Effect of Noise Control Nursing Guideline on Nurses' Knowledge, Practices, and Noise Level in Neonatal Intensive Care Unit

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Abstract

Background: The Neonatal Intensive Care Unit (NICU) is highly susceptible to harmful noise levels, which can adversely affect neonatal health outcomes. **This study aimed to**: Evaluate effect of noise control nursing guideline on nurses' knowledge, practices, and noise level in NICU at Cairo University Children Hospital (El Monira). **A quasi-experimental research design** (pre and post – test one group) was utilized. **A convenience sample** of 40 NICU nurses participated in the intervention. **Four tools used for data collection: (I)** A structured interview questionnaire, **(II) A** Nurses' Knowledge Assessment Questionnaire, **(III) An** observation checklist for nursing practices, and **(IV)** A noise measurement instrument. **The results** showed the total mean knowledge scores increased from a pre-intervention average of 30.9 to 42.6 post-intervention, with a slight decline to 41.9 post one month. The total mean Practice scores rose from 29.18 to 36.73 post-intervention and reached 36.98 post one month. All changes were statistically significant (P = 0.000). Noise levels in the NICU significantly decreased following the intervention (P = 0.000). A positive correlation was found between nurses' knowledge and practice (r = 0.47, p = 0.00), while noise levels showed strong negative correlations with both knowledge (r = –0.97, p = 0.001) and practice (r = –0.96, p = 0.002).**Conclusion**: The study conclude that**,** noise control nursing guideline effectively enhanced nurses' knowledge and practices, contributing to a quieter NICU environment. **Recommendation**: The study recommended that sustainable implementation of noise control nursing guidelines across neonatal units is essential to enhance staff competency and achieve meaningful reductions in environmental noise levels.

Key words: Nose control, Nursing guideline, Nurses' knowledge, Practice, Nose level

Introduction

Admissions to Neonatal Intensive Care Units (NICUs) have risen significantly, yet prolonged stays are linked to increased neonatal complications, mortality, and economic burdens on families and healthcare systems **(Fu, Song, Yu, Yu, & Yang, 2023)**. NICUs are highly technical and crowded environments, filled with life-support equipment such as ventilators and ECG monitors. Critical procedures like intubation and resuscitation are often performed bedside, contributing to noise and sleep disruption (**Zhang, Hua, Li, Cao, & Hu, 2022**).

The American Academy of Pediatrics and the US Environmental Protection Agency recommend maintaining NICU noise levels below 45 dB to support infant comfort and recovery (**Abdel Hamid, Khairy, Bakeer, Ibrahim, & Amin, 2021**). However, frequent exposure to loud sounds—machine alarms, staff handovers, parental interactions, and phones—can cause physiological stress in preterm infants, including increased heart and respiratory rates and altered oxygen saturation. These disturbances may lead to sleep issues, hearing loss (**Gramajo, 2023; Rossi et al., 2025**), and long-term neurosensory deficits, behavioral challenges, and impairments in attention, language, and academic performance **(Fucile, Patterson & Dow, 2023).**

Noise also affects NICU staff and families. Nurses report elevated stress, burnout, and health problems in noisy environments (**McCullagh, Xu, Dickson, Tan, & Lusk, 2022**). Parents experience emotional distress,

anxiety, and communication barriers, often perceiving the NICU as chaotic and disorganized **(Chifa, Hadar, Politimou, Reynolds, & Franco, 2021).**

Despite these challenges, evidence shows that noise reduction in NICUs yields substantial benefits. For infants, it improves autonomic regulation, reduces ventilation days, enhances digestion, shortens hospital stays, and supports healthy sleep and neurodevelopment. For healthcare professionals, quieter environments improve focus and reduce errors, enhancing care quality (**Sanz-Segura, Manchado-Perez, Ferrer-Duce, Gonzalez de la Cuesta, & Özcan, 2020).**

Recommended strategies include keeping unit doors closed, limiting unnecessary entry, and posting silence signs to raise awareness among staff, families, and cleaning personnel (**Martins et al., 2022**). Establishing quiet times and clustering interventions are essential for maintaining calm (**Zhang, Hua, Li, Cao, & Hu, 2022**). Long-term success depends on ongoing education, structural and cultural changes, and staff training in developmental care and environmental management (**Gholami, Borimnejad, & Jafari, 2020; Abdel Hamid, Abdel Latif, Bakeer, Ibrahim, & Nasef, 2021**).

Significant of the study

Neonates in NICU are exposed to excessive noise often exceeding safe limits of 45 decibels—leading to physiological instability, sleep disruption, and long-term developmental harm (**Gramajo, 2023; Fucile, Patterson & Dow, 2023; Singh & Fusch, 2021**). This noisy environment also negatively affects medical staff and parents, contributing to stress and poor health outcomes (**McCullagh et al., 2022; Chifa et al., 2021; Vozza et al., 2024**). Despite international recommendations, many Egyptian NICUs lack standardized noise control protocols (**Abdel Hamid et al., 2021**). Nurses play a critical role in mitigating environmental stressors, and evidence supports the need for continuous training and feedback to implement sustainable noise reduction practices (**Gholami et al., 2020; Fucile et al., 2023**). Therefore, the study was conducted to evaluate the effect of noise control nursing guideline on nurses' knowledge, practices, and noise level in neonatal intensive care unit.

Aim:

The aim of the present study is to evaluate effect of noise control nursing guideline on nurses' knowledge, practices, and noise level in neonatal intensive care unit.

Research Hypotheses

1. Nurses who receive noise control nursing guideline will have higher mean score of knowledge than before.
2. Nurses who receive noise control nursing guideline will have higher mean scores of reported practices than before.
3. Noise level decibels (dB) in neonatal intensive care unit after application noise control nursing guideline will be lower than before

Subject and methods

Research design:

A quasi experimental one group pre/ post research design was utilized in the current study. Thus, quasi-experimental research design test cause-and effect relationships, lacking random assignment or presence of a control group, used when it is not logistically, feasible or ethical to conduct a randomized controlled trial. Pre-post (one-group) design is used when there is just one study group available (Wood and Haber, 2022).

Setting:

The current study was conducted in the neonatal intensive care unit (NICU) which is allocated on the third floor of Cairo University Children Hospital (El Monira). The unit is divided into three units (ICU for critical cases, intermediate care, and neonatal jaundice). Each unit includes central location, nursing station, and infant's bedside incubator. Capacity of this unit includes 52 incubators that provide free care for high-risk neonates from all over the republic of Egypt. The unit includes other connected rooms, especially for intravenous fluid and formula preparation, breast feeding room, sterilization rooms, laundry and storage rooms

for equipment and supplies. The study will be carried out in ICU and intermediate care.

Sample:

A convenience sample of 40 bedside nurses working in NICU, intermediate care, who meet inclusion criteria and are responsible for providing direct care to neonates and willing to participate in the study. These 40 nurses were assigned as control and study group before and after intervention.

