



Effect of Modified Protocol on Prevention and Control of Infections Among Health Care Professionals in the Neonatal Intensive Care Unit

1. Sr. Jolly Sebastian,

Designation: - Associate Professor.

Department of Nursing

BCM College of Nursing, Khairabad, Sitapur. Uttar Pradesh. India

2. Dr. Vijay Laxmi Verma.

Designation: -Associate Professor

Department of Nursing

Aligarh Muslim University, Aligarh. India

Abstract

Background of the study

The neonatal intensive care unit is a special place in the hospital because the infants need special care and assistance. Newborns are exposed to many different caregivers and may have multiple blood tests, intravenous lines, and other invasive procedures that are required to preserve the life of newborns. Infection control in the neonatal setting is concerned with preventing nosocomial or healthcare-associated infection in the NICU. Healthcare workers should adhere to practices or techniques that control or prevent infection thus protecting neonates from various diseases. Although knowledge is high in some areas, infection control practices in preventing the spread of infection need improvement in the actual practices of central venous catheter care and hand hygiene. Infections in the NICU are often caused by negligence in infection control practices and procedures, non-sterile environments and unclean surfaces, and ill healthcare providers. Nurses are the heart and hand of the health team and are the first-line care providers to the neonates; they carry out sterilization and disinfection as part of their duties. It is believed that an efficient and skilled performance of the healthcare staff is a strategy for the prevention and control of healthcare-associated infection, contributing to improving the quality of life of the newborn. It is worth stressing that all the members of the healthcare team are responsible for preventing and controlling infections in the NICU. This study examines the knowledge and practice of healthcare workers on prevention and control of infections and their associated factors among health professionals working at various neonatal intensive care units. A modified protocol for the prevention and control of infection in the NICU assisted healthcare professionals in using it while working in the NICU.

Aims and Objectives

The study aimed to assess the effectiveness of a modified protocol in the prevention and control of infections on knowledge and practice among healthcare professionals in neonatal intensive care units. The objectives of this were to assess and compare the pre and post-intervention knowledge and practice score of infection control measures used by all healthcare professionals working in NICU and also to find out the association between knowledge score and practice score of infection control measures used by all health care professionals working in NICU and its related demographic variables such as age, gender, professional qualification, and years of experience.

Methods

A quantitative research approach was used in this study and A Pre-experimental research design One group pretest–posttest design was used to assess the effectiveness of the modified protocol in the prevention and control of infections on knowledge and practice among healthcare professionals in neonatal intensive care units in selected hospitals of Uttar Pradesh. The data collection was done from selected hospitals in Uttar Pradesh. First, the pre-test was done by using a structured knowledge questionnaire to assess the knowledge of healthcare professionals and observation checklists of NICU set up and observation checklist on individual healthcare professionals for their practice, by the investigator then modified protocol was administered to the samples. The post-test was done after 10 days.

Results

Among the 357 healthcare professionals working in neonatal intensive care units in selected hospitals of Uttar Pradesh (129) 36 % were male and (228) 64 % were female. There is a significant increase in the knowledge score of all the health care professionals after the implementation of the protocol. ANMs had pre-test knowledge of 45%, post-test knowledge of 75%, and practice pre-test score of 77.1%, and a post-test score of 99.5%. GNMs had pre-test knowledge 43.3% post-test knowledge 97.5% and for practice pre-test score 79.5%, post-test score was 100%. BSc/ Post Basic BSc had pre-test knowledge of 56.6%, a post-test score was 100% and for practice, a pre-test score of 79% post-test score was 100%. Doctors had a pre-test knowledge score of 70%, a post-test score was 100%, and for practice pre-test score was 76.6% post-test score was 100%. The knowledge level of healthcare professionals at a 5% level of significance $t = 15.5$ is much greater than the critical value of $t = 2.26$. In the practice of healthcare professionals, at a 5% level of significance, $t = 11.10$ is much greater than the critical value of $t = 2.26$. There is a significant improvement in the knowledge level and a significant improvement in practical skills after the implementation of the protocol. So, the infection control protocol is found to be effective.

Interpretation and conclusion

The present study aimed to assess the effectiveness of infection control protocol on knowledge and practice among healthcare professionals in the NICU. The findings of the data analysis revealed that the protocol enhances the knowledge and practice of healthcare professionals. Hence, the infection control protocol in the NICU can be utilized by healthcare professionals to prevent the risk of nosocomial infection among neonates. Statistically significant improvement is seen in the healthcare professional's knowledge and practice after the implementation of the protocol. This study reveals that the protocol can be used effectively in all the NICU settings. The findings of the study have great implications for nursing practice, education, administration, and research.

Keywords: - Effectiveness, Protocol, Knowledge, Practice, Healthcare professionals

Introduction

The neonatal intensive care unit is a special place in the hospital setting because the infants need special care and assistance. Infections acquired in the hospital, while receiving care and treatment form an important cause of neonatal morbidity or mortality. Newborns are exposed to many different caregivers and may have multiple blood tests, intravenous lines, and other invasive procedures that are required to preserve the life of newborns. Proper surveillance of healthcare-associated infections following standard methodology is essential to implement any infection control program. Healthcare workers are the front line of protecting themselves and clients from infection¹. Studies demonstrated that microorganisms were initially detected on NICU surfaces, which is then followed by the guts of infants with the most probable reservoir being tubing (e.g., nasogastric feeding tube) and their incubators and sinks^{2,3}. Newborns hospitalized in neonatal intensive care units (NICUs) are at risk of various microorganisms already present in the NICU or acquired from contact with healthcare providers because of their physiologic unsteadiness and acquaintance with invasive strategies and broad-spectrum antibiotics⁴. Infection control in the neonatal setting is concerned with preventing nosocomial or healthcare-associated infection in the NICU. Multidisciplinary interventions can be used to improve knowledge and practice in the control of infections in the NICU⁵. Infection prevention and control strategies include hand hygiene, use of standard precautions, environmental cleaning, education and training to healthcare personnel, and reinforcing implementation and monitoring adherence to these strategies are core infection prevention and control practices for safe healthcare delivery in all settings⁶.

