

From Standards to Sustainable Practice: A Hospital-Wide Quality Improvement Program for Infusion Management in a Resource-Conscious Multispecialty Hospital in India

T.P. Shedin Bharathan¹

¹Consultant Anesthesiologist and In-charge, Department of Anesthesia and Critical Care, Indira Gandhi Cooperative Hospital (IGCH), Kochi, Kerala, India; Head of Innovations and Quality, Hopebridge Anesthesia and Critical Care Services, Plexus Anesthesia Associates, Kochi, Kerala, India

ABSTRACT

Corresponding author

T.P. Shedin Bharathan

Consultant Anesthesiologist and In-charge, Department of Anesthesiologist and Critical Care, Indira Gandhi Cooperative Hospital (IGCH), Kochi, Kerala, India; Head of Innovations and Quality, Hopebridge Anesthesia and Critical Care Services, Plexus Anesthesia Associates, Kochi, Kerala, India
E-mail: @shedin_in@hotmail.com

How to cite this article:

Bharathan TPS. From standards to sustainable practice: a hospital-wide quality improvement program for infusion management in a resource-conscious multispecialty hospital in India. *J Infus Nurses Soc India*. [2026;1:(1);35-42 doi:[DOI].

Received: 24-01-2026

Accepted: 04-10-2026

Published: 03-11-2026

Introduction: Vascular access is one of the most frequently performed interventions in hospitalized patients. Variation in device selection, insertion technique, securement, maintenance, access and documentation can contribute to preventable infectious, mechanical, and patient-experience complications. Contemporary standards provide an evidence-based framework, but translating them into routine practice in a resource-conscious hospital requires more than procurement of products.

Objectives: To describe the implementation of a hospital-wide infusion management quality improvement program in a 250-bed multispecialty cooperative-sector hospital in Kerala, India, and to evaluate post-implementation adherence and vascular-access surveillance findings. Material &

Materials and Methods: The program incorporated hospital-wide education, establishment of a seven-member infusion management team, standardized vascular-access terminology, aseptic non-touch technique, standardized skin antisepsis, dedicated vascular-access trays, standardised catheter selection and securement, closed intravenous systems, structured PICC and long peripheral catheter services, ultrasound-guided subclavian central venous access, and weekly digital auditing. Post-implementation audit data were collected from 2 December 2025 to 13 September 2026. A staged, hospital-wide infusion management program was successfully implemented through structured staff education, competency-based training, multidisciplinary governance, standardization of vascular access devices and procedures, development of advanced vascular access services, and continuous digital surveillance. A total of 5159 audit observations were recorded following implementation, demonstrating sustained integration of the program into routine clinical practice. **Results:** Audit findings showed high adherence to key infusion-care processes, including dressing integrity (~99%), catheter patency (~95%), and documented hand-hygiene compliance (~91.5%), with the majority of observations showing VIP score 0. **Conclusion:** A hospital-wide infusion management program can be implemented in a resource-conscious Indian hospital through structured education, standardization, dedicated clinical ownership, selective technology adoption, cost-conscious procurement and continuous audit. The post-implementation dataset demonstrates high adherence to several core infusion-care processes and provides a practical framework for longitudinal surveillance. The program illustrates that contemporary infusion standards need not be restricted to high-resource corporate hospitals.

Keywords:

Infusion therapy, Vascular access, Quality improvement, Peripheral intravenous catheter, Picc, Long peripheral catheter, Phlebitis, Patient safety, Vascular access team.