Data Collection Tools:

Data was collected through four tools

Tool I: **Structured Interview Questionnaire:** It was developed by the researchers, and it includes nurse's personal data. It is concerned with the personal characteristics of the studied nurses, it include (10 items) about: age, gender, educational level, years of experience in the field of pediatric nursing, and NICU, their attendance to training programs in the field of neonatal intensive care, and noise prevention in the NICU, last received training program about neonatal care, and noise prevention in the NICU, and finally their source of information about noise prevention at NICU.

Tool II: Nurses' Knowledge Assessment Questionnaire (pre/ post-posttest): It was developed by the researchers after reviewing the related literature. It is in the form of multiple choice (17 questions) and true/false (10 questions) to assess nurses' knowledge about noise control at NICU regarding the following items: definition of noise; recommended noise level in NICU according WHO; sources of noise in and out NICU; negative impact of noise on neonate, staff, and parents; and finally noise control nursing guideline in NICU

Scoring System: For multiple choice questions each question was from 0-2 grades whereas complete answer scored two grades, incomplete scored 1 and score zero for incorrect response.

For true / false questions, each question was from 0-1 grade where, correct answer scored one grade and score zero for incorrect response.

The obtained scores were converted to percentile values and classified under as the following: Low scores: (0 <50%); Middle scores: (50 <75%); Favorable scores: (75 ≤100%) (Mansourian et al., 2020)

Tool III: **Observation checklist for nurses' practices**

It was developed by researchers after reviewing the related literature. It is in the form of three Likert scale to assess nurses' practices about noise control at NICU. It includes 25 items. The three point Likert scale are never=0, sometimes=1, and always=2 and the total score ranges from 0 to 50.The obtained scores were converted to percentile values and classified as the following: Low scores: (0 <50%); Middle scores: (50 <75%); Favorable scores: (75 ≤100%) (Mansourian et al., 2020).

Tool IV: **Noise Measurement Instrument**

Noise level in the study was measured by Uni-t Ut353 standard device that was used for noise measurement by meter (decibel). It is a digital sound level meters that converts ambient sound into electric signals, process data and displays results on LCD. They can constantly monitor ambient sound. Uni-t Ut353 can transfer measurement data through blue tooth to UNI-T's custom mobile APP (iENV) for further analysis, storage, and export. The device was new and was calibrated every day according to their respective manual. The device was connected to a computer using a USB cable. The data was first transferred to Excel, and then to the Statistical Package for the Social Sciences (SPSS) after measurements (**Tureková, Marková, Brečka, Hyneková, Kóša, 2024**)

Tools validity and reliability

Tools (I, II, III) were given to three experts in the field of neonatology and pediatric nursing to examine the content validity.

Reliability of tools was performed to confirm its consistency using Cronbach's alpha test. Reliability of nurse's knowledge (tool II) was 0.79 while reliability of observational checklist for nurses' practices (tool III) was 0.85.

Tool (IV) Uni-t Ut353 is a stable, safe, reliable mini sound meter, widely used in noise detection, quality control, health control, environmental noise measurement in factory, traffic, home, audio and other places. China is the developer, manufacturer and marketer of reliable testing, measuring and inspecting products to over 100 countries and regions globally. Retrieved from: https://meters.uni-trend.com/download/ut353-user manual/? wpdmdl= 7376& refresh= 66a6a4 9736 be81 722197143

Ethical Considerations

A primary written ethical approval was obtained from the Institutional Research Ethical Committee of the Faculty of Nursing, Cairo University. A written informed consent was obtained by the researchers from each nurse after complete description of the aim nature of the study and its benefits to obtain their consent. Each study tool was coded, and the nurse's names did not appear on them for confidentiality. The nurses could withdraw from the study at any time.

Data Collection Procedure

1.Preparatory phase: the researcher developed noise control nursing guideline and tools that were utilized in the study after extensive review of literature. After obtaining the approval of the ethics committee, official permission was obtained from hospital administrators, and head of NICU department of Cairo University Children Hospital (El Monira) to conduct the study. The aim, methodology and nature of the study were explained to the administrators.

Assessment phase: at first day before starting noise control nursing guideline the researchers met the neonatal nurses in the classroom of NICU for a clear and simple explanation of the aim, nature and the expected outcomes of the study. Those who gave their consent were included in the sample. The researchers distributed tool I (nurses' personal data), tool II (Nurses' Knowledge Assessment Questionnaire) to be filled out by nurse to obtain baseline assessment (pretest). It took about 30-45 minutes to complete the study tools according to nurses' physical, mental readiness and circumstances of the unit's work. Tool III (observation checklist for nurses' practices) was observed by the researchers two times randomly to fill the practices for once.

The noise level was measured before application of noise control nursing guideline (tool IV) at different times of the day at three shifts (the morning, afternoon, and night). The noise level was measured in three locations in each previous mentioned unit: central location; nursing station in the infants' bedside Incubator. The researcher starts to be demonstrating the technique for using the sound meter device for the nursing staff and redemonstrate more than once tell be sure the nursing staff can work the device competently.

2.Implementation phase: In this phase, the noise control nursing guideline was carried out for all nurses in the study setting. The nursing guidelines program was provided to the nurses in the form of power point presentation through two consecutive sessions for a group of nurses ranging from 3 to 5 nurses. Time consumed for each session was around 30 minutes. The first session encompassed knowledge related to definition of noise, recommended noise level in NICU according to WHO, sources of noise in and out NICU. The second session encompassed knowledge related to negative impact of noise on neonate, staff, parents, and noise control nursing guidelines in NICU.

Booklet and poster were developed by researchers, it included items related: definition of noise, recommended noise level in NICU, sources of noise in the NICU, negative impact of noise on neonate, staff, parents, and noise control nursing guideline in NICU. After completing the nursing guideline program, the researchers assigned the booklets for all participated nurses and shared a copy of the Power Point presentation with the nurse educator for future in-services and dissemination of information.

3. Evaluation and follow up phase: Nurses' knowledge and nurses' practices were re-evaluated (tool II & tool III) immediately after implementation of the noise control nursing guideline program (post-test) and one month after intervention to determine the retained knowledge and practices as to evaluate the effect

of the noise control nursing guideline. The noise level was measured immediately after implementation noise control nursing guideline and one month later (tool IV).

Statistical analysis

Statistical analysis was conducted using IBM Statistical Package for Social Sciences (SPSS) version 29.0. Sound measurement data was introduced into a Microsoft Excel spreadsheet. The data collected was tabulated and analyzed. Numbers and percentage were calculated for qualitative variables while means and standard deviations were calculated for quantitative variables. ANOVA was used to test the differences between the mean values at the three measurements. Chi square test was used to test for differences in qualitative variables. Pearson correlation coefficient was used to study correlations between variables. The level of significance for all tests was set at $p<0.05$.

