Research Paper

Quality Improvement Interventions to Sustain Hand Rub Compliance in Neonatal Care

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ABSTRACT

Background: Hand hygiene using alcohol-based hand rub (AHR) is one of the simplest, most cost-effective interventions for preventing healthcare-associated infections, especially in neonatal intensive care settings where newborns are highly vulnerable. Although hand rub is quick, easy to use, and requires minimal resources, many healthcare facilities still practice it inconsistently. The study aimed to improve and sustain hand hygiene compliance by enhancing AHR use through a multi-stakeholder quality improvement (QI) approach to reduce neonatal sepsis in a special neonatal care unit at a tertiary government children's hospital in Chennai, India.

Methods: This prospective, interventional QI study used multi-stakeholder engagement and plan-do-study-act (PDSA) cycles. Using the WHO point-of-care QI (POCQI) model, a multi-stakeholder QI team, including doctors, nurses, health workers, and mothers, identified barriers to hand rub use. The study was conducted using fishbone analysis and 6 implemented weekly PDSA cycles in 2017. Contextual and low-cost interventions included fixing measuring tapes on AHR bottles to monitor use, placing fixed bedside holders for easy access, displaying IEC (information, education, and communication) posters and signboards in the regional language to reinforce awareness, and involving mothers in daily practice reinforcement. A run chart tracked average AHR use per baby per day. To prioritize the most influential contributors, we developed a Pareto chart. Data were analyzed using SPSS software, version 23. Regression analysis assessed trends in AHR use, the F-statistic evaluated intervention effects, and descriptive statistics were used to generate Pareto charts.

Results: Regression analysis showed a significant upward trend in AHR use over 6 weeks (β=+7.44 mL/baby/d/wk; R^2=0.983). The high F-statistic (288.4) and P<0.001 confirmed the improvement was statistically significant and aligned with the upward shift in the run chart toward the target level. Simplified SOPs (standard operating procedures), defined staff responsibilities, and periodic recognition ensured continued adherence and ownership.

Conclusion: Simple, low-cost, contextually relevant interventions, when implemented through a participatory, multi-stakeholder approach, can sustain hand hygiene improvement in neonatal settings. This model shows that sustainability in infection prevention depends not on complex technology but on shared ownership, continuous feedback, and practical design.

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Highlights

- AHR effectively prevents hospital infections.
- Neonates are highly vulnerable to infections in the NICUs.
- In this prospective, interventional QI study, we employed multi-stakeholder engagement and PDSA cycles.
- AHR use increased significantly over 6 weeks.
- Observed improvement was significant and aligned with the upward shift in the run chart toward the target level.
- Periodic recognition ensured continued adherence and ownership.

Plain Language Summary

Although hand rub is quick and easy to use, many healthcare facilities still do not use it consistently and optimally. In this study, we used alcohol-based hand rub (AHR) employing a multi-stakeholder quality improvement (QI) approach and plan-do-study-act (PDSA) cycles to reduce neonatal sepsis in a special neonatal intensive care unit (NICU) at a tertiary government children's hospital in Chennai, India. The results showed a significant upward trend in AHR use over 6 weeks. Periodic recognition ensured continued adherence and ownership. The results show that sustainable infection prevention does not depend on complex technology but on shared ownership, continuous feedback, and practical design.

Introduction

Hand hygiene remains the cornerstone of infection prevention in healthcare settings, particularly in neonatal intensive care units (NICUs) and special newborn care units (SNCUs), where newborns are uniquely vulnerable to healthcare-associated infections (HAIs) (Adams-Chapman & Stoll, 2002). The neonatal period is characterized by immature immune defenses, invasive procedures, and frequent handling by multiple caregivers (Chandonnet et al., 2017) increased resource use, higher costs, and extended hospitalizations. Proper hand hygiene. Despite widespread awareness, sustained adherence to hand hygiene practices among healthcare workers (HCWs), mothers, and support staff remains challenging. Alcohol-based hand rub (AHR) is recognized globally as the most effective, feasible, and time-efficient method for ensuring hand hygiene compliance, especially in resource-constrained environments (Boyce et al., 2017) the US Food and Drug Administration (FDA) requested that a "maximal use" trial be conducted to ensure the safety of frequent use of AHR. However, inconsistent use, limited availability, technical inaccuracy, and insufficient reinforcement undermine sustained use and, consequently, its effectiveness in infection prevention (Curtis & Shetty, 2008).