Access this Article Online
Quick Response Code:

Website: https://jinsindia.com
DOI: XXXXXXXXXX

Introduction

Vascular access is fundamental to modern hospital care. Peripheral and central vascular-access devices are used for administration of medications, fluids, blood products, parenteral nutrition and other therapies. Because these devices are so ubiquitous, rela-

tively small variations in insertion and maintenance practice can affect a large number of patients. Internationally, unwarranted variation in vascular-access practice has been associated with preventable infectious complications such as catheter-related bloodstream infection, mechanical complications in-

cluding infiltration, dislodgement and occlusion, and patient-experience harms such as pain, repeated venepuncture and treatment interruption.^[1-4] Phlebitis in particular remains one of the most common and under-recognized peripheral-catheter complications, and structured visual scoring tools have been developed specifically to allow bedside nursing staff to detect it early and act before it progresses.^[1]

Over the past decade, vascular-access practice has moved from fragmented, institution-specific convention toward a body of consensus, evidence-based standards. Contemporary infusion standards provide an evidence-based framework for infusion therapy and vascular-access device management, while WHO recommendations emphasise education, asepsis, device selection, surveillance, and multimodal implementation.^[1-3] Specialty consensus statements have further refined specific domains: the GAVeCeLT consensus for central venous access in critically ill patients,^[5] the ERPIUP consensus for peripheral and midline device selection,^[6] and the NAVIGATE project's proposed standardized nomenclature for vascular-access devices, intended to improve communication, reproducibility and comparability across studies and institutions.^[7] Taken together, this literature offers a reasonably mature evidence base for what good vascular-access practice looks like.

What remains far less established is how these standards can be implemented and sustained outside high-resource settings. Much of the published implementation literature originates from well-resourced corporate or academic hospitals, where procurement of premium devices, dedicated vascular-access teams, and continuous electronic surveillance infrastructure can often be assumed. This leaves an important gap for hospitals operating with real financial constraints and an explicit affordability mandate to the populations they serve, which is common across much of India's cooperative, trust and public hospital sectors. The challenge, however, is not simply knowing what constitutes good practice. The more difficult question is how contemporary standards can be implemented and sustained in a hospital where resources are limited and affordability of healthcare is an important institutional responsibility. In such settings, adopting every high-cost product or practice described in international standards is neither feasible nor necessarily the correct quality-improvement strategy. However, resource constraints are not an acceptable reason to defer standardization, given the scale of preventable harm that unwarranted vascular-access variation can cause. There is therefore a need for documented, real-world accounts of how evidence-based infusion standards can be translated into a sustained hospital-wide practice through a deliberately resource-conscious systems approach that can combine education, standardization, dedicated clinical ownership, selective rather than blanket technology adoption and continuous audit, with

transparent reporting of what was achieved, where gaps persisted, and how the program was evaluated over time.

Accordingly, this quality improvement program was undertaken to implement and describe a hospital-wide infusion management system in a resource-conscious multispecialty hospital in India, and to evaluate post-implementation adherence and vascular-access surveillance findings, including areas of variation warranting continued attention.

Objectives

To describe the implementation of a hospital-wide infusion management quality improvement programme in a 250-bed multispecialty cooperative-sector hospital in Kerala, India, and to evaluate post-implementation adherence and vascular-access surveillance findings

Materials and Methods

This quality improvement program was implemented at Indira Gandhi Cooperative Hospital (IGCH), Kadavanthra, Kochi, Kerala, India, a 250-bed multispecialty hospital functioning in the cooperative healthcare sector. The institution provides relatively affordable healthcare to a large and socioeconomically diverse patient population in the district. Post-implementation audit data reported here were collected from 2 December 2025 to 13 September 2026. Before implementation, infusion practices varied between clinical areas. Variation was identified in vascular-access terminology, insertion-site selection, equipment preparation, securement, dressing practice, connector use, flushing, administration-set management and documentation. The challenge was not simply a lack of willingness to provide good care but variable exposure to contemporary vascular-access standards, persistence of traditional practices, inconsistent availability and arrangement of equipment, and financial constraints affecting procurement decisions. In a cooperative hospital serving a large population for whom affordability is important, quality improvement required deliberate cost-benefit assessment. The program, therefore sought to avoid a false choice between quality and affordability. The guiding principle was to invest in interventions with meaningful clinical value, standardise processes in which variation created risk, and eliminate avoidable expenditure without compromising safety. This report follows the SQUIRE 2.0 reporting guidelines.^[8]