During the clinical experience in the neonatal unit, the researcher observed the occurrence of various infections and the practice of staff nurses. They lacked knowledge and skills regarding the prevention and control of infections. It is noticed that often they fail to disinfect their hands appropriately or to use personal protective equipment as they should, which may lead to the spread of infections. I also observed that many staff members in the NICU were knowledgeable but failed to practice the infection control techniques effectively. There was a strong need to conduct a study that would help healthcare professionals develop knowledge and practice in the prevention of infections in

neonatal units. Given the above context, the present study is undertaken to assess the knowledge and practice of healthcare providers regarding infection in neonatal units.

This study will examine the knowledge and practice of healthcare workers on prevention and control of infections and their associated factors among health professionals working at various neonatal intensive care units. A modified protocol for the prevention and control of infection in the NICU will assist healthcare professionals in using it while working in the NICU.

Methods

Research Approach

A quantitative research approach was used in this study to assess the effectiveness of the modified protocol in the prevention and control of infections on knowledge and practice among healthcare professionals in neonatal intensive care units in selected hospitals of Uttar Pradesh.

Research Design

Pre-experimental research design One group pretest–posttest design was used to assess the effectiveness of the modified protocol in the prevention and control of infections on knowledge and practice among healthcare professionals in neonatal intensive care units in selected hospitals of Uttar Pradesh.

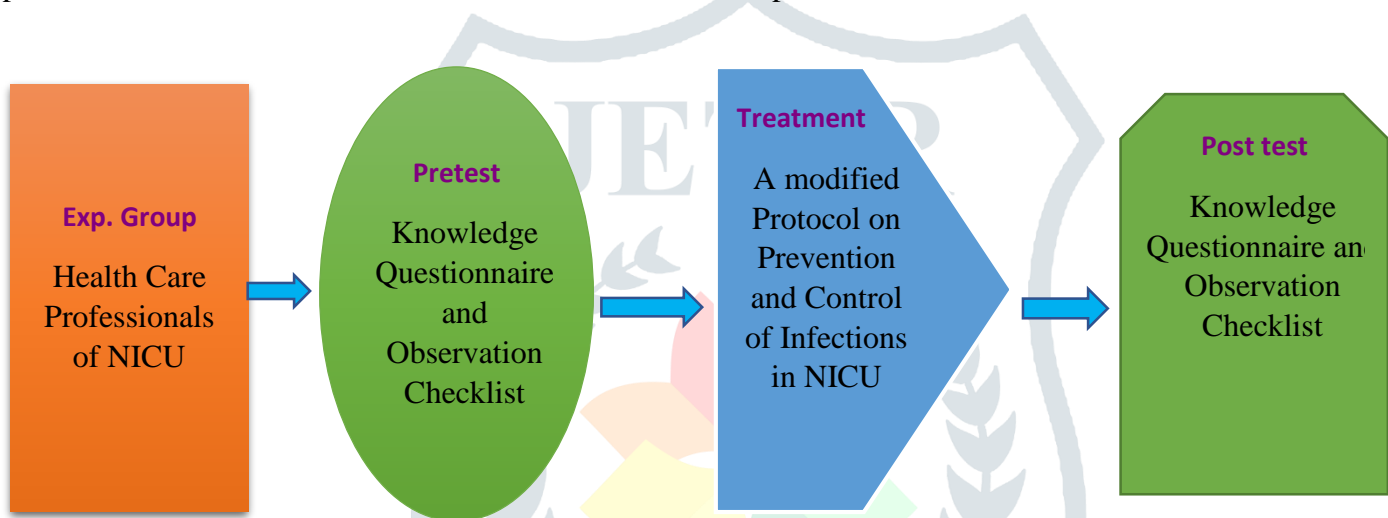


Figure 2: - Schematic Representation of One-Group Pretest – Posttest Design

Research Variables Under Study

The dependent variable is the knowledge and practice of health care professionals on prevention and control of infections in NICU

The Independent variable is modified protocol in the prevention and control of infections in the NICU.

The demographic variables in this study are age, sex, professional qualification, and years of experience.

The extraneous variable is health care professionals in different shift duties.

Description of Setting of the Study

The study was conducted in neonatal intensive care units in selected hospitals in Uttar Pradesh. From February 2022 to March 2023.

Population for the Study

- **Target population**

The health care professionals such as BSc, Post basic BSc, GNM, ANM nurses, and doctors of neonatal intensive care units of Uttar Pradesh

- **Accessible population**

The health care professionals such as BSc, post-basic BSc, GNM, ANM nurses, and doctors of NICU of selected hospitals of Uttar Pradesh are available at the time of data collection.

