"Improving patient safety in Pakistan's hospitals: a mobile health solution for enabling and monitoring the 'First, do no harm' principle"

Indus Hospital

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Background

The World Alliance for Patient Safety (WAPS) based at the World Health Organization (WHO) estimates that tens of millions of patients worldwide suffer disabling injuries or death due to unsafe medical care annually[1]. An estimated 234 million surgical procedures are done globally each year, with a peri-operative mortality rate of 3-17% in industrialized countries, and estimated to be even higher in developing countries. The International Nosocomial Infection Control Consortium (INICC) estimates that device acquired infections (DAIs) in the Intensive Care Units (ICUs) of developing countries pose even greater threats to the patient's safety than in ICUs of the developed world[2]. WHO advocates tackling patient safety internationally using a comprehensive, multifaceted approach involving cultural change, system development, and technical expertise.

The conclusions of recent reviews are alarming. Central line associated blood stream infection (CLABSI) rates in developing countries are estimated to be between 1.6 to 44.6 per 1000 central line (CL) days in adult ICUs, and 2.6 to 60.0 per 1000 CL days in neonatal ICUs, with an odds ratio ranging from 2.8 to 9.5 for significant extra mortality[4]. In comparison, ICU's in the developed world reported CLABSI rates between 1.2 and 2.1 per 1000 CL days[5]. The overall rate of ventilator-associated pneumonia (VAP) was 4 times higher in developing country ICUs than in ICUs in more developed countries (13.6 versus 3.3 per 1000 ventilator-days), and that of catheter-associated urinary tract infection (CAUTI) was twice as high (6.3 versus 3.3 per 1000 catheter-days)[3]. Sick, poor patients in developing countries risk disabling injuries or death simply by being admitted into hospitals with absent or poor patient safety protocols.

Examples of success in mitigating medical harm are few and most come from the developed world. One notable example is the "Keystone ICU Project" developed at the Johns Hopkins University (JHU). This was successfully applied in ICUs across the state of Michigan with a significant decrease in hospital acquired infection rates and is now being implemented throughout the United States[6]. In addition, the WHO has implemented this strategy internationally in United Kingdom and Spain with local partners. Similarly, the use of the surgical safety checklist reduced peri-operative complications and death rates by almost half[7.]

The Comprehensive Unit Based Safety Program (CUSP) was central to the success of the Keystone ICU Project. It is designed to integrate safety practices into the daily work of a unit or clinical area. CUSP follows a six-step iterative process to improve patient safety and the culture that drives safety attitudes and practices. Culture is a major focus because it is the set of shared attitudes, values, goals, and practices that characterize an organization (or unit/clinical area). Studies have demonstrated that improvement associated with a standardized checklist is moderated by culture[8]. Safety culture has also been shown to be related to outcome with improved clinical outcomes and lower rates of staff turnover reported in areas with positive perceptions of the culture of safety.

CUSP is continuous and should become a part of the daily activities in each unit or clinical area. Implementation of multifaceted interventions have been associated with large-scale sustained reductions in healthcare-associated infections such as central line associate blood stream infections (CLABSI) across diverse healthcare settings in the U.S., Spain, UK and Peru. Although the technical

components of this program (the evidence, summaries, and the way to measure infections) are broadly applicable anywhere, the way implementation approach needs to be adapted to local resources and context. Developing countries such as Pakistan are likely to have unique barriers to implementing such a project. Although the CUSP program has met considerable success over several sites across the world it comes with the considerable burden of paperwork and personnel requirement, translating into financial costs as well. This project aimed to use radio-frequency identification (RFID) based patient identification linked to a custom designed open-source software to address these challenges. The program also aimed to evaluate the efficacy of the Comprehensive Unit Based Safety Program (CUSP) in improving the existing safety culture and in training hospital personnel to learn from mistakes and the impact of evidence-based intervention checklists in reducing the incidence of surgical errors, central line associated blood stream infections (CLABSI), ventilator associated pneumonias (VAP) and catheter-associated urinary tract infections (CA-UTI).

Methodology

Population and Settings

This study was conducted at the Indus Hospital, serving a low to middle income catchment population of approximately 2.5 million in urban Karachi, Pakistan. Karachi is the largest city of Pakistan and is one of the largest metropolitan areas of the world. Indus Hospital is a 150-bed tertiary care facility providing free of cost services. 6 beds each are assigned for intensive and coronary care units. A 10 fold expansion phase is currently underway, and the plans include a special emphasis on critical care beds, of which there is a severe shortage in the city and region.

Study Design

The USAID funded 'Do No Harm Project' was designed as a year-long (July 1, 2012-June 30, 2013) prospective study. It was granted exemption by the IRD institutional review board.

In the absence of existing systematic infection surveillance, data collected in the first project quarter (Q1) was regarded as baseline. Q1 period was used to adapt protocols and develop software. The intervention was implemented in Q2, and all data subsequently was regarded as post intervention data.

CUSP

Implementing CUSP is a longitudinal commitment to reorganizing systems of patient care delivery. A CUSP team was first identified which was composed of hospital staff from multiple disciplines including a CUSP leader or a clinical champion who was primarily responsible for looking after the program (Appendix 1). In our settings, this CUSP team formed the core of the program and was an extension of the Infection Control Committee meeting. The team also included a senior hospital executive with the view to opening lines of communication, improving caregivers' attitudes about leadership, educating leaders about the clinical issues and safety hazards caregivers face daily, and increasing financial and other resources to improve safety.

The CUSP program implemented the intervention using the "4Es" change model (engage, educate, execute and evaluate) developed by at JHU and already implemented with resounding success in the Keystone Project, Michigan. Curriculum already developed at the Armstrong Institute of Patient Safety and Quality team based on their past experience was used. A series of talks were delivered by Dr. Peter Pronovost and Dr. Asad Latif, either in person or online.

Engage

In the initial session, caregivers were engaged by demonstrating the magnitude of preventable patient safety problems worldwide, especially the prevalence of hospital acquired infections and the cost of these preventable infections. The data was personalized using patient stories and the effect on their lives.

Educate

The next few sessions focused on ensuring that the CUSP team understood their roles in preventing infections, with an emphasis on the importance of teamwork and communication. An important aspect discussed during these sessions was the need to investigate systems of care to identify safety hazards and ways to participate in making care safer.

Execute

Recommended evidence-based interventions in the form of checklists were then contextualized for our settings. These checklists were initially implemented as paper forms and then transitioned onto an Android based Google Nexus Tablet (details in Section: Data collection), allowing real time data entry and collation.

