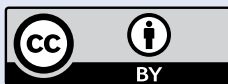


Awareness and practice of care bundles for prevention of healthcare-associated infections in critical care units of a tertiary care hospital.

Bishwo Ram Amatya¹, M.D., Priyanka Singh², B.N., Sunita Pokharel², M.N., Sapana Gurung³, M.N., Bhagwati Sharma⁴, M.N., Sushila Khatri⁵, M.N., Shova Shrestha⁶, M.D.

¹Department of Anaesthesiology & Critical Care, ²Medical ICU, ³Surgical ICU, ⁴Neuro ICU, ⁵CCU, Nepalese Army Institute of Health Sciences, Sanobharyang, Kathmandu, Nepal, ⁶Department of Paediatrics, Patan Academy of Health Sciences, Lalitpur, Nepal.



This work is licensed under a Creative Commons Attribution 4.0 Unported License.

Corresponding author:

Dr. Bishwo Ram Amatya

M.D. Anaesthesiology, Fellowship in adult critical care
Department of Anaesthesiology & Critical Care
Nepalese Army Institute of Health Sciences
Sanobharyang, Kathmandu, Nepal
Phone: +977-9841337206
ORCID ID: 0000-0002-8527-8858
Email: bishwo.amatya@naihs.edu.np

ACCESS THIS ARTICLE ONLINE



View PDF

HOW TO CITE THIS ARTICLE IN VANCOUVER STYLE?

Amatya BR, Singh P, Pokharel S, Gurung S, Sharma B, Khatri S, Shrestha S. Awareness and practice of care bundles for prevention of healthcare-associated infections in critical care units of a tertiary care hospital. *Journal of Nepalese Society of Critical Care Medicine*. 2025 Jan;3(1):5-10.

Submitted : December 19, 2024
Accepted : December 30, 2024
Published Online : January 5, 2025
Declaration : None
Conflicts of Interest : None

ABSTRACT

Background and aims: Healthcare-associated infection is infection acquired by patients in a hospital or health care facility that are not present at the time of admission. Care bundles are evidence-based practices that improve patient outcomes when implemented collectively. Since implementation of care bundle in resource-limited settings remain a challenge, this study was planned with the aim of exploring its awareness and practice among health care professionals working in critical care units.

Methods: A population and provider based online observational survey was conducted in six different critical care units with 43 total ICU beds of a tertiary care hospital involving 95 health care workers during one month period. Google form questionnaire was used to collect responses. Awareness and practice score was categorized into excellent, good, average and poor. Excellent and good score were labeled as satisfactory whereas average and poor score were labeled as unsatisfactory.

Results: Maximum participation was from registered nurses (57.89%) with 76.87 % of them having less than one year of working experience and only 10.57% having training on IPC. There was excellent awareness of VAP (88.42%) and CLABSI bundles (83.15%) with good awareness of CAUTI (77.89%) and SSI bundles (67.36%). However, practice of VAP (53.37%), CLABSI (55.69%), CAUTI (59.45%) and SSI (46.87%) bundles were only average.

Conclusion: Participants having satisfactory awareness had unsatisfactory and inadequate practice of care bundles indicating poor adherence, compliance and implementation requiring adequate training of infection prevention and control, protocolized checklists and monitoring of best practices in ICU.

Keywords: awareness, care bundle, infections prevention practice.

INTRODUCTION

Healthcare-associated infections (HCAI) are the infection acquired by patients in a hospital or health care facility that are not present at the time of admission.¹ The term refers to infections acquired in an acute care hospital (earlier known as hospital acquired or nosocomial infections) and other health care settings like long term care, family medicine clinics, home care and ambulatory care after 48 hours of admission.² The incidence of HCAI is 7 out of 100 in developed countries and 10 out of 100 in developing countries.³ The prevalence of HCAI in a tertiary care teaching hospital of Nepal was 3.31%, which was likely under-estimated, as per the authors.⁴

