

Lessons learned in establishing a quality improvement project to reduce hospital acquired infections in the neonatology ward at a referral hospital in Rwanda

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Abstract

Purpose – Improving healthcare quality has become a worldwide effort. Strategic problem solving (SPS) is one approach to improve quality in healthcare settings. This case study aims to illustrate the process of applying the SPS approach in implementing a quality improvement project in a referral hospital.

Design/methodology/approach – A project team was formed to reduce the hospital-acquired infection (HAI) rate in the neonatology unit. A new injection policy was implemented according to the root cause identified.

Findings – The HAI rate decreased from 6.4 per cent pre-intervention to 4.2 per cent post-intervention. The compliance of performing the aseptic injection technique significantly improved by 60 per cent.

Practical implications – This case study illustrated the detailed application of the SPS approach in establishing a quality improvement project to address HAI and injection technique compliance, cost-effectively. Other departments or hospitals can apply the same approach to improve quality of care.

Originality/value – This study helps inform other hospitals in similar settings, the steps to create a quality improvement project using the SPS approach.

Keywords Quality improvement, Hospital-acquired infection, Strategic problem solving, Aseptic injection, Resource-limited setting

Paper type Case study

Background

Improving healthcare quality has become a worldwide effort (Cohen *et al.*, 2008; Restuccia *et al.*, 2014; DelliFraine *et al.*, 2010; Mazzocato *et al.*, 2010; Walshe, 2009). In many developed countries, quality improvement efforts have become essential parts of the everyday operations in healthcare organizations (Glasgow *et al.*, 2010; Andersen *et al.*, 2014; DelliFraine *et al.*, 2013; Kaplan *et al.*, 2010; Poksinska, 2010; Hoot and Aronsky, 2008; Higginson, 2012; Boyle *et al.*, 2012; Boade *et al.*, 2008; Burns *et al.*, 2011; Wong *et al.*, 2012). Healthcare quality improvement efforts draw from a variety of approaches (e.g. Six Sigma, Total Quality Management and Plan-Do-Study-Act), yet all share some common principles:

- understanding process and systems;
- process measurement and standardization;
- capacity management (demand, supply and flow);

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- customer focus; and
- staff engagement (Boade *et al.*, 2008).

Strategic problem solving (SPS) is one such methodology that is commonly used to improve quality in healthcare settings (Burns *et al.*, 2011). SPS is a systematic problem-solving approach consisting of eight steps:

1. defining the problem;
2. setting an objective;
3. conducting a root cause analysis;
4. generating alternative strategies;
5. comparing strategies;
6. selecting a strategy;
7. implementing the strategy; and
8. evaluating its impact on the problem.

The approach emphasizes on a data-driven, evidence-based, decision-making process where stakeholders work collaboratively to find solutions.

Many quality improvement initiatives using the SPS approach have demonstrated positive results in resource-limited settings (Wong *et al.*, 2012; Robinson *et al.*, 2015; Atnafu *et al.*, 2015; Kmanzi *et al.*, 2015). This case study describes the process of using SPS to implement a quality improvement project in a neonatology unit at a referral hospital in Rwanda. The process described by this paper will help inform other hospitals in similar settings of the steps followed and the lessons learned throughout the process.

Methodology

Setting

Centre Hospitalier Universitaire de Butare (CHUB) is the only teaching hospital in the Southern Province of Rwanda. It has 500 beds and receives referrals from 15 district hospitals. The hospital has a 32-bed neonatology unit. In 2014, the neonatology unit had a total of 573 admissions and an average occupancy rate of 49.1 per cent. Hospital-acquired infection (HAI) rates in the unit were high, as evidenced by the Infection Prevention and Control (IPC) Committee's monthly HAI surveillance reports. Supported by the hospital senior management team and in collaboration with the IPC committee, the neonatology unit decided to initiate a quality improvement project to address the issue following the eight-step SPS approach (Burns *et al.*, 2011). A project team which included the director of nursing, the department head, nurse manager and nurses of neonatology and the IPC coordinator was formed.