Research claims that correct AHR use reduces bacterial counts by 90% before and 82% after clinical procedures (Laustsen et al., 2008). However, several studies in India have highlighted persistent gaps in hand hygiene practices in neonatal units. Compliance rates in tertiary newborn care settings were reported to be as low as 33%, even when basic facilities were available (Tyagi et al., 2018). Quality improvement (QI) is a core part of good clinical care, using local data and system-based methods to help healthcare teams understand their processes and make care safer and better (Alexander & Hearld, 2009; Lynn et al., 2007). Because most QI research in hospitals uses multiple interventions and process measures, this study adopted a similar approach by involving multiple stakeholders.

Evidence from other QI projects supports this pattern. A 2020 study showed that structured PDSA (plan-do-study-act) interventions in a Bengaluru SNCU increased hand hygiene compliance from 69% to over 85% (Arunakumar et al., 2024). A study in a Government SNCU showed similar gains, where on-site mentoring and stakeholder involvement increased compliance from almost zero to over 80% (Deorari, 2018). Collectively, these findings establish that hand hygiene compliance is achievable and sustainable when QI principles are integrated with context-specific solutions.

In many SNCUs, the challenge lies not only in knowledge deficits but also in system-level barriers such as erratic supply chains, absence of functional refill mechanisms, and limited involvement of ancillary staff and mothers in infection control practices. Recognizing that lasting improvements in infection control depend on active participation from all frontline groups, effective QI efforts increasingly emphasize multi-stakeholder engagement including pediatricians, nurses, cleaners, and mothers to build ownership, accountability, and shared responsibility rather than relying solely on top-down monitoring; the present study is designed to incorporate this approach within its methodology.

The PDSA model provides a flexible yet structured framework for systematically identifying gaps, testing context-specific changes, and refining effective strategies through cyclic refinement over time. In the context of hand hygiene within SNCUs, this approach supports adaptive QI initiatives that respond to evolving clinical and behavioral needs. By fostering continuous feedback, reinforcement, and team engagement, the PDSA model offers a pragmatic pathway to enhance and sustain hand hygiene practices.

Baseline measurement

During the plan phase of the initial PDSA cycle, the QI team met to define baseline indicators and determine appropriate data-collection methods. To ensure accurate measurement, bedside AHR bottles were labeled with a graduated sticker from 1 to 500 mL. Each bottle was filled to the 500 mL mark and placed at the selected beds (implemented across all the beds in the unit). After 24 hours, the bottles were refilled to the same level, and the volume difference was recorded as the AHR used per baby per day by the researcher. The researcher repeated this procedure over three consecutive days to obtain a stable baseline average. Bottles were refilled whenever they became empty or when the volume dropped below 100 mL to ensure uninterrupted availability and maintain measurement accuracy. The baseline assessment covered all three SNCU units (term, preterm, and kangaroo mother care [KMC] rooms) and the nursery (80 functional beds total). A structured, computer-based datasheet was maintained for each unit, and the remaining volume in each bedside bottle was measured and recorded daily. In addition to measuring AHR compliance, an exploratory baseline assessment was conducted to identify contributory factors influencing AHR use and to inform subsequent QI actions. This assessment used non-participant observation and unit walk-throughs conducted by designated unit staff responsible for refilling AHR bottles, who were oriented to observe predefined indicators. Factors assessed included the availability and functionality of AHR dispensers at points of care, entry and exit points, and procedure areas; visibility and accessibility of AHR; consistency in the use of correct hand rub technique among mothers, HCWs, and ancillary staff during routine care; and the presence of reinforcement practices such as visual reminders, posters, and informal verbal prompts supporting AHR use. Observations were documented using a structured checklist (WHO [World Health Organisation] hand hygiene evaluation tool- observation forms), and findings from the baseline assessment were used to guide targeted QI interventions.

