitals in resource poor settings: improvement in quality of care through introduction of a package of interventions in rural Bangladesh. PLoS One 2017. doi:10.1371/journal.pone.0170267

[27] Ullah N, Khan K, Khan U, et al. Clinical audit on fever workup and timeliness of antibiotics administration in febrile patients. J Popul Ther Clin Pharmacol 2024. doi:10.53555/p18scg50

[28] Perveen F, Khaliq A, Khan N, et al. Implementation of disease-based standard order sets in emergency department of tertiary care hospital, Pakistan: a novel approach for enhancing patient care. J Pak Med Assoc 2020. doi:10.5455/jpma.21977

[29] Singh K, Devarajan R, Mohanan P, et al. Implementation and acceptability of a heart attack quality improvement intervention in India: a mixed methods analysis of the ACS QUIK trial. Implement Sci 2019. doi:10.1186/s13012-019-0857-7

[30] Negi JS, Arya DP, Kaur D. Optimized STEMI pathway for rapid door-to-balloon times: a quality improvement initiative at Fortis Flt. Lt. Rajan Dhall Hospital. Int J Res Appl Sci Eng Technol 2026. doi:10.22214/ijraset.2026.83620

[31] Bashir S, Masih S, Barolia R, et al. Enhancing clinical outcomes and quality of life in acute myocardial infarction patients through standard clinical pathway implementation: a study from a public tertiary care hospital in Karachi, Pakistan. Pak Heart J 2024. doi:10.47144/phj.v57i2.2699

[32] Pokhrel M, Lamsal D, Indrasena BSH, et al. Challenges and barriers to implementing the WHO Trauma Care Checklist in an emergency department in Nepal: the need for transformational leadership. Leadersh Health Serv 2023. doi:10.1108/lhs-10-2022-0107

[33] Rai N, Mahajan P, Katyal A, et al. Impact of Pediatric Trauma Resuscitation Module (PTRM) on clinical outcomes in a Level-1 trauma centre in India. Indian Pediatr 2026. doi:10.1007/s13312-025-00259-3

[34] Mitra B, Kumar V, O'Reilly G, et al. Prehospital notification of injured patients presenting to a trauma centre in India: a prospective cohort study. BMJ Open 2020. doi:10.1136/bmjopen-2019-033236

[35] Sachdeva S, Kumar A, Aggarwal P. Impact of targeted bundles to reduce the nebulization time gap from prescription to administration among red triaged patients in emergency department: a quality improvement initiative. Research Square 2021 [preprint]. doi:10.21203/rs.3.rs-820832/v1

[36] Mehanni S, Jha D, Kumar A, et al. Implementing a quality improvement initiative for the management of chronic obstructive pulmonary disease in rural Nepal. BMJ Open Quality 2019. doi:10.1136/bmjoq-2018-000408

[37] Saqib M. Rapid implementation of guideline-based care for acute exacerbations of COPD in a low-resource setting: an improvement brief. Jt Comm J Qual Patient Saf 2025. doi:10.1016/j.jcjq.2025.11.004

[38] Khan N, Khan U, Ahmed N, et al. Improvement in the diagnosis and practices of emergency healthcare providers for heat emergencies after HEAT (heat emergency awareness & treatment) an educational intervention: a multicenter quasi-experimental study. BMC Emerg Med 2023. doi:10.1186/s12873-022-00768-5

[39] Kumari S, Wattoo MA, Imtiaz A, et al. From 20% to 80% adherence: a pre-post intervention audit of NICE guideline implementation for hypertensive emergencies in Pakistan. IJQHC Commun 2025. doi:10.1093/ijcoms/lyaf021

[40] Yangchen, Pandian J, Tenzin T, et al. Bhutan's Response Against Increasing Number of Stroke (BRAINS): a hybrid type II effectiveness-implementation study. Cureus 2026. doi:10.7759/cureus.103394

[41] Jayasekera M, Edirisinghe EMDT, Ekanayake E, et al. A clinical audit on recognition and management of stroke in a tertiary care hospital of Sri Lanka. Sri Lanka J Med Sci 2025. doi:10.4038/sljms1.v2i1.49