Results:

Table (1) Indicate that (67.5%) of the studied nurses were females and (60%) of them were in the age group 21-30 years, their mean age was 30.5±7.8. In terms of education, (52.5%) of nurses had bachelor's degree in nursing while less than one third (22.5%) of nurses' technical institute. Half of them (50%) had less than 5 years of experience in the field of pediatric nursing and (57.5%) had less than 5 years of experience in the NICU. (70%) of nurses received training about neonatal care while most of nurses. While (15%) received training program about noise prevention. Less than one third (27.5%) of nurses said their source of information about noise prevention at NICU was protocol while 20% of them had no source of information.

Table (2) illustrates that there was an increase in mean scores of nurse's knowledge post noise control guideline intervention. For example, the mean score of nurse's knowledge regarding the recommended safe environmental sound levels in NICU and physiological changes that occur to newborns due to noise inside NICU both were increased with high statistical significance difference (p= 0.000). Additionally, nurses' knowledge regarding the sources of noise inside NICU increased from 0.20 pre intervention to 1.73 post then to 1.78 post one month with statistical significance difference (p= 0.040). Also nurses knowledge about noise in NICU had a negative psychological and behavioral impact on nurses, which increased from 0.50 pre intervention to 1.13 post intervention then to 1.15 post one month with statistical significance difference (p= 0.000).

Table (3) represent that nurse's knowledge regarding the general principles of "quiet time" within neonatal intensive care units and knowledge of the nursing principles for noise control within neonatal intensive care units were increased with high statistical significance difference (p= 0.003) & (p= 0.000) respectively. Concerning nurses' knowledge about sound-absorbing materials and equipment should be installed where appropriate in NICU, it increased from 1.50 pre intervention to 1.90 post intervention and post one month with high statistical significance difference (p= 0.005). The total mean nurses' knowledge increased from 30.9 pre noise control nursing guidelines intervention to 42.6 post intervention then 42.6 post one month. There was a significant difference between total mean knowledge of nurses studied pre and post intervention (p= 0. 000).

Table (4) highlights that there was an increase in mean scores of practice post noise control guidelines intervention. For example, practice regarding using low-noise equipment and muffling devices where appropriate increased from 0.40 pre intervention to 0.95 post intervention then to 0.93 post one month with high statistical significance difference (p= 0.000). Also practice regarding minimizing noise levels while performing nursing procedures in the NICU and knowledge regarding keeping alarms volume as low as possible and turn on the alert lights increased with statistical significance difference (p= 0.040) and (p= 0.003) respectively. Concerning reduce unit's phone volume and moving it away from incubators, it increased from 0.35 pre intervention to 1.23 post intervention then to 1.25 post one month with high statistical significance difference (p= 0.000)

Table (5) shows that practice regarding not making noise while using or cleaning the equipment and, dragging things such as chairs

and tables into the unit quietly were increased with high statistical significance difference (p= 0.001). & (p= 0.005) respectively. While regarding putting objects on top of the incubator in the unit reduced from 1.18 pre intervention to 0.78 post intervention then to 0.80 post one month with high statistical significance difference (p= 0.003). Concerning monitoring and recording noise level on a regular basis and adhering to pictures and posters about sound control and decrease noise in the NICU were increased with high statistical significance difference (p= 0.016). & (p= 0.001) respectively. The total mean nurses' practice increased from 29.18 pre noise control nursing guidelines intervention to 36.73 post intervention then 36.98 post one month. There was a significant difference between total mean practice of nurses studied pre and post intervention (p= 0. 000).

Table (6) reveals that total percentage of nurses' knowledge increased post noise control nursing guideline from 2.5% high knowledge pre intervention to 77.5% post intervention then to 75% post one month. There was a significant difference between level of knowledge of nurses studied pre and post intervention (X2=60.7, P=0.000).

Table (7) illustrate that total percentage of nurses practice increased post noise control nursing guideline from 42.5% moderate percentage pre intervention to 80% post intervention then to 82.5% post one month. There was a significant difference between level of practice of nurses studied pre and post noise control nursing guideline intervention (X2= 19.2, P=0.000).

Table (8) shows that there was a significant decline in noise level post noise control nursing guideline intervention at all places of neonatal intensive care unit (NICU), intermediate, and neonatal jaundice (P=0.000). Highest mean noise level was at nursing station in the NICU, it was 71.12 pre intervention while decreased post intervention to 62.40 then 63.00 post one month. Lowest mean noise level was at nursing station in the neonatal jaundice, it was 64.13 pre intervention while decreased post intervention to 54.62 then 50.33 post one month. Also, the mean noise level at central location in the NICU decreased from 66.80 pre intervention to 60.52 post intervention then 62.02 post one month, while in the intermediate the mean noise level decreased from 67.00 pre intervention to 60.05 post intervention then 59.05 post one month. In the neonatal jaundice the mean noise level decreased from 67.30 pre intervention to 56.83 post intervention then 51.20 post one month. The mean noise level at the infant bedside incubator in the NICU decreased from 67.47 pre intervention to 63.45 post intervention then 58.88 post one month, while in the intermediate the noise level decreased from 65.13 pre intervention to 58.85 post intervention then 56.43 post one month. In the neonatal jaundice the mean noise level decreased from 65.08 pre intervention to 54.25 post intervention then 52.10 post one month.

Table (9) illustrate that there was a significant positive direct correlation between knowledge and practice of studied nurses (r=0.47, p=0.00) while there was a significant negative inverse correlation between noise level and both knowledge and practice of studied nurses (r=.-0.97, p=0.001; r=.-0.96, p=0.002).

Table (10) reveals that there was no correlation between nurse's age, education, experiences with noise level, knowledge, and practice. There was a significant positive direct correlation between training program about neonatal care and knowledge (r=0.23, p=0.00) while there was a negative inverse correlation between training programs about neonatal care and noise level (r=-0.22, p=0.00).

Table (1): Percentage distribution of nurse's personal data (n=40)

Items	No.	%
Gender		
Male	13	32.5
Female	27	67.5
Age		
<20 years	2	5.0
21-30 years	24	60.0
31-40 years	9	22.5
>40 years	5	12.5
Mean±SD	**30.5±7.8**	
Education		
Diploma of nursing school	10	25.0
Nursing technical institute	9	22.5
Bachelor's degree in nursing	21	52.5
Experience in the field of pediatric nursing		
<5 years	20	50.0
5-10 years	6	15.0
>10 years	14	35.0
Experience in the NICU		
<5 years	23	57.5
5-10 years	4	10.0
>10 years	13	32.5
Training program about neonatal care		
Yes	28	70.0
No	12	30.0
Last received training program about neonatal care		
0	2	5.0
<1 years	25	62.5
1-3years	3	7.5
Receive training program about noise prevention in NICU		
Yes(<1 year)	6	15.0
No	34	85.0
Source of information about noise prevention in NICU		
Protocol	11	27.5
Doctor orders	5	12.5
Text book or Articles	6	15.0
Expert peers	5	12.5
Social media	5	12.5
no source	8	20.0