Evaluate

Monthly data on pre-specified indicators was collected over the course of the project to measure progress. The four types of events in focus were Central Line Associated Blood Stream Infections (CLABSI), Catheter Associated Urinary Tract Infections (CAUTI), Ventilator Associated Pneumonia (VAP) and Surgical Site Infections (SSI). Standardized definitions from the Centers for Disease Control and Prevention (CDC) for each of type of event (CLABSI, CAUTI, VAP and SSI) were used and event rates were reported to ICU and CCU staff directly as well as with the CUSP group on a monthly and quarterly basis. Adherence to protocol was also measured along with data on the length of stay in the ICU/CCU.

Safety culture data was measured annually using a scientifically sound instrument, the *Hospital Survey on Patient Safety Culture.* This is a tool developed by the Agency for Healthcare Research and Quality (AHRQ) intended to help hospitals assess the extent to which their cultures emphasize the importance of patient safety, facilitate open discussion of error, encourage error reporting, and create an atmosphere of continuous learning and improvement.

The survey asks frontline clinicians, staff, and leaders to evaluate several aspects of safety culture, including seven dimensions that make up local unit or work area level safety culture, three dimensions of hospital level culture, and several outcome measures like an overall patient safety grade and the frequency of events reported. Each dimension of safety culture is measuring using a composite score

that is created based on responses to 3 or 4 questions. Scores greater than 75% can be considered areas of strength and scores less than 50% can be considered priority areas for improvement.

Staff at the ICU, CCU and the OR was invited to come to any of four sessions to fill out the survey. Infection control monitors (ICM's) administered the survey which was made available in both Urdu and English language. The remaining staff were given survey forms at their units by the respective unit in charge and collected by the ICM's. No identifiers of the respondents were collected ensuring that the feedback was anonymous.

Baseline data

There was no existing data on prevalence of hospital-acquired infections when the project was initiated. Therefore, the first quarter of the project served as baseline for CLABSI, CAUTI, VAP and SSI rates. The CUSP sessions were delayed until this data had been captured. ICU/ CCU LOS data for the preceding year was obtained using the Hospital Medical Information System.

Study Instruments

Forms and checklists currently being used by the National Health and Safety Network and those recommended by the CUSP protocol were adapted to local needs and settings. Screenshots of some of the forms used in the study can be found in Appendix B.

Data Collection

A low-cost, easy to implement radio-frequency identification (RFID) mobile health solution utilizing RFID tags for patients and open-source software on RFID capable tablet devices for health workers was developed to improve implementation of patient safety guidelines in surgical theaters and ICUs. The tablets support NFC (Near Field Communication) and a customized Android application was used to uniquely identify RFID tags on patient bracelets. The Android application is being used to electronically capture patient and event information as well as for entering data directly on to checklists to ensure adherence to protocol (Appendix B – Screenshots).

Data is uploaded to a web-based database and can be monitored in real time on both the web-dashboard and the Android tablet. The application also generates charts and tables on pre-defined variables (Appendix B – Screenshots), thus allowing real time review of reports by team members. Providing feedback and reports on a real time basis plays a vital role in improved participation by the team.

Findings

A downward trend was observed through the first three quarters in the rates of CLABSI and VAP infections (Table 1). However, a spike was observed in quarter 4. No CAUTI was observed at baseline but was observed in the latter quarters. No SSI was reported in the first two quarters, but a high rate was observed in quarter 3 when the method of follow-up with post op patients was altered.

Table 1: Cumulative Event Rate (per 1000 device days) per Quarter								
Quarter	**CAUTI**	**% change**	**CLABSI**	**% change**	**VAP**	**% change**	**SSI**	**% change**
Q1 – Baseline	0.00		13.22		21.28		0.00**	
Q2	3.68		10.75		9.80		0.00**	
Q3	0.00		0.00		9.62		36.59	
Q4	2.00		12.77		11.63		9.80	

*standard formula for hcai event rate: (no. of events/no. of intervention days)X1000

**incidence in first two quarters measured using passive surveillance system. Active follow-up of surgery patients started from quarter 3.

Table 2: Adherence to Protocol by Quarter			
Quarter	**Catheter**	**Central Lines**	**Ventilator**
Q1 – Baseline	-	-	-
Q2	-	-	-
Q3	-	96.4%	88.9%
Q4	100%	97.1%	87.6%

*adherence to protocol expressed as an average of % protocol adherence for all checklists submitted

No checklist protocols were in place for CLABSI, VAP, CA-UTI and SSI at the start of the study. Therefore, no baseline data exists for adherence to checklist protocols. The adherence of protocol could only be measured over two quarters beginning from the implementation of the Android software until the end of the funding period (Table 2). Over the course of these two quarters no significant difference was seen in the adherence to protocol across all three interventions.

Length of stay data was collected for a full year to allow for season variations. The median length of stay in ICU and CCU was 3.0 days (range: (0-59)) during October 1 2011 and Sep 30 2012 (pre-CUSP intervention). This decreased to 2.0 days (range: (0-58)) during the intervention period.

Hospital Survey on Patient Safety Culture

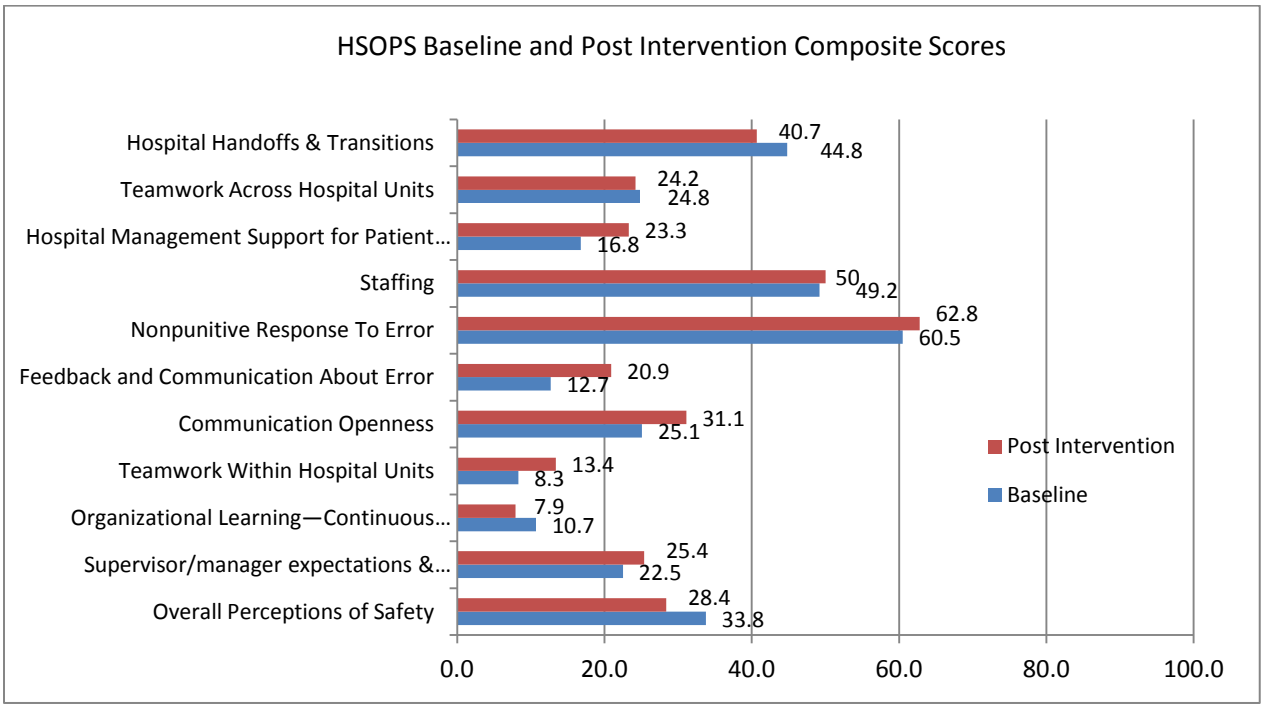
The HSOPS survey assessed the culture of patient safety in healthcare organizations at baseline, and 12 months later, after implementing interventions to improve culture of safety and teamwork. The response rate for the HSOPSC survey in the baseline period was 79% with 121 responses out of the targeted 154 personnel. This rate went down to 61% for the post intervention period with 103 responses out of 169 hospital personnel targeted.