[42] Chaulagain D, Målqvist M, Brunell O, et al. Performance of health workers on neonatal resuscitation care following scaled-up quality improvement interventions in public hospitals of Nepal: a prospective observational study. BMC Health Serv Res 2021. doi:10.1186/s12913-021-06366-8

[43] Kc A, Paudel P, Bhattarai P, et al. Effect of remote essential newborn care training paired with in-person quality improvement on optimizing immediate and resuscitative care practices. Acta Paediatr 2026. doi:10.1111/apa.70607

[44] Mallick A, Banerjee M, Mondal B, et al. A quality improvement initiative for early initiation of emergency management for sick neonates. Indian Pediatr 2018. doi:10.1007/s13312-018-1378-1

[45] Diggikar S, Shalet N, S P, et al. Hypothermia reduction during neonatal transport in a tertiary care center in South India: a quality improvement initiative. Int J Contemp Pediatr 2021. doi:10.18203/2349-3291.IJCP20211073

[46] Paily V, Girijadevi R, George S, et al. Crash caesarean delivery: how to optimise decision-to-delivery interval by initiating a novel code? A clinical audit. J Obstet Gynecol India 2022. doi:10.1007/s13224-022-01693-0

[47] Rishard M, Riyal H, Rajaratne K, et al. Enhancing postpartum hemorrhage management in Sri Lanka: a pilot study to assess the impact and appropriateness, acceptability, and feasibility of a locally co-created quality improvement intervention. Int J Gynaecol Obstet 2025. doi:10.1002/ijgo.70774

[48] Chopra M, Arora N, Sinha S, et al. Improving postpartum care in a large hospital in New Delhi, India. BMJ Open Quality 2018. doi:10.1136/bmjoq-2018-000423

[49] Taneja G, Sarin E, Bajpayee D, et al. Care Around Birth approach: a training, mentoring, and quality improvement model to optimize intrapartum and immediate postpartum quality of care in India. Glob Health Sci Pract 2021. doi:10.9745/GHSP-D-20-00368

[50] Sarin E, Kole SK, Patel R, et al. Evaluation of a quality improvement intervention for obstetric and neonatal care in selected public health facilities across six states of India. BMC Pregnancy Childbirth 2017. doi:10.1186/s12884-017-1318-4

[51] Saleem SG, Ali S, Khatri A, et al. Clinical outcomes following the implementation of a novel one-year training program in emergency medicine in Karachi, Pakistan. Ann Glob Health 2023. doi:10.5334/aogh.3890

[52] Ahluwalia T, Toy S, Gutierrez C, et al. Feasible and effective use of a simulation-based curriculum for post-graduate emergency medicine trainees in India to improve learner self-efficacy, knowledge, and skills. Int J Emerg Med 2021. doi:10.1186/s12245-021-00363-8

[53] Bhandari R, Kalaunee ABC, Amatya A, et al. Evaluating the effectiveness and utilization of the primary emergency care training in Nepal: a longitudinal mixed methods study. BMC Emerg Med 2026. doi:10.1186/s12873-026-01593-w

[54] Sinharay DN, Sarkar D. A quality improvement initiative to decrease referral from a subdistrict hospital in rural India. Saudi J Med Pharm Sci 2025. doi:10.36348/sjmps.2025.v11i09.009

[55] Waris B, Butt N, Khizar I, et al. Assessing completeness of emergency notes documentation: an audit and re-audit to enhance quality of patient care. J Liaquat Natl Hosp 2025. doi:10.37184/jlnh.2959-1805.4.3

[56] Appuhamy S, Hewage D. Improving decision making, communication and documentation regarding advanced resuscitation decisions in a tertiary care hospital in Sri Lanka. Asian J Intern Med 2022. doi:10.4038/ajim.v1i1.33

[57] Naim F, Khan S, Saqib M, et al. Improving adherence to venous thromboembolism prophylaxis guidelines in medical inpatients: a single-center, prospective, closed-loop clinical audit in a medical department. ASIDE Health Sci 2026. doi:10.71079/aside.hs.041526619