Table (2): The mean score of knowledge pre and post noise control nursing guideline among studied nurses (n=40)

Knowledge	Pre		Post		Post 1 month		F	p
	Mean	SD	Mean	SD	Mean	SD		
1.The recommended safe sound levels in the Neonatal Intensive Care Unit (NICU)	0.30	0.72	1.45	0.90	1.45	0.90	24.50	.000*
2. Peak Periods of Noise Intrusion in NICU	0.98	0.53	1.95	0.22	1.98	0.16	109.89	.000*
3. General Sources of Noise in NICU	0.20	0.56	1.73	0.64	1.78	0.58	90.70	.000*
4. Equipment-Generated Noise in NICU	0.18	0.45	1.00	0.55	1.03	0.58	33.43	.000*
5. Staff-Generated Noise in NICU	0.40	0.50	0.98	0.48	0.98	0.48	18.72	.000*
6. Factors Contributing to Elevated Noise Levels in NICU	1.60	0.74	1.78	0.53	1.78	0.53	1.09	.337
7. Is There Physiological Effects of NICU Environment on Neonates	1.75	0.67	2.00	0.00	2.00	0.00	5.57	.005*
8.Specific Physiological Alterations in Neonates Due to Noise	0.08	0.27	0.93	0.62	0.95	0.60	36.92	.000*
9.Adverse Impact of NICU Noise on Neonatal Health	1.80	0.61	1.98	0.16	1.98	0.16	2.92	.058
10.Short-Term Adverse Effects of NICU Noise on Neonates	1.30	0.79	1.43	0.50	1.30	0.46	0.57	.566
11.long-term Consequences of NICU Noise Exposure	0.58	0.55	1.08	0.57	1.03	0.53	9.99	.000*
12.Impact of NICU Noise on Family Experience	1.38	0.84	1.75	0.44	1.55	0.50	3.68	.028*
13.Physical Health Implications for NICU Nurses	0.28	0.51	1.00	0.51	1.00	0.51	27.35	.000*
14.Psychological and Behavioral Effects of NICU Noise on Nurses	0.50	0.51	1.13	0.52	1.15	0.48	21.53	.000*

***Significant at p-value<0.05**

Table (3): The mean score of knowledge pre and post noise control nursing guideline among studied nurses (n=40) (cont.,)

Knowledge	Pre		Post		Post 1 month		F	p
	Mean	SD	Mean	SD	Mean	SD		
15. Principles of "Quiet Time" in NICUs	0.43	0.81	1.08	0.97	1.03	0.97	6.15	.003*
16.Nursing Practices for Noise Control in NICUs	1.85	0.48	1.98	0.16	1.93	0.27	1.44	.241
17.Nursing Principles for Noise Reduction in NICUs	1.43	0.75	1.98	0.16	1.90	0.38	14.68	.000*
18. Impact of Excessive Noise on Neonates and Staff	1.90	0.44	1.95	0.32	1.95	0.32	0.25	.777
19. Routine Monitoring of NICU Noise Levels	1.45	0.90	1.75	0.67	1.70	0.72	1.73	.181
20.Sources of Intrusive Noise in NICUs	1.15	1.00	1.40	0.93	1.40	0.93	0.91	.402
21.Benefits of Noise Reduction for Neonatal Development	1.70	0.72	1.90	0.44	1.85	0.53	1.29	.277
22. Availability of Noise Measurement Tools in NICUs	0.75	0.98	1.05	1.01	1.00	1.01	1.03	.360
23. Effect of NICU Noise on Family Experience	1.70	0.72	1.60	0.81	1.45	0.90	0.95	.389
24.Installation of Sound-Absorbing Materials in NICUs.	1.50	0.88	1.90	0.44	1.90	0.44	5.52	.005*
25.Parent and Visitor Education on Noise Reduction	2.00	0.00	2.00	0.00	1.95	0.32	1.00	.371
26.Allocation of Quiet Time for Neonatal Care	1.95	0.32	1.95	0.32	1.95	0.32	0.00	1.000
27. Use of Visual Aids to Promote Noise Awareness pictures and poster	1.80	0.61	2.00	0.00	2.00	0.00	4.33	.015*
Total Mean of Nurses Knowledge	**30.9**	**3.93**	**42.6**	**4.5**	**41.9**	**4.5**	**91.73**	**.000***

***Significant at p-value<0.05**

Table (4): The mean score of practices pre and post noise control nursing guideline among studied nurses (n=40)

Practice	Pre		Post		Post 1 month		F	p
	Mean	SD	Mean	SD	Mean	SD		
1. Utilization of Low-Noise Equipment	0.40	0.67	0.95	0.68	0.93	0.69	8.31	0.000*
2. Maintenance of Mechanical Ventilation Systems as accumulation of water in tubes	1.58	0.71	1.80	0.41	1.78	0.48	2.02	0.13
3.Noise Minimization During Nursing Procedures, feeding, suction….	1.28	0.72	1.60	0.55	1.55	0.55	3.29	0.040*
4. Soft Verbal Communication Near Incubators	1.35	0.80	1.55	0.60	1.55	0.60	1.18	0.31
5.Quiet Communication During Clinical Rounds	1.18	0.87	1.40	0.67	1.50	0.64	2.04	0.13
6. Mute cell phone or vibrator inside the unit.	1.00	0.85	1.33	0.73	1.35	0.70	2.62	0.07
7. Using headphones during phone conversations.	0.48	0.72	0.80	0.65	0.78	0.66	2.86	0.06
8. Avoidance of Noisy Footwear	1.30	0.82	1.68	0.57	1.68	0.57	4.22	0.017*
9.Adjustment of Unit Telephone Settings	0.35	0.58	1.23	0.66	1.25	0.74	23.83	0.000*
10.Alarm Management Protocols	1.05	0.88	1.50	0.60	1.53	0.55	5.98	0.003*
11. Quik Response to alarms.	1.75	0.49	1.83	0.38	1.83	0.38	0.41	0.66
12. Rapid Response to crying babies.	1.65	0.62	1.85	0.36	1.85	0.36	2.46	0.08
13. Keep NICU organized and removing extra equipment and Layout	1.60	0.67	1.85	0.36	1.90	0.30	4.59	0.012*

***Significant at p-value<0.05**

Table (5): The mean scores of practices pre and post noise control nursing guideline among studied nurses (n=40) (cont.,)