Step 1: Problem statement

The first step in SPS is defining a clear problem statement upon which the team can focus its attention (Burns *et al.*, 2011). Although the neonatology unit was facing multiple and complex issues at that time, it was important for the team to concentrate its efforts on a single problem that could be addressed in a realistic manner, using available resources. In SPS, a good problem statement is one that is widely shared by key constituents and addresses a single but important issue in a short statement (Burns *et al.*, 2011). The project team agreed on, "The hospital-acquired infection rate in the neonatology unit is high".

Step 2: Objective

A file audit conducted in September and October 2015 revealed that out of the 652 babies admitted to the neonatology unit between June 2014 and April 2015, 42 had developed

HAIs. This baseline assessment indicated a 6.4 per cent HAI rate for the neonatology unit of CHUB, which is comparable to that of other hospitals in Africa which have reported an HAI range between 2.5 and 14.8 per cent (Nejad *et al.*, 2011). Based on the evidence collected, the team set a SMART objective (specific, measurable, achievable, realistic and time bound) of “reducing the neonatology HAIs rate from 6.4 to 4 per cent by March 2016”.

Step 3: Root cause analysis

The team began the root cause analysis by conducting a literature review on the common causes of HAIs in neonatology. They also met with 19 staff nurses, 3 doctors and 3 lab technicians of the neonatology unit to collect their opinions about the possible causes behind the high rate of HAIs in the unit. From the literature and discussions with staff, the suggested root causes included poor hand hygiene compliance, poor aseptic technique during injection, shortage of disinfecting materials and healthcare workers not being knowledgeable about HAI. After collecting the possible root causes, the team proceeded to collecting the relevant data for verification.

Hand hygiene compliance observation study. A hand hygiene compliance study was conducted in the neonatology unit by the IPC coordinator during nine randomly selected days in March and April 2015. The coordinator observed and recorded hand hygiene opportunities and actions performed by staff, based on the five moments recommended by the WHO (2009). The study showed the overall hand hygiene compliance rate was only 25 per cent in the neonatal intensive care unit (NICU) (Table I).

Aseptic technique. From the chart audit, the team found 90 per cent of the patients had received injections at some point during the course of their treatment. A head nurse from the project team conducted an observation study during eight days in September and October 2015. The head nurse used a tool adapted from the WHO best practices for injections and related procedures toolkit (WHO, 2010) to observe nurses from NICU giving injections to patients.

The tool contained four criteria:

1. hand hygiene before injection;
2. site or skin disinfection;
3. prepare dose from vial or ampoule correctly; and
4. use of gloves.

Proper aseptic technique was considered performed when all four criteria were fulfilled. According to the 15 observations, only two injections (13 per cent) had fulfilled all four aseptic technique criteria (Table II).

To rule out environmental factors, they verified hand washing stations in the neonatology unit. The unit has four rooms, each one containing one sink. Locally made mobile hand washing stations called Canacra were placed in the unit by porters when running water was not available. Alcohol hand rub was also provided to all staff in the NICU.

Knowledge of HAI. To verify the staff’s knowledge of HAI, the team tested 22 clinical staff by asking them to name at least three HAIs and at least three methods to prevent HAIs.

Table I Table summarizing the five moments of hand hygiene compliance rates

Moments	Opportunities	Actions	Compliance (%)
Before touching patient	40	7	18
Before clean/aseptic procedure	9	2	22
After body fluid exposure	5	3	60
After touching patient	31	12	39
After touching patient surrounding	11	0	0
Overall hand hygiene	96	24	25

Table II Results of using aseptic technique during injection

<i>Aseptic technique criteria</i>	<i>No. (%)</i>
Hand hygiene before injection	2 (13)
Skin or site disinfection	3 (20)
Prepare correct dose from vial or ampoule	15 (100)
Use of gloves	15 (100)
<i>Overall aseptic technique properly used</i>	<i>2 (13)</i>
<i>Total number of observations</i>	<i>15</i>

Only 32 per cent could name three HAIs and only 41 per cent could name three preventive measures, indicating knowledge level of staff about HAI was relatively low.