Baseline assessment across the 3 units revealed substantial underutilization of AHR. The preterm unit recorded an average of 12.5 mL per baby per day (based on 10 observed handlings per baby; range 8–15), the Term unit 16 mL per baby per day, and the KMC unit 12 mL per baby per day, all well below the expected 60 mL per baby per day. Observations indicated that mothers and ancillary staff rarely used AHR, while HCWs demonstrated variable adherence. These findings highlight considerable AHR underuse across all units despite frequent newborn handling and underscore the need for a structured QI intervention.

The study was conducted at the Institute of Child Health & Hospital for Children (ICH), Egmore, Chennai, the designated state nodal center for SNCUs in Tamil Nadu. The newborn unit manages a substantial caseload, admitting around 7000 newborns annually, making it one of the state's busiest referral centers. Given its high patient volume and central role in guiding SNCU practices statewide, the unit provided an appropriate setting to implement and evaluate improvements in hand hygiene practices.

Materials and Methods

The study used a point-of-care QI (POCQI) model to implement a policy change through multi-stakeholder involvement to improve AHR compliance in the neonatal care unit, reducing the incidence of neonatal sepsis. A multidisciplinary QI team was constituted comprising neonatologists, nurses, infection control staff, cleaning personnel, and mothers of admitted newborns, ensuring that all key perspectives in newborn care were represented. This inclusive approach enabled comprehensive problem identification and assessment of the feasibility of proposed interventions.

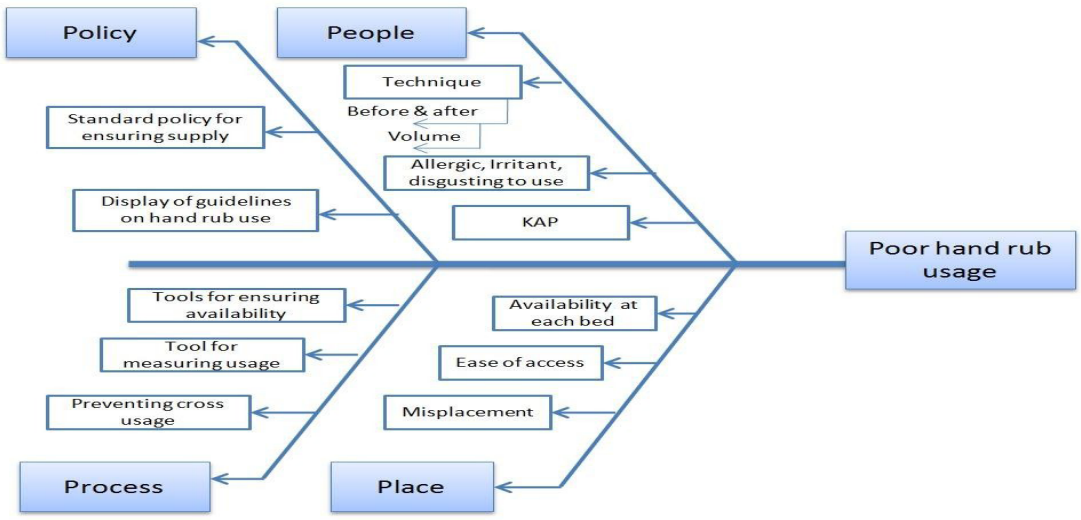


Figure 1. Fishbone diagram of factors associated with poor AHR usage

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During the baseline phase, the team identified inconsistent AHR use, awareness gaps, and frequent bedside availability issues. A fishbone analysis was performed to systematically explore potential root causes related to people, process, materials, environment, and methods. To prioritize the most influential contributors, we developed a Pareto chart, which highlighted that most missed hand hygiene opportunities were linked to poor AHR accessibility, inadequate staff awareness (using the WHO hand hygiene knowledge questionnaire for HCWs), and inconsistent replenishment practices.