Practice	Pre		Post		Post 1 month		F	p
	Mean	SD	Mean	SD	Mean	SD		
14.Utilization of Low-Noise Equipment	0.83	0.75	1.30	0.56	1.30	0.56	7.55	.001*
15. Careful Handling of Unit Doors	1.35	0.70	1.58	0.50	1.60	0.50	2.30	.104
16. Silent Movement of Furniture	0.98	0.77	1.38	0.63	1.43	0.59	5.46	0.005*
17. Avoid Placing Objects on Incubators	1.18	0.71	0.78	0.42	0.80	0.56	6.00	0.003*
18. Gentle Handling of Incubator Doors	1.50	0.78	1.80	0.41	1.78	0.42	3.47	0.034*
19. Gentle Handling of Incubator Drawers	1.53	0.72	1.75	0.49	1.75	0.49	2.02	0.136
20. Clustering nursing Care procedures	1.55	0.71	1.75	0.49	1.83	0.45	2.54	0.083
21. Commitment to “Quiet Time”	1.55	3.41	1.43	0.59	1.45	0.55	.043	0.958
22. Education of Parents and Visitors about noise reduction	1.13	0.88	1.53	0.60	1.58	0.55	5.07	0.008*
23. Regular Noise Levels Monitoring	0.70	0.85	1.13	0.65	1.10	0.67	4.26	0.016*
24. Adherence to Visual Reminders pictures and posters related sound control	0.83	0.93	1.43	0.68	1.38	0.67	7.52	0.001*
25. Peer-to-Peer Reminders to decrease voice in the NICU.	1.13	0.79	1.55	0.50	1.55	0.50	6.37	0.002*
Total Mean of Nursing Practice	**29.18**	**11.19**	**36.73**	**6.03**	**36.98**	**5.87**	**12.02**	**0.000***

***Significant at p-value<0.05**

Table (6): Total percentage of knowledge level pre and post noise control nursing guideline among studied nurses (n=40)

knowledge	Pre		Post		Post 1 month		X2	p
	No.	%	No.	%	No.	%		
Low (<50%)	5	12.5	0	0	0	0	60.7	0.00*
Moderate (50%-75%)	34	85	9	22.5	10	25		
High (>75%)	1	2.5	31	77.5	30	75		

***Significant at p-value<0.05**

Table (7): Total percentage of practice level pre and post noise control nursing guideline among studied nurses (n=40)

Practice	Pre		Post		Post 1 month		X2	p
	No.	%	No.	%	No.	%		
Low (<50%)	22	57.5	8	20	7	17.5	19.2	0.00*
Moderate (50%-75%)	17	42.5	32	80	33	82.5		
High (>75%)	0	0.0	0	0	0	0		

***Significant at p-value<0.05**

Table (8): The mean noise level in the neonatal intensive care unit, intermediate, and neonatal jaundice unit pre and post noise control nursing guideline (n=40)

Place		Mean Noise level (dB)			F	p
		Pre	Post	Post 1 month		
Central location	NICU	66.80	60.52	62.02	23.66	0.000*
	Intermediate	67.00	60.05	59.05	28.98	0.000*
	Neonatal jaundice	67.30	56.83	51.20	65.77	0.000*
Nursing station	NICU	71.12	62.40	63.00	45.62	0.000*
	Intermediate	70.62	59.15	60.13	78.94	0.000*
	Neonatal jaundice	64.13	54.62	50.33	54.26	0.000*
Infants' bedside incubator	NICU	67.47	63.45	58.88	9.70	0.003*
	Intermediate	65.13	58.85	56.43	23.66	0.000*
	Neonatal jaundice	65.08	54.25	52.10	70.37	0.000*

***Significant at p-value<0.05**

Table (9): Correlation between noise level, knowledge and practice of studied nurses (n=40)

	Knowledge		Practice		Noise level	
	r	p	r	p	r	p
Knowledge	-	-	0.47	0.00*	-0.97	0.001*
Practice	0.47	0.00*	-	-	-0.96	0.002*
Noise level	-0.97	0.001*	-0.96	0.002*	-	-

***Significant at p-value<0.05**

Table (10): Correlation between nurse's personal data with noise level, knowledge, and practice (n=40)

Personal data	Knowledge		Practice		Noise level	
	r	p	r	p	r	p
Age	0.12	0.43	0.1	0.52	0.07	0.4
Education	0.13	0.42	0.19	0.24	0.09	0.1
Experience in the field of pediatric nursing	0.01	0.95	0.22	0.15	0.06	0.5
Experience in the NICU	0.12	0.46	0.16	0.29	0.09	0.1
training program about neonatal care	0.23	0.00*	0.09	0.5	-0.22	0.00*
receive training program about noise prevention at NICU	0.13	0.39	0.07	0.6	0.11	0.5

***Significant at p-value<0.05**

Discussion

The current study reveals that more than two third of the studied nurses were females. Contradict with the study by **El-Afifi et al (2021)** reported that, male nurses were slightly predominance. More than half of studied nurses were in the age group 21-30 years, their mean age was 30.5±7.8. This finding agrees with **Hendy et al. (2024)** they found 73.7% of nurses working in NICU were female, 37.5% of them were aged between 25 and less than 30 years, with a mean age of 28.99±7.43 years.

In terms of education more than half of nurses had bachelor's degree in nursing while less than one third of nurse's technical institutes. Half of them had less than 5 years of experience in the field of pediatric nursing and more than half had less than 5 years of experience in the NICU. The result was in the same line with **Khalil, Mohamed, Mohamed & Mousa (2021)** they found that more than two-thirds of the

studied nurses (69.4%) had a bachelor's degree, while less than one-fifth of them had secondary technical school of nursing. Also, **Arslan and Akkoyun (2025)** stated that 66.6 % of nurses have their education bachelor's degree, 50% working experience 11 years and more, 41.6% experience in NICU 3 to 5 years. While these results disagree with **Hendy et al. (2024**) they found more than half of the nurses (52.5%) had received their nursing education from technical health institutes. Additionally, 28.7% of the nurses had 10 to less than 15 years of work experience with a mean experience of 9.45 ±3.87 years.

Regarding training program more than two thirds of nurses had training program about neonatal care while most nurses hadn't received training program about noise prevention at NICU. Less than one third of nurses their source of information about noise prevention at NICU was protocol while 20% of them had no source of information. This result is supported by **McCallig, Pakrashi and Durkin (2024)** who showed that 38.3% of all respondents reported having received no information or training about noise in the NICU. Also, Salins and colleagues revealed in their study the need for intensive teaching and training of physicians and nurses for the successful implementation and practice on neuroprotective environment from noise for neonates among health care professionals in clinical settings (**Salins, Sunny, Conrad, Sneha, & Saldanha, 2023**). The researcher justified this finding by lack of in-service education, continuous training, and staff development in the study settings.

Concerning mean score of nurses' knowledge regarding the recommended safe environmental sound levels in NICU increased from 0.30 pre intervention to 1.45 post intervention and post one month with high statistical significance difference (p= 0.000). This finding was consistent with Fortes (2021) who showed that the greatest improvement in percentage of correct responses was regarding questions about World Health Organization (WHO) Guidelines for acceptable ranges of noise levels in the hospital. In pre-test responses, 12.5% or 2/16 nurses responded with the appropriate response. In post-test responses, 87.5% or 14/16 nurses responded with the appropriate response. This revealed an increase of 75%.