Table 1: - The sample selection criteria and technique

SI No.	Area	Population. Available	Samples selected for the study	Sampling technique
1	6 hospitals in Lucknow	82	55	Purposive
2	13 Hospitals of Ghaziabad	130	98	

3	3 Hospitals Noida	22	18	
4	11 hospitals of Meerut	179	130	
5	3 hospitals in Bareilly	110	42	
6	1 Hospital of Shahjahanpur	4	3	
7	1 Hospital of Khairabad	18	11	
	Total	545	357	

Sample Selection Criteria-

Inclusive criteria: -

- Health care professionals such as BSc, post-basic BSc, GNM, ANM nurses, and doctors of the NICU of selected hospitals.
- Health care professionals with six months and above experience in NICU.
- Health care professionals who are registered in nursing / medical council and willing to participate in the study.

Exclusive criteria:

- Health care professionals with below six months of experience and not registered in the Nursing / Medical council.
- Health care professionals who have already attended such types of interventions.

Sampling Technique

The purposive sampling technique was used in this study. The healthcare professionals who met the criteria for the selection of samples were chosen according to their availability and specific purpose. The technique enables the researcher to complete data collection within a limited period.

Sample Size

Healthcare professionals in the NICUs of selected hospitals in Uttar Pradesh were the sample. (Sample size was calculated by power analysis after the pilot study) 357 Health care professionals in the NICU of selected hospitals of Uttar Pradesh.

Tools for Data Collection

Part 1. Demographic Data

Demographic data will include the age, sex, professional qualification, and years of experience of each participant.

a) Assessment of knowledge by knowledge questionnaire

For the assessment of the knowledge of health care professionals on the prevention and control of infections in NICU, a structured knowledge questionnaire was prepared with multiple choice questions.

b) Assessment of practice by observation checklist

For the assessment of the practice of health care professionals in the NICU, an observation checklist was prepared. The researcher also maintained a Checklist of each NICU

Part 2. A modified protocol prepared concerning WHO, CDC, and HIPAC guidelines and implemented for the prevention and control of infections in NICU.

Content Validity

Content validity of the tool was obtained from 10 experts after a formal approval of the tool, the experts from the field of Paediatric Medicine, Paediatric nursing, and Communicable diseases departments were requested to evaluate critically the items for clarity, relevance, appropriateness, and meaningfulness for the study. The tool was modified as per the suggestions of experts and the final tool was constructed.

Reliability

Reliability denotes the degree of consistency of the tool. Test and Re-test method was used to calculate the reliability of the tool. The reliability of the tool was calculated by using Karl Pearson's co-efficient co-relation formula. The calculated value of the correlation coefficient is .844 which shows good reliability.

Procedure for Data Collection

Before starting the data, the collection investigator obtained written permission from the administrators/directors of the hospitals. The investigator collected data from selected hospitals in Uttar Pradesh. The data was collected from February 2022 to February 2023 for one year.

First, the pre-test was done by using a structured knowledge questionnaire to assess the knowledge of healthcare professionals and observation checklists of NICU set up and observation checklist on individual healthcare professionals for their practice, by the investigator then modified protocol was administered to the samples. The post-test was done after 10 days.

The data collection procedure was in these steps:

1. Obtained written permission from the administrators/directors of the hospitals.
2. Explained the procedure and obtained consent from the health care professionals for the participation in the study.

3. Pre-test was done by using a structured knowledge questionnaire to assess the knowledge of healthcare professionals.
4. Observation checklists of NICU setup were done by the investigator.
5. An observation checklist on individual healthcare professionals for their practice was done by the investigator.
6. The modified protocol was administered to the samples through lecture cum discussion and clarified their doubts and a handout the of modified protocol was given to all the participants.
7. The post-test was done after 10 days using the same tools.

The data was entered in the master data sheet analyzed, interpreted, and presented in the table and graphs. Descriptive and inferential statistics were used for data analysis.

Table 2: - Frequency and percentage distribution of health care professionals working in neonatal intensive care unit by their demographic characteristics

N=357

S.NO	VARIABLES	FREQUENCY	PERCENTAGE
1	Age in Years		
	a) 20 - 25 years	130	37 %
	b) 25 - 30 years	112	31 %
	c) 30 - 35 years	79	22 %
	d) 35 - 40 years	36	10 %
2	Gender		
	a) Male	129	36 %
	b) Female	228	64 %
3	Professional Qualification		
	a) ANM	60	17%
	b) GNM	191	53.50 %
	c) BSc/ Post Basic BSc	49	14 %
	d) MBBS / BAMS / DCH	57	16%
4	Years of Experience		
	a) 6months -1 year	37	10.4 %
	b) 1 year - 2 years	101	28.3 %
	c) 2 years - 3 years	87	24.4 %
	d) 3 years and above	132	37 %

Table 2 shows the frequency and percentage distribution of healthcare professionals working in neonatal intensive care units by their demographic characteristics such as age, sex, professional qualification, and years of experience. Among the 357 healthcare professionals working in neonatal intensive care units in selected hospitals of Uttar Pradesh (129) 36 % were male and (228) 64 % were female. In age group (130) 37 % belong to 20 - 25 years of age, (112) 31 % belong to 25 - 30 years, (79) 22 % were 30 - 35 years of age group and only 36 (10 %) were 35 - 40 years of age group. Among the health professionals, the professional qualifications 60 (17 %) were ANM, 191(53.5 %) the majority were GNM, 49 (14 %) were BSc/ Post Basic BSc and 57(16%) were MBBS / BAMS / DCH. Among the health care professionals' years of experience 37(10.4 %) had 6 months -1 year of experience, 101(28.3 %) had 1 year - 2 years, 87 (24.4 %) were with 2 years - 3 years and 132 (37 %) had 3 years and above experience in NICU.