The study therefore aimed to establish a reliable system to maintain adequate AHR stock at all points of care, supported by visual reminders such as posters and better-placed dispensers. Accordingly, the team set a clear aim, ie, to increase AHR utilization from a baseline of 16.3 mL per baby per day to 60 mL per baby per day within 2 months, strengthening infection-prevention practices and reducing neonatal morbidity and mortality.

A series of PDSA cycles were then designed to test feasible solutions on a small scale before wider implementation. The cycles included hand hygiene demonstrations for staff and mothers, educational sessions, display of motivational posters near neonatal beds, and improved AHR accessibility through portable bedside holders. AHR bottles were labeled with measurement stickers from 1 to 500 mL to allow precise monitoring of daily use. Standard operating procedures (SOPs) were also developed for refilling, indenting, and maintaining adequate stock, with senior staff providing regular supervision and reinforcement.

Weekly QI team meetings were conducted to review progress. Trends in AHR utilization across the SNCU were monitored using a run chart, which enabled the team to visualize changes over time, identify shifts or trends, and assess the impact of each PDSA cycle. For each measurement period, mean AHR usage was calculated from values recorded over 3 consecutive days across all units, providing a stable estimate of usage patterns. Bed occupancy ranged from 85% to 92%, and these data were collected alongside AHR usage to contextualize variations. The team assessed hand hygiene compliance through direct observation using a structured checklist, and compliance improved substantially, reaching 89% after the second PDSA cycle.

Quality improvement meetings

The quality improvement (QI) initiative began in the first week of January 2017. In PDSA cycle 1, the neonatologist in charge led an orientation session for all SNCU staff on the importance of hand hygiene and the correct use of AHR.

In the second week (PDSA cycle 2), the team identified key barriers, including inconsistent stock availability and poor visibility of AHR bottles. To address these challenges, the storekeeper was added as a permanent QI team member, and the indenting process was redesigned using buffer stock principles—new indents were raised once 50% of the monthly supply was consumed. This practice ensured uninterrupted availability and prevented stockouts.

