**Appendix 1.** Infection Prevention Bundles for SSI, CLABSI, and VAP.

|  |  |  |
| --- | --- | --- |
| Surgical site infection (SSI) | Central line-associated bloodstream infection (CLABSI)  | Ventilator-associated pneumonia (VAP) |
| * Effective antibiotic prophylaxis
* Minimal skin trauma related to hair removal
* Maintenance of normothermia
* Glycemic control
 | * Appropriate hand hygiene
* Use of chlorhexidine for skin preparation
* Use of full-barrier precautions during central venous catheters insertion
* Avoid using the femoral vein for central venous catheters in adult patients
* Remove unnecessary central venous catheters
 | * Maintain elevation of the head of the bed to >=30 degrees
* Perform oral care 6 times daily
* Use chlorhexidine while performing oral care twice daily
* Use of subglottic suctioning endotracheal tubes for patients ventilated for > 72 hours
* Use of spontaneous awakening and spontaneous breathing protocol
 |

|  |
| --- |
| **Appendix 2.** Characteristics of respondents for Hospital Survey on Patient Safety Culture |
|   | Baseline  |   | Time 2 |   | Time 3 |   |
|   | n | % |   | n | % |   | n | % | P value\* |
| Staff position |  |  |  |  |  |  |  |  |  |
| Nurse | 265 | 58.9 |  | 611 | 66.3 |  | 328 | 73.2 | <0.001 |
| Physician (except for anesthesiologist) | 41 | 9.1 |  | 45 | 4.9 |  | 20 | 4.5 |  |
| Anesthesiologist | 29 | 6.4 |  | 42 | 4.6 |  | 13 | 2.9 |  |
| Mid-level provider | 34 | 7.6 |  | 38 | 4.1 |  | 14 | 3.1 |  |
| Technician | 45 | 10.0 |  | 34 | 3.7 |  | 8 | 1.8 |  |
| Administrator/Manager | 20 | 4.4 |  | 50 | 5.4 |  | 21 | 4.7 |  |
| Other | 16 | 3.6 |  | 101 | 11.0 |  | 44 | 9.8 |  |
| Years in current specialty/profession |  |  |  |  |  |  |  |  |  |
| Less than 1 year | 30 | 6.8 |  | 73 | 8.2 |  | 46 | 10.4 | 0.271 |
| 1 to 10 years | 218 | 49.7 |  | 434 | 48.7 |  | 224 | 50.7 |  |
| 11-20 years | 104 | 23.7 |  | 235 | 26.4 |  | 102 | 23.1 |  |
| 21 years or more | 87 | 19.8 |  | 150 | 16.8 |  | 70 | 15.8 |  |
| Years in current hospital |  |  |  |  |  |  |  |  |  |
| Less than 1 year | 49 | 11.1 |  | 107 | 12.0 |  | 65 | 14.6 | 0.137 |
| 1 to 10 years | 278 | 63.2 |  | 525 | 59.0 |  | 255 | 57.3 |  |
| 11-20 years | 59 | 13.4 |  | 154 | 17.3 |  | 83 | 18.7 |  |
| 21 years or more | 54 | 12.3 |  | 104 | 11.7 |  | 42 | 9.4 |  |
| Years in current work area/unit |  |  |  |  |  |  |  |  |  |
| Less than 1 year | 62 | 14.2 |  | 134 | 15.1 |  | 76 | 17.2 | 0.065 |
| 1 to 10 years | 280 | 63.9 |  | 562 | 63.2 |  | 262 | 59.3 |  |
| 11-20 years | 53 | 12.1 |  | 131 | 14.7 |  | 78 | 17.7 |  |
| 21 years or more | 43 | 9.8 |  | 63 | 7.1 |  | 26 | 5.9 |  |
| Work hours per week |  |  |  |  |  |  |  |  |  |
| Less than 40 hours | 182 | 41.3 |  | 456 | 51.2 |  | 230 | 51.8 | 0.001 |
| 40 hours or more  | 259 | 58.7 |  | 435 | 48.8 |  | 214 | 48.2 |  |
| Patient contact |  |  |  |  |  |  |  |  |  |
| Yes | 411 | 94.5 |  | 834 | 93.7 |  | 424 | 95.7 | 0.324 |
| No | 24 | 5.5 |  | 56 | 6.3 |  | 19 | 4.3 |  |
| Unit type |  |  |  |  |  |  |  |  |  |
| CVOR | 145 | 32.2 |  | 260 | 28.2 |  | 117 | 26.1 | <0.001 |
| ICU | 202 | 44.9 |  | 310 | 33.7 |  | 122 | 27.2 |  |
| Floor | 69 | 15.3 |  | 218 | 23.7 |  | 178 | 39.7 |  |
| Universal | 34 | 7.6 |   | 133 | 14.4 |   | 31 | 6.9 |   |
| \*From chi-squared tests |  |  |  |  |  |  |  |  |  |

