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Original Article

Quality Improvement Checklist for Nurses in Critical Care Units: Development and Validation

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Abstract

Introduction: Patient in critical care units (CCUs) are admitted with multiple clinical problems and busy environment with critical situations makes nurses prone to commit mistakes. Thus, the quality checklist helps the staff in providing adequate, safe, and efficient client care. The objective of the present study was to develop quality improvement checklist for nurses working in CCU.

Methods: A methodological study was carried out to develop quality improvement checklist for CCU in different phases. Validity was measured in terms of face, content, and construct validity. Modified Delphi technique used for content validity. Construct validity was analyzed by factor analysis. Reliability was investigated in terms of internal consistency of checklist and inter-rater reliability.

Results: There were a total of 32 items in the final draft of the checklist. Cronbach's alpha which 0.78 was. Cohen's kappa was 0.88. Inter-item correlation was found between 0.2 and 0.7. The content validity index (CVI) was 0.98. All items were loaded in 8 factors and accounted for 60.7% of variance.

Conclusion: Quality improvement checklist has good validity and reliability and it can be used to evaluate and improve the quality of CCU.

Introduction

Critical care unit (CCU) is a precisely staffed and equipped, distinct and self-contained area of a hospital allocated for the management and monitoring of patients with life threatening conditions. It provides special expertise and the facilities for the support of vital functions and uses the competence of medical, nursing and other personnel experienced in the management of critically ill patient.[1]

In order to provide care to critically ill patients CCU performance is to be monitored precisely to upgrade the effectiveness and the quality of care delivered in CCU treatments. The efficacy of any health-care unit is judged by its quality indicators. The Institute of Medicine (IOM) defines Quality as "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge". The effect of Quality assurance majors in the CCU has been shown to minimize hospital acquired infections, enhance outcomes as well as decrease the cost.[2]

Hemodynamically unstable patients are overburden with disease and hence delivering care to them is complex.[3] Hospitals, chiefly their CCU are not safe for high dependency patients due to an inflated chances of life – threatening mistakes to occur. Even some mistakes produce slight difference to patient status, the risk for complications that bring harm to patients is clearly present. Errors can occur throughout the hospital, the intensive care unit (ICU) surely provides abundant opportunities for making them, as ICU patients are conceivably among those who are least able to withstand the consequences of a mistake.[4] Thus checklists have been put forward as an instrument to make certain that vital elements of care are not omitted.[5]

Human memory is liable to error, and acute stress can adversely affect performance and attention. Checklist make certain that all protocols are followed rather than depending solely on human memory.[6] Hence Checklists tremendously reduces errors, morbidity and mortality.[7]

There is an increased risk of an adverse event during intra-hospital transport as critically ill patients are frequently transported between the ICU and other sections of the hospital for diagnostic and/or therapeutic interventions transport.[8] Thereupon checklists have also been demonstrated to improve safety.[9]

As considering that there exist only few data that encompasses all the domains that is desired to improve the quality of CCU. So, this study aims to develop a quality

improvement checklist for CCU in order to minimize errors of omissions and increase quality of CCU.

Materials and Methods

In the present study, quantitative research approach and methodological research design have been used. The objective of the present study was to develop quality improvement checklist for nurses working in CCU. The study was conducted in CCU (Adult ICU and High Dependency Unit). The sample included in study is 190 nurses working in AICU and HDU selected by non - probability convenient sampling. Sample selection criteria were: Nurses who were available and willing to participate in the study were enrolled in the study.

The data was collected in month of December 2020 with Quality Improvement checklist which was developed under different phases. Ethical clearance has been obtained from the Institutional Ethical Committee, AIIMS Jodhpur, and Rajasthan, India (AIIMS/IEC/2020-21/2096). Written informed consent was obtained from the nurses involved in the study after providing a complete explanation of the research information. Confidentiality of the subjects was maintained and the study subject was given full autonomy to withdraw from the study at any time.