The program was based principally on the Infusion Therapy Standards of Practice,^[1] the CDC guideline for prevention of intravascular catheter-related infections,^[4] the WHO guideline for peripheral catheters,^[2] the recent WHO guideline for central venous catheters,^[3] the GAVeCeLT consensus for central venous access in critically ill patients,^[5] the ERPIUP consensus for peripheral venous access devices^[6] and the NAVIGATE project nomenclature for vascular-access devices^[7]. The NAVIGATE project was particularly relevant because it proposed standardized nomenclature for vascular-access devices, supporting

clearer communication, reproducibility and comparability. The ERPIUP consensus provided a framework for selection and management of short peripheral, long peripheral and midline devices.^[6,7]

The intervention combined hospital-wide education, standardization of equipment and terminology, and development of advanced vascular-access capability. The first phase was deliberate, pan-hospital education. Training was not restricted to intensive care or high-dependency areas. The nursing workforce was taught from fundamental concepts to practical application, including vascular-access terminology, device selection, peripheral catheter insertion, central venous access, aseptic non-touch technique, hand hygiene, skin antisepsis, securement, dressing management, needle-free connectors, flushing, administration-set management, phlebitis and infiltration recognition, documentation, and catheter removal. Multiple sessions were conducted over approximately two months, followed by mandatory hands-on training through external agencies using practical skill workstations. A seven-member infusion management team was established, including senior nursing personnel, the Nursing Superintendent and the Infection Control Nurse. The governance structure placed the Medical Superintendent at the level of major institutional approvals, the Senior Infusion Management Consultant/Adviser as clinical adviser, the Nursing Superintendent as implementation and oversight lead, and the Infection Control Nurse as infusion-team lead. The team was responsible for education, implementation, bedside support, audit, identification of practice gaps, corrective teaching, maintenance of standards and review of complications, and was designed primarily as an educational and improvement resource rather than a policing mechanism. When a deviation was identified, the preferred response was targeted bedside teaching or a focused mini-training session. Hospital-wide terminology was aligned with the NAVIGATE project,^[7] and aseptic non-touch technique was incorporated into peripheral and central vascular-access procedures.

Standardization extended to antisepsis, equipment and devices. A 2.5% chlorhexidine-containing alcohol preparation was adopted as the institutional antiseptic for peripheral and central vascular access. It was procured in bulk by the central store as 5-liter containers and stored in air-conditioned storerooms, with the aim of maintaining the manufacturer's recommended storage temperature of 8–24 °C. It was then issued to ward in-charges, who transferred it into labeled, supplier-provided dispensing bottles for use in the clinical areas. Dedicated peripheral vascular-access trays were introduced in clinical areas, each containing a defined minimum inventory with labeled components, and a dedicated central vascular-access trolley with printed, photograph-illustrated inventory lists was introduced in the intensive care environment. Dedicated reusable trays were established for long

peripheral catheter, centrally inserted central catheter, femorally inserted central catheter and arterial catheter procedures, with contents standardized, displayed, and sterilisation quality monitored using autoclave sterilization indicators. For short peripheral catheters, the forearm was established as the preferred initial site where clinically appropriate, with avoidance of placement over joints, representing a change from the traditional approach of cannulating the most immediately accessible vein. All short peripheral vascular-access devices were progressively transitioned from polytetrafluoroethylene to polyurethane catheter material,^[1] considered together with catheter size, site selection, securement, dwell strategy and surveillance rather than as an isolated product substitution. The program also initiated a transition towards injection-port-free short peripheral catheters, incorporated into a closed extension-and-needle-free-connector configuration, to minimise unnecessary manipulation and the mechanical irritation associated with an integrated injection port.

