

Nurse-Led Interventions in the Prevention of Catheter-Associated Urinary Tract Infections: A Narrative Review

Bot Lal^{*1}, Dr. Rohina Rabec Francis²

¹PhD Scholar, Jaipur National University, Jaipur, Rajasthan, India

²Professor, Jaipur National University, Jaipur, Rajasthan, India

Abstract

Catheter-associated urinary tract infections (CAUTIs) remain one of the most common and largely preventable healthcare-associated infections, contributing substantially to prolonged hospital stay, increased healthcare cost, and, in a small proportion of cases, bacteraemia and heightened mortality risk. Because insertion, maintenance, and continued-need assessment of indwelling urinary catheters fall squarely within nursing scope of practice, CAUTI incidence is widely regarded as a nurse-sensitive quality indicator. This narrative review synthesises recent evidence (2019-2025) on nurse-led approaches to CAUTI prevention, including nurse-driven catheter removal protocols, multimodal insertion and maintenance care bundles, nursing empowerment and staff education models, and electronic health record (EHR)-based reminder and alert systems. Across the reviewed literature, nurse-driven removal protocols that permit nurses to discontinue catheters without a physician order once clinical indications lapse were consistently associated with reduced catheter-days and reduced CAUTI rates, in several quality-improvement projects exceeding 50% relative reduction. Multimodal bundles combining daily necessity review, standardised insertion and maintenance technique, and structured documentation produced more consistent and durable reductions than single-component interventions, and nursing empowerment, through continuous education, decision-making authority, and interdisciplinary accountability, was repeatedly identified as a determinant of sustained bundle adherence. The review concludes with implications for nursing leadership, education, and future research, emphasising autonomous nurse-driven removal protocols, EHR-embedded decision support, and sustained audit-and-feedback infrastructure as priorities for maintaining gains in catheter-associated infection outcomes.

Keywords: catheter-associated urinary tract infection; CAUTI; nurse-driven protocol; care bundle; nursing empowerment; healthcare-associated infection; patient safety.

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Introduction

A catheter-associated urinary tract infection (CAUTI) is a urinary tract infection that develops in a patient with an indwelling urinary catheter in place or removed within the preceding 48 hours, and is one of the most frequently reported healthcare-associated infections, accounting for roughly three in ten such infections in acute care. CAUTIs are associated with prolonged hospitalisation, elevated healthcare costs, and, in approximately 5% of cases, progression to bacteraemia, which further raises mortality risk. The financial burden is considerable, with a single infection estimated to cost between roughly \$600 and \$20,000 and aggregate annual healthcare expenditure attributable to CAUTIs reaching into the hundreds of millions of dollars in the United States alone.

While some CAUTI risk factors, such as advanced age, are non-modifiable, many others, including prolonged and unnecessary catheterisation, poor insertion technique, and inconsistent maintenance care, are directly amenable to nursing intervention, with an estimated 17% to 69% of CAUTIs considered preventable through consistent infection-control practice. Because nurses are responsible for catheter insertion, daily maintenance, and ongoing assessment of continued need, nursing practice occupies a central position in both the causation and prevention of CAUTIs. This narrative review therefore examines the recent evidence base for nurse-led interventions in CAUTI prevention, drawing on quality-improvement projects, scoping reviews, and quasi-experimental studies published largely between 2019 and 2025, with the aim of identifying which nursing strategies produce the most consistent and sustainable reductions in incidence.

2. Review Methodology

This is a narrative review rather than a systematic review or meta-analysis. Recent peer-reviewed literature, quality-improvement reports, and quasi-experimental studies addressing nurse-led CAUTI prevention were identified and synthesised thematically. Priority was given to studies and reports published between 2019 and 2025 to ensure the review reflects current practice standards, including guidance from the Centers for Disease Control and Prevention's Targeted Assessment for Prevention strategy and the Agency for Healthcare Research and Quality's CAUTI toolkit. As a narrative synthesis, this review does not follow a PRISMA protocol and does not report a formal risk-of-bias assessment; its purpose is to orient nursing practitioners, educators, and administrators to current intervention themes rather than to provide an exhaustive quantitative synthesis.