Compare the pre and post-intervention knowledge score and practice score of infection control measures used by all health care professionals working in NICU.

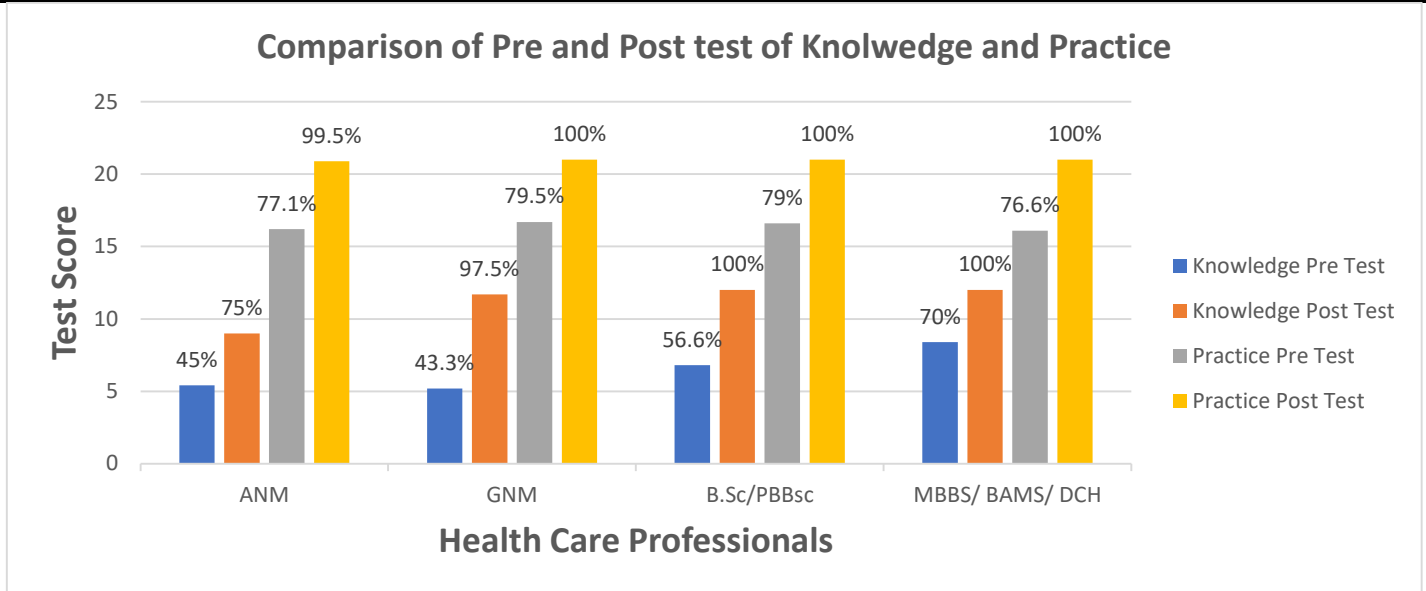


Figure 2: - Comparison of pre and post-test knowledge score and practice score of infection control measures used by all health care professionals working in NICU

Figure 2 shows that the ANMs had pre-test knowledge of 45%, post-test knowledge of 75%, and practice pre-test score of 77.1%, the post-test score was 99.5%. GNMs had pre-test knowledge 43.3% post-test knowledge 97.5% and for practice pre-test score 79.5%, post-test score was 100%. BSc/ Post Basic BSc had pre-test knowledge of 56.6%, a post-test score was 100% and for practice, a pre-test score of 79% post-test score was 100%. Doctors had a pre-test knowledge score of 70%, a post-test score was 100%, and for practice pre-test score was 76.6% post-test score was 100%.

All the healthcare professional’s knowledge level and practical skills have increased after the implementation of the protocol. There is a highly significance difference between the pre-test and post-test. The protocol given to the health care professionals has made a very significant increase in knowledge and improvement in practices of infection control measures used by health care professionals working in NICU. So null hypothesis is rejected and the research hypothesis is accepted.

Table 3: - Comparison between pre and post-interventional knowledge and practice of health care professionals working in NICU. N=30

Effectiveness of Protocol	Mean	S D	df	t -calculated	t. table Value	Significance
Knowledge	3.06	1.19	29	15.5	2.26	Effective
Practice	4.46	4.1084	29	11.10	2.26	Effective

Table 3 shows the knowledge level of health care professionals at a 5% level of significance, the critical value of $t = 2.26$. Since the computed value of $t = 15.5$ is much greater than the critical value of $t = 2.26$, it falls in the rejection region. In the practice of healthcare professionals, at a 5% level of significance, the critical value of $t = 2.26$. Since the computed value of $t = 11.10$ is much greater than the critical value of $t = 2.26$, it falls in the rejection region. Hence the null hypothesis is rejected and the alternative hypothesis is accepted. There is a significant improvement in the knowledge level and a significant improvement in practical skills after the implementation of the protocol. So, the infection control protocol is found to be effective.