For central venous access, ultrasound guidance was adopted as an institutional capability. For adult patients requiring a centrally inserted central catheter, the subclavian vein was established as the preferred insertion site wherever clinically appropriate, with a deliberate transition from conventional landmark-based subclavian access towards real-time ultrasound-guided subclavian venous access, incorporating both infraclavicular and supraclavicular approaches. All anesthesiologists involved in central catheter insertion were progressively trained in real-time ultrasound-guided subclavian access, requiring deliberate training in venous identification, dynamic ultrasound imaging, probe optimization, needle-tip tracking, guidewire handling and recognition of anatomical variation. A large proportion of centrally inserted central catheters at the institution are now performed using real-time ultrasound-guided subclavian venous access. The CDC recommends the subclavian site over jugular or femoral sites in adult patients to reduce infection risk for non-tunneled central venous catheters, while also requiring consideration of mechanical risks and patient-specific factors.^[4]

Securement, dressing, flushing and administration-set practices were standardized hospital-wide. Stabilization securement was introduced for peripheral vascular-access devices, and transparent semipermeable dressings were standardized, with chlorhexidine-containing transparent dressings used for selected higher-risk vascular-access devices. Vascular-access dressing changes were transitioned from a routine time-based practice to an INS Standards-aligned approach, with dressings maintained for up to 7 days and replaced earlier if soiled, loose, damp or compromised.^[1] Normal saline was adopted as the standard flushing solution, with sterile single-use prefilled normal-saline syringes introduced for selected higher-risk central vascular-access devices. The hospital transitioned towards a closed intravenous system,

with neutral-displacement needle-free connectors standardized across clinical areas, disinfecting caps introduced for central vascular-access devices, and alcohol disinfection of the connector incorporated before access to peripheral devices. Peripheral vascular-access devices were connected to approximately 10-cm extension systems with needle-free connectors, reducing repeated direct manipulation of the catheter hub. Continuous administration sets were managed on a 96-hour schedule and intermittent sets on a 24-hour schedule under institutional protocol. Peripheral vascular-access devices were transitioned from routine time-based replacement to clinically indicated removal, in accordance with the INS Standards and ERPIUP recommendations,^[1,6] with devices removed in the presence of phlebitis, infiltration, occlusion, dislodgement, suspected infection, loss of function or completion of therapy, aiming to avoid unnecessary venepuncture, preserve peripheral venous access and reduce avoidable consumption of vascular-access materials.

Advanced vascular-access capability was developed alongside these standardization measures. An Advanced Vascular Access Service was established to provide ultrasound-guided difficult peripheral access, long peripheral catheter placement, PICC insertion, assessment of difficult intravenous access and structured follow-up. A structured PICC insertion service incorporated pre-insertion assessment and a standardized procedural protocol, using the PICC Zone Insertion Method (ZIM)^[9] to select the optimal upper-arm insertion zone. PICC insertion was performed under strict aseptic conditions in the operating theater using real-time ultrasound guidance for venous access and fluoroscopy for catheter-tip position, with intra-procedural trimming and structured follow-up documented in a dedicated PICC register. Long peripheral catheters, including both Seldinger-based and mini-midline/bullpup-type devices, were introduced as an intermediate option between conventional short peripheral access and central vascular access.

Continuous surveillance underpinned the program. The infusion team performed weekly audits using an electronic data-collection system, capturing timestamp, device type, insertion date and location, insertion site, site visibility, site condition, dressing condition, line labeling, administration-set status, catheter patency, insertion-date documentation, hand hygiene compliance, patient-reported pain or burning, VIP score, comments and photographs where necessary. Audits were carried out by nurses assigned to each ward, who periodically visited the ward and audited patients with vascular access devices selected at random; repeat audits of the same catheter were not deliberately sought. Hand hygiene compliance was assessed by direct observation by the auditor at the time of the audit and recorded as compliant or non-compliant. A separate infusion-management component was developed within the hospital's documentation

system, including infusion-management records and IV flow sheets, designed around local workflow to create a common language between nurses, physicians, infection-control personnel and the infusion team.

Because no pre-implementation audit dataset was available for comparison, this analysis is descriptive and longitudinal within the post-implementation period rather than a controlled pre/post evaluation, and the findings should be interpreted accordingly.