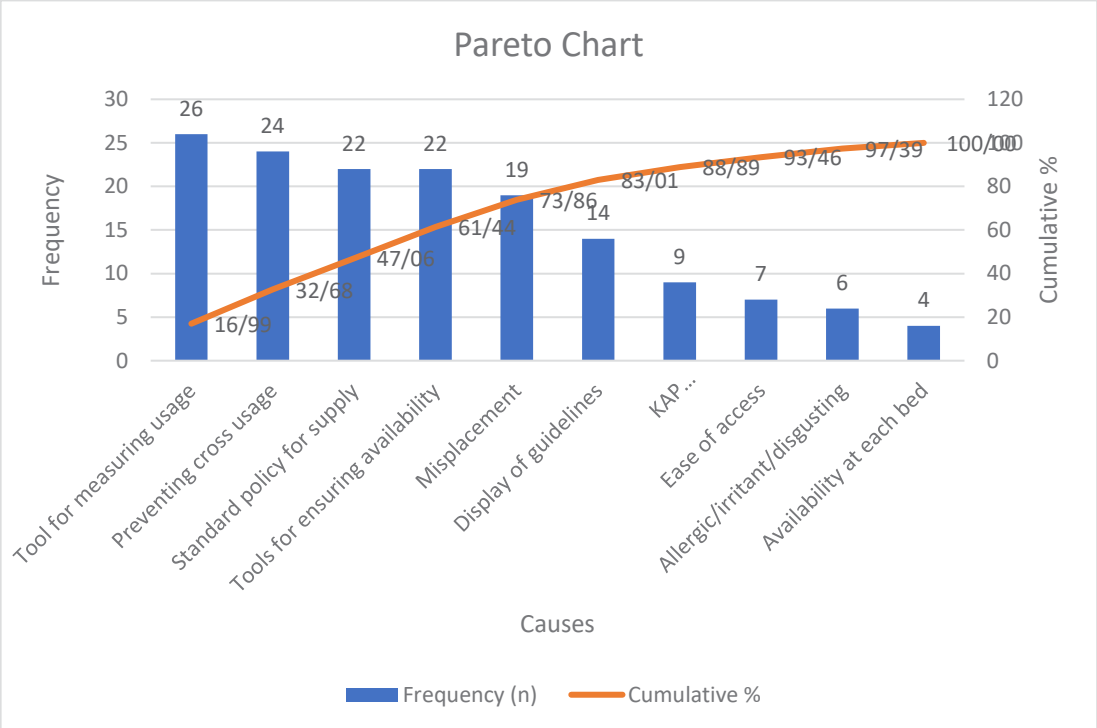


Figure 2. Pareto chart illustrating barriers to optimal AHR usage

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Knowledge strengthening and awareness-building continued in PDSA cycle 3, supported by visual reinforcements and ongoing educational sessions. To improve accessibility and visibility, PDSA cycle 4 introduced labeled AHR bottles (1 mL to 500 mL) placed in portable bedside holders on each warmer trolley. This standardized placement enabled real-time monitoring of daily consumption per baby. Staff recorded daily usage, and the resident team conducted random verification checks to ensure accuracy.

The focus then shifted to logistics and sustainability. PDSA cycle 5 finalized the redesigned indenting and stock management process into a draft unit policy to maintain consistent AHR supply and appropriate placement. In PDSA cycle 6, the team integrated the drafted policy and hand hygiene guidelines into routine practice

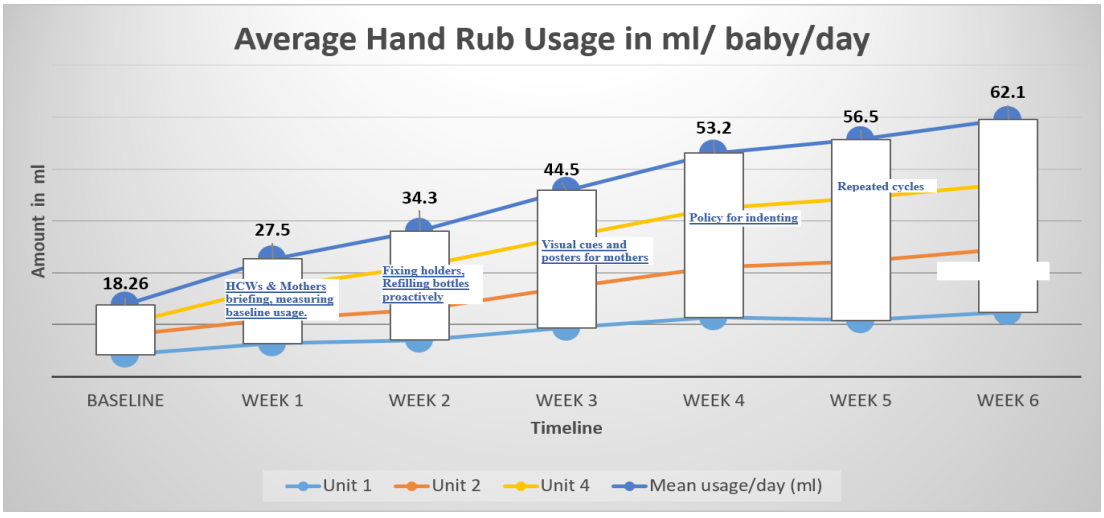


Figure 3. Run chart displaying average AHR usage

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Table 1. QI activities undertaken to strengthen hand hygiene practices using AHR in SNCU