**Appendix 3**. Fidelity of the comprehensive unit-based safety program (CUSP) and infection prevention steps among cardiovascular operating rooms: first and no-cost extension year of the project

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | First year |   | Sustainability period | Uptake differences(B) - (A) |
|   | n | % (A) |   | n | % (B) |
| **Implementation of CUSP activities\*** |  |  |  |  |  |  |
| Science of Safety video | 7 | 86 |  | 11 | 73 | -13 |
| Culture Checkup | 7 | 43 |  | 11 | 55 | 12 |
| Shadowing | 7 | 29 |  | 11 | 55 | 26 |
| Barrier Identification and Mitigation | 7 | 29 |  | 11 | 73 | 44 |
| Learning from Defects | 7 | 57 |  | 11 | 82 | 25 |
| Pre-operative Briefing | 7 | 86 |  | 11 | 100 | 14 |
| Post-operative Debriefing | 7 | 71 |  | 11 | 100 | 29 |
| Pre-operative Daily Huddle | 7 | 43 |  | 11 | 73 | 30 |
| Intra-operative Handoff Tool for Anesthesia Providers | 7 | 43 |  | 11 | 100 | 57 |
| **Implementation of SSI reduction steps**§ |  |  |  |  |  |  |
| Appropriate use of skin prep (Rigorous back and forth motion for Chlorhexidine) | 6 | 100 |  | 11 | 100 | 0 |
| Do you use a designated team/member for skin prep  | 6 | 83 |  | 11 | 100 | 17 |
| Allow the skin prep to dry prior to placing drapes  | 6 | 100 |  | 11 | 91 | -9 |
| A member halts placement of the drapes if the prep is not dry | 6 | 100 |  | 11 | 100 | 0 |
| Limits the area of hair removal to the immediate incision sites | 6 | 100 |  | 11 | 100 | 0 |
| Utilize a standard glycemic control protocol in the OR | 6 | 100 |  | 11 | 91 | -9 |
| Confirm the patient received at least one dose of mupirocin (nasal decolonization) prior to procedure (e.g. during time-out or briefing) | 5 | 60 |  | 11 | 73 | 13 |
| Discuss timing of antibiotic redosing during the time-out | 6 | 100 |  | 11 | 91 | -9 |
| Utilize a mechanism for a reminder for antibiotic redosing (e.g. computer support, write time of subsequent doses on the white board/smart board) | 6 | 83 |  | 11 | 91 | 8 |
| Do you use a shared display mechanism to stay on dose with antibiotic redosing? | 6 | 67 |  | 11 | 82 | 15 |
| Limit the use of flash sterilization of equipment | 6 | 83 |  | 10 | 100 | 17 |
| Staff go back-to-back when moving past each other while scrubbed | 6 | 100 |  | 11 | 82 | -18 |