Post-implementation audit data were extracted from the institutional electronic audit workbook. The dataset contained 5,159 observations recorded between 2 December 2025 and 13 September 2026. Audit-level compliance was calculated as the proportion of applicable checklist items answered 'Yes' (items answered 'Not applicable' were excluded). Ward-level and overall compliance are the mean of audit-level scores. Two single observations recorded from the operating theater and emergency department were grouped as 'Other' in ward-level analyses. The unit of analysis was an audit observation rather than a unique patient or unique catheter episode. It included process measures (site visibility, site condition, dressing integrity, line labeling, administration-set interval, patency, insertion-date documentation and hand hygiene), patient-reported symptoms, and a Visual Infusion Phlebitis (VIP) score. VIP outcomes are reported only for peripheral catheters, for which the scale is intended. VIP percentages are expressed as a proportion of peripheral-catheter audit observations and are not patient-level or catheter-level incidence rates.

Ethical Considerations

This manuscript reports an institutional quality improvement programme based on routine clinical practice and quality-assurance surveillance. No experimental intervention was undertaken, and no patient was subjected to an intervention solely for research purposes. The audit formed part of routine hospital quality-improvement activities. The programme and the audit were approved by the Medical Superintendent before implementation, and the existing and the new methods of documentation were explained to and approved by the institutional authorities before the programme began. No separate Institutional Ethics Committee review was undertaken, as this was a routine quality-improvement activity. Separate, individual patient consent for participation in the audit itself was not sought, as the audit involved routine review of device-care and process-of-care checklist items rather than any patient-directed intervention, and no patient-identifiable information was recorded in the audit dataset or is reported in this manuscript. Informed consent for peripheral vascular-access devices continued to be obtained as part of routine admission procedure, and separate informed consent continued to be obtained and maintained for central vascular-access devices, independent of and unaffected by the audit described here.

Table 1: Monthly audit volume and VIP ≥1 among peripheral-catheter observations (n=5159)

Month	Audit observations	Peripheral-catheter observations	VIP ≥1	VIP ≥1 (% of peripheral observations)
December 2025	381	352	10	2.84%
January 2026	749	723	20	2.77%
February 2026	695	669	12	1.79%
March 2026	593	557	6	1.08%
April 2026	515	489	5	1.02%
May 2026	437	402	3	0.75%
June 2026	733	702	4	0.57%
July 2026	436	399	2	0.50%
August 2026	467	401	4	1.00%
September 2026*	153	142	1	0.70%
Total	5,159	4,836	67	1.39%

*September 2026 includes data through 13 September only.

Results

A total of 5,159 audit observations were recorded during the study period. The program generated sustained surveillance across the implementation period, providing a large body of post-implementation observations for feedback and subsequent improvement cycles. Monthly audit volume alongside the corresponding VIP ≥1 flag rate is presented in Table 1.

The device mix audited across the study period is summarized in Table 2. Short peripheral catheters accounted for the large majority of observations, consistent with their status as the most frequently used vascular-access device hospital-wide. Central venous catheters, PICCs, hemodialysis catheters and long peripheral catheters together made up the remainder, reflecting the smaller but clinically important caseload served by the advanced vascular-access and PICC services described in methods.

Table 2: Vascular-access device distribution (n=5159)

Device	Observations	Percentage
Short peripheral catheter (SPC)	4,830	93.62%
Central venous catheter (CVC)	217	4.21%
PICC	98	1.90%
Hemodialysis catheter (HD)	8	0.16%
Long peripheral catheter (LPC)	6	0.12%

Table 3 summarizes adherence across the nine core infusion-care process measures captured at each audit. Compliance was consistently high for measures related to site and dressing integrity such as site visibility, cleanliness, absence of local inflammatory signs, and dressing condition all exceeded 98.5%, as was adherence to line labeling and administration-set interval. The three measures with the lowest compliance were catheter patency (94.96%), insertion-date documentation (94.17%) and hand hygiene compliance (91.48%). Although still rela-

tively high in absolute terms, these represent the largest residual gaps identified by the audit and are the measures most directly implicated in the ward-level findings reported below.