In the same line of study for **Martins et al. (2022),** They recommended that a protective measure aimed at reducing noises can be implemented, such as measuring noise frequently, electronic panels indicating decibels in the environments and noise flags as monitoring and follow up the sound level at NICU. From the researcher's point of view the visual sound intensity meter is vital equipment that should be available at workplace to help the health care teams and visitors pay attention for intensity of sound level at NICU

Additionally, nurses' knowledge regarding the sources of noise inside NICU increased from 0.20 pre intervention to 1.73 post then to 1.78 post one month with statistical significance difference (p= 0.040). The result agrees with **Hendy et al. (2024)** they stated that only 10% and 15% of the studied nurses had accurate knowledge regarding the components of a healing environment from noise and the permissible sound level, respectively. In contrast, post intervention, 81.3% and 90% of the participants had correct knowledge regarding these aspects, respectively. Also, **McCallig, Pakrashi and Durkin (2024**) reported that sources of noise within the NICU were equipment alarms, staff-to-staff conversations and telephone/ call systems. In addition, **Vozza**, **Scully and Sortica da Costa (2024)** identified that ward rounds, closing and opening of bin containers, monitors and syringe alarms as the most common source of noise.

In a study conducted by **Hernández-Salazar et al, (2020)** In relation to noise sources, the study highlights mechanical events that produce greater noise and which due to their nature may be avoided or have their loudness reduced, like handling of formula bottles, alarms of various types, movement of furnishings or their parts, sounds of objects due to falls, placement on a surface, or dragging on the floor. In this respect, maintenance or replacement of furniture, equipment and fixtures should be sought to make environmental and periauricular noise reduction possible.

El-Afifi et al (2021) reported that, the noisiest source perceived by most nurses in their different departments was the quarrels of the medical staff with patient relatives and visitors inside and outside departments and this could be due to the nature and culture of some people in addition to the stressful conditions people experience daily in Palestine that might make them stressed and nervous. Medical equipment and co-workers' conversations and conversations of patients' visitors were also mentioned.

Qualitative study for **Arslan et al, (2025)** reported that, the awareness of nurses about the sources of noise is important in noise reduction. The knowledge of nurses about the sources of noise can be associated with having to work for prolonged periods, their attending in-house training on neonatal care, their participation in congresses and other meetings, and their following up on this subject in literature.

Concerning nurses' knowledge about the physiological changes that occur to newborns due to noise inside NICU increased from 0.08 pre intervention to 0.93 post intervention then to 0.95 post one month with high statistical significance difference (p= 0.000). The results agree with **Das, Chakraborty, Bora, and Chakraborty (2023); Rossi et al. (2025)** mentioned that noise pollution causes immediate increase in heart rate and respiratory and altered sleep pattern in the babies. Controlling noise pollution within NICU is of paramount importance, since numerous adverse effects can harm the infant physiological stability and future neurodevelopment. In a study for **Arslan , Eren , Özçelik (2025)** the majority of the nurses participating in the study determined the sources of noise in the neonatal intensive care unit which can penetrate NICU walls and create stress for neonates, affecting their physiological stability.

In their study, **Dall'Oglio et al. (2022)** reported that to prevent any long-term adverse effects of newborns in the NICU environment, they would have to be provided with individualized developmental care. Individualized developmental care can be useful in selecting and adjusting sources of noise (e.g., alarms, closing of incubator access ports, trash cans). **Furthermore, Arslan et al (2025)** show that preventing unnecessary noises was one of the prioritized responsibilities of the nurses in the context of individualized developmental care.

Also nurses knowledge about noise in NICU had a negative psychological and behavioral impact on nurses increased from 0.50 pre intervention to 1.13 post intervention then to 1.15 post one month with statistical significance difference (p= 0.000). This result goes on line with **Vozza, Scully and Sortica da Costa (2024)** they mentioned that continuous exposure to noise in the NICU can affect the well-being of parents and healthcare professionals. Also, **Rozensztrauch et al. (2024)** found that noise not only negatively affects hospitalized patients but also impacts the medical staff themselves. Respondents admitted that they themselves struggle with fatigue and irritation caused by the large number of alarms and technical signals from equipment - as many as 68% indicated experiencing such inconveniences during their work in the unit. While the result contradicts with **Arslan et al. (2025).** They mentioned that nurses stated that becoming used to the noises or no longer being irritated by the sounds were underlying triggers of noise in the unit. From my point of view, enhance nurses' knowledge and awareness of the negative effect of noise at NICU on their health, behavior and performance for early identification and better treatment outcomes. Provide supportive feedback for nurses to determine priorities for occupational support, improvement in logistics, identify areas of support for the nurse as well as institutional measures for noise reduction.

As regard knowledge regarding the general principles of "quiet time" within neonatal intensive care units increased from 0.43 pre intervention to 1.08 post intervention then to 1.03 post one month with high statistical significance difference (p= 0.003). Also, knowledge of the nursing principles for noise control within neonatal intensive care units increased from 1.43 pre intervention to 1.98 post intervention then to 1.90 post one month with high statistical significance difference (p= 0.000). This was consistent with **Vozza, Scully and Sortica da Costa (2024)** they found that staff awareness of noise levels has increased, an educational video on the impact of noise on NICU has been shared with all hospital staff and

transitioning to quiet time has been considered. Also **McCallig, Pakrashi and Durkin (2024)** concluded that enforcement of the daily 'quiet hour', reduced volume levels on alarms and to erecting signage to remind people to keep noise down. The most common response was to implement an awareness campaign for staff and parents on the control and reduction of noise within NICU.

Additionally, **Séassau, Munos, Gire, Tosello and Carchon (2023)** mentioned that nursing recommendations for noise control within neonatal intensive care units occurs through: minimizing excessive exposure to noise by speaking in a low voice, not using the top of incubators as a table surface, closing porthole doors gently, responding quickly to alarms, and limiting the use of personal radios.

From my point of view the impact of noise on newborns in NICU is an issue that has not received adequate attention in our health care setting due to lack of knowledge or continuous education for health care staff. So, caring for neonates in NICUs poses a significant challenge for the entire health care givers to ensure optimal conditions of developmental care. As maintaining adequate temperature, lighting, and quite environment. However, achieving this task is extremely difficult, especially in NICU room, filled with the necessary equipment and medical apparatus, to perfectly replicate or even resemble the environment known to newborns from fetal life and enable staff and parents to control sound levels to the sick infants.

Concerning nurses' knowledge about sound-absorbing materials and equipment should be installed where appropriate in NICU, it increased from 1.50 pre intervention to 1.90 post intervention and post one month with high statistical significance difference (p= 0.005). These results were supported by **National Institute for Occupational Safety and Health (NIOS) (2024).** They mentioned that noise controls involve modifying equipment or making physical changes to the surrounding environment that reduce the noise level at the worker's ear. Also, **Sibrecht, Wróblewska-Seniuk and Bruschettini (2024)** found that that lowering the sound levels in NICU through treating the infant in a section of a NICU, in a 'private' room, or in incubators in which the sound levels are controlled; or by reducing sound levels at the individual level using earmuffs or earplugs. By lowering sound levels, the resulting stress can be diminished, thereby promoting growth and reducing adverse neonatal outcomes. From researcher's point of view medical staff training and the use of noise absorbing material are necessary ways to reduce excessive noise in NICU.