3. Nurse-Led Intervention Strategies

3.1 Nurse-Driven Catheter Removal Protocols

The single most consistently effective nurse-led strategy identified across the reviewed literature is the nurse-driven catheter removal protocol, in which nurses assess catheter necessity against defined clinical indications each shift and discontinue the catheter without requiring a physician order once indications no longer apply. A multi-hospital academic health system that implemented such a protocol found that catheter utilisation and CAUTI rates decreased significantly at the hospital with the highest baseline rate, though the effect varied at hospitals with already-low baseline rates, suggesting the protocol yields the greatest benefit where catheter overuse is most pronounced. In a surgical trauma intensive care unit, a nurse-directed removal protocol embedded within a

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multimodal bundle reduced the CAUTI rate from 5.1 to 2.0 infections per 1,000 catheter-days, while a paediatric intensive care unit reported a decline from 4.8 to 0.8 per 1,000 device days in the year following protocol implementation, alongside a 28% reduction in catheter device-days. A Singapore quality-improvement project similarly reduced CAUTI rates from 4 to 0 per 1,000 catheter-days over six months with 89% staff compliance, despite a slight increase in catheter use during the same period.

A scoping review of nurse-led urinary catheter removal protocols found consistent evidence that such protocols, particularly when combined with electronic reminder systems and bundled care packages, reduced CAUTI incidence across diverse patient populations, though study heterogeneity in outcome definitions limited direct pooling of effect sizes. Taken together, this body of evidence positions nurse-driven removal, rather than physician-initiated discontinuation, as the pivotal mechanism by which unnecessary catheter-days, and the infection risk associated with them, are minimised.

3.2 Multimodal Care Bundles

The strongest and most durable evidence for CAUTI reduction comes from multimodal, nurse-delivered bundles rather than any single intervention in isolation. A four-year longitudinal quasi-experimental study at a 643-bed academic acute care hospital used the Plan-Do-Check-Act model to implement evidence-based insertion and maintenance bundles, achieving a 38% reduction in the CAUTI standardised infection ratio and a 10.67% reduction in the catheter standardisation utilisation ratio, both exceeding the hospital's pre-set improvement targets. A scoping review synthesising 26 multimodal, nurse-driven quality-improvement interventions from 2019 to 2024 identified eight recurring nurse-driven components, most commonly training and education, monitoring and feedback, and daily necessity assessment, and concluded that the synergistic effect of bundled strategies, rather than any single isolated component, was central to their effectiveness.

A patient safety and quality-improvement project at a large Middle Eastern rehabilitation facility combined an interdisciplinary care bundle with patient and family engagement in catheter care, reducing the CAUTI rate from 1.28 to 0.42 infections per 1,000 catheter-days. A separate initiative embedding CAUTI prevention prompts and decision-support tools directly into the electronic health record reported a 65% reduction in CAUTI rates alongside 94% compliance with daily catheter necessity reviews, illustrating that automation of maintenance-bundle elements can meaningfully reduce reliance on manual nursing processes while reinforcing, rather than replacing, bedside judgement.

3.3 Nursing Empowerment and Staff Education

Sustained staff education and structural nursing empowerment are repeatedly identified as necessary companions to protocols and bundles rather than standalone solutions. A single-arm intervention study in Saudi Arabia examining a preventive care bundle paired with nursing empowerment found that nursing teams supported through continuous education, decision-making authority, interdisciplinary collaboration, and accountability frameworks were more likely to adhere to bundle protocols and proactively identify deviations from

best practice. The same body of evidence highlights that, despite the wealth of international and national guidance, consistent implementation of CAUTI prevention strategies remains constrained by variable training, resource limitations, and institutional culture, underscoring that empowerment and education operate as enabling conditions rather than one-time interventions.

An intensive care unit CAUTI reduction task force that combined education with practice-focused interventions, including a structured daily checklist, raised documentation compliance from 50% before the initiative to 83.3% during it, and the resulting programme was subsequently adapted for hospital-wide rollout, with informatics teams integrating the checklist and removal protocol directly into the electronic health record to sustain the gains achieved through frontline nursing engagement.