| **Implementation of CLABSI reduction steps**§ |  |  |  |  |  |  |
| Appropriate hand hygiene | 7 | 100 |  | 11 | 100 | 0 |
| Use of chlorhexidine in a back and forth motion for skin preparation  | 7 | 100 |  | 11 | 100 | 0 |
| Full-barrier precautions during the insertion (maintaining a sterile field) | 7 | 100 |  | 11 | 100 | 0 |
| Maintenance of dressing during the cardiac procedure | 7 | 100 |  | 11 | 100 | 0 |
| Monitoring of line insertion by a second provider who is not placing the line | 7 | 86 |  | 11 | 100 | 14 |
| Violation of line insertion protocol | 7 | 57 |  | 11 | 36 | -21 |
| Halting line insertion if protocol is violated | 7 | 100 |  | 11 | 100 | 0 |
| **Perceived barriers to progress**§ |  |  |  |  |  |  |
| Insufficient knowledge of evidence supporting interventions | 7 | 14 |  | 10 | 10 | -4 |
| Lack of team member consensus regarding goals  | 7 | 0 |  | 10 | 20 | 20 |
| Not enough time  | 7 | 71 |  | 10 | 50 | -21 |
| Lack of quality improvement skills  | 7 | 14 |  | 10 | 20 | 6 |
| Not enough buy-in from other CVOR anesthesiologists/ anesthesia staff | 7 | 0 |  | 10 | 20 | 20 |
| Not enough buy-in from other CVOR surgeons/ surgical staff  | 7 | 14 |  | 10 | 10 | -4 |
| Not enough buy-in from other nursing staff in your area  | 7 | 14 |  | 10 | 20 | 6 |
| Not enough buy-in from other CVOR perfusionists in your area | 7 | 14 |  | 10 | 40 | 26 |
| Staff Turnover  | 7 | 29 |  | 10 | 20 | -9 |
| Turnover on CUSP team | 7 | 29 |  | 10 | 40 | 11 |
| Confusion about how to proceed with CUSP activities  | 7 | 43 |  | 10 | 40 | -3 |
| Burden of data collection  | 7 | 29 |  | 10 | 40 | 11 |
| Not enough leadership support from executives  | 7 | 29 |  | 10 | 30 | 1 |
| Not enough leadership support from surgeons  | 7 | 14 |  | 10 | 0 | -14 |
| Not enough leadership support from anesthesiologists | 7 | 0 |  | 10 | 0 | 0 |
| Not enough leadership support from perfusion | 7 | 0 |  | 10 | 0 | 0 |
| Not enough leadership support from nurses  | 7 | 14 |  | 10 | 0 | -14 |
| Insufficient autonomy/authority | 7 | 29 |  | 10 | 40 | 11 |
| Competing priorities or distractions (e.g., new EMR, accreditation visit, death of staff, sentinel event) | 7 | 43 |  | 10 | 50 | 7 |
| Inability of team members to work together | 7 | 0 |   | 10 | 0 | 0 |