Results

Phase I: Preliminary Phase

A preliminary draft of quality improvement checklist has been prepared by reviewing available literature related to quality improvement protocol or policy in CCU and various checklist used in CCU.

Current practices related to various checklist that were being followed in the designated unit were assessed and conducted focussed group discussion (FGD), data was collected with the help of FGD guide from 8 nurses working in CCU. After reviewing the content of group discussion, the conclusion was drawn and suitable points were used to formulate the checklist.

An initial pool of items were generated through literature review, FGDs and through researcher's personal experience of the CCU. The blue print of preliminary draft of quality improvement checklist was prepared with 55 items under following domains: infection control, patient care and safety, nutrition and elimination, inventory, recording and reporting, handover evaluation. Scoring of quality improvement checklist was done as 1 and 0. Score of 1 was given for yes, score of 0 was given for no and no score was given for not applicable. Maximum score was 55 and minimum score was 0.

Phase II - Validation of Drafts of Quality Improvement Checklist

The modified Delphi technique was used for the content validation of first draft and subsequent draft of quality improvement checklist. A panel of ten experts were selected from the different institutions. The first draft of the checklist was circulated among 10 experts for the content validation of the quality improvement checklist. Modifications in the checklist were made in accordance with the expert's opinion. Three subsequent rounds of modified Delphi technique were completed for preparation of final draft of quality improvement checklist. The blue print of preliminary draft and subsequent drafts of the checklist were circulated among 10 experts for the content validation of the quality improvement checklist. They were requested to go through the items and give their suggestions regarding the checklist in terms that items are relevant, need modification or omitted for assessment of the content validity of the checklist. Modifications in the checklist were made in accordance with the expert's opinion.

Final Draft of Quality Improvement Checklist

There are six domains in the checklist namely: infection control (14 items), patient care and safety (9 items), nutrition and elimination (2 items), inventory (3 items), recording and reporting (3 items), continuing nursing education (1 items). Total of 32 items are retained in the final draft of quality improvement checklist for CCU. The minimum score of the checklist is 0 and maximum score of checklists is 32. Higher scores reflect efficient quality of CCU.

Phase III: Pilot Study

The pilot study was conducted to assess the feasibility of the checklist. Twenty nurses working in AICU and HDU were administered the quality improvement checklist. The result of pilot study revealed that the checklist was comprehensible and easy to understand. The average completion time for quality improvement checklist for CCU was 8-10 minutes. The tool was found to be feasible with adequate composition and sequence of items in the checklist. No modification was done after pilot study.

Phase IV – Final Tryout

Reliability of Quality Improvement Checklist

Internal Consistency

Internal consistency of the checklist was calculated by Cronbach's alpha and it was found to be 0.78 which indicates good internal consistency.

Each item was deleted one by one to see the changes in the value of Cronbach's alpha in order to examine the individual contribution of items. When the individual item was deleted the value of Cronbach's alpha either remained same or decreased for 31 items which indicated that all 31 items are contributing to the reliability of the checklist. But for 1 item the value of Cronbach's alpha was increased when the individual item was deleted. As the item has significant contribution in the checklist despite the increased value of Cronbach's alpha after their deletion (Table 1).

Table 1. Reliability analysis of checklist by Cronbach's alpha

Items	Checklist mean if Item deleted	Corrected item – total correlation	Cronbach's Alpha if item deleted
1	29.74	0.43	0.77
2	29.75	0.20	0.77
3	29.74	0.31	0.77
4	29.73	0.29	0.77
5	29.88	0.22	0.78
6	29.78	0.33	0.77
7	29.73	0.42	0.77
8	29.77	0.56	0.76
9	29.75	0.14*	0.78
10	29.77	0.37	0.77
11	29.77	0.27	0.77
12	29.74	0.04*	0.78
13	29.81	0.27	0.77
14	29.84	0.04*	0.79
15	29.74	0.06*	0.78
16	29.77	0.49	0.76
17	29.77	0.52	0.76
18	29.77	0.47	0.76
19	29.76	0.30	0.77
20	29.76	0.19*	0.78
21	29.74	0.51	0.77
22	29.77	0.65	0.75
23	29.77	0.25	0.77
24	29.79	0.26	0.77
25	29.74	0.39	0.77
26	29.77	0.33	0.77
27	29.74	0.27	0.77
28	29.73	0.02*	0.78
29	29.77	0.12*	0.78
30	29.78	0.25	0.77
31	29.77	0.25	0.77
32	29.76	0.31	0.77

*Items in the checklist which shows item to total correlation < 0.2.