Care bundles like ventilator associated pneumonia (VAP) bundle, central line associated blood stream infection (CLABSI) bundle, catheter associated urinary tract infection (CAUTI) bundle and surgical site infection (SSI) bundles are evidence-based practices that improve patient outcomes when implemented collectively especially in prevention of HCAI.⁵ They contribute to infection prevention, reduce unnecessary antibiotic prescribing and may limit the development of antibiotic resistance in healthcare facilities.⁶ This was supported by a cohort study done in a tertiary care hospital of Kathmandu, Nepal showing low incidence of HCAI (5 in 100 patient admission) reflecting good infection prevention and control standards.⁷

Implementation of care bundles among health care workers in resource limited settings remains a challenge and there have been limited studies particularly on awareness and practice on bundles of care. Hence, this study has been planned with the aim of finding the awareness and practice of bundles of care among health care professionals working in critical care units of a tertiary care hospital of a lower middle-income country like Nepal.

METHODS

After ethical approval from institutional review committee (IRC), a population and provider based online observational survey was conducted in critical care units like Medical ICU (MICU), Surgical ICU (SICU), Neurosurgical ICU, Coronary Care Unit (CCU), Pediatric ICU (PICU) and Neonatal ICU (NICU) of a tertiary care hospital with total of 43 ICU beds. Convenience sampling from these units was done involving only those health care professionals who were directly involved in care of critically ill patients like consultants (intensivists, anaesthesiologists, physicians, surgeons, neurosurgeons, pediatricians and cardiologists), residents (anaesthesia, surgery, medicine and pediatrics), medical officers and registered nurses. Physiotherapist, dietitian, pharmacist, paramedics and sweepers were excluded, as they were not involved directly in care of critically ill patients in above mentioned critical care units. A short pilot online survey of knowledge and practice of hand hygiene among 40 staffs of MICU was done and found that those staffs who were excluded were uncomfortable in participating in digital survey. General objective of the study was

to find out knowledge of health care associated infections and bundles of care in prevention of health care associated infections where as specific objective of the study were to find out awareness and practice of bundles of care among health care professionals working in critical care units. Sample size was calculated using online sample calculator using the formula $z^2 \times p(1-p)/e^2$ divided by $1 + z^2 \times p(1-p)/e^2 N$. Calculation was based upon population size of one hundred twenty-five (N) health care professionals working in all critical care units in the center, 5% margin of error ($e=0.05$) and 95% confidence level ($z=1.96$) and population proportion ($p= 50\%$ or 0.5).⁸ The calculated sample size was 95.

The study was conducted during one month period from October 25 to November 24, 2024 at Shree Birendra Hospital, Kathmandu. Google form was used to collect responses from health care workers willing to participate in the study based upon list of questions created in google form. The informed consent was included in the beginning of Google form that mentioned purpose of survey, voluntary participation, confidentiality and protection of personal information, duration of participation and checkbox or button for agreement to participate in the survey. The participants were reassured for adherence to ethical standards.

The questionnaire used in the survey are in the [supplementary appendix](#) and were based upon similar studies done by Ismaiel EH⁹ and Aziz Z et al.¹⁰ All the elements of care bundles and infection prevention control were standard and based upon Infectious Disease Society of America (IDSA) recommendations⁵. To improve validity of the questionnaire, it was evaluated and revised by the authors of this manuscript, who are the experts in the field, which was followed by pilot testing of the questionnaire.

Dependent variables for the study were responses of awareness of bundles of care and practices of infection prevention control (IPC) expressed as percentage among health care workers. Independent variables for the study were sampling unit (name of critical care unit, profession, working duration, specific duration of IPC training), awareness of bundles of care (VAP bundle, CLABSI bundle, CAUTI bundle, SSI bundle) and practice of infection prevention and control (hand hygiene, allocation of visiting hour, provision of appropriate PPE, practice of cleaning and disinfection). Data analysis was done using cross tabulation where row represented frequency in terms of total number or percentage. Awareness and practice score was categorized into excellent, good, average and poor based upon percentages as shown in Table 1. Excellent and good score category were labeled as satisfactory whereas average and poor score category were labeled as unsatisfactory awareness and practice in terms of quality measures.