[58] Malik A, Awais MA, Aziz M, et al. Quality care through clinical audit: blood sampling practices by nurses in the emergency department of a university affiliated teaching hospital. J Rawalpindi Med Coll 2024. doi:10.37939/jrmc.v28i3.2393

[59] Wangdi S, Dechen P, Dorji K, et al. Initiative to improve oxygen prescribing and oxygen delivery to patients in the emergency department of a national referral hospital. BMJ Open Quality 2025. doi:10.1136/bmjoq-2024-003132

[60] Gadgeesh PB, Kumar VS, Venkatramana NH, et al. Prescription audit as a quality improvement tool: impact of repeated interventions in paediatric outpatient department (OPD) and inpatient department (IPD) settings. Cureus 2025. doi:10.7759/cureus.98960

[61] Datta V, Pradeep J, Srivastava S, et al. Enhancing hand hygiene compliance to reduce healthcare-associated infections in a coronary care unit: a quality improvement initiative in a tertiary hospital in South India. BMJ Open Quality 2024. doi:10.1136/bmjoq-2025-003838

[62] Karthikeyan A, Sinha T, Bisht N. To improve the pre-hospital health care bundle compliance, provided to critically ill patients presenting to the AIIMS emergency department through government-run ambulance services. Inj Prev 2024. doi:10.1136/injuryprev-2024-safety.304

[63] Kharel R, Pathak M, Lubetkin D, et al. Pilot implementation of a culturally adapted prehospital trauma program for community health responders in rural Nepal. Prehosp Disaster Med 2026. doi:10.1017/s1049023x26103239

[64] Kumar S, Pothapregada S, Parameswaran N, et al. Improving the outcome of sick children referred from district hospitals in and around Puducherry by establishing a communication network: a community-based quality improvement initiative. Indian J Crit Care Med 2024. doi:10.5005/jp-journals-10071-24850

[65] Ezhumalai G, Jayashree M, Nallasamy K, et al. Referrals to a pediatric emergency department of a tertiary care teaching hospital before and after introduction of a referral education module: a quality improvement study. BMC Health Serv Res 2020. doi:10.1186/s12913-020-05649-w

[66] Banu M, Akter M, Begum K, et al. 'The clock keeps ticking' — the role of a community-based intervention in reducing delays in seeking emergency obstetric care in rural Bangladesh: a quasi-experimental study. Public Health 2014. doi:10.1016/j.puhe.2014.01.009

[67] Eid K, Dønnem M. Introduction of systematic triage in the emergency room at Dhulikhel Hospital, Nepal: evaluation of a quality improvement project [master's thesis]. Trondheim: Norwegian University of Science and Technology; 2016.

[68] Kaur R, Kant S, Goel A, et al. A quality improvement intervention to improve early initiation of breastfeeding among newborns delivered at a secondary level hospital in northern India. Med J Armed Forces India 2021. doi:10.1016/j.mjafi.2021.01.011

[69] Verma G, Bajpayee D, Sirdhar V, et al. Experiential training to improve quality of care for mothers and newborns at the time of birth. Eur J Public Health 2017. doi:10.1093/eurpub/ckx187.734

[70] Ali S, Saleem SG, Khatri A, et al. 'To teach or not to teach — that is the question': the educational and clinical impact of introducing an outcome based, modular curriculum in Social Emergency Medicine (SEM) at a private tertiary care center in Karachi, Pakistan. BMC Med Educ 2023. doi:10.1186/s12909-023-04385-z

[71] Ayaz M, Sarwar H, Yaqoob A, et al. Enhancing knowledge of family caregivers and quality of life of patients with ischemic stroke. Pak J Neurol Surg 2022. doi:10.36552/pjns.v25i4.625

[72] Deerasinghe D, Sabhapathige R, Samarakoon S, et al. Implementation of a medical emergency team to improve the quality of the acute emergency management system in the Accident Service of National Hospital, Sri Lanka: impact on staff perception in in-ward emergency care. Hosp Top 2026. doi:10.1080/00185868.2026.2652289

[73] Zafar H, Akhtar R, Zafar A, et al. A syringe in an emergency saves time: an audit on the utility of syringe provision in eye emergency. Cureus 2023. doi:10.7759/cureus.37618