Table 3: Core infusion-care process compliance (n=5159)

Audit measure	Compliant/applicable	Compliance
IV site visible and accessible	5,130/5,159	99.44%
Site clean, dry and intact	5,127/5,159	99.38%
No redness, swelling or discharge	5,097/5,159	98.80%
Dressing dated and intact	5,107/5,159	98.99%
Line labeled (applicable)	4,531/4,588	98.76%
Administration-set interval compliant (applicable)	4,066/4,143	98.14%
Catheter flushed and patent	4,899/5,159	94.96%
Insertion date documented	4,858/5,159	94.17%
Hand hygiene compliant (recorded responses)	4,541/4,964	91.48%

The distribution of VIP scores among the 4,836 peripheral-catheter observations is shown in Table 4. The large majority (98.61%) recorded a VIP score of 0; scores of 3 or higher were rare (3 observations, 0.06%).

Table 4: Visual Infusion Phlebitis (VIP) score distribution among peripheral-catheter observations (n=4,836)

VIP score	Observations	Percentage
0	4,769	98.61%
1	44	0.91%
2	20	0.41%
3	1	0.02%
4	1	0.02%
5	1	0.02%

Contd...

VIP score	Observations	Percentage
VIP ≥1	67	1.39%
VIP ≥2	23	0.48%

Monthly VIP ≥1 among peripheral-catheter observations (Table 1) declined from 2.84% in December 2025 to approximately 1% in March and April 2026 (1.08% and 1.02%), and was at or below 1.0% from May 2026 onward. Pain or burning was reported in 578 of 5,159 audit observations (11.20%) and no pain or burning was recorded in 4,581 observations (88.80%). Patient-reported symptoms were retained as a separate audit domain because symptom reporting and visual phlebitis assessment are not necessarily concordant.

Because pooled, hospital-wide averages can obscure meaningful differences between clinical units, compliance, phlebitis flags and patient-reported pain were additionally examined across the 13 audited wards (two single observations recorded from the operating theatre and emergency department are grouped as 'Other') as shown in the ward scorecard in Table 5.

Table 5: Ward-level scorecard (2 December 2025 to 13 September 2026; n=5,159), sorted by compliance. (n=5,159)

Ward	Audits	Compliance*	VIP ≥1
G	1,471	91.8%	9
SICU	54	96.8%	5
E	311	97.1%	9
CCU	182	97.1%	8
E Cubicle	185	97.6%	6
MICU	244	97.8%	13
B	249	99.0%	5
C	365	99.2%	9
H	227	99.4%	0
A	1,353	99.7%	5
F	423	100.0%	0
D	5	100.0%	1
Onco ICU	88	100.0%	0
Other (OT, ED)	2	100.0%	0
Total	5,159	97.0%	70

*Compliance is the mean audit-level proportion of applicable checklist items answered 'Yes'

Ward G accounted for 1,471 of the 5,159 audit observations (28.5%) and was the clear outlier, at 91.8% compliance against 97.0% overall. Its hand hygiene non-compliance (25.1%), undocumented insertion dates (19.0%) and flush/patency failures (14.5%) were several-fold higher than in all other wards combined (1.9%, 0.6% and 1.2%, respectively). Ward G accounted for 84% of all hand hygiene non-compliance, 93% of undocumented insertion dates and 82% of flush/patency failures. Ward G's compliance rose from 67.6% in December 2025 and

71.3% in January 2026 to 99.4–100% from February to July 2026, dipped to 91.7% in August (n=42), and was 98.5% in September (n=15). Ward H, a paediatric ward, recorded pain or burning in 186 of 227 observations (81.9%), far above other wards, although none of its observations scored above VIP 0. Pain or burning during infusion may be reported more often in pediatric patients, and this finding is therefore presented descriptively and should not be interpreted as evidence of a clinical problem in this ward.

Discussion

The central finding of this quality improvement program is the development of a hospital-wide infusion governance system rather than the introduction of any single product or procedure. The program combined evidence-based standards, education, standardization, dedicated clinical ownership, selective technology adoption, cost-conscious procurement and continuous audit. This approach is consistent with the contemporary direction of vascular-access guidance, particularly the WHO emphasis on education and training, asepsis, appropriate catheter selection, surveillance, and multimodal implementation.^[2,3]

The program deliberately began with education rather than procurement. Introducing a new catheter, connector or dressing without changing the underlying knowledge and behavior of the workforce would not be expected to produce sustainable improvement. Training was therefore designed to explain what had changed, why it had changed and how the new practice should be performed.