Corrected Item to Total Correlation

Corrected item to total correlation was applied on 32 items of checklist, 25 items in the checklist had item score to total correlation between 0.2–0.7 whereas 7 items in the checklist had item score to total correlation less than 0.2 indicating their inconsistency with the overall checklist. Despite of the low score to a total correlation, all 7 items were retained in the checklist as all the items in the checklist measures different phenomenon, therefore item to total correlation shows low correlation.

Interrater Reliability

Cohen's kappa was calculated which is a measure of interrater reliability and was found to be 0.88 for the quality improvement checklist that implies 88% as a percentage of agreement.

Validity of Quality Improvement Checklist

Face Validity

Face validity was assessed through consultation with several sets of experts who suggested that quality improvement checklist was systematic and organized. Hence, the face validity of the checklist was considered good.

Content Validity

Content validity of the checklist was calculated by evaluation of the quality improvement checklist by panel of experts. Evaluation of checklist was done through Content Validity Performa which was developed by Davis in 1992 under the 4 relevancy criteria for each item in checklist: highly relevant (4), quite relevant (3), somewhat relevant (1), and not relevant (0). Scoring was done by dichotomizing these four criteria in relevant which includes highly relevant and quite relevant; and not relevant includes somewhat relevant and not relevant. On the basis of 8 expert's evaluation content validity index (CVI) was calculated for the items (I-CVI) and for the checklist (S-CVI). The I-CVI ranges from 0.8 to 1 and S-CVI/Ave is 0.98.

Construct Validity

Construct validity of Quality Improvement checklist was calculated by using exploratory factor analysis in which Principal Component method was applied.

To proceed with the collected data for factor analysis the adequacy of the sampling as well as the eligibility of checklist items was assessed by calculating Kaiser–Meyer–Olkin (KMO) value and Bartlett's test of sphericity. The KMO value was 0.671 which was calculated by SPSS (IBM version 20.0) and p value of Bartlett's test of sphericity was 0.000 which was found significant. It indicates that sample was suitable for factor analysis.

Principal Component analysis (PCA) extraction method was used to calculate extraction communality value of each item of checklist. Initial communality was assumed as 1 (100%) for each item. Extraction communality of items was in the range of 0.32-0.83 (Table 2). Average communality extraction was 0.60 (Average communality extraction should be > 0.5). It means data is suitable for proceeding factor analysis.

For analyzing rotated component matrix, PCA applied along with varimax (Table 3). PCA with varimax rotation had yielded total of 8 factors with eigenvalues more than 1. The eigenvalues of 8 factors ranges between 1.26 to 5.82. All 8 factors accounted for 60.7% variance.

Scree Plot

In this study from Scree plot it showed initial 8 factors had major contribution towards total variance (point of first inflection). Successive to first 8 factors, the scree plot curve does not have any further deflection and is smoother. So,

Table 2. Extraction communality of each item

Item	Initial	Extraction
1	1.00	0.65
2	1.00	0.81
3	1.00	0.55
4	1.00	0.80
5	1.00	0.56
6	1.00	0.54
7	1.00	0.82
8	1.00	0.71
9	1.00	0.72
10	1.00	0.49
11	1.00	0.51
12	1.00	0.61
13	1.00	0.51
14	1.00	0.38
15	1.00	0.73
16	1.00	0.64
17	1.00	0.71
18	1.00	0.61
19	1.00	0.47
20	1.00	0.39
21	1.00	0.83
22	1.00	0.80
23	1.00	0.39
24	1.00	0.63
25	1.00	0.78
26	1.00	0.53
27	1.00	0.68
28	1.00	0.68
29	1.00	0.54
30	1.00	0.32
31	1.00	0.33
32	1.00	0.58

initial 8 factors and all the 32 items were retained on the basis of Scree plot (Figure 1).