[74] Gupta T, Sharma K, Sarkar A, et al. Decreasing prevalence of anaemia in pregnant women at delivery: a quality improvement initiative. BMJ Open Quality 2025. doi:10.1136/bmjoq-2024-003300

[75] Chhetri K, Rinchen U, Lamichaney G, et al. Team approach to fall reduction in paediatric ward of national referral hospital, Thimphu, Bhutan: a quality improvement initiative. BMJ Open Quality 2022. doi:10.1136/bmjoq-2022-001892

[76] Khan A, Abdullah A, Ahmad H, et al. Impact of International Quality Improvement Collaborative on congenital heart surgery in Pakistan. Heart 2017. doi:10.1136/heartjnl-2016-310533

[77] Qadri U, Hussain A, Shaikh S. Change in perception and behavior of patients/attendant and healthcare workers after introduction of low-cost violence prevention interventions at emergency department of a tertiary care hospital in Karachi. Pak J Public Health 2021;11(4):255–60.

[78] Appuhamy S, Hewage D. Improving decision making, communication and documentation regarding advance resuscitation decisions in a tertiary care hospital in Sri Lanka. Research Square 2021 [preprint]. doi:10.21203/rs.3.rs-799205/v1

[79] Abbas A, Aziz F, Siddiqui N, et al. Impact of introduction of a rounding checklist in a pediatric intensive care unit of a developing country: a quality improvement project. J Pediatr Crit Care 2023. doi:10.4103/jpcc.jpcc_67_23

[80] Hack-Adams N, Day L, Hruschka D. Advocating for quality low-cost management of children with diarrhoea in rural Bangladesh. Arch Dis Child 2015. doi:10.1136/archdischild-2015-308599.238

[81] Mitchell R, Bornstein S, Piamnok D, et al. Multimodal learning for emergency department triage implementation: experiences from Papua New Guinea during the COVID-19 pandemic. Lancet Reg Health West Pac 2023;33:100683. doi:10.1016/j.lanwpc.2023.100683

[82] Tenner AG, Sawe HR, Amato S, et al. Results from a World Health Organization pilot of the Basic Emergency Care Course in Sub Saharan Africa. PLoS One 2019;14:e0224257. doi:10.1371/journal.pone.0224257

[83] Khongo BD, Schmiedeknecht K, Aron MB, et al. Basic emergency care course and longitudinal mentorship completed in a rural Neno District, Malawi. PLoS One 2023;18:e0280454. doi:10.1371/journal.pone.0280454

[84] Tenner AG, Greenberg AL, Nicholaus P, et al. Mobile application adjunct to the WHO basic emergency care course: a mixed methods study. BMJ Open 2022;12:e056763. doi:10.1136/bmjopen-2021-056763

[85] Robison JA, Ahmad ZP, Nosek CA, et al. Decreased pediatric hospital mortality after an intervention to improve emergency care in Lilongwe, Malawi. Pediatrics 2012;130:e676–82. doi:10.1542/peds.2012-0026

[86] Granger C, Xavier D. Improving evidence for implementation of guideline-based care in low- and middle-income countries. JAMA 2018. doi:10.1001/jama.2017.21905

[87] Rominski S, Bell SA, Oduro G, et al. The implementation of the South African Triage Score (SATS) in an urban teaching hospital, Ghana. Afr J Emerg Med 2014;4:71–5. doi:10.1016/j.afjem.2013.11.001

[88] Dalwai M, Twomey M, Maikere J, et al. Is the South African Triage Scale valid for use in Afghanistan, Haiti and Sierra Leone? BMJ Glob Health 2017;2:e000160. doi:10.1136/bmjgh-2016-000160

[89] Mitchell R, Bue O, Nou G, et al. Validation of the Interagency Integrated Triage Tool in a resource-limited, urban emergency department in Papua New Guinea. Lancet Reg Health West Pac 2021;13:100194. doi:10.1016/j.lanwpc.2021.100194

[90] Mitchell R, McKup JJ, Banks C, et al. Validity and reliability of the Interagency Integrated Triage Tool in a regional emergency department in Papua New Guinea. Emerg Med Australas 2022;34:99–107. doi:10.1111/1742-6723.13877