Table 4: - Association between knowledge score and practice score of infection control measures used by all health care professionals working in NICU and its related demographic variables such as age, gender, professional qualification, and years of experience. n=30

F-test						
	Sample Size	df	Level of significance	Calculated F Value	Table Value	Significance difference Yes/ No
Knowledge Vs Age	30	(3,116)	0.05	42.7	2.12	yes
Knowledge Vs Professional Qualification	30	(3,116)	0.05	21.45	2.68	yes

Knowledge Vs Years of Experience	30	(3,116)	0.05	29.21	2.68	yes
Practice Vs Age	30	(3,116)	0.05	65.75	2.68	yes
Practice Vs Professional Qualification	30	(3,116)	0.05	4.19	2.68	yes
Practice Vs Years of Experience	30	(3,116)	0.05	14.96	2.68	yes
				t-test	Table Value- t	
Knowledge Vs Gender	30	(29)	0.05	1.77	2.045	no
Practice Vs Gender	30	(29)	0.05	0.271	2.045	no

Table 4 shows the association of knowledge of health care professionals to the demographic variable of age group, the table value at 95% confidence level (.05) and 3 degrees of freedom of groups and 116 degrees of freedom of errors is 2.488 since there is calculated value of F (42.7) >table value (2.488), We reject the null hypothesis. There is a significant difference between the age groups in accepting the knowledge. For the knowledge Vs professional qualification table value at 95% confidence level (.05) and 3 degrees of freedom of groups and 116 degrees of freedom of errors is 2.488, since there is a calculated value of F (21.4) >table value (2.488), we reject the null hypothesis. There is a significant difference between the professional qualification groups in accepting the knowledge. For the knowledge Vs years of experience table value at 95% confidence level (.05) and 3 degrees of freedom of groups and 116 degrees of freedom of errors is 2.488, since there is a calculated value of F (29.21) >table value (2.488), We reject the null hypothesis. There is a significant difference between the years of experience groups in accepting the knowledge. The table further shows the association between practice and demographic variable of age group, the table value at 95% confidence level (.05) and 3 degrees of freedom of groups and 116 degrees of freedom of errors is 2.488 since there is a calculated value of F (65.7) >table value (2.488), We reject the null hypothesis. There is a significant difference between the age groups in their practical skills. For the practice Vs professional qualification, the table value at 95% confidence level (.05) and 3 degrees of freedom of groups and 116 degrees of freedom of error is 2.488, since there is a calculated value of F (4.19) >table value (2.488), we reject the null hypothesis. There is a significant difference between the professional qualification groups in their practical skills. For the practice Vs years of experience table value at 95% confidence level (.05) and 3 degrees of freedom of groups and 116 degrees of freedom of errors is 2.488, since there is a calculated value of F (14.9) >table value (2.488), We reject the null hypothesis. There is a significant difference between the years of experience groups in their practical skills. Table further shows the association between gender vs knowledge table value at 95% confidence level (.05) degree of freedom of groups 29, the calculated t value (1.77) is less than the table value 2.045. We accept the null hypothesis and for the gender vs practice table value at 95% confidence level (.05) degree of freedom of group 29, the calculated t value (0.271) is less than the table value 2.045. We accept the null hypothesis and reject the research hypothesis. There is no difference in knowledge and practice between male and female healthcare professionals.

MAJOR FINDINGS OF THE STUDY

Background Information of the Study Participants: -

The data presented in Table 2 shows the frequency and percentage distribution of healthcare professionals working in neonatal intensive care units by their demographic characteristics such as age, sex, professional qualification, and years of experience. Among the 357 health care professionals (129) 36.13 % were male and (228) 64 % were female. In age group (130) 36.41 % belonged to 20 - 25 years of age, (112) 31.37 % belonged to 25 - 30 years, (79) 22.12 % were 30 - 35 years of age group and only 36 (10.08 %) were 35 - 40 years of age group. Among the healthcare professionals, the professional qualifications 60 (16.80 %) were ANM, 191(53.50 %) the majority were GNM, 49 (13.72%) were BSc/ Post Basic BSc and 57(15.96%) were MBBS / BAMS / DCH. Among the health care professionals' years of experience, 37(10.36 %) had 6 months -1 year of experience, 101(28.29 %) had 1 year - 2 years, 87 (24.36 %) were with 2 years - 3 years and 132 (36.97 %) had 3 years and above experience in the NICU.

Knowledge and practice

ANMs had pre-test knowledge of 45%, post-test knowledge of 75%, and practice pre-test score of 77.1%, and a post-test score of 99.5%. GNMs had pre-test knowledge 43.3% post-test knowledge 97.5% and for practice pre-test score 79.5%, post-test score was 100%. BSc/ Post Basic BSc had pre-test knowledge of 56.6%, a post-

test score was 100% and for practice, a pre-test score of 79% post-test score was 100%. Doctors had a pre-test knowledge score of 70%, a post-test score was 100%, and for practice, a pre-test score was 76.6% and a post-test score was 100%. All the healthcare professional's knowledge level and practical skills have increased after the implementation of the protocol. There is a highly significant difference between the pre-test and post-test. The protocol given to the health care professionals has made a very significant increase in knowledge and improvement in practices of infection control measures used by health care professionals working in NICU.

There is a significant association between the knowledge score and practice scores of all the health care professionals to demographic variables like age, professional qualification, and years of experience after the implementation of the protocol. There is no association between male and female healthcare professionals after the implementation of the protocol.