Overall, improvements were seen in the average composite scores for several dimensions of safety culture. Feedback and communication about errors demonstrated the largest average improvement (8.3% improvement from 12.7% positive to 20.9% positive), while significant improvements were also seen in hospital management support for patient safety (6.6% improvement from 16.8% positive to 23.3% positive) and communication openness (6.0% improvement from 25.1% positive to 31.1% positive). Positive improvements in safety culture also occurred in areas of teamwork within hospital units, supervisor expectations & actions promoting safety and non punitive response to error.

Baseline Survey:

OT technicians (39%) and registered nurses (17%) made up the majority of participants in the (56%) baseline survey. Almost 78% of those surveyed had direct contact with patients and almost 75% had less than 5 years of experience in their current specialty. Out of the 121 participants surveyed at baseline almost 50% identified the Operation theatre as their primary work area while 22% were primary based at Intensive care units.

The findings from the survey suggested that non-punitive response to error, staffing and hospital hand-offs and transitions were areas of strength and that teamwork within hospital units, organizational learning and feedback and communication about errors were opportunities for improvement.



Post Intervention Survey:

The bulk of participants (63%) in the post-intervention survey was also made up of OT Technicians (47%) and registered nurses (16%). Of the 103 individuals who identified their primary work area in the post intervention survey, 51% identified the Operation theatre as their primary work area while 21% were based out of Intensive care units. The staff was more experienced with only 53% reporting less than 5 years of experience in their current specialty. Eight two (82%) of participants reported they had direct contact with participants.

In the post intervention survey non-punitive response to error, staffing and hospital hand-offs and transitions were areas of strength while teamwork within hospital units, organizational learning and feedback and communication about errors were opportunities for improvement

Compared to the baseline survey meaningful improvements were seen in feedback and communication about error (8.3%), hospital management support for patient safety (6.6%), communication openness (6%) and teamwork within hospital units (5.1%). Overall perceptions of safety declined the most, with a -5.4% decrease in the score followed by hospital handoffs and transitions (-4.1%). Organization learning, teamwork within hospital units and feedback and communication about error remained areas for continued improvement after the intervention.

Discussion

The CUSP program has been successfully implemented across multiple sites in the United States[5]. However, this success has yet to be reproduced in a developing country setting, where multiple challenges exist in the form of financial, human and technical resources. The CUSP program was contextualized to address these challenges and was reinforced with the added innovation of technology, designed to make the process efficient, stringent and reduce the cost of paper and human resource.

The pooled CLABSI rate estimated from the 837 US Medical/surgical critical care units (with less than 15 beds) participating in the National Healthcare Safety Network was 1.40 infections per 1000 central line days in 2009. During the same period, event rates per 1000 device days for VAP and CAUTI were 1.4 and 1.3 respectively[5]. The baseline rate in a study conducted across 86 Intensive care units in under developed countries under the INICC initiative was found to be 14.5 per 1000 central line days [9]. At the Indus Hospital, baseline rates for VAP (21.3 per 1000 central line days) and CLABSI (13.2 per 1000 central line days) were well above internationally accepted standards, and seen to be more in line with the situation in over developing countries. To fulfill the objective of bringing the infection rates down to zero, it is therefore essential to understand the differences between the health systems in developed and under-developed countries and to identify the potential additional factors that determine the difference in incidence of infection.

Although an overall downward trend was observed for CLABSI and VAP during the first three quarters, a spike was observed during the 4th quarter for both events. A major limitation in analysis of data was the small numbers of critical care beds and device days in our setting. This reduced the denominator, with the occurrence of even a single event producing a major impact on the infection rates.

Length of Stay

The implementation of the CUSP program was associated with a reduced length of stay in the intensive care units. Length of stay in an intensive care unit is linked with increased risk of acquiring a HCAI [10]. Therefore, one of the key aims to any program aimed at reducing the incidence of these infections is to reduce the length of stay in intensive care units.

HSOPS

Focus on improving the hospital safety culture is integral to the holistic nature of the CUSP program. The 2012 AHRQ National HSOPS Trending Database report indicates that in a sample of 650 U.S. hospitals

that composite scores increased by 1% over a period of 20 months on average[11]. The AHRQ National Trending Database also indicated that almost 50% of hospitals see both increases and decreases in their composite scores. Meaningful Improvements were seen in the average composite scores of several dimensions of safety culture in the post intervention survey. Improving safety culture is a continuous process as culture is continuously evolving. Over the course of the two surveys several dimensions have been identified that either showed a decrease in positive responses or not enough of an improvement in terms overall positive responses. These are areas in which future improvement efforts can be focused.

Update of RFID equipment and patient safety rollouts listed in Milestone 3.

Google Nexus Tablets and RFID tags were used for the project implementation. During the study period, 673 patients were registered and 192 checklists filled on these tablet. As well as a data entry portal, the application also has a reporting function, allowing healthcare providers real time updates on current patients in their units, devices attached to those patients and infections rates.

There was initial reluctance on the part of the health providers in the ICU and CCU to use these tablets. However, with time, they have become comfortable in the use of the application. The software developers worked closely with the frontline staff, incorporating their suggestions and making the application as user friendly as possible. These interventions have now become part of routine hospital practice and are continuing to be used actively well past the funded project duration. The project team and the hospital administration were committed to ensuring the sustainability of these essential practices beyond the project duration, and steps were taken to ensure the same during the year-long project activities.

Evidence Based Institution Wide Changes

The introduction of the CUSP program led to numerous hospital wide changes. During the site initiation visit by Dr. Asad Latif some preliminary recommendations were made. Based on problems observed and feedback from the health providers, several interventions were implemented during the course of the study.