Table 1. Awareness and practice score.

| Score (%) | Score category | Quality level |
|-----------|----------------|----------------|
| 80-100 | Excellent | Satisfactory |
| 61-79 | Good | |
| 40-60 | Average | Unsatisfactory |
| <40 | Poor | |

RESULTS

Among one hundred twenty-five health care workers of various critical care units (MICU, SICU, Neuro ICU, CCU, PICU, NICU) with 43 ICU beds; ninety-five consented on Google form and participated in the survey. Among 95 health care professionals, 44 (46.31%) were from MICU, 31 (32.63%) were from SICU, 7 (7.36%) were from Neuro ICU, 5 (5.26%) were from CCU, 5 (5.26%) were from NICU and 3 (3.15%) were from PICU. Most common profession among participant was registered nurses 55 (57.89%) followed by consultants 18 (18.94%), residents 18 (18.94%) and medical officers 4 (4.21%). 73 (76.84%) participants had less than one year of experience working in critical care unit, 11 (11.57%) participants had 1-5 year of working experience, 5 (5.26%) participants had 5-10 year of working experience and 6 (6.31%) participants had more than 10 years of working experience. Only 10 participants (10.52%) had formal training on infection prevention and control (IPC) whereas 85 participants (89.47%) had not received any kind of training on IPC. Most of the participants were aware of care bundles as shown in Table 2 with VAP bundle being the most common care bundle which participant were aware of followed by CLABSI, CAUTI and SSI bundles.

Table 2. Awareness of care bundles.

| Care bundles | Awareness of care bundles | |
|---------------|---------------------------|-------------|
| | Yes | No |
| VAP bundle | 84 (88.42%) | 11 (11.57%) |
| CLABSI bundle | 79 (83.15%) | 16 (16.84%) |
| CAUTI bundle | 74 (77.89%) | 21 (22.10%) |
| SSI bundle | 64 (67.36%) | 31 (32.63%) |

As shown in Table 3, out of 84 participants who said they were aware of VAP bundle, only 45 participants (53.57 %) have been practicing all the elements of VAP bundle. Out of remaining 39 participants, hand hygiene was the most common individual element followed by head of bed elevation, suctioning of endotracheal tube or subglottic suction, spontaneous awakening trial or spontaneous breathing trial, oral care with chlorhexidine and stress ulcer prophylaxis. Similarly, out of 79 participants who said they were aware of CLABSI bundle, only 44 (55.69 %) have been practicing all the elements of insertion bundle. Out of remaining 35 participants, hand hygiene was the most common individual element followed by maximum

sterile barrier precautions, central line checklist, optimal site selection, use of checklist and daily review of line.

Table 3. Practice of all elements of care bundles.

| Care bundles | Practice of all elements of care bundles |
|---------------------------|--|
| VAP bundle | 45 (53.57%) |
| CLABSI insertion bundle | 44 (55.69 %) |
| CLABSI maintenance bundle | 46 (58.22 %) |
| CAUTI bundle | 44 (59.45 %) |
| SSI bundle | 30 (46.87 %) |

Out of 79 participants who said they were aware of CLABSI bundle, only 46 participants have been practicing all the elements of maintenance bundle whereas out of remaining 33 participants, the most common individual element of maintenance bundle of CLABSI was wearing clean or sterile gloves while changing dressing followed by daily inspection of catheter insertion site, use of gauze dressing & replacement every alternate day, use of transparent dressing & replacement every seven days and use of Chlorhexidine instead of Povidone iodine for catheter site dressing. Similarly, out of 74 participants who said they were aware of CAUTI bundle, only 44 participants have been practicing all the elements of CAUTI bundle. Out of remaining 30 participants, the most common individual element of CAUTI bundle that the participants were aware of was use of aseptic technique with sterile equipment for catheter insertion followed by hand hygiene before & after insertion of catheter, use of close drainage system with bag below bladder level, empty bag when half full and daily review of catheter needs. Similarly, out of 64 participants who said they were aware of SSI bundle, only 30 participants have been practicing all the elements of SSI bundle whereas out of remaining 34 participants, the most common individual element was sterile aseptic hand hygiene technique followed by parenteral antibiotic prophylaxis, alcohol-based disinfectant for skin preparation in operative room, patient bath with soap night before surgery and avoid hair removal use electric clippers if necessary.