Cycle	Theme	Plan (P)	Do (D)	Study (S)	Act (A)
1	Building the QI team baseline assessment	Identify stakeholders; prepare agenda; plan team roles and communication.	Conduct first QI meeting; present problem; assign roles; agree on aim and meeting schedule Measure the volume of AHR usage in all units.	Review participation, team completeness, clarity of roles. Study the discrepancy between baseline and optimum level of usage.	Modify the team, strengthen communication, and plan the next cycle (baseline). Check AHR stock maintenance to support optimum usage.
2	Identify issues	Plan an issue-identification meeting; prepare tools such as a fishbone diagram and process map; review baseline findings and gather initial observations	Conduct brainstorming sessions; identify gaps in AHR availability, compliance, workflow, and placement; prioritize issues based on team consensus.	Analyze issues under people, process, policy, and place categories to identify root causes.	Finalize key problems; refine the problem statement; plan the next PDSA cycle to address the identified root causes.
3	Addressing causes related to process and policy	Plan to address root causes related to process and policy by ensuring uninterrupted AHR supply, reducing stockouts, and improving visibility. Prepare to introduce a 50% buffer stock system, structured stock–usage logs, and placement of bedside holders for better access.	Procured sufficient AHR bottles; implemented the stock maintenance policy (refill/purchase when stock falls below 50%). Introduced daily logbooks and Excel tracking for usage and purchase. Installed bedside AHR holders and enhanced visibility by placing labeled bottles at each warmer/trolley.	Reviewed compliance with the 50% buffer stock policy; checked completeness and accuracy of logs and Excel sheets; assessed reduction in stockouts Evaluated usage increase after improving visibility and placement of holders.	Refined the stock–purchase policy, improved documentation practices, reinforced correct placement of holders, and planned the next cycle to strengthen monitoring, reinforcement, and adoption across all staff.
4	Education & sensitization	Identify gaps in staff awareness based on earlier cycles; plan informal sensitization strategies such as posters, bedside reminders, and brief demonstrations during rounds	Display posters on “five moments of hand hygiene” and correct AHR technique; provide informal on-the-spot demonstrations; offer quick reminders during routine patient care activities.	Review staff receptiveness, observe improved technique during routine care, and assess the visibility and usefulness of posters and reminders.	Reinforce messages during daily rounds; replace or reposition posters for better visibility; continue short, informal refreshers as needed.
5	Reinforcement and assessing readiness for routine integration	Plan to reinforce previously introduced strategies (availability, placement, visibility, and informal sensitization). Prepare to assess staff readiness to adopt these practices routinely.	Reinforce correct AHR use during rounds; remind staff to check stock, maintain logs, and use bedside holders. Informally observe practice patterns to gauge readiness for daily integration.	Assess staff consistency in following these practices; review adherence to stock systems and AHR holder use; evaluate overall readiness to embed changes into everyday workflow.	Identify remaining gaps; plan the next cycle to formalize and incorporate these improvements into routine policy and practice
6	Ensuring ustainability through policy integration & routine practice	Plan to institutionalize all improved practices (stock system, bedside holders, visibility, logging, and reminders). Draft a formal policy/SOP and integrate responsibilities into routine workflow.	Implement the finalized policy on AHR purchase, 50% buffer stock, usage logging, bedside placement, and daily checks Assign responsibilities to designated staff (nurse in-charge/storekeeper). Introduce these practices into routine supervisory rounds and appraisal discussions.	Review adherence to the new policy; assess consistency of logs, stock maintenance, and bedside holder upkeep. Evaluate staff ownership and integration of practices into daily care. Identify areas needing further reinforcement.	Finalize and adopt the policy as routine practice; include it in unit orientation for new staff; embed responsibilities in job roles; schedule periodic audits to ensure long-term sustainability.

Table 2. Linear regression analysis of AHR usage over 6 weeks

Variable	B (Slope)	R^2	F	P
Time (wk)	7.44	0.983	288.40	<0.001

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through structured monitoring, documentation, supervisory reviews, and reinforcement during staff appraisals, ensuring long-term sustainability of the improvements achieved (Table 1). Data analysis was performed using advanced statistical methods, including regression analysis to evaluate trends and predictors of AHRB use. The F-statistic assessed the overall significance of the intervention effect, and descriptive statistics were used to construct Pareto charts to identify key contributing factors. A P<0.01 was considered statistically significant.