Chlorhexidine: Povidine-Iodine was in use. This was replaced by Chlorhexidine as a skin preparation agent, Non-prescription mouthwash was replaced by oral Chlorhexidine. In both instances, evidence from scientific publications was used to convince the executive that this change was necessary.

Central line insertion technique: Inadequate sterility was noted for line insertions during the initiation visit and identified as an area for improvement. A checklist was implemented for all line insertions, which allowed for close adherence to standardized guidelines during the procedure and for monitoring of in situ devices. For this purpose standard templates from 'Johns Hopkins Armstrong Institute' and 'CDC's National Healthcare Safety Network' were contextualised to reflect the local settings and digitized for use on tablets.

An evidence-based recommendation adopted was to place a trolley with all equipment required for central line insertion available at that one station. This facilitated practice of standardized guidelines by ensuring all required equipment was readily available.

Empowerment of providers: A main focus of the CUSP program is empowerment of nursing staff to enable them to identify issues, prioritize them implement solutions them according to institutional needs. There was a conscious effort to ensure there were barriers in the implementation of the checklist protocols due to staff/positional hierarchy, with the nurses being asked to report directly to the Director of Medical Services in case of any untoward incidents.

The implementation of the CUSP program highlighted the issue of patient safety for the entire hospital. This led to some institution wide changes that were not directly within the mandate of the CUSP program. One of the challenges faced by the infection control team before the implementation of the project had been a high staff turnover in Infection control nurses. The hospital administration took interest in infection control leading to empowerment of the departmental staff. Moreover, realizing the importance of infection control the hospital administration agreed to increase the number of staff allocated to the department creating two funded Infection Control Monitor positions.

Hepatitis B Vaccination: A hospital wide Hepatitis B vaccination campaign was organized, ensuring that all current and new employees were provided vaccinations free of cost by the hospital. Although not part of the CUSP protocol, it was recognized that this was essential to the frontline staff working in close proximity with patients. During this campaign 389 existing hospital staff completed all 3 doses of the Hepatitis B vaccination while 78 new employees started the vaccination course.

Associated infections: The infection control team also identified other areas of focus that are not part of the core CUSP protocol. The application was expanded to include forms developed specifically catering to Phlebitis, GI prophylaxis, DVT prophylaxis, Hand Hygiene and Needle Stick Injuries and surveillance is now being carried out for these indicators throughout the hospital.

Limitations:

We recognize several challenges and limitations that must be taken into account before any conclusions are drawn from the findings of the project. The study design was not a cluster randomized trial because there were not enough participating units for randomization. This restricts our ability to make any causal inference about the interventions and outcomes. Moreover, before the study was initiated there was no existing surveillance system. The first quarter of the project was used as baseline, but during the course of a year infection rates might vary due to seasonal changes leading to increased disease incidence in the community and therefore higher admission rates. Therefore, the baseline infection rates may not account for seasonal variations. Similarly the absence of checklist protocols at baseline meant that the protocol adherence could not be compared against an already set standard.

The Indus Hospital is a 150 bed hospital with a 12 bed intensive care unit. This meant there was a very small denominator number every month and every quarter resulting in skewed data. The incidence of a single infection or event would therefore result in a very large change in the infection rate for the month and the quarter.

Another project barrier was linked with the health system at place at the Indus Hospital and more specifically with the capacity of its administration. The CUSP protocol relies heavily on steady interest from executives involved in the project to keep the other staff involved in the project invested in achieving the project aims. In settings such as ours where the administration was involved in clinical responsibilities, fund raising, and planning for expansion of the hospital the executives found it difficult to remain invested in the project through the course of the study period. This can be seen by the mild response to the HSOPS follow-up survey and the decrease in the number of issues identified and resolved by the CUSP team during the latter quarters of the study.

Plans for Scale up

The CUSP model has been implemented successfully in different settings across multiple countries. Engagement and commitment from senior hospital executives is critical to its success. In a developing country like Pakistan, there is little data to demonstrate the extent of HCAI and its impact on patient outcomes. As a result, it is difficult to make a convincing case and to get adequate buy-in from executives for CUSP. Therefore, we propose that scale up of the implementation at the Indus Hospital be started with setting up an infection surveillance network. The CUSP strategy will be phased in later, once there is baseline data available, documenting the extent and enormity of the problem.

The mobile health solution developed by this project to enable and monitor the 'First, do no harm' principle can cater to the requirements of an infection control surveillance network in most private and semi-private tertiary care facilities in this region. The application is easily adapted for use in other android devices and may be used in devices with mobile connectivity for facilities lacking Wi-Fi capability.

HCAI Surveillance: The project team has identified several hospitals across Pakistan where collaborations can be established for a multi-center scale up. Baseline infection rates will be documented across these centers using standard tools. This will allow data to be compared across centers. Privacy of data will be ensured, with collated figures being shared with the participating facilities while individual data for each center is kept confidential. This will allow individual centers to compare their data with the collated data, and assess their own outcomes, without needing to publicize infection rates that we anticipate may be worse than internationally accepted standards to start with.

Establish and Empower Infection Control Teams: Empowerment of facility based infection control teams is an essential step in ensuring the sustainability of surveillance. It is important that in-house teams take ownership to improve outcomes in their own facilities. This will allow the planned scale up to be effective beyond the grant period, an approach that we have demonstrated with success at the Indus Hospital and that we believe is critical for the long term sustainability of this initiative.

Handheld device for data collection: Use of the custom designed software will allow easy data entry that can be saved real time for rapid collation and reporting. The program team will do trainings in the use of the handheld device, with discussions on how to record the data in diverse clinical situations. Minimal investment in data management and equipment will be required. The program can be adapted to meet varying needs and additional requirements of specific facilities.

CUSP Intervention: It is envisaged that the surveillance data will highlight infection related problems that all facilities face. Once the enormity of the problem is documented, attempts will be made to engage the executives of each facility, using center specific and collated data to highlight the extent of the problem. It is hoped that a positive rapport will have been established with the infection control team at each facility during the surveillance phase, and suggestions for implementing the CUSP intervention will be well received. Moreover, it is expected that the infection control team at each facility will take a lead role in implementing the intervention at their own facility, and also help other centers and teams in addressing challenges that they have learnt from.

Expansion: Over time, it is expected that an increasing number of facilities will be added to this national network, allowing countrywide surveillance to be established. In due course, this experience and technology can be shared with other facilities in the region and the developing world that face challenges similar to ours.