Table 4. Awareness and practice score category of care bundles.

| Care bundles | Awareness score (%) | Awareness category | Practice score (%) | Practice category |
|-----------------------------|---------------------|--------------------|--------------------|-------------------|
| VAP bundle | 88.42 | Excellent | 53.37 | Average |
| CLABSI (insertion bundle) | 83.15 | Excellent | 55.69 | Average |
| CLABSI (maintenance bundle) | 83.15 | Excellent | 58.22 | Average |
| CAUTI bundle | 77.89 | Good | 59.45 | Average |
| SSI bundle | 67.36 | Good | 46.87 | Average |

As shown in Table 4, most participants have excellent awareness of VAP and CLABSI bundle followed by good awareness of CAUTI and SSI bundles. However, there was only average practice of care bundles among those who were found to have excellent and good awareness.

Table 5. Awareness & practice score of all elements of waste management, ipc and hand hygiene.

| Protocol | Awareness score (%) | Awareness category | Practice score (%) | Practice category |
|------------------|---------------------|--------------------|--------------------|-------------------|
| Waste management | 92.63 | Excellent | 79.54 | Good |
| IPC | 90.52 | Excellent | 70.93 | Good |
| Hand Hygiene | 94.73 | Excellent | 38.88 | Poor |

As shown in Table 5, out of 95 participants, 88 were aware of standard protocol for waste management system. Among 88 participants, only 70 participants have been practicing all elements of waste management protocol. Out of remaining 18, the most common element of waste management protocol was strict use of color coded bins for waste segregation followed by sterilization of reusable patient care equipment before using with another patient, discarding single use device after each use, separating used needles in sharp box & discarding them and label human & lab wastes as hazardous infectious wastes. Similarly, out of 95 participants, 86 were aware of standard protocol for infection, prevention and control (IPC). Among 86 participants, only 61 have been practicing all the elements of IPC. Out of remaining 25 participants, hand hygiene was the most common element of IPC followed by general environmental cleaning, waste management, injection safety, personal protective equipment (PPE) and respiratory hygiene and cough etiquette. Out of 95 participants, 90 were aware of hand hygiene making it the most common standard IPC protocol however out of 90 participants, only 35 participants (36.84%) have been practicing all the elements of hand hygiene. Out of remaining 60, the most common individual element that participants have been practicing was use of hand hygiene before clean/aseptic procedures followed by after body fluid exposure, before touching a patient, after touching a patient and after touching a patient's immediate surroundings. This showed participants have excellent awareness of all the elements of waste management, IPC protocol and hand hygiene. Though practice of waste management and IPC protocol was good, there was poor practice of all the elements of hand hygiene.

DISCUSSION

According to WHO recent report on patient safety, HAI is common in resource limited settings (low- and middle-income countries) as compared to developed countries with prevalence rate between 5.7% and 19.1%.¹¹ Care bundle with all its elements strictly adhered, complied and implemented can reduce incidence of health care associated

infections and there by improve patient safety and overall patient outcome.^{12,13} A larger study involving 18 intensive care units in South India have found that there was month wise decrease in rate of device associated infections like VAP, CLABSI and CAUTI when care bundles are implemented and compliance rate was evaluated.¹⁴ However compliance and implementation of all elements of care bundle still remains a challenge particularly in a resource limited settings. Hence in this study, we tried to find out awareness and practice of care bundles among health care workers in 6 different critical care units of a resource limited tertiary care hospital.