The above data findings were consistent with the study conducted by Pradeepa M. (2011) that, in group A almost all 100% had adequate knowledge whereas in group B almost all 100% had moderately adequate knowledge of infection control measures. The analysis of the post-intervention level of practice on infection control measures revealed that, in group A, the majority 30(100%) had a good practice level on infection control measures whereas in group B majority 30(100%) had a fair level of practice on infection control measures.⁷

The findings of the study supported by Anupam S (2013) that the overall knowledge and awareness regarding different infection control practices were excellent in 5% of the nursing professionals, good in 37%, average in 40%, and below average in 18%. The study confirms findings from the literature that infection control knowledge among nurses is fairly good, but a wide range of improvements is needed. Regular educational programs and training on infection control, standard and transmission-based precautions, and ward-based teaching programs must be included to overcome any shortcomings in the knowledge, attitude, and practice of infection control by HCWs.⁸

This study is supported by Peter AT (2021)⁹ on the knowledge and practice of hand hygiene among healthcare workers in the paediatrics and NICU. Most doctors generally had a better knowledge of hand hygiene whilst nurses generally had poor knowledge. A statistical association was found between having received formal education and the performance of routine hand hygiene practices. The study concluded that most of the healthcare workers had a fair knowledge of hand hygiene with a few having poor knowledge. The majority of healthcare workers reported they routinely use hand washing and alcohol hand rub in their daily practice. Studies suggest that regular education and practice of hand hygiene are essential to the prevention of the spread of diseases. This is similar to the previous study conducted by Mohammed & Ibrahim (2016)¹⁰ who found an improvement in nurses' knowledge regarding infection control in NICU after implementation of health educational program. Also, this was in line with the study carried out in India by Koshy & Patel (2015)¹¹ who compared the post-test and pre-test nurses' knowledge total scores about the infection control measures and they found them to be highly significant.

Acceptability of protocol

The result of the study demonstrated the full acceptance of protocol by 18 (85.7%) of the respondents and partially accepted by 3(14.2%). The language used in the protocol is simple and easy to understand and fully accepted by 20 (95%) and partially accepted by 1(4.7%). This protocol can be implemented in NICU is fully accepted by 17(18%) and partially accepted by 4(19.7%). This showed that protocol content was simple comprehensive and acceptable for NICU healthcare professionals. A few healthcare professionals expressed that they did not get sufficient time to read and understand the protocol. Many of the sample expressed their feeling that the protocol was very useful for the NICU setting and helped them to refresh their knowledge and enhance their practice. These findings were supported by the findings of the research study.

Implication of the Study

The finding of this study elicits the implications on nursing practice, nursing education, nursing administration, and nursing research.

Nursing is a dynamic process, which involves quality-based practice, scientific knowledge, and dissemination of research knowledge and practice. Nursing professionals find that prevention is better than cure and they use relevant measures to prevent and control infections in various settings. So, the present study aids major implications in various areas of nursing to provide knowledge and practices of infection control measures used by health care professionals in the NICU.

The study had the following implications in nursing:

Nursing Practice

Nurses working in specialized areas should commit to attending any form of an education program to provide quality nursing care and update their knowledge. Nurses need to have a thorough knowledge of various aspects of infection control measures such as sources of infection, routes of infection, high-risk clients, and ways to prevent the risk of hospital-acquired infection. They can update their knowledge by attending continuing education programs and in-service education programs regarding infection control measures in the critical care unit. Demonstration of medical and surgical asepsis to all staff nurses working in the critical care unit and adequate supervision, instruction,

and evaluation of staff nurses while rendering nursing care in critical care units which will improve infection control practices. Continue to emphasize infection control policies and frequent surveillance must be ensured to bring down the infection rate.

Quality Improvement Initiative

Overall, the proposed quality improvement initiative is comprehensive and involves all the evidence-based strategies discussed above. First, the institution should update its standards for infection control by current guidelines. Secondly, managers should evaluate and improve the availability of materials in the NICU. The third component of the intervention is additional staff training on the new guidelines to raise awareness of changes and standards. Full clinical supervision should also be implemented for at least one month to evaluate performance and compliance. Next staffing rates for every shift should be reviewed, and additional nurses should be hired if necessary. These strategies would help to prevent and control infections in the NICU.

The Impact of Nursing

To reduce health professionals associated infections various measures, including hand hygiene, surveillance, contact prevention, patient isolation, and environmental disinfection, have been recommended in healthcare settings. Nurses can play a key role in it.

The role of nurses in quality improvement in clinical settings is critical because nurses can promote best practices. First, they can implement best practices in their work, thus decreasing the rates of HAIs. On the other hand, they can observe other care providers' compliance with guidelines and offer comments or suggestions for improvement. Nurses can also use their position and experience to draw the management's attention to important issues in clinical practice, including HAI rates. Hence, it is critical to target nurses as part of the quality improvement initiative to achieve great results.

Infection Prevention and Control is paramount in nursing, it protects both patients and healthcare workers from disease. Several implications can be drawn from the present study for nursing practice. The expanded role of a professional nurse emphasizes the activities that promote health and well-being.

Nurses play an active role in policies and procedures implemented to control and minimize the dissemination of infections in hospitals and other healthcare settings with the main purpose of reducing infection rates. The prevention of infection is a major concern of all health workers and health policymakers. Nursing is crucial to the success of any preventive program aimed at reducing the incidence of infections in our healthcare facilities. Nurses, therefore must possess adequate knowledge and demonstrate practices towards achieving the goal of prevention of infections.