Appendix

1	Senior Executive (Chief Operations Officer)	Dr. Wasif Shehzad
2	ICU Director	Dr. Akhtar Aziz
3	Unit Champion (Project leader)	Dr. Lubna Samad
4	Senior Consultant (Laboratory Services)	Dr. Altaf Ahmed
5	ICU Physician	Dr. Imran Ahmed
6	Content Specialist (Resident – Infectious Diseases)	Dr. Fivzia Harekar
7	Nurse Champion ICU	Arthur Johnson
8	Nurse Champion CCU	Muhammad Hussain
9	Nurse Champion OT	Imran Roberts
10	Nurse Educator	Syed Shahzad Shahid
11	CSSD	Muhammad Ali
12	Hospital Patient Safety Officer (Infection Control Nurse)	Rukshana Ravji
13	Program Associate	Fayez Jawed
14	Infection Control Nurse Monitor 1	Mehreen Kanwal
15	Infection Control Nurse Monitor 2	Sameena Parveen
16	Content Specialist - In training (Resident – Infectious Diseases)	Dr. Samreen

Month	No. Of patients	No. of catheterized patient days	No. Of CAUTI events	CAUTI rate per 1000 catheter days for the month
Jul-12	327	127	0	0.00
Aug-12	323	195	0	0.00
Sep-12	320	197	0	0.00
Oct-12	303	168	0	0.00
Nov-12	295	171	1	5.85
Dec-12	324	204	1	4.90
Jan-13	308	186	0	0.00
Feb-13	257	139	0	0.00
Mar-13	321	192	0	0.00
Apr-13	299	159	0	0.00
May-13	305	175	1	5.71
Jun-13	283	166	0	2.00

Month	No. Of patients	No. Of central line patient days	No. Of CLABSI events	CLABSI rate per 1000 central line days for the month
Jul-12	327	81	2	24.69
Aug-12	323	90	0	0.00
Sep-12	320	56	1	17.86

Oct-12	303	45	0	0.00
Nov-12	295	77	1	12.99
Dec-12	324	64	1	15.63
Jan-13	308	66	0	0.00
Feb-13	257	42	0	0.00
Mar-13	321	73	0	0.00
Apr-13	299	66	0	0.00
May-13	305	81	3	37.04
Jun-13	283	88	0	0.00

Month	No. Of patients	No. Of ventilator patient days	No. Of VAP events	VAP rate per 1000 ventilator days for the month
Jul-12	327	65	1	15.38
Aug-12	323	49	2	40.82
Sep-12	320	27	0	0.00
Oct-12	303	29	0	0.00
Nov-12	295	33	0	0.00
Dec-12	324	40	1	25.00
Jan-13	308	52	1	19.23
Feb-13	257	19	0	0.00
Mar-13	321	33	0	0.00
Apr-13	299	45	1	22.22
May-13	305	24	0	0.00
Jun-13	283	17	0	0.00

Month	No. Of patients	No. Of Surgeries	No. Of SSI events	SSI rate for the month
Jul-12	327	31	0	0.00
Aug-12	323	31	0	0.00
Sep-12	320	35	0	0.00
Oct-12	303	36	0	0.00
Nov-12	295	34	0	0.00
Dec-12	324	29	0	0.00
Jan-13	308	26	2	76.92
Feb-13	257	27	1	37.04
Mar-13	321	29	0	0.00
Apr-13	299	34	0	0.00
May-13	305	22	1	45.45

Jun-13	283	46	0	0.00

Activities

Implement interventions to reduce CLABSI, VAP and CA-UTI.

Educate staff on evidence-based practices to reduce CLABSI (12).

- Hand washing with soap
- Cleaning the patient's skin with chlorhexidine antiseptic
- Putting sterile drapes over the entire patient
- Wearing a sterile mask, hat, gown, and gloves
- Placing a sterile dressing over the catheter site once the line is in place

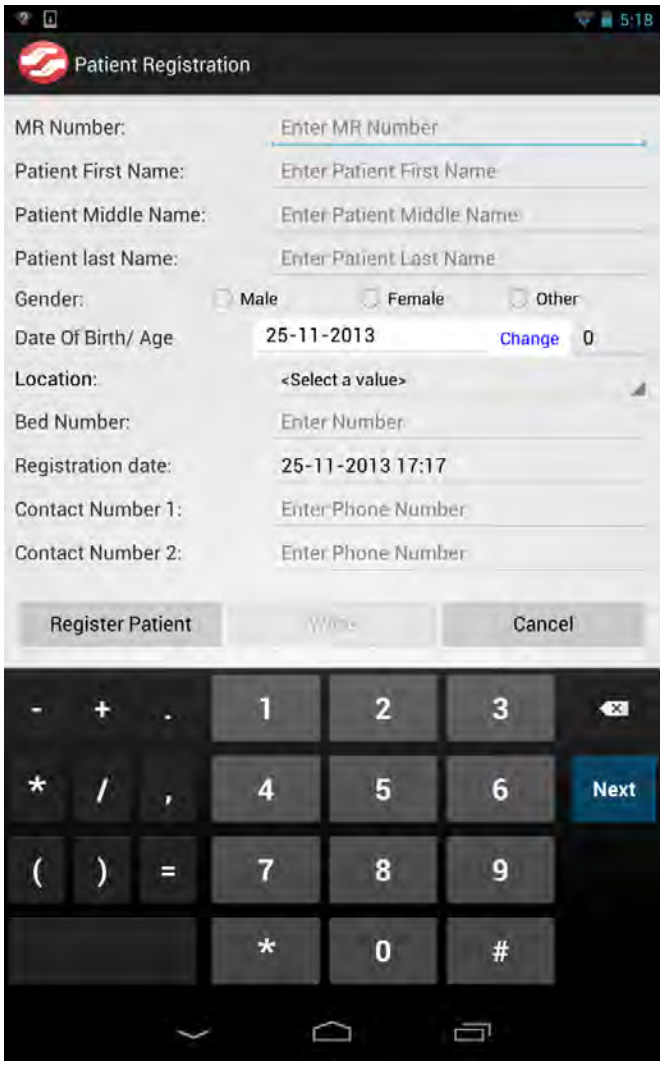
Educate staff on evidence-based practices to reduce VAP (13-15).