Results

The root-cause analysis using a fishbone framework revealed multiple system-level contributors to suboptimal hand rub use in the SNCU (Figure 1). Under the policy component, the unit lacked a clearly defined, visibly displayed guideline on AHR use, leading to inconsistent practice. People-related factors included inconsistent adherence to hand rub before and after newborn contact, technique gaps, and inadequate understanding of the required volume for effective decontamination. Process issues were prominent, particularly the lack of a structured method to measure usage, a mechanism to ensure continuous availability, and the possibility of cross-using bottles between beds. The place dimension highlighted operational barriers, including insufficient AHR placement at individual bedsides and reduced access during routine care.

Collectively, these findings indicated that poor compliance arose not from a single behavioral lapse but from interconnected gaps across policy, workflow, and environment—reinforcing the need for a comprehensive, system-oriented QI strategy.

The Pareto chart (Figure 2) further showed that the most frequent barriers to optimal AHR use were the lack of tools to measure usage, the absence of a system to prevent cross-usage, and the lack of a standard supply policy, together accounting for more than 60% of the problem. Issues related to ensuring availability and misplacement contributed to nearly 80% of cumulative causes. Lower-frequency contributors, such as poor guideline display, knowledge gaps, and limited ease of access, had comparatively smaller impact. The chart emphasized that addressing the top 3 to 5 causes would yield the greatest improvement in hand-hygiene compliance.

The regression analysis showed a strong, statistically significant upward trend in AHR usage over 6 weeks. The slope of +7.44 mL/baby/day/week indicated steady and consistent improvement, while the R^2 of 0.983 showed that 98.3% of the variation in AHR use was explained by time. The large F-statistic (288.4) and P<0.001 confirmed that the improvement was not due to chance (Table 2). These findings aligned closely with the run chart, which depicted a clear rise toward the target level of 62.1 mL/baby/day (Figure 3).

This increased AHR use, along with improved compliance among HCWs and mothers (92.5%), helped reduce potential infection transmission, as reflected in a decline in sepsis cases from 5 to 3 during the study period. Overall, the interventions produced meaningful, sustained, and clinically relevant improvements in hand-hygiene practices and neonatal safety.

Discussion

This QI initiative showed that structured PDSA cycles and multimodal interventions can substantially improve AHR use in a neonatal care setting. At baseline, AHR usage in our unit was significantly below the estimated requirement of 62.1 mL per baby per day, largely due to inconsistent bottle availability, poor visibility of hand rub points, lack of refill systems, and limited sensitization of staff and mothers. Through sequential PDSA cycles that addressed policy gaps, process barriers, and behavior-related issues, we observed steady, statistically significant improvement in AHR use. Regression analysis of the six-week run chart showed an average increase of 7.44 mL/day per week, with a very high R^2 value of 0.983, indicating that 98.3% of the increase was explained by interventions over time. The significant P value (<0.001) and large F-statistic further affirmed the robustness of this improvement.

The significant upward trend in AHR use observed in this study aligns with evidence from intervention research showing that targeted QI activities effectively enhance hand hygiene practices. For example, multimodal QI interventions using PDSA cycles have been success-

fully implemented in similar settings to increase hand hygiene compliance, with significant improvements in observed behavior and AHR use following structured interventions and root cause analyses addressing system barriers such as dispenser placement and awareness gaps (Kumar et al., 2022; Chitamanni et al., 2023). Additionally, long-term studies have shown that increased hand hygiene product use and improved compliance are associated with lower healthcare-associated infection rates, supporting the clinical relevance of quantifying AHR use as a process indicator (Yue & Pan, 2025; Biswas et al., 2019). A quasi-experimental study from China demonstrated that compliance rates and per-patient-day use of AHR products increased substantially after a systemic intervention, underscoring the value of multidimensional strategies that include education, monitoring, and improved supply logistics (Mu et al., 2016; Borghesi et al., 2011). These findings reinforce the importance of addressing organizational and accessibility barriers such as measurement tools, supply policy, and usage systems as identified in the Pareto analysis in the current study. Moreover, meta-analytic evidence suggests that integrated multi-level interventions targeting individual and institutional determinants yield the greatest improvements in hand hygiene compliance, emphasizing that sustained behavioral change requires not only resources but also supportive systems and reinforcement practices (Kaveh et al., 2021).