In the field of neonatal nursing, nurses have a great responsibility to protect the health of Newborns. Nurses working in NICU care settings have a major role in health promotion, health maintenance, and prevention of infections. Nurses can effectively communicate best practices to their colleagues to ensure the safety of patients in an institution's care. Nurses can organize seminars on infection prevention and control in their healthcare setting strengthening and high-quality care delivery, to improve patient and health worker safety. Proper hand hygiene is the single most important infection prevention and control practice. In doing so, nurses provide and promote the best possible patient care.

Nursing Education

Nurses, before utilizing the practices, need to have a strong foundation in terms of education. An awareness needs to be created among nursing students regarding the importance of infection control practices in critical provision of care thereby preventing complications. Teaching strategies such as demonstrations, video shows, procedure manuals, and computer-assisted interventions to train the student nurses regarding NICU settings and infection control strategies can be incorporated into the curriculum. There must be adequate supervision, instruction, and evaluation when student nurses are posted in the NICU settings which will enhance their knowledge and skills.

Clinical Supervision

Clinical supervision involves healthcare professionals overseeing their colleague's compliance with standards and guidelines. Clinical supervision can be either full or partial, depending on the needs of the workforce. Full clinical supervision means that all procedures and staff members are supervised by others, whereas partial supervision only requires oversight of high-risk procedures and employees with limited experience (Snowdon, Leggat, & Taylor, 2017)¹². As shown in the study by Snowdon et al. (2017), clinical supervision showed a positive correlation with guideline compliance and improved patient-reported quality of care. In the proposed intervention, clinical supervision should be supported by other strategies for quality improvement.

Appropriate in-service educational programs at regular intervals will help healthcare professionals to be updated and motivated. There must be adequate guidance supervision and evaluation of nursing students on various nursing-related procedures to have good knowledge and practice on infection control measures. One of the first, most important, and enduring lessons nursing students must learn is that of infection control protocols.

Nursing Research

The essence of the research is to build a body of knowledge in nursing. Nursing research is the main source by which the nursing profession is growing. The generalization of the study results can be made by replication of the study. The standard of the nursing profession can be improved by improving the knowledge, attitude, and skills of nurses. There is a need for extensive and intensive research in this area so that the loopholes can be detected and thus the services can be improved. The research studies concerning the knowledge and practice of staff nurses on infection control measures to provide evidence-based care. Nurse researchers must be encouraged in NICU settings. Student researchers are also can be motivated to conduct studies in this area.

The result of the study indicates that statistically significant improvement is seen in the healthcare professional's knowledge and practice after the implementation of the modified protocol. This study will serve as a valuable reference material for future investigation.

Nursing Administration

Staff development program in any organization is the prime responsibility of the administrator. In the event of the development of various paediatric specialties, increasing social demands and improved medical technology put a challenge for healthcare professionals in their professional and personal growth. There can be regular in-service education programs to update and reinforce their knowledge and skills. The nurse administrator must assume the responsibility of equipping the specialized units like NICU and PICU with currently available literature, procedures, manuals, journals, and textbooks on various aspects of infection control measures to reduce the risk of hospital-acquired infection. Nurse administrator also needs to take the responsibility of conducting periodic staff appraisal in these units to assess the needs and improvement in the care provided by the staff nurses.

Nursing administrators can provide guidance and monitor in-service education periodically for nurses regarding infection control practices. Nurse administrator plays an important role in educating professionals in developing strategies and implementing policies.

Nurse administrators need to move from the planning stage into the implementation and monitoring stages to prevent the spread of infections in healthcare settings. Infection prevention and control is a practical, evidence-based approach to preventing patients and health workers from being harmed by avoidable infections. It requires constant action at all levels of the health system, including policymakers, facility managers, health workers, and those who access health services. The Administrators should promote feedback on practice, individual reinforcement, and appropriate rewards for good practice.

The Role of the Nurse Leader

The nurse leader should be in command of the implementation of processes in NICU settings. They should be responsible for making changes to current infection control standards and employee training. It would also be beneficial for the nurse leader to apply change management theory to ensure that all staff members take part in the change process. At the administrative level, nurse leaders should use a systematic approach to ensuring adequate workload and staffing. The success of the intervention can be measured based on the results of clinical supervision and the rate of hospital-acquired infections.

Health Systems and Outcomes of Care

The goal of health services is to protect and improve the health of individuals and populations. Health systems research provides evidence that, when applied, can make healthcare affordable, safe, effective, equitable, accessible, and patient-centered. Research helps to generate new evidence to help healthcare systems and healthcare professionals improve the lives of the patients they serve. Research enables frontline clinicians and patients to make better decisions, support healthcare delivery systems, and organize care processes to improve safety, effectiveness, and efficacy, and can be used to design healthcare benefits and inform policy.

The present study showed significant improvement in the healthcare professional's knowledge and practice after the implementation of the modified protocol. The protocol enhances the knowledge and practice of healthcare professionals. It improves the safety of newborns and effective ways to provide care to newborns. This study when applied, helps to organize care processes to improve safety also it makes healthcare affordable, safe, effective, equitable, accessible, and patient-centred.