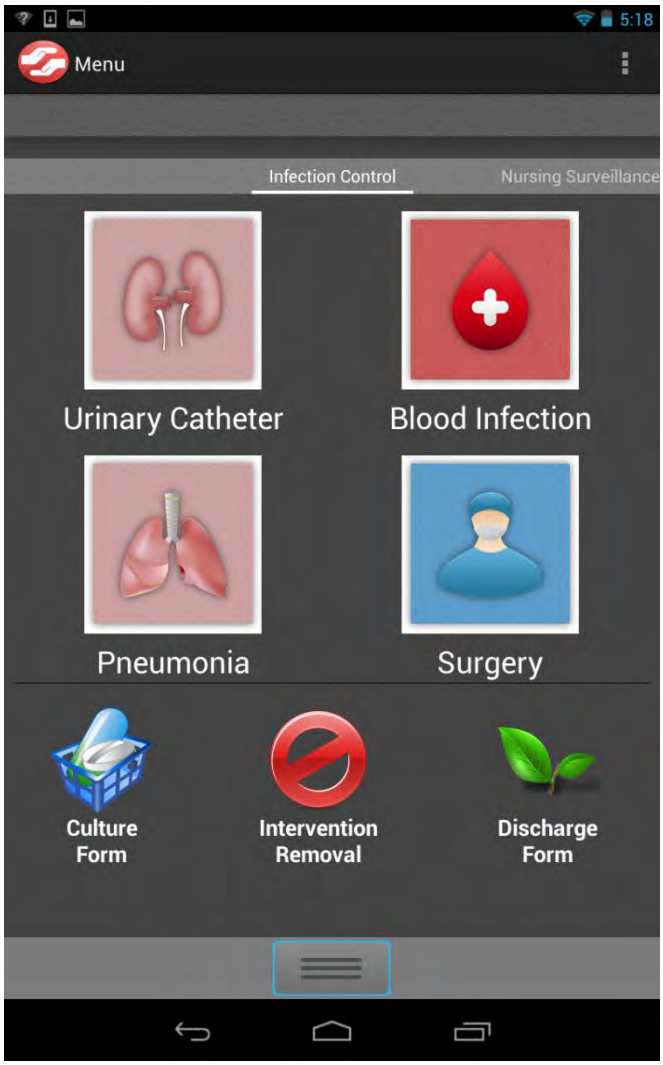
- HOB elevation greater than 30°
- Daily sedation break
- Daily assessment for extubation
- Peptic ulcer prophylaxis
- Deep vein thrombosis prophylaxis

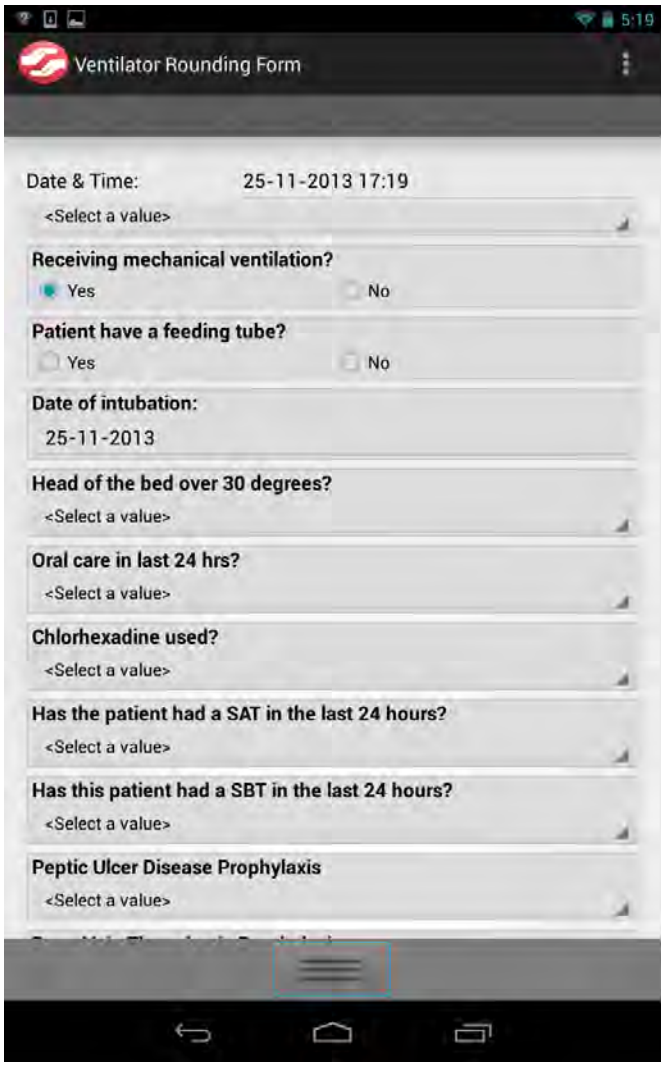
Educate staff on evidence-based initiatives to reduce CA-UTI (16, 17).

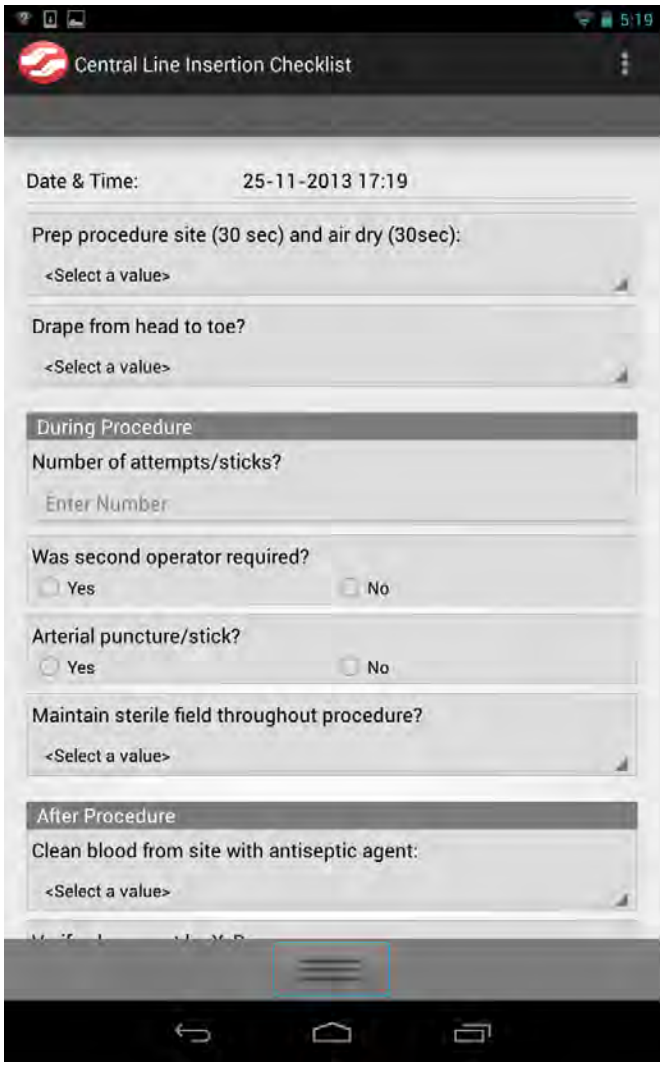
- Assessment regarding need for catheter on arrival, and on a daily basis
- Sterile technique during insertion
- Collection bag always lower than patient especially during transport
- Mandatory removal of urinary catheter at 5 days unless physician counter order written
- Implement a checklist to ensure compliance with these practices
- Empower nurses to ensure that doctors comply with the checklist
- Provide feedback on infection rates to the hospital and at the unit level
- Implement a monthly team checklist to assess overall progress of the project