Phase V– Evaluation Phase

After completing the four phases of checklist development, Quality Improvement checklist has been developed. The Quality improvement checklist has good validity and reliability. Training session was conducted for nursing staff to explain how to use the checklist and how to do scoring as well interpretation of the quality improvement checklist. Feedback regarding checklist was taken which revealed that the: Checklist is systematic and easy to use, useful in assessing CCU as a whole, helped in finding the shortcoming in CCU and improving the overall quality of CCU as it helps in reducing chances of errors in patient care and safety and prevents omission in documentation.

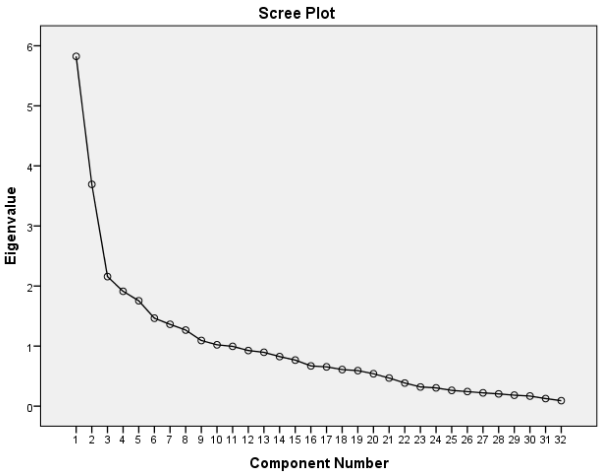

Figure 1. Scree plot of factor analysis

Discussion

The present study was conducted to develop quality improvement checklist for nurses working in CCU. The Quality improvement checklist for CCU was developed under six domains namely: Infection control, patient care and safety, nutrition and elimination, inventory, recording and reporting and continuing nursing education. Similarly Chang et al developed quality improvement rounding checklist for trauma ICU which consisted of following domains namely: infection control, delirium monitoring, endotracheal tube and respiration, removal of catheter, pressure sore prevention, glucose control, stress ulcer prevention, head elevation, thromboembolic prophylaxis, sedation, analgesia and feeding in order to reduce errors of omission without overburdening nurses.[10] Reliability of quality improvement checklist was analyzed in term of internal consistency which was found 0.78 by Cronbach's alpha. Cohen's kappa is a measure for inter – rater reliability which was 0.88 for the quality improvement checklist signified that percentage of agreement was 88%. De Macedo and Bohomol conducted a study at patient safety centers in health care institutions to validate an instrument for the self-assessment for which Cronbach's alpha was 0.857 and percentage of agreement was 70%.[11] For calculation of construct validity of quality improvement checklist principle component factor analysis was applied which yielded 8 factors according to the components. Thus, all the items were having loading value > 0.30 on factors which shows the quality improvement checklist was having good construct validity. Rashvand et al developed a tool for safe nursing care assessment for which construct validity was calculated using PCA which extracted four factors with overall variance of 63.54%.[12] As there is no clinically applicable instrument in the literature which is specific and included multiple domains that can aid in quality improvement of CCU as a whole, this study was aimed at developing the quality improvement checklist for CCU. And the findings suggest that quality improvement checklist for CCU is valid and highly