The total mean knowledge increased from 30.9 pre noise control nursing guidelines intervention to 42.6 post intervention then 42.6 post one month. There was a significant difference between total mean knowledge of nurses studied pre and post intervention (p= 0. 000). The results agree with **Fortes (2021)** who found that in review of pre and post test scores, all nurses demonstrated an improvement about noise reduction strategies. The mean score for pre-test percentage of correct responses was 55%. The mean score for post-test percentage of correct responses was 84.375%. This represents a 29.375% increase post educational intervention.

These results in agreement with **Hendy et al. (2023)** who found that, there was a high significant detected with p value. (000) regarding a linear regression model for nurses' knowledge. This model also explained that education level, practice score training had high frequency positive effect on knowledge score. These results supported with the study by **Jalali et al. (2022)** who showed that training courses had positive effect on nurses' knowledge.

Similar study in the US by **Hull and Wright (2023).** noise levels were measured before and after the implementation of a noise reduction programmed, and the measures applied had the intended effect of reducing sound intensity as a result for training and raising awareness of the nursing staff.

Regarding mean score of practice about using low-noise equipment and muffling devices where appropriate increased from 0.40 pre intervention to 0.95 post intervention then to 0.93 post one month with high statistical significance difference (p= 0.000). Also practice regarding minimizing noise levels while

performing nursing procedures in the NICU increased from 1.28 pre intervention to 1.60 post then to 1.55 post one month with statistical significance difference (p= 0.040). These results are supported by Patil, **Mhashal and Harkut (2023)** they revealed that NICU personnel should device simple strategies to reduce noise (no tapping or writing on the tops of incubators and hoods, careful closing of incubator doors, soft shoes). If these basic strategies fail to reduce monitored noise levels, more technical strategies need to be considered (incubator covers, using equipment that is less noisy). Also, **Maturana (2025)** mentioned that careful consideration to noise is important in NICU by selecting devices, everything from monitors to incubators to phototherapy equipment, featured with elements that push sound away from the infant compartment. Utilize sound absorbing material on walls and ceilings.

Concerning reduce unit's phone volume and moving it away from incubators, it increased from 0.35 pre intervention to 1.23 post intervention then to 1.25 post one month with high statistical significance difference (p= 0.000). keeping the alarms volume as low as possible and turn on the alert lights increased from 1.05 pre intervention to 1.50 post intervention then to 1.53 post one month with statistical significance difference (p= 0.003). The results in the same line with **Witek et al. (2025)** they found that after implementation a bundle of interventions the noise levels reduced in intensive care units which involved; Adapting work processes, e.g., restructuring ward rounds; reacting promptly to alarms, avoiding false alarms; introducing rest periods; quieter setting of the ward telephone; conducting telephone calls and conversations outside patients' rooms whenever possible or quiet conversations in the rooms; reducing the volume of monitors; and avoiding additional noise sources (e.g., radio). In addition, **Arslan and Akkoyun (2025)** added that health care professionals in NICUs play a vital role in supporting and ensuring the protection of infants' sleep through keeping monitor alarms at a certain level, putting covers on top of the incubators, immediately attending to crying infants, having personnel speak softly, and using a decibel meter.

regarding nurses practice of not making noise while using or cleaning the equipment increased from 0.83 pre intervention to 1.30 post intervention and post one month with high statistical significance difference (p= 0.001). While regarding putting objects on top of the incubator in the unit reduced from 1.18 pre intervention to 0.78 post intervention then to 0.80 post one month with high statistical significance difference (p= 0.003). The results were concurrent with Martins et al. (2022) they found improvement in practice after implementing a noise care bundle through precaution includes not hitting or writing on the top of incubators, responding to the alarms as quickly as possible, handling medical equipment carefully, minimizing opening and closing of incubators. In the same context the result of **Patil**, **Mhashal and Harkut (2023)** they found that simple strategy to reduce noise in nursery-soft shoes, no tapping or writing on the top of incubators, careful closing of incubator doors and earmuffs.

Concerning monitoring and recording noise level on a regular basis nurses knowledge increased from 0.70 pre intervention to 1.13 post intervention then to 1.10 post one month with high statistical significance difference (p= 0.016). As regards adhering to pictures and poster about sound control and decrease noise in the NICU increased from 0.83 pre intervention to 1.43 post intervention then to 1.38 post one month with high statistical significance difference (p= 0.001). The findings are in agreement with **Martins et al. (2022); McCallig, Pakrashi and Durkin (2024)** they found that protective interventions aimed at reducing noises can be implemented, such as measuring noise frequently, installing automatic doors, electronic panels indicating decibels in the environments, noise flags, not wearing high heels, avoiding the use of mobile phones, reducing telephone bell volumes, performing handoffs in a separate room from the hospitalization rooms, placing anti-impact stickers on the trash cans, doors, drawers and cabinets, signaling the unit with posters stimulating silence, and maintaining periodic educational programs on noise for the health team.

The total percentage of nurses' knowledge increased post noise control nursing guideline from 2.5% high knowledge pre intervention to 77.5% post intervention then to 75% post one month of intervention. There was a significant difference between level of knowledge of nurses studied pre and post intervention (X2=60.7, P=0.000). This result goes in line with **Hendy et al. (2024)** they found that prior to intervention most of the nurses (62.4%) demonstrated poor knowledge. However, after the intervention, a significant improvement was observed, with 60.0% of the nurses demonstrating good knowledge.

The total percentage of nurses practice increased post noise control nursing guideline from 29.18 pre intervention to 36.73 post intervention then 36.98 post one month. There was a significant difference between total mean practice of nurses studied pre and post intervention (p= 0. 000). This result agrees with **Elarousy, W., Abd El Aziz R.A.E., and Youssef (2020)** they concluded that majority of nurses had "unsatisfactory" scores in their practices before the training program, but this difference was statistically significant compared to immediately after the training program and one month later. The researcher's point of view that enhancing knowledge among nurse through noise control nursing guideline had positive effect on changing their practices in the NICU

There was a significant decrease in noise level post noise control nursing guideline intervention at all places of neonatal intensive care unit (NICU), intermediate, and neonatal jaundice (P=0.000). The finding was concurrent with **Gennattasio et al**. (**2024**) they found that education efforts and technical improvements successfully reduced median noise levels within the step-down unit (P < .001).