Appendix B - Screen Shots of Application






5:19
Ventilator Rounding Form
Date & Time:
25-11-2013 17:19
<Select a value>
Receiving mechanical ventilation?
Yes
No
Patient have a feeding tube?
Yes
No
Date of intubation:
25-11-2013
Head of the bed over 30 degrees?
<Select a value>
Oral care in last 24 hrs?
<Select a value>
Chlorhexadine used?
<Select a value>
Has the patient had a SAT in the last 24 hours?
<Select a value>
Has this patient had a SBT in the last 24 hours?
<Select a value>
Peptic Ulcer Disease Prophylaxis
<Select a value>


5:19
Central Line Insertion Checklist
Date & Time:
25-11-2013 17:19
Prep procedure site (30 sec) and air dry (30sec):
<Select a value>
Drape from head to toe?
<Select a value>
During Procedure
Number of attempts/sticks?
Enter Number
Was second operator required?
Yes
No
Arterial puncture/stick?
Yes
No
Maintain sterile field throughout procedure?
<Select a value>
After Procedure
Clean blood from site with antiseptic agent:
<Select a value>

Surgical Preparation Checklist

Date & Time: 25-11-2013 17:19

<Select a value>

Appropriate antibiotic choice:
Yes No

Appropriate timing of intial dose:
Yes No

Appropriate redosing:
Yes No

Discontinuation within 48 hours:
Yes No

Hair removal avoided if possible:
Yes No

Razors correctly disposed:
Yes No

Perioperative normothermia ≥ 36 C:
Yes No

Glycemic Control with continous insulin infusion (in cardiac patients):
Yes No n/a