A key philosophical decision was that the infusion team should not function primarily as an enforcement agency. An audit finding was treated as an opportunity for education. The intended cycle was observation, identification of the gap, bedside explanation, corrective practice and reassessment, designed to create compliance through knowledge and ownership rather than fear of inspection.

Several interventions were deliberately simple: standard terminology, standard trays, standard antisepsis, standard connectors, standard extensions, standard documentation, and standard audit questions. Individually, each may appear modest; collectively, they reduce unwarranted variation. The NAVIGATE project similarly highlights the importance of standardized terminology for clear communication and reproducibility.^[7] Catheter material and configuration were also treated as system-level variables. Replacing PTFE with polyurethane and moving towards injection-port-free short peripheral catheters were not isolated procurement decisions; they were integrated into the broader strategy of reducing mechanical irritation, standardizing the vascular-access platform and simplifying a closed IV system.

IGCH functions within the cooperative healthcare sector and serves a population for whom affordability is important. The program, therefore did not equate quality

with maximum expenditure. Bulk procurement, reusable procedure trays, selective use of higher-cost prefilled flushes and targeted introduction of advanced vascular-access technology were used to align expenditure with clinical value. The underlying principle was that the objective is not to provide the most expensive infusion care possible, but the safest sustainable infusion care possible within the resources available. This distinction may be particularly relevant to healthcare institutions across India and other resource-conscious healthcare systems.

The 5,159 post-implementation observations provide a substantial surveillance base. Several core measures demonstrated high adherence, including site visibility, site integrity, absence of visible local inflammatory findings, dressing integrity, line labeling and administration-set compliance. The audit also identified areas requiring continued attention, particularly hand hygiene, insertion-date documentation and catheter patency. It also identified where continued attention should be targeted rather than distributed evenly: one ward, disproportionately represented in the dataset, accounted for a substantial share of the hospital's residual compliance and documentation gaps. This finding would have been invisible in the hospital-wide averages alone and illustrates why unit-level reporting is a necessary companion to aggregate quality metrics in infusion-surveillance programs, not an optional elaboration of them. A mature quality-improvement audit should not merely demonstrate success; it should identify the next problem to solve. The present dataset therefore functions as both an assessment of implementation and a baseline for the next improvement cycle.

Pain and burning were incorporated into the audit because vascular-access quality is not limited to infection prevention. Repeated cannulation, catheter failure, phlebitis and infiltration can cause discomfort and interrupt treatment. Including patient-reported symptoms alongside objective site assessment provides a more patient-centred surveillance model.

This quality improvement program is supported by a large post-implementation surveillance dataset of 5,159 audit observations, generated through hospital-wide implementation rather than a single-unit intervention. It was underpinned by a dedicated infusion-management governance structure and integrated education, standardization, advanced vascular-access services, and continuous audit into a single coherent system. The program also gave explicit consideration to affordability and resource utilisation throughout, and combined patient-reported symptoms with VIP scoring alongside conventional process measures, offering a more patient-centred view of vascular-access quality than process compliance alone would provide.

However, this remains a single-centre quality improvement experience, and the absence of a pre-inter-

vention audit dataset means causal pre/post comparisons cannot be made; the marked early decline in VIP scores and one ward's rapid compliance recovery, both concentrated in the first three months of surveillance, cannot be distinguished from an audit-reactivity (Hawthorne-type) effect or the progressive completion of training and equipment roll-out during that same window, and should be read descriptively rather than as evidence of causal improvement. Audit observations are not necessarily unique patients or unique catheter episodes, and the dataset does not contain central-line days or the information required to calculate CLABSI rates. Ward-level findings reported here also reflect audit observation counts rather than adjustment for patient acuity, staffing ratios, or case mix, and the disproportionate audit volume in the lowest-performing ward may itself partly reflect ward size or audit scheduling rather than practice alone; both should be accounted for in any follow-up analysis targeting that ward specifically. Audit volume also varied substantially between wards and over time. Ward G contributed approximately 45–51% of audits in January to March 2026 but 5–10% from June 2026 onward, so the early pooled trends partly reflect one ward's audit intensity and performance rather than a uniform hospital-wide change. Because the unit of analysis was the audit observation and repeat audits of the same catheter could not be distinguished, VIP rates represent the proportion of peripheral-catheter observations with a score rather than phlebitis incidence per patient, per catheter or per catheter-day.