3.4 Electronic Decision Support and Documentation

Electronic health record integration is increasingly used to operationalise nurse-driven CAUTI prevention at scale. Embedding catheter necessity worksheets, removal-protocol algorithms, and automated reminders and alerts into the EHR reduces reliance on manual tracking and has been associated with improved compliance with daily necessity reviews and measurable reductions in both catheter utilisation and CAUTI rates. Implementation guidance from national bodies frames these electronic tools, including nurse-driven removal algorithms that require no physician order, as standard components of a comprehensive CAUTI prevention programme, reinforcing that documentation infrastructure is not a peripheral administrative task but a direct extension of nursing surveillance practice.

3.5 Application Across Care Settings

Nurse-led CAUTI prevention strategies have been implemented and evaluated across a wide range of care settings, from paediatric and surgical intensive care units to general academic acute care hospitals and rehabilitation facilities, with broadly consistent findings that nurse-driven removal, bundled maintenance care, and structured education produce measurable reductions in infection rates regardless of setting. However, the magnitude of benefit appears to depend on baseline catheter overuse and organisational readiness. Settings with the highest baseline catheter utilisation and CAUTI rates have tended to show the largest absolute reductions following nurse-driven protocol implementation, while settings that had already achieved low baseline rates showed more modest or variable incremental gains, suggesting that resource allocation for CAUTI prevention programmes may be most efficiently targeted toward units with the greatest baseline burden.

4. Discussion

Taken together, the reviewed literature points to a consistent conclusion: sustained CAUTI reduction depends on nurses being granted the autonomy to remove unnecessary catheters without waiting for physician authorisation, supported by standardised insertion and maintenance bundles and reinforced through continuous education and electronic decision support. Nurse-driven removal protocols consistently produced measurable reductions in catheter-days and infection rates, but their effectiveness varied with baseline catheter overuse, indicating that protocol design alone cannot substitute for

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organisational commitment to reducing unnecessary catheterisation in the first place. Multimodal bundles translated assessment into consistent bedside action, but the scoping review evidence indicates that no single bundle element, whether training, monitoring, or documentation, was sufficient in isolation; the synergy between components was what produced durable reductions.

This synthesis also highlights that nursing empowerment, decision-making authority, interdisciplinary accountability, and continuous education, functions as an enabling condition that determines whether bundles and protocols are followed with fidelity, rather than as a discrete intervention that can be delivered once and assumed to persist. The evidence on electronic health record integration suggests that automation of reminders and necessity checklists can meaningfully reduce the manual burden associated with maintaining protocol adherence, but such systems appear most effective when they reinforce, rather than replace, nurse-driven clinical judgement about catheter necessity. Finally, the observation that the largest gains occur in settings with the highest baseline catheter overuse suggests that CAUTI prevention resources may be most efficiently directed toward units where unnecessary catheterisation is most prevalent.

5. Implications for Nursing Practice and Education

- Adopt nurse-driven catheter removal protocols that permit nurses to discontinue indwelling catheters without physician order once clinical indications no longer apply, as the default nursing standard rather than an exception process.
- Embed daily catheter necessity review into routine nursing assessment and documentation, supported by a standardised checklist or algorithm.
- Adopt multimodal, nurse-delivered maintenance bundles covering insertion technique, ongoing care, and documentation, rather than relying on any single prevention element.
- Invest in nursing empowerment structures, including continuous education, decision-making authority, and interdisciplinary accountability, to sustain bundle adherence over time.
- Integrate catheter necessity prompts, removal-protocol algorithms, and automated reminders into the electronic health record to reduce reliance on manual tracking while preserving nursing clinical judgement.
- Prioritise CAUTI prevention resources and audit attention toward units with the highest baseline catheter utilisation, where nurse-driven interventions have shown the greatest measurable impact.

6. Conclusion

Catheter-associated urinary tract infections remain a largely preventable but persistent challenge in inpatient care, and nursing practice sits at the centre of effective prevention. Current evidence indicates that nurse-driven removal protocols, multimodal maintenance bundles, sustained nursing empowerment and education, and

electronic decision support, achieve substantially greater and more durable reductions in CAUTI incidence than any single intervention applied in isolation. As nursing education and health-system leadership continue to prioritise catheter-associated infection outcomes, future research should focus on standardising outcome definitions across studies, refining electronic decision-support tools, and identifying which organisational conditions most reliably sustain nurse-driven prevention gains over time.

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