Table 3. Rotated component matrix

No.	Items	Component							
		1	2	3	4	5	6	7	8
1	Maintaining professional attire.	0.70			0.32				
2	Hand-rub antiseptic solution is available at patient bedside for practicing hand hygiene whenever required.						0.83		
3	Wearing appropriate PPE as per institutional guidelines.				0.52	0.39			
4	Contaminated instruments are cleaned and disinfected.			0.80					0.30
5	Three bucket system is followed for mopping of floor.								0.65
6	Housekeeping staff and hospital attendants are trained in infection control and waste management.		0.32	0.33					0.53
7	Patient bedsheet is changed daily or whenever required as per institutional policy.		0.84						
8	Bio medical waste management protocol are being followed as per guideline.	0.70		0.37					
9	Suction bottle jar is cleaned with 1% hypochlorite and not filled more than 2/3rd.					0.83			
10	Changing the ventilator tubing circuit and filter if visibly soiled.	0.58		0.34					
11	Cleaning/changing of feeding bag and syringe with Pressure monitoring line for infusion pump routinely or as indicated.		0.55					0.37	
12	Labelling of multi dose vials, medicine bottles and prepared injectable with dose, date and time.					0.44			-0.53
13	Number of visitors and visits of patient's relatives are limited.			0.41		0.39	0.35		
14	Culture swab of environment (air, surfaces, selected sites), health personnel (hand culture) is taken regularly.							0.50	
15	Personal hygiene is provided routinely (bed bath, eye care, hair care and perineal care, etc.) or as required.							0.83	
16	Oral care is performed regularly or whenever required.	0.69							
17	Assessing the risk of pressure ulcer and initiating preventive measures (repositioning & back care every 2 hourly)	0.77	0.31						
18	Assessing the surgical site/cannulation site/ CVP line site for signs of infiltration and infection and changing the dressing for any soiling whenever required.	0.44	0.30		0.53				
19	Tracheostomy dressing is clean and changed every day.			0.60					
20	Chest physiotherapy and limb physiotherapy is provided in every shift or whenever required.		0.59						
21	Invasive lines, feeding tube, and catheters are labelled with date and secured to prevent dislodgement.		.50		0.67				
22	Senior nursing officer and nursing officer attends daily patient rounds.	0.81							
23	Patient safety is maintained (use of bed rails, pillows and keeping distance between patient and warmer etc).	0.41							
24	Recording weight and height of patient as per requirement.		0.36			0.67			
25	Dietary recommendation is followed for the patient with proper documentation (type of diet, calorie count, route of administration)		0.86						
26	Stock registers and inventories are maintained.	0.70							
27	Indent and buffer stock of consumable items are maintained.	0.54						0.55	
28	Inventory of schedule H drugs are kept under lock and key.						0.81		
29	Patient file is maintained in order with documentation of complete records and reports like vital signs, intake and output chart, informed consent, shifting notes, procedures done, treatment and nursing care given etc.				0.71				
30	Census is maintained and submitted on time.	0.52							
31	Specific incident report is maintained and informed to concerned authority.	0.41							
32	CNE, training sessions and demonstration are being organized periodically.			0.68					

PPE, Personal protective equipment; CVP, central venous pressure.

reliable checklist to improve the quality of CCU.

Conclusion

On the basis of finding on the present study, conclusion can be drawn that the Quality Improvement checklist is valid and highly reliable. The checklist is feasible to be used in CCU to evaluate and improve the quality of CCU.

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Research Highlights

What is the current knowledge?

- Standard checklist for quality improvement is needed to ensure better outcomes and safety in CCUs.

What is new here?

- A comprehensive, evidence-based quality improvement checklist developed tailored for nurses in CCU.
- The quality improvement checklist validated through rigorous testing and feedback from frontline critical care nurses.

Authors' Contribution

Conceptualization: Ritika Rajput, Nipin Kalal, Ashok Kumar Bishnoi.
Data curation: Ritika Rajput, Nipin Kalal, Ashok Kumar Bishnoi.
Formal analysis: Ritika Rajput, Nipin Kalal, Ashok Kumar Bishnoi.
Investigation: Ritika Rajput, Nipin Kalal, Ashok Kumar Bishnoi.
Methodology: Ritika Rajput, Nipin Kalal, Ashok Kumar Bishnoi.
Project administration: Ritika Rajput, Nipin Kalal, Ashok Kumar Bishnoi, Nikhil Kothari.
Resources: Ritika Rajput, Nipin Kalal, Ashok Kumar Bishnoi.
Software: Ritika Rajput, Nipin Kalal.
Supervision: Ritika Rajput, Nipin Kalal.
Validation: Ritika Rajput, Nipin Kalal, Ashok Kumar Bishnoi.
Visualization: Ashok Kumar Bishnoi.
Writing–original draft: Ritika Rajput, Nipin Kalal, Ashok Kumar Bishnoi.
Writing–review & editing: Ritika Rajput, Nipin Kalal, Ashok Kumar Bishnoi.