Limitation

1. The researcher found it very difficult to get permission from corporate hospitals, to conduct the main study.
2. The investigator found it difficult to gather healthcare professionals at a time to conduct a post-test.
3. The study is limited to the health care professionals of NICU only.
4. The study was limited only to selected NICUs of a few cities in Uttar Pradesh.

The current study recommends the following:

1. The researcher has encouraged the use of protocol on infection control measures in various NICUs.
2. The researcher has recommended the utilization of protocol by all the health care professionals in all the departments.

3. The researcher has recommended using the protocol to update the knowledge of all the health care professionals in all the departments and the NICU settings.
4. In the future the hospital nursing administration staff can utilize the protocol to strengthen the neonatal care services to prevent nosocomial infections.
5. Updating knowledge and practice of health care professionals of NICU through continuing in-service educational programs.
6. Emphasizing the importance of following the latest evidence-based practices of infection control measures in the NICU in continuing education/training programs.
7. Provide training programs for freshers about infection control measures at regular intervals.
8. A replication of this study using camera recording should be done to assess the level of practice of health care professionals in NICU
9. The Administrators should promote feedback on practice, individual reinforcement, and appropriate rewards for good practice.
10. Various other interventional modalities, which vary in content and method can be used to assess the infection control measures in NICU and also in other ICUs.

Conclusion

The present study aimed to assess the effectiveness of infection control protocol on knowledge and practice among healthcare professionals in the NICU. The findings of the data analysis revealed that the protocol enhances the knowledge and practice of healthcare professionals. Hence, the infection control protocol in the NICU can be utilized by healthcare professionals to prevent the risk of nosocomial infection among neonates. Statistically significant improvement is seen in the healthcare professional's knowledge and practice after the implementation of the protocol.

This study reveals that the protocol can be used effectively in all the NICU settings. The findings of the study have great implications for nursing practice, education, administration, and research. The study gave a deep sense of satisfaction to the investigator and it was an enriching experience. the study was a new learning experience for the investigator. It also shows that there is a greater need to develop and implement protocols for various procedures. Guidance from the experts, co-operation from the hospital and health care professionals of NICU, and the help and support from the guide and colleagues contributed to the successful completion of the study.

Reference

1. Chudleigh J1, Fletcher M, Gould D. Infection control in neonatal intensive care units. *J Hosp Infect.* 2005; 61(2):123-9.
2. Gejwal R, Kodi M, Sembian N. Effectiveness of planned teaching program regarding infection control measures. *IJAR* 2015; 1(8): 815 -17. www.allresearchjournal.com
3. Nzegwu NI, Rychalsky MR, Nallu LA, Song X, Deng Y, Natusch AM, et al. Implementation of an antimicrobial stewardship program in a neonatal intensive care unit. *Infect Control Hosp Epidemiol*; 2017; 38:1137– 43. <https://doi.org/10.1017/ice.2017.151>
4. Rastogi V, Nirwan PS, Jain S, Kapil A. Nosocomial outbreak of septicemia in neonatal intensive care unit due to extended-spectrum β -lactamase producing klebsiella pneumonia showing multiple mechanisms of drug resistance. *Indian J Med Microbiol.* 2010;28(4):380-4. <https://doi.org/10.4103/0255-0857.71834>.
5. Kennedy, Allison M, Elward, Alexis M, Fraser, Victoria J. Survey of knowledge, beliefs, and practices of neonatal intensive care unit healthcare workers regarding nosocomial infections, central venous catheter care, and hand hygiene. *Infection Control and Hospital Epidemiology.* 2004; 747-752. https://digitalcommons.wustl.edu/open_access_pubs/913
6. Larson EL, Quiros D, Lin SX. Dissemination of the CDC's hand hygiene guideline and impact on infection rates. *Am J Infect Control.* 2007;35(10):666–675
7. Pradeepa. M. Effectiveness of infection control protocol on knowledge and practice among NICU nurses at selected hospitals, Kanyakumari, Tamilnadu 2012.thesis article URI: <http://repository-tnmgrmu.ac.in/id/eprint/12984>.
8. S.Anupam, K.Sodhi, M. Arya, M. Kumar. Knowledge of infection control practices among intensive care nurses in a tertiary care hospital; *Journal of Infection and Public Health*; Volume 6(4) August 2013: 269-275. <https://www.sciencedirect.com>.
9. Peter AT, Josephine A. Hand Hygiene: knowledge and practice among healthcare workers in the paediatrics and neonatal intensive care unit of the Cape Coast Teaching Hospital; *Journal of Advances in Medicine and Medical Research*; 33(2): 23-33, 2021; <http://europeanrepository.uk>.

10. Mohammed S. & Ibrahim K. (2016). Effect of Health Educational Program on Nurses Knowledge and Practice Regarding Infection Control in Neonatal Intensive Care Unit at Pediatric Hospitals in Khartoum State, Sudan-2015. *Pyrex Journal of Nursing and Midwifery*; 2 (3): 20-27
11. Koshy, S. and Patel, R., (2015). Effectiveness of Planned Teaching Program on Knowledge Regarding the Infection Control Measures in Labour Room among the Staff Nurses Working in Maternity Unit in Selected Hospital of Panchmahal District. *International Journal of Innovative Research and Development*; 4(4): 29-41.
12. Snowdon DA., Nicholas FT, Sandra GL. (2017). Does clinical supervision of healthcare professionals improve the effectiveness of care and patient experience? A systematic review; *BMC Health Service Research* 2017; 17: 786. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5706384>.