These findings are strongly supported by previous QI studies showing that AHR usage can increase dramatically from 44 to 92 mL per baby per day through similar PDSA-driven changes, with sustained results for over 2 years (Singh et al., 2021). Similarly, structured multimodal interventions that included staff education and improved AHR accessibility led to substantial gains in hand hygiene compliance, increasing rates from 27.2% to 57.1% and from 40.6% to 69.8% (Kumar et al., 2022; Rai et al., 2021).

Sustainability is a key challenge in hand hygiene improvement programs, as some studies reported sustained hand hygiene gains only when processes were embedded in routine workflows (Lynn et al., 2007; Borghesi et al., 2011). Our fifth and sixth PDSA cycles specifically focused on preparing the unit for long-term adoption by introducing a simple stock-management policy, improving bottle visibility, maintaining a daily logbook, and reinforcing correct practice among both staff and mothers (Garland & Uhing, 2009). These cycles were unique to our QI initiative because they explicitly targeted sustainability by making optimal hand-rub practices a routine, shared responsibility for all stakeholders (Van Den Hoogen et al., 2011). This multi-stakeholder involvement, engaging neonatologists, nurses, infection-control personnel, and mothers, distinguished our project from many others, where sustainability components are often less emphasized.

Overall, our findings align with global evidence that QI-driven, low-cost interventions can significantly improve AHR use, increase compliance, and ultimately improve neonatal outcomes. The interventions implemented in this study are simple, scalable, and particularly well-suited to resource-limited neonatal care environments.

The present study demonstrates that significant improvements in AHR utilization can be achieved through low-cost, process-oriented strategies without requiring sophisticated technological inputs or substantial additional financial investment. Although a formal cost-effectiveness analysis was not undertaken, the interventions primarily involved workflow redesign, structured monitoring, improved visibility, and stakeholder engagement, highlighting the practical feasibility and scalability of such approaches in resource-limited neonatal settings. While AHR utilization was used as a process indicator rather than a direct behavioral observation measure, sustained increases in product utilization strongly suggest improved adherence to hand hygiene practices. Furthermore, the structured incorporation of sustainability-focused PDSA cycles supports continued adherence, as accountability mechanisms and shared responsibility were embedded in routine unit processes.

Study limitations

Several contextual factors, such as staffing variations, workload changes, IEC (Information Education Communication) poster awareness activities, new staff orientation, or concurrent audits, may have influenced hand-rub usage but were beyond our control. The NICU had continuous inflow of new admissions and new mothers, each requiring orientation to hand hygiene practices. This turnover may have influenced AHR usage and compliance patterns, making it difficult to attribute changes solely to the intervention. Because compliance was assessed through direct observation, HCWs and mothers may have altered their behavior when observed, potentially inflating compliance rates.

Conclusion

This QI initiative showed that a structured, multi-pronged approach—ensuring AHR availability, staff

sensitization, mother engagement, and visual reminders—led to a marked and sustained improvement in hand hygiene practices. AHR usage steadily increased toward the 62.1 mL/baby/day target, supported by a strong regression trend indicating consistent behavioral change. Importantly, sustainability was achieved through simple stock-management processes, improved bottle visibility, logbook maintenance, and routine reinforcement, which helped embed optimal hand rub practices into daily workflow. The rise in AHR usage, along with high compliance (92.5%) and fewer sepsis cases, highlights both durable practice change and clinical benefit. While this study demonstrated improved AHR use through a QI approach, prospective longitudinal or cohort studies would allow systematic assessment of temporal associations between AHR adherence and infection outcomes. Such analytical designs would provide stronger evidence on whether sustained improvements in AHR use translate into measurable reductions in healthcare-associated sepsis.

Ethical Considerations

Compliance with ethical guidelines

All stakeholders approved participation in the study. The related Ethics Committee approved the study (EC Reg No: ECR 270/Inst.TN 2013).

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Conflict of interest

The author declared no conflict of interest.

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