\* Response options for CUSP activities in the Team Check-up Tool ranges from “No” to “Implemented” (4 options). We report % of teams that implemented the activities.

§ Response options for infection deduction steps and perceived barriers are “Never/Rarely”, “Under ½ the time”, “½ the time”, “Over ½ the time” and “Almost all/All” (5 options). We report % of teams reporting that they complied the steps or encounter the barriers over 1/2 the time and almost all/all.

**Appendix 4**. Fidelity of the comprehensive unit-based safety program (CUSP) and infection prevention steps among intensive care units: first and no-cost extension year of the project

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | First year |   | Sustainability period | Uptake differences(B) - (A) |
|   | n | % (A) |   | n | % (B) |
| **Implementation of CUSP activities\*** |  |  |  |  |  |  |
| Science of Safety video | 9 | 56 |  | 11 | 82 | 26 |
| Morning Briefing | 9 | 78 |  | 11 | 73 | -5 |
| Daily Goals | 9 | 78 |  | 11 | 82 | 4 |
| Observing Rounds (i.e. a fly on the wall) | 9 | 44 |  | 11 | 73 | 28 |
| Culture Checkup Tool | 9 | 33 |  | 11 | 64 | 30 |
| Shadowing Tool | 9 | 11 |  | 11 | 55 | 43 |
| Barrier Identification and Mitigation Tool | 9 | 22 |  | 11 | 45 | 23 |
| Learning from Defects | 9 | 67 |  | 11 | 82 | 15 |
| Structured Communication tools (e.g. SBAR, DESC, ALEEN) | 9 | 100 |  | 11 | 91 | -9 |
| **Implementation of SSI reduction steps**§ |  |  |  |  |  |  |
| Check the site for signs of infection | 0 | 0 |  | 11 | 100 | 100 |
| Check if the patient need an additional dose of prophylactic antibiotics  | 0 | 0 |  | 7 | 100 | 100 |
| **Implementation of CLABSI reduction steps**§ |  |  |  |  |  |  |
| Appropriate hand hygiene | 9 | 100 |  | 10 | 100 | 0 |
| Use of chlorhexidine in a back and forth motion for skin preparation  | 9 | 100 |  | 10 | 100 | 0 |
| Full-barrier precautions during the insertion (maintaining a sterile field) | 9 | 100 |  | 10 | 100 | 0 |
| Avoiding the femoral site for placement | 9 | 100 |  | 10 | 100 | 0 |
| Removing unnecessary lines | 9 | 89 |  | 10 | 100 | 11 |
| Monitoring of line insertion by a second provider who is not placing the line | 9 | 100 |  | 10 | 100 | 0 |
| Violation of line insertion protocol | 9 | 67 |  | 10 | 30 | -37 |
| Halting line insertion if protocol is violated | 9 | 89 |  | 10 | 100 | 11 |
| Use of a line maintenance protocol | 9 | 100 |  | 10 | 100 | 0 |
| **Perceived barriers to progress**§ |  |  |  |  |  |  |
| Insufficient knowledge of evidence supporting interventions  | 9 | 33 |  | 10 | 0 | -33 |
| Lack of team member consensus regarding goals  | 9 | 22 |  | 10 | 50 | 28 |
| Not enough time  | 9 | 56 |  | 10 | 70 | 14 |
| Lack of quality improvement skills  | 9 | 22 |  | 10 | 20 | -2 |
| Not enough buy-in from physician staff members in your area  | 9 | 22 |  | 10 | 40 | 18 |
| Not enough buy-in from nursing staff in your area  | 9 | 22 |  | 10 | 0 | -22 |
| Not enough buy-in from other staff in your area  | 9 | 22 |  | 10 | 0 | -22 |
| Staff Turnover on unit | 9 | 22 |  | 10 | 30 | 8 |
| Turnover on CUSP team | 9 | 11 |  | 10 | 40 | 29 |
| Confusion about how to proceed with CUSP activities  | 9 | 22 |  | 10 | 50 | 28 |
| Burden of data collection  | 9 | 44 |  | 10 | 70 | 26 |
| Not enough leadership support from executives  | 9 | 22 |  | 10 | 40 | 18 |
| Not enough leadership support from physicians  | 9 | 22 |  | 10 | 30 | 8 |
| Not enough leadership support from nurses  | 9 | 11 |  | 10 | 20 | 9 |
| Insufficient autonomy/authority  | 9 | 11 |  | 10 | 60 | 49 |
| Competing priorities or distractions (e.g., new EMR, accreditation visit,) | 9 | 22 |  | 10 | 80 | 58 |
| Inability of team members to work together  | 9 | 11 |   | 11 | 82 | 71 |

\* Response options for CUSP activities in the Team Check-up Tool ranges from “No” to “Implemented” (4 options). We report % of teams that implemented the activities.

§ Response options for infection deduction steps and perceived barriers are “Never/Rarely”, “Under ½ the time”, “½ the time”, “Over ½ the time” and “Almost all/All” (5 options). We report % of teams reporting that they complied the steps or encounter the barriers over 1/2 the time and almost all/all.