Maximum participation in our study was from registered nurses with 55 in number as they were directly involved in implementation of care bundle which was similar to a study done in Egypt by Ismaiel EH⁹ where 84 nurses of medical ICU was involved. In our study, we categorized awareness and practice of care bundles among health care workers into excellent, good, average and poor based upon score percentage which was similar to the study done by Aziz Z et al¹⁰ in Lahore, Pakistan where 136 nurses were involved. However, it was different to the study done by Moutiwty Adel AL¹⁵ in Mosul, Iraq where 60 nurses were involved with knowledge and skills of care bundles categorized into failure (Score 0-1), not acceptable (Score 2), acceptable (Score 3), good (Score 4) and excellent (Score 5) based upon answer to elements of care bundles. Involvement of maximum nurses in our study was also supported by the author manuscript written by Balas et al.¹⁶ The effectiveness of care bundles was further supported by the study done by Bhandary R¹⁷ in a 17 bedded medical ICU where nursing implemented, protocol directed care bundle was found to be successful and resulted in better outcome.

In our study, we found that there was excellent awareness of VAP and CLABSI care bundles with good awareness of CAUTI and SSI care bundles among the participants. However, their practice of above care bundles was only average indicating of poor compliance and inadequate evaluation of care bundle implementation. This might have also been affected by inadequate work experience along with insufficient training on infection, prevention and control as most of the participants (76.84%) have less than one year working experience in their critical care unit and only 10.52% have got proper IPC training. This was similar to study done by Aziz Z et al¹¹ where participant nurses were found to have poor knowledge (37.5%) and average practice (60.8%) indicating substandard care bundle implementation. Similarly, in our study, though the participants had good awareness of IPC, there was poor practice of hand hygiene which is the key element of IPC. This showed that adherence and compliance to all the five elements of hand hygiene was poor probably due to lack of protocol or checklist and insufficient monitoring or evaluation in study sites which was supported by pre and post-observational study done by Byrnes MC¹⁸ where mandatory verbal review of best practice checklist at bed side improved implementation of best practices in a 24 bed surgical ICU.

There were few limitations in our study. Firstly, all healthcare workers were not included in the survey as they were not directly involved in care of critically ill patients and they were found to be poorly responding to a pilot online survey on awareness and practice of hand hygiene probably because they were uncomfortable with digital tools. Secondly, there might have been response bias because of self-reported nature of survey.

Since adequate knowledge of participants in our study did not satisfactorily translate into practice, we recommend training of IPC with care bundles to be included in academic curriculum of nursing, polytechnic, undergraduate and postgraduate medical program. Such training needs to be refreshed and updated periodically. In order to ensure implementation of knowledge into practice, we also recommend quality and patient safety department in every hospital with IPC committee for monitoring and evaluation of protocolized checklists on care bundles with support from local and central governing bodies. We recommend for change in behavior and understanding of own responsibility in IPC by all health care workers.

CONCLUSION

Participants having satisfactory awareness had unsatisfactory and inadequate practice of care bundles for prevention of health care associated infection in critical care units of a tertiary care hospital in a resource limited setting indicating poor adherence, compliance and implementation of care bundles. Adequate training of IPC, implementation of protocolized checklists and monitoring of best practices in ICU is desirable.

Supplementary appendix (Questionnaire)

REFERENCES:

- Horner D L, Bellamy M C. Care bundles in intensive care. Continuing education in anesthesia, critical care & pain. 2012;12(4):199-202. DOI:10.1093/bjaceaccp/mks021. [Google Scholar | DOI]
- Revelas A. Healthcare - associated infections: A public health problem. Niger Med J. 2012;53(2):59-64. DOI: 10.4103/0300-1652.103543 [PubMed | Google Scholar | DOI]
- Lavalle JF, Gray TA, Dumville J, Russel W, Cullum N. The effects of care bundles on patient outcome. Implement Sci. 2017;12:142. DOI: 10.1186/s13012-017-0670-0. [PubMed | Google Scholar | DOI]
- Liu X, Shrestha R, Koju P, et al. The direct medical economic burden of healthcare associated infections and antimicrobial resistance: A preliminary study in a teaching hospital of Nepal. J Glob Antimicrob Resist. 2022; 29:299-303. DOI: 10.1016/j.jgar.2022.04.016. [PubMed | Google Scholar | DOI]
- Wasserman S, Messina A. Bundles in infection prevention and safety Chapter 16. International Society of Infectious Diseases; 2017. Available from: https://www.isid.org/isid_infectionguide_Chapter16/en/. [Last accessed on 2024 Dec 15].
- Resar R, Griffin F, Haraden C, Nolan T. Using care bundles to improve health care quality. Innovation series; 2012. DOI:10.12691/ajnr-7-6-5.
- Koju P, Liu X, Zachariah R, et al. Incidence of healthcare associated infections with invasive devices and surgical procedures in Nepal. Public Health Action. 2021;11(1):32-37. DOI: 10.5588/pha.21.0039. [PubMed | Google Scholar | DOI]
- Memon M, Ting H, Chea J, Thursamy H, Chuah F, Cham T. Sample size for survey research and recommendations. Journal of applied structural equation modeling 2020; 4(2): i-xx. DOI: 10.47263/JASEM.4(2)01.
- Ismail EH, Mohammed ET, Ameen DA, Abdullah D. Assess nursing performance during implementation of care bundle for critically ill patients. Egyptian Journal of Health Care 2022;13(3):182-193. DOI: 10.21608/EJHC.2022.251019. [Google Scholar]
- Aziz Z, Kausar S, Zahid S, Farooqi S, Aziz Zara, Ahmad R. Knowledge and practice of ventilator care bundle for preventing ventilator associated pneumonia by ICU nurses of tertiary care hospitals of Lahore. Anesthesia, Pain & Intensive Care 2020;24(4):426-34. DOI: 10.35975/apic.v24i4.1315. [Google Scholar | DOI]
- World Health Organization. The Burden of Health Care Associated Infection Worldwide;2008. Available from: https://www.who.int/gpsc/country_work/burden_hcai/e/. [Last accessed on 2024 Dec 15].
- Pittet D, Allegranzi B, Storr J, et al. Infection control as a major World Health Organization priority for developing countries. J Hosp Infect 2008;68:285-92. DOI: 10.1016/j.jhin.2007.12.013. [PubMed | Google Scholar | DOI]
- Speck K, Rawat N, Weiner NC, Tujuba HG, Farley D, Berenholtz S. A systematic approach for developing a ventilator-associated pneumonia prevention bundle. Am J Infect Control. 2016;44:652-6. DOI: 10.1016/j.ajic.2015.12.020. [PubMed | Google Scholar | DOI]
- Prakash SS, Rajshekhar D, Cherian A, Sastry AS. Care bundle approach to reduce device associated infections in a tertiary care teaching hospital, South India. J Lab Physicians. 2017;(4):273-278. DOI: 10.4103/JLP.JLP_162_16. [PubMed | Google Scholar | DOI]
- AL-Moutiwy AYA, AL-Wily MAS. Nurses' Knowledge and Skills Regarding Care Bundle guideline in Mosul Hospitals. Kufa Journal of Nursing Sciences 2023;13(1):124-130. DOI: 10.36321/kjns.vi20231.1229. [Google Scholar | DOI]

16. Balas MC, Vaselivskis EE, Burke WJ, et al. Critical Care Nurses Role in Implementing the “ABCDE Bundle” into practice. *Crit Care Nurse*. 2012;32(2):35-48. DOI: 10.4037/ccn2012229. [[PubMed](#) | [Google Scholar](#) | [DOI](#)]
17. Bhandary R, Marla A, Anita KB. Care bundles: a boon to prevent health care associated infections. *Journal of the Academy of Clinical Microbiologists*. 2021;23(2):69-74. DOI: 10.4103/jacm.jacm_55_21. [[Google Scholar](#) | [DOI](#)]
18. Byrnes MC, Scheurer D, Schallom ME. Implementation of a mandatory checklist of protocols and objectives improves compliance with a wide range of evidence based intensive care unit practices. *Crit Care Med*. 2009;37(10):2275-81. DOI: 10.1097/CCM.0b013e3181a96379. [[PubMed](#) | [Google Scholar](#) | [DOI](#)]