Catheter Insertion Checklist

Date & Time: 25-11-2013 17:19

Type catheter used:
<Select a value>

Insertion performed during emergency situation?
Yes No

Full peri care done?
Yes No

Size of foley:
14F 16F Other

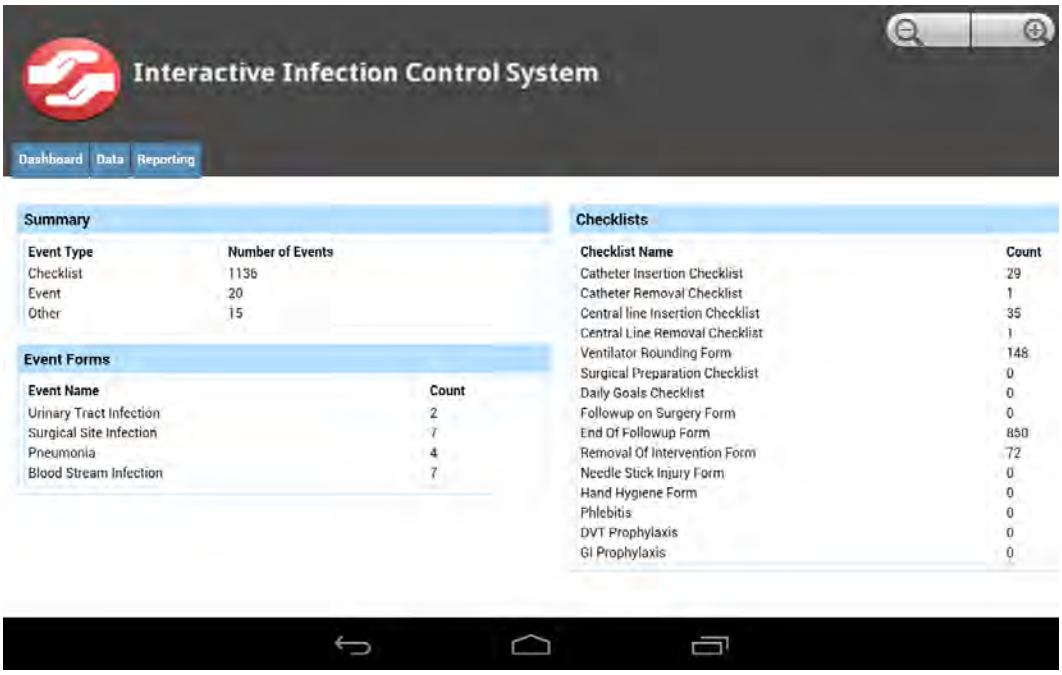
Buddy System Used:
<Select a value>

Number of cotton swabs used:
Enter Number

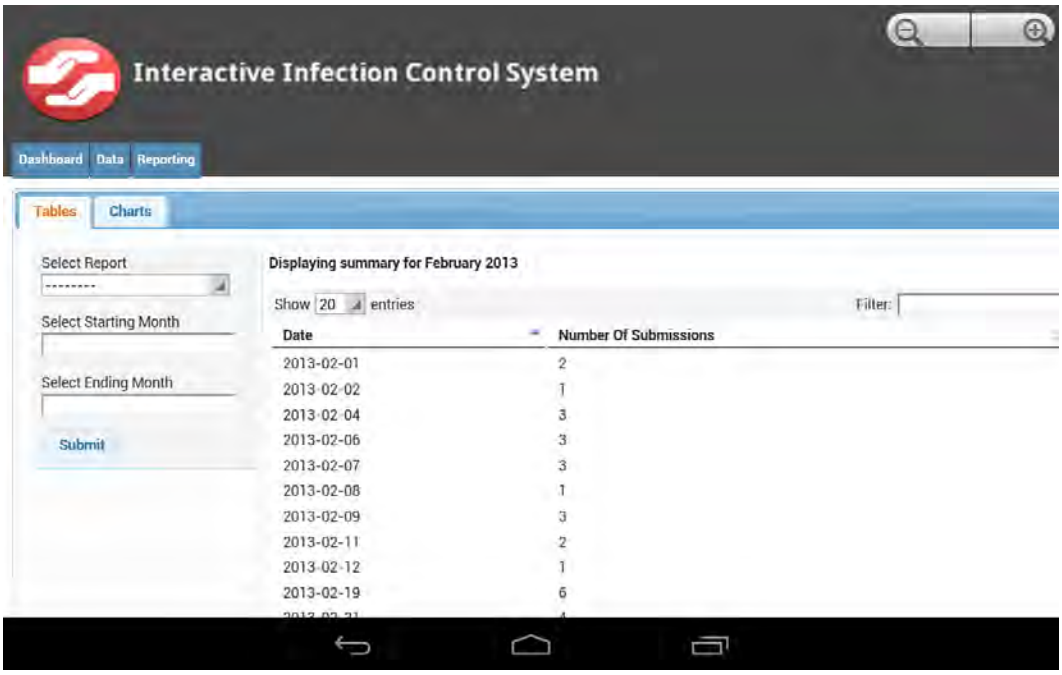
Multiple kits used:
Yes No

U/A and C and S obtained:
Yes No

Submit



Housekeeping table showing number of forms filled out per day



Tab **Table displaying data for pre selected parameters for central lines.**

Chart showing Infection rate against Central line days by months

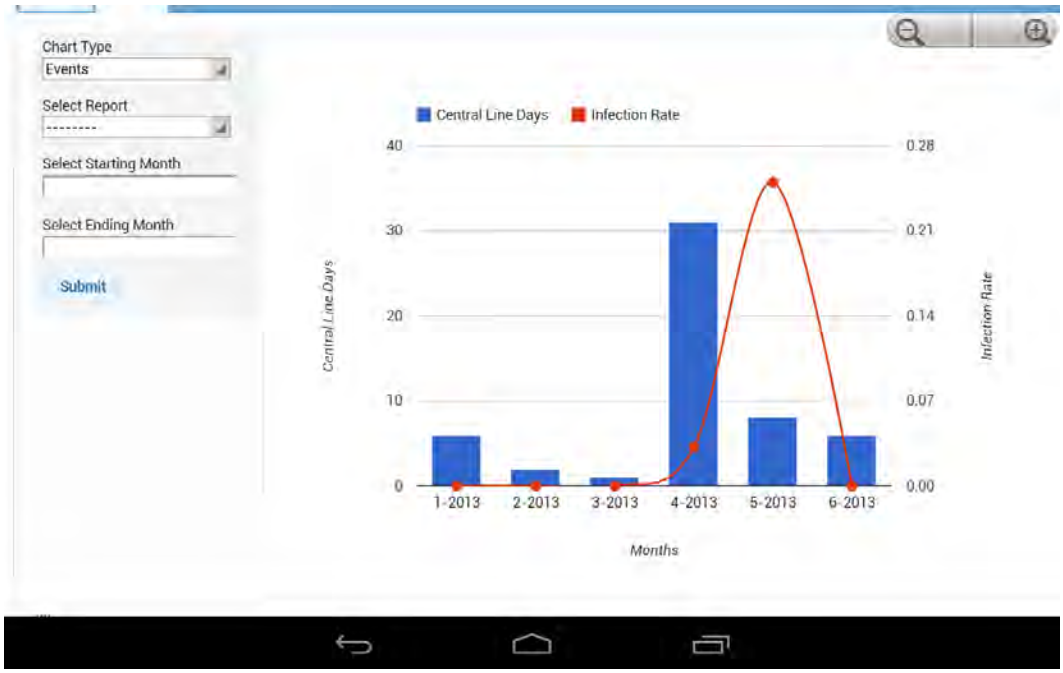


Chart showing number of events against central line days by months

References

1. Summary of the evidence on patient safety: Implications for research. WHO Patient Safety; 2008; cited 10/18/2010]. Available from: http://whqlibdoc.who.int/publications/2008/9789241596541_eng.pdf.

2. Rosenthal VD, Maki DG, Salomao R, Moreno CA, Mehta Y, Higuera F, et al. Device-associated nosocomial infections in 55 intensive care units of 8 developing countries. Ann Intern Med. 2006 Oct 17;145(8):582-91.

3. Rosenthal VD, Maki DG, Jamulitrat S, Medeiros EA, Todi SK, Gomez DY, et al. International nosocomial infection control consortium (INICC) report, data summary for 2003-2008, issued june 2009. Am J Infect Control. 2010 Mar;38(2):95,104.e2.

4. Rosenthal VD. Central line-associated bloodstream infections in limited-resource countries: A review of the literature. Clin Infect Dis. 2009 Dec 15;49(12):1899-907.

5. Dudeck MA, Horan TC, Peterson KD, Bridson KA, Morrell GC, Pollock DA, National Healthcare Safety Network (NHSN) Report, Data Summary for 2009, Device-associated Module. Centers for Disease Control and Prevention 2010. Available from: http://www.cdc.gov/nhsn/PDFs/dataStat/2010NHSNReport.pdf

6. Pronovost PJ, Berenholtz SM, Goeschel C*, et al.* Improving patient safety in intensive care units in Michigan Journal of critical care 2008 June: 23; 207-221

7. Programme action areas: WHO; 2010. Available from: http://www.who.int/patientsafety/about/programmes/en/index.html.

8. Weaver SJ, Lubomksi LH, Wilson RF, Pfoh ER, Martinez KA, Dy SM. Promoting a culture of safety as a patient safety strategy: a systematic review. Ann Intern Med. 2013 Mar 5;158(5 Pt 2):369-74.

9. Rosenthal VD, Impact of International Nosocomial Infection Control Consortium (INICC) Strategy on Central Line–Associated Bloodstream Infection Rates in the Intensive Care Units of 15 Developing Countries, Infection Control and Hospital Epideomiology, 2010. Vol 31 no. 12

10. Barnett AG, Page K, Campbell M*, et al.* (2013) The increased risks of death and extra lengths of hospital and ICU stay from hospital-acquired bloodstream infections: a case-control study BMJ open 3; e003587

11. Sorra J, Famolaro T, Dyer N, et al. Hospital Survey on Patient Safety Culture 2012 user comparative database report. (Prepared by Westat, Rockville, MD, under Contract No. HHSA 290200710024C). Rockville, MD: Agency for Healthcare Research and Quality; February 2012.AHRQ Publication No. 12-0017

12. Pronovost P, Needham D, Berenholtz S, Sinopoli D, Chu H, Cosgrove S, et al. An intervention to decrease catheter-related bloodstream infections in the ICU. N Engl J Med. 2006 Dec 28;355(26):2725-32.

13. Institute for healthcare improvement: Implement the ventilator bundle: Institute for Healthcare Improvement. Available from: http://www.ihi.org/IHI/Topics/CriticalCare/IntensiveCare/Changes/ImplementtheVentilatorBundle.htm.

14. Al-Tawfiq JA, Abed MS. Decreasing ventilator-associated pneumonia in adult intensive care units using the institute for healthcare improvement bundle. Am J Infect Control. 2010 Sep;38(7):552-6.

15. Bird D, Zambuto A, O'Donnell C, Silva J, Korn C, Burke R, et al. Adherence to ventilator-associated pneumonia bundle and incidence of ventilator-associated pneumonia in the surgical intensive care unit. Arch Surg. 2010 May;145(5):465-70.

16. Venkatram S, Rachmale S, Kanna B. Study of device use adjusted rates in health care-associated infections after implementation of "bundles" in a closed-model medical intensive care unit. J Crit Care. 2010 Mar;25(1):174.e11,174.e18.

17. Miller RS, Norris PR, Jenkins JM, Talbot TR,3rd, Starmer JM, Hutchison SA, et al. Systems initiatives reduce healthcare-associated infections: A study of 22,928 device days in a single trauma unit. J Trauma. 2010 Jan;68(1):23-31.