Competing Interest

The authors declare no conflict of interest in this study.

Data Availability Statement

The datasets are available from the corresponding author on reasonable request.

Ethical Approval

Ethical clearance has been obtained from the Institutional Ethical Committee, AIIMS Jodhpur, and Rajasthan, India (AIIMS/IEC/2020-21/2096).

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References

1. Marshall JC, Bosco L, Adhikari NK, Connolly B, Diaz JV, Dorman T, et al. What is an intensive care unit? A report of the task force of the World Federation of Societies of Intensive and Critical Care Medicine. J Crit Care. 2017; 37: 270-6. doi: 10.1016/j.jcrc.2016.07.015
2. Chelluri LP. Quality and performance improvement in critical care. Indian J Crit Care Med. 2008; 12(2): 67-76. doi: 10.4103/0972-5229.42560
3. Chrusch CA, Martin CM, Project TQ. Quality improvement in critical care: selection and development of quality indicators. Can Respir J. 2016; 2016: 2516765. doi: 10.1155/2016/2516765
4. Simpson SQ, Peterson DA, O'Brien-Ladner AR. Development and implementation of an ICU quality improvement checklist. AACN Adv Crit Care. 2007; 18(2): 183-9. doi: 10.1097/01.AACN.0000269262.37288.bf
5. Cavalcanti AB, Bozza FA, Machado FR, Salluh JI, Campagnucci VP, Vendramim P, et al. Effect of a quality improvement intervention with daily round checklists, goal setting, and clinician prompting on mortality of critically ill patients: a randomized clinical trial. JAMA. 2016; 315(14): 1480-90. doi: 10.1001/jama.2016.3463
6. Hart EM, Owen H. Errors and omissions in anesthesia: a pilot study using a pilot's checklist. Anesth Analg. 2005; 101(1): 246-50. doi: 10.1213/01.Ane.0000156567.24800.0b
7. Just KS, Hubrich S, Schmidtke D, Scheifes A, Gerbershagen MU, Wappler F, et al. The effectiveness of an intensive care quick reference checklist manual--a randomized simulation-based trial. J Crit Care. 2015; 30(2): 255-60. doi: 10.1016/j.jcrc.2014.10.007
8. Brunsveld-Reinders AH, Arbous MS, Kuiper SG, de Jonge E. A comprehensive method to develop a checklist to increase safety of intra-hospital transport of critically ill patients. Crit Care. 2015; 19(1): 214. doi: 10.1186/s13054-015-0938-1
9. Arriaga AF, Bader AM, Wong JM, Lipsitz SR, Berry WR, Ziewacz JE, et al. Simulation-based trial of surgical-crisis checklists. N Engl J Med. 2013; 368(3): 246-53. doi: 10.1056/NEJMsa1204720
10. Chang YR, Chang SW, Kim DH, Yun J, Yun JH, Lee SW, et al. Quality improvement in the trauma intensive care unit using a rounding checklist: the implementation results. J Trauma Inj. 2017; 30(4): 113-9. doi: 10.20408/jti.2017.30.4.113
11. de Macedo RS, Bohomol E. Validation of self-assessment instrument for the Patient Safety Center. Rev Bras Enferm. 2019; 72(Suppl 1): 259-65. doi: 10.1590/0034-7167-2017-0657
12. Rashvand F, Ebadi A, Vaismoradi M, Salsali M, Yekaninejad MS, Griffiths P, et al. The assessment of safe nursing care: development and psychometric evaluation. J Nurs Manag. 2017; 25(1): 22-36. doi: 10.1111/jonm.12424