Conclusion

The implementation of evidence-based infusion practice in a resource-conscious hospital is challenging, but achievable. The experience at IGCH demonstrates that a hospital does not require unlimited financial resources to establish a meaningful infusion-management program.

The principal intervention was not a particular catheter, dressing or connector. It was the creation of a system in which infusion care was deliberately examined, standardized, taught, audited and improved. Education created knowledge, standardization reduced variation, the infusion team created ownership, advanced vascular-access services provided escalation pathways, and continuous audit provided feedback. That same audit also showed that improvement was not uniform across the hospital, and that acting on unit-level findings and not just hospital-wide averages, will determine whether the gains reported here are sustained and extended.

In a developing healthcare system, quality improvement must be designed around the realities of the population being served. The objective is not to reproduce the most expensive model of infusion care, but to achieve the highest sustainable standard of safe infusion care for the resources available.

Declarations

Conflict of Interest

The author declares no conflict of interest related to this quality improvement program.

Funding

No external funding was received for this quality improvement program.

Acknowledgements

The author gratefully acknowledges the Secretary, Medical Superintendent, Nursing Superintendent, Infection Control Nurse, members of the Infusion Management Team, and the nursing personnel of Indira Gandhi Cooperative Hospital for their valuable support, active participation, and contribution to the implementation and continued development of the infusion management program.

References

1. Nickel B, Gorski L, Kleidon T, Kyes A, DeVries M, Keogh S, et al. Infusion therapy standards of practice, 9th edition. *J Infus Nurs.* 2024;47(1 Suppl 1):S1–S285.
2. World Health Organization. Guidelines for the prevention of bloodstream infections and other infections associated with the use of intravascular catheters. Part 1: peripheral catheters. Geneva: World Health Organization; 2024.
3. World Health Organization. Guidelines for the prevention of bloodstream infections and other infections associated with the use of intravascular catheters. Part 2: central venous catheters. Geneva: World Health Organization; 2026.
4. O'Grady NP, Alexander M, Burns LA, Dellinger EP, Garland J, Heard SO, et al.; Healthcare Infection Control Practices Advisory Committee (HICPAC). Guidelines for the prevention of intravascular catheter-related infections. *Clin Infect Dis.* 2011;52(9):e162–e193.
5. Pinelli F, Pittiruti M, Annetta MG, Barbani F, Bertoglio S, Biasucci DG, et al. A GAVeCeLT consensus on the indication, insertion, and management of central venous access devices in the critically ill. *J Vasc Access.* 2025;26(4):1096–1114.
6. Pittiruti M, Van Boxtel T, Scoppettuolo G, Carr P, Konstantinou E, Ortiz Miluy G, et al. European recommendations on the proper indication and use of peripheral venous access devices (the ERPIUP consensus): a WoCoVA project. *J Vasc Access.* 2023;24(1):165–182.
7. van Rens MR, van der Lee R, Spencer TR, van Boxtel T, Barone G, Crocoli A, et al.; WoCoVA Foundation and Global Vascular Access Network. The NAVIGATE project: a GloVANet–WoCoVA position statement on the nomenclature for vascular access devices. *J Vasc Access.* 2025;26(5):1439–1446.
8. Ogrinc G, Davies L, Goodman D, Batalden P, Davidoff F, Stevens D. SQUIRE 2.0 (Standards for Quality Improvement Reporting Excellence): revised publication guidelines from a detailed consensus process. *BMJ Qual Saf.* 2016;25(12):986–992.
9. Dawson RB. PICC Zone Insertion Method (ZIM™): a systematic approach to determine the ideal insertion site for PICCs in the upper arm. *J Assoc Vasc Access.* 2011;16(3):156–165.