**Appendix 5**. Fidelity of the comprehensive unit-based safety program (CUSP) and infection prevention steps among floor units: first and no-cost extension year of the project

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | First year |   | Sustainability period | Uptake differences(B) - (A) |
|   | n | % (A) |   | n | % (B) |
| **Implementation of CUSP activities\*** |  |  |  |  |  |  |
| Science of Safety video | 4 | 75 |  | 6 | 67 | -8 |
| Morning Briefing  | 4 | 100 |  | 6 | 83 | -17 |
| Daily Goals  | 4 | 100 |  | 6 | 83 | -17 |
| Observing Rounds (i.e., A fly on the wall)  | 4 | 75 |  | 6 | 67 | -8 |
| Culture Checkup Tool | 4 | 50 |  | 6 | 33 | -17 |
| Shadowing Tool | 4 | 25 |  | 6 | 33 | 8 |
| Barrier Identification and Mitigation Tool | 4 | 100 |  | 6 | 67 | -33 |
| Learning from Defects | 4 | 100 |  | 6 | 83 | -17 |
| Structured Communication tools, e.g., SBAR, DESC, ALEEN | 4 | 100 |  | 6 | 100 | 0 |
| **Implementation of SSI reduction steps**§ |  |  |  |  |  |  |
| Check the site for signs of infection |  |  |  | 6 | 100 |  |
| Check if the patient need an additional dose of prophylactic antibiotics  |  |  |  | 4 | 100 |  |
| **Implementation of CLABSI reduction steps**§ |  |  |  |  |  |  |
| Appropriate hand hygiene | 4 | 100 |  | 5 | 100 | 0 |
| Use of chlorhexidine in a back and forth motion for skin preparation  | 4 | 100 |  | 6 | 100 | 0 |
| Full-barrier precautions during the insertion (maintaining a sterile field) | 4 | 100 |  | 6 | 83 | -17 |
| Avoiding the femoral site for placement | 4 | 100 |  | 6 | 67 | -33 |
| Removing unnecessary lines | 4 | 100 |  | 6 | 100 | 0 |
| Monitoring of line insertion  | 4 | 100 |  | 6 | 67 | -33 |
| Violation of line insertion protocol | 4 | 25 |  | 6 | 17 | -8 |
| Halting line insertion if protocol is violated | 4 | 75 |  | 6 | 67 | -8 |
| Use of a line maintenance protocol | 4 | 100 |  | 6 | 100 | 0 |
| **Perceived barriers to progress**§ |  |  |  |  |  |  |
| Insufficient knowledge of evidence supporting interventions  | 4 | 25 |  | 5 | 0 | -25 |
| Lack of team member consensus regarding goals  | 4 | 25 |  | 5 | 20 | -5 |
| Not enough time  | 4 | 75 |  | 5 | 60 | -15 |
| Lack of quality improvement skills  | 4 | 25 |  | 5 | 20 | -5 |
| Not enough buy-in from physician staff members in your area  | 4 | 50 |  | 5 | 40 | -10 |
| Not enough buy-in from nursing staff in your area  | 4 | 75 |  | 5 | 40 | -35 |
| Not enough buy-in from other staff in your area  | 4 | 75 |  | 5 | 20 | -55 |
| Staff Turnover on unit | 4 | 25 |  | 5 | 20 | -5 |
| Turnover on CUSP team | 4 | 0 |  | 5 | 20 | 20 |
| Confusion about how to proceed with CUSP activities  | 4 | 50 |  | 5 | 60 | 10 |
| Burden of data collection  | 4 | 50 |  | 5 | 40 | -10 |
| Not enough leadership support from executives  | 4 | 25 |  | 5 | 60 | 35 |
| Not enough leadership support from physicians  | 4 | 50 |  | 5 | 40 | -10 |
| Not enough leadership support from nurses  | 4 | 25 |  | 5 | 20 | -5 |
| Insufficient autonomy/authority  | 4 | 50 |  | 5 | 60 | 10 |
| Competing priorities or distractions (e.g., new EMR, accreditation visit, death of staff, sentinel event) | 4 | 100 |  | 5 | 80 | -20 |
| Inability of team members to work together  | 4 | 0 |   | 5 | 60 | 60 |

\* Response options for CUSP activities in the Team Check-up Tool ranges from “No” to “Implemented” (4 options). We report % of teams that implemented the activities.

§ Response options for infection deduction steps and perceived barriers are “Never/Rarely”, “Under ½ the time”, “½ the time”, “Over ½ the time” and “Almost all/All” (5 options). We report % of teams reporting that they complied the steps or encounter the barriers over 1/2 the time and almost all/all.