[91] Mitchell R, O'Reilly G, Banks C, et al. Triage systems in low-resource emergency care settings. Bull World Health Organ 2025;103:204–12. doi:10.2471/BLT.23.290863

[92] Das M, Arora N, Dalpath S, et al. Improving quality of care for pregnancy, perinatal and newborn care at district and sub-district public health facilities in three districts of Haryana, India: an implementation study. PLoS One 2021. doi:10.1371/journal.pone.0254781

[93] Kannan VC, Tenner A, Sawe HR, et al. Emergency care systems in Africa: a focus on quality. Afr J Emerg Med 2020;10(Suppl 1):S65–72. doi:10.1016/j.afjem.2020.04.010

[94] Rice B, Calo S, Kamugisha JB, et al. Emergency care of sepsis in sub-Saharan Africa: mortality and non-physician clinician management of sepsis in rural Uganda from 2010 to 2019. PLoS One 2022;17:e0264517. doi:10.1371/journal.pone.0264517

[95] Jayaraman S, Mabweijano JR, Lipnick MS, et al. Current patterns of prehospital trauma care in Kampala, Uganda and the feasibility of a lay-first-responder training program. World J Surg 2009;33:2512–21. doi:10.1007/s00268-009-0180-6

[96] Delaney PG, Bamuleke R, Lee YJ. Lay first responder training in Eastern Uganda: leveraging transportation infrastructure to build an effective prehospital emergency care training program. World J Surg 2018;42:2293–302. doi:10.1007/s00268-018-4467-3

[97] Eisner ZJ, Delaney PG, Klapow MC, et al. Identifying a 'super-responder' phenomenon in three African countries: implications for prehospital emergency care training. Injury 2022;53:176–82. doi:10.1016/j.injury.2021.09.064

[98] Mock C, Arreola-Risa C, Quansah R. Strengthening care for injured persons in less developed countries: a case study of Ghana and Mexico. Inj Control Saf Promot 2003;10:45–51. doi:10.1076/icsp.10.1.45.14114

[99] Joshipura M, Mock C, Goosen J, et al. Essential trauma care: strengthening trauma systems round the world. Injury 2004;35:841–5. doi:10.1016/j.injury.2003.08.005

[100] Juillard CJ, Mock C, Goosen J, et al. Establishing the evidence base for trauma quality improvement: a collaborative WHO-IATSIC review. World J Surg 2009;33:1075–86. doi:10.1007/s00268-009-9959-8

[101] World Health Organization. Guidelines for trauma quality improvement programmes. Geneva: World Health Organization; 2009.

[102] Samuel JC, Akinkuotu A, Villaveces A, et al. Epidemiology of injuries at a tertiary care center in Malawi. World J Surg 2009;33:1836–41. doi:10.1007/s00268-009-0113-4

[103] King C, Dube A, Zadutsa B, et al. Paediatric Emergency Triage, Assessment and Treatment (ETAT) — preparedness for implementation at primary care facilities in Malawi. Glob Health Action 2021;14:1989807. doi:10.1080/16549716.2021.1989807

[104] Desmond N, Henrion MYR, Gondwe M, et al. Improving care pathways for children with severe illness through implementation of the ASPIRE mHealth primary ETAT package in Malawi. PLOS Glob Public Health 2024;4:e0002786. doi:10.1371/journal.pgph.0002786

[105] Deorari A, Kumar P, Chawla D, et al. Improving the quality of health care in special neonatal care units of India: a before and after intervention study. Glob Health Sci Pract 2022. doi:10.9745/GHSP-D-22-00085

[106] Brunell O, Chaulagain D, Kc A, et al. Effect of a perinatal care quality improvement package on patient satisfaction: a secondary outcome analysis of a cluster-randomised controlled trial. BMJ Open 2022. doi:10.1136/bmjopen-2021-054544

[107] Huffman MD, Mohanan P, Devarajan R, et al. Acute Coronary Syndrome Quality Improvement in Kerala (ACS QUIK): rationale and design for a cluster randomized stepped wedge trial. Am Heart J 2016. doi:10.1016/j.ahj.2016.10.026