According to the root cause analysis, 90 per cent of the patients received injections at some point during the course of their hospitalization. Aseptic technique was properly performed on only 13 per cent of the injections, both because skin was not disinfected (20 per cent) and/or hand hygiene not performed (13 per cent). General hand hygiene compliance rate was also low (25 per cent). The knowledge of staff about HAI was also low, whereas access to hand hygiene materials was not a problem. Based on findings, the team decided to address the poor performance of the aseptic procedure during injection due to poor hand hygiene compliance and lack of HAI knowledge.

Step 4: Generate alternative interventions

Based on the selected root cause, the team proposed comprehensive, feasible-to-implement and mutually exclusive alternative solutions to address the problem:

- implement new injection policy and procedures in the NICU and provide on-the-job aseptic injection technique training to all nurses;
- appoint one aseptic technique-competent nurse per shift to give all injections;
- send nurses to other hospital units to observe proper aseptic techniques; and
- send nurses to continuous professional development training on aseptic injection.

Step 5: Comparative analysis of alternatives

A comparative analysis was conducted to compare the alternative solutions, and the team selected four evaluative criteria to rate and choose among the alternative strategies. The evaluative criteria were effective to addressing the problem, cost, timely in effect and feasibility. A matrix was drawn to evaluate each alternative against the criteria. Each alternative was given a score from 1 (least ideal) to 5 (most ideal) for each criterion. The total score for the alternative was the sum of all scores for the criteria.

Step 6: Select the best intervention

Based on the results of the comparative analysis, the team selected to implement an injection policy and procedures accompanied by on-the-job training on aseptic injection technique for all nurses. Acknowledging this strategy would not completely address all the different causes of HAI, and the team agreed that implementing this strategy would be the beginning of a series of interventions to be implemented in the future.

Step 7: Develop implementation plan and implement

The project team spent two weeks to plan the selected strategy. A Gantt chart was used to summarize and monitor the implementation progress.

The team met with the NICU staff to seek their input and feedback in developing the policy. After the policy was developed, it was circulated in the neonatology unit for feedback. Modifications were made before the final policy was officially approved in February 2016.

New policy and procedures were disseminated to the unit, and the team trained all nurses on the injection technique. Written permission from the hospital for this quality improvement project was obtained.

Step 8: Develop evaluation plan and evaluate

To measure the effectiveness of the intervention, the team measured the pre- and post-intervention HAI rate in the NICU. The post-intervention evaluation was conducted in April 2016, two months after official implementation. The team also measured the pre- and post-intervention percentages of compliance of aseptic injection technique in March 2016. The same data collection methods used in the pre-intervention evaluation were repeated in the post-intervention evaluation.

The pre-intervention and post-intervention HAI rates were analysed using the χ^2 test. The pre- and post-intervention results for aseptic injection compliance rates were analysed using Fisher's exact tests. All the tests were conducted using SPSS software v.21, with statistical significance at $\alpha = 0.05$.

Results

In the pre-intervention period, 42 patients out of 652 admissions (6.4 per cent) had developed HAI. In the post-intervention period, 6 out of 140 admissions (4.2 per cent) developed HAI. The HAI rate decreased 2.2 per cent, although it was not statistically significant ($p = 0.332$). In the pre-intervention period, out of 15 injections observed, only two (13.3 per cent) were performed using proper aseptic technique. In the post-intervention period, 11 out of 15 (73.3 per cent) observed injections were performed with proper aseptic technique. The compliance of aseptic injection technique significantly improved by 60 per cent, with $p = 0.003$ (Table III).

Among the different components of aseptic technique, performing hand hygiene before any injection significantly improved from pre-intervention (13.3 per cent) to post-intervention (100 per cent) ($p < 0.001$). For the 15 injections observed, two nurses performed hand hygiene before injection pre-intervention. For the 15 injections observed, all the nurses washed their hands post-intervention. Proper skin disinfection rate increased significantly from 20 per cent (3 out of 15) in the pre-intervention period to 100 per cent (15 out of 15) in the post-intervention period, $p < 0.001$.