Highest mean noise level was at nursing station in the NICU, it was 71.12 pre intervention while decreased post intervention to 62.40 then 63.00 post one month. Lowest mean noise level was at nursing station in the neonatal jaundice, it was 64.13 pre intervention while decreased post intervention to 54.62 then 50.33 post one month. The result agrees with **Martins et al. (2022)** found that the mean noise level in the first measurement always was 58.5dB by area (Area A), 61.5dB (Area B), and 61.9dB (Area C). After intervention, the means noise level decreased to 56.1dB (Area A), 57.4dB (Area B), and 57.3dB (Area C). Noise levels after the intervention were lower, although still above recommended levels. In Pearson's correlation, two times presented p-value=0.001.

In the same line **Hull and Wright (2023)** found that at the end of the project for noise reduction in NICU, noise levels decreased from 62.6 dBA to 54 dBA, a 13.7% reduction. While the results disagree with **Souza et al. (2022)** they found that there is no statistically significant differences were detected in general noise levels between the periods before and after the implementation of the best practices (P=0.853). Researcher's point view lowest mean noise level was at nursing station in the neonatal jaundice unit could be related to the neonate cases in the neonatal jaundice more stable not need advanced nursing care, nurse patient ratio at neonatal jaundice less than NICU, and it contains limited number of devices and equipment that cause increase noise level.

Concerning the mean noise level at central location in the NICU decreased from 66.80 pre intervention to 60.52 post intervention then 62.02 post one month, while in the intermediate the mean noise level decreased from 67.00 pre intervention to 60.05 post intervention then 59.05 post one month. In the neonatal jaundice the mean noise level decreased from 67.30 pre intervention to 56.83 post intervention then 51.20 post one month. The results agree with **Witek et al. (2025)** they concluded that a bundle of interventions can reduce noise levels in intensive care units. After the intervention phase, they observed a significant overall reduction in the sound level of 0.77 decibels (A-weighted) (dB (A)), 95%-CI [0.06, 1.49], p = 0.034 with post-intervention measurements of LAeq1h 56.43 dB (A) compared to pre-intervention measurements of 57.21 dB (A). The difference was particularly large (2.21 dB (A) (p < 0.0001) in one of the three intensive care units.

The mean noise level at the infant bedside incubator in the NICU decreased from 67.47 pre intervention to 63.45 post intervention then 58.88 post one month, while in the intermediate

the noise level decreased from 65.13 pre intervention to 58.85 post intervention then 56.43 post one month. In the neonatal jaundice the mean noise level decreased from 65.08 pre intervention to 54.25 post intervention then 52.10 post one month. This finding agrees with **Patil, Mhashal, & Harkut (2023); Rossi et al. (2025)** they revealed that mean dB of environmental noise recorded in the different NICU rooms at various times of day, both at the patient's bedside and inside the incubators. The recorded environmental noise was always greater than 45 dB. Moreover, research conducted by **Andy, Fan, Valerie and Jing (2025)**, their study identified 1651 studies, screened 871, reviewed 112 and included 47. All reported NICU average equivalent sound levels were consistently louder than recommended guidelines (45 dB).

Researcher's point of view noise levels that although noise level post intervention was decreased but still more than American Academy Recommendations may be related to many aspects: infant bed side always hot area for nursing and medical intervention; health team round and conversation always near the patients; critically ill neonate were attached with advanced medical devices such as mechanical ventilators, monitors that produce more noise allover the time; infrastructure of equipments not promote noise absorption. Also, it could be related to not using visual measuring devices adhering to international sound level meter (SLM) standards that lead staff always careful regarding measure and control noise in the NICU.

There was a significant positive direct correlation between knowledge and practice of studied nurses (r=0.47, p=0.00) while there was a significant negative inverse correlation between noise level and both knowledge and practice of studied nurses (r=.-0.97, p=0.001; r=.-0.96, p=0.002) the results is in agreement with **Hendy**, **Alsharkawy, and El-Nagger (2023).** They revealed that there was high positive correlation between nurses' knowledge and their practice scores at r. 981 and p value .000. High lighting the importance of knowledge enhancement in improving nursing practice. Also, the results agree with **Sugiura et al. (2025).** They concluded that there is significant correlations exist between nurses' subjective noise perceptions and objective noise measures (**Leq**, L5, L50, and Lmin). Researcher's point of view that control noise nursing guideline had apositive effect on nurses' knowledge about importance of controlling noise which reflected in their practices to control noise.

There was no correlation between nurses' age, education, experience with noise level, knowledge, and practice. While there was a significant positive direct correlation between training program about neonatal care and knowledge (r=0.23, p=0.00) while there was a negative inverse correlation between training program about neonatal care and noise level (r=-0.22, p=0.00). The results in agreement with **Hendy**, **Alsharkawy and El-Nagger, (2023**) they found that educational level had positive effect but without any significant at p value >0.05. Also, in that knowledge score and training courses had high frequency positive effect on practice score at p value <0.01. The results contradict with **Hendy, Alsharkawy and El-Nagger, (2023)** they concluded that nurses age and their years of experience had high frequency negative effect on practice score at p value 0.05. In addition, the results disagree with **Rozensztrauch et al. (2024)** they stated that nurses belonging to the oldest age group with the longest work experience demonstrated a significantly higher level of knowledge in this regard compared to younger individuals.

Conclusion

Based on the current study's findings:

There is an improvement in the total mean score of nurses' knowledge and practices increased immediately post and post one month from noise control nursing guideline with a statistically significant difference. There was a significant decrease in noise level post noise control nursing guideline at all places (neonatal intensive care unit (NICU), intermediate, and neonatal jaundice) but remained above the recommended level. There was a significant positive direct correlation between knowledge and practice of nurses studied, while there was a significant negative inverse correlation between noise level and both knowledge and practice of nurses.

Recommendation

The results of the current study suggest that:

- Integration of Noise Control Guidelines should be embedded into the orientation and onboarding processes for all healthcare professionals working in neonatal care settings—including physicians, nurses, occupational therapists, physical therapists, dietitians, and social workers
- Implementation of Visual Reminders in Clinical Areas placement of visual cues such as posters, dashboard alerts, and designated "quiet time" signage within NICUs can reinforce awareness and adherence to noise control practices among staff, visitors, and families.
- Regular Monitoring and Documentation of Noise Levels in NICU using calibrated devices that comply with international Sound Level Meter (SLM) standards. Data should be systematically recorded to facilitate ongoing evaluation and targeted interventions.
- Healthcare institutions should mandate periodic assessments and in-service training sessions focused on environmental safety standards, with specific emphasis on noise control strategies tailored to neonatal intensive care environments.
- Future studies should incorporate larger sample sizes and extended follow-up periods to better understand the long-term impact of environmental noise on neonatal outcomes and staff performance.
- Further investigation is warranted to quantify the noise output of individual medical devices within NICUs and to evaluate the efficacy of muffling technologies in reducing their acoustic footprint.
- Sustainable implementation of noise control nursing guidelines across neonatal units is essential to enhance staff competency and achieve meaningful reductions in environmental noise levels.

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