Discussion

Following the SPS approach, the team set up a quality improvement project to reduce the HAI rate in the NICU. The project team developed, trained and implemented an aseptic injection policy in the NICU. Our results showed the HAI rate was significantly reduced and the overall proper aseptic technique compliance was significantly increased.

The project team involved key stakeholders in the problem-solving process at every step of the project. The eight-step SPS approach was the cornerstone of the success of this study. Defining a project based on data helped the staff and hospital leadership

Table III Summary of results of HAI and injection aseptic technique

Aseptic technique criteria	Pre-intervention			Post-intervention			P-value
	Sample	No.	(rate %)	Sample	No.	(rate %)	
Hospital-acquired infection	652	42	(6.4)	140	6	(4.2)	0.332
Overall proper aseptic technique compliance	15	2	(13.3)	15	11	(73.3)	0.003
Proper hand hygiene before injection compliance	15	2	(13.3)	15	15	(100.0)	<0.001
Proper skin or site disinfection compliance	15	3	(20.0)	15	15	(100.0)	<0.001
Proper prepare dose compliance	15	15	(100.0)	15	11	(73.3)	0.050
Compliance to glove use	15	15	(100.0)	15	15	(100.0)	NA

understand the actual magnitude and importance of the issues; they received buy-in and support at an early stage of the project. Setting a reasonable objective gave them a clear direction and achievable target, thus motivating staff to continue participating in the future. Complex hospital issues often have multiple root causes, and by conducting a root cause analysis using data and evidence, the team was able to focus on the root cause that contributed the most to the problem, in this case the aseptic injection technique. They were able to quickly address it and begin planning for future interventions addressing other root causes, such as hand hygiene compliance and/or disinfectant supply.

Because the hospital has limited financial resources to support this quality improvement project, the team selected an intervention that could be implemented within available resources and time. For example, one of the suggested intervention was to send nurses to attend continuous professional development training on aseptic injection; however, this intervention required significant financial investments and was eliminated from the comparative analysis. Another suggested intervention was to assign only one nurse in each shift to perform all injections. By following the SPS approach, the team conducted proper comparative analysis to select the most cost-effective strategy and was able to monitor the implementation to ensure progress.

The staff of the neonatology unit was consulted during the root cause analysis process. Their opinions and ideas were considered, and as a result, they showed concern for the proper implementation of the intervention. Following the SPS steps, the results of this intervention showed a reduction in HAI rate – even if it was not statistically significant. The project also showed a significant increase in aseptic injection practice compliance. The findings were consistent with other similar studies conducted in developing countries ([Aly et al., 2005](#)). Longer-term follow-up is needed to evaluate the actual outcome and sustainability.

The SPS approach emphasizes on evidence-based practice. Hand hygiene and skin disinfection are both recommended by the WHO and best practices for injections ([WHO, 2010](#)). The team created an aseptic injection policy based on the recommended procedures. SPS also emphasizes team work, which was one of the factors contributing to the project's success. The team involved many people in this project, including senior management, staff and secretary working in the NICU, IPC coordinator, chairperson of the Policy and Procedures committee and nursing director. They gained great support through their active participation, input and feedback. Nevertheless, there were challenges and limitations. The multi-disciplinary team inevitably faced disagreements among its members, and it was important to work in harmony and find common understanding; open, honest and frequent communication was necessary. In addition, there were unpredicted events, such as staff resignation, which delayed the implementation. They had to be flexible and adjust the plan accordingly. They added extra training sessions and incorporated more practice time to accommodate the new staff to ensure everyone was up-to-date on the training. They also provided more coaching to the inexperienced staff by pairing them with more senior nurses and trainers. Moreover, we cannot be sure about the sustainability of the project, and longer-term follow-up is needed.

The objective of this case study was to illustrate the detailed application of the SPS approach in establishing a quality improvement project. By following the step-to-step approach, the project team identified that the proper aseptic injection technique was the root cause, and, accordingly, implemented an aseptic injection policy. The results of the study showed that the HAI rate was reduced and compliance rate of conducting proper aseptic technique in injection was increased, with no extra financial cost added to the hospital. Other departments or hospitals can apply the same approach to implement a quality improvement project to improve quality of care.

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