

# Effectiveness of Noise Reduction Strategies on Adherence to Noise Control and its Awareness among Health Care Professionals in the Intensive Care Unit

<sup>1.</sup> Malsawmkimi  
Student

MSc Nurse Practitioner in Critical Care  
St John's College of Nursing  
Bengaluru, Karnataka, India

<sup>2.</sup> Sugandhi D'Souza

Assistant Professor & Nursing Superintendent  
Department of Medical Surgical Nursing  
St John's College of Nursing  
Bengaluru, Karnataka, India

<sup>3.</sup> Dr. Moses Charles D'Souza  
Professor & HOD

Surgical Intensive Care Unit  
Department of Anesthesiology and Critical Care  
St John's Medical College Hospital  
Bengaluru, Karnataka, India

**Abstract:-** Noise is an unintentional sound wave that has no rhythm or harmony and can impede with hearing. Noise could be an unnoticed additional factor that adds to employee fatigue and mental stress. Due to the health effects, the World Health Organization (WHO) recommends that average hospital sound levels should not exceed 35 dB, with a maximum of 40 dB at night. Most of the research shows that noise levels in ICUs, EDs, and other hospital wards are usually higher than recommended. An experimental research design was used. 36 HCP were chosen using complete enumeration. Observational checklists, structured questionnaires and noise meter mobile apps were used. According to the study's findings, 83.33% of them were female. 50% of the HCPs had experience in the ICU for less than a year, and 39% of the HCPs had experience of 1 to 3 years. 100% of people had never heard of noise reduction in ICU. Maximum and minimum sound levels before and after intervention differ significantly in all shifts at the level of  $p < 0.001$ . There is a difference in adherence to noise reduction strategies between pre and post intervention at the level of  $p=0.002$ . In comparison of awareness to the pretest score of 8.58, the mean post test score is 12.22 higher. The results of the current study indicate that the teaching session and poster display on noise reduction measures encouraged the HCP to maintain a reduced noise level in the ICU.

**Keywords:-** Adherence, Awareness, Health Care Professional, Effect.

## I. INTRODUCTION

Noise is an accidental sound wave that lacks harmony or rhythm and can affect perception. The amount of annoying environmental commotion is known as noise pollution. Hearing issues result from noise levels above 85 dB. Lower levels of noise may not cause severe hearing issues, but they

can still have a number of detrimental effects, including poor physical consequences, a lack of speaking awareness and recognition and a restriction on personal privacy. Increased anxiety is a result of loud noise, which also masks important alarms and hinders verbal contact. It could be an additional, hidden source of staff emotional stress and early fatigue.

The World Health Organization (WHO) recommends that average hospital sound levels not exceed 35 dB, with a maximum of 40 dB at night due to the health effects that can be caused by sleep disturbances, and as low as feasible in treatment rooms due to interference with rest and recovery. Sound pressure levels in intensive care units and operating rooms should be monitored closely.

Many studies have been conducted to assess the effect of noise pollution on patients and carers in intensive care units (ICUs), neonatal intensive care units (NICUs), and other critical care units. Noise pollution, in general, raises the likelihood of errors in intensive care units and emergency departments (EDs). Consequently, it may lead to occupational burnout and negative patient outcomes. Most studies indicate that noise levels in ICUs, EDs, and other hospital wards are typically higher than recommended levels.

### ➤ *Statement of the Problem:*

A study to assess the effectiveness of noise reduction strategies on adherence to noise control and its awareness among health care professionals in the Intensive Care Unit of a selected tertiary hospital, Bangalore.

### ➤ *Objectives:*

- To compare the adherence to noise control strategies before and after intervention.
- To compare the awareness of health care personnel regarding noise control strategies before and after the intervention

## II. METHODOLOGY

### ➤ Study Design and Setting:

Data was gathered using a quantitative research approach. One group pre-test post-test research design was adopted among healthcare professionals working in the ICU of selected Tertiary Hospital in Bangalore. The study was conducted in Intensive Care Unit of St. John’s Medical College Hospital, which is a tertiary hospital with 1350 beds and have 59 beds in Intensive Care Unit with 80-85% bed occupancy on an average 10 to 15 patients are on ventilator per day in the ICU.

### ➤ Participants, Sample Size and Sampling Technique:

Participants comprises of all the health care professionals working in Intensive Care Unit of St. John’s Medical College Hospital who fulfil the inclusion and exclusion criteria. The sample size required to observe the average noise level before and after as 57 and 55.3 respectively and standard deviation of 2 and 3 before and after respectively with 90% power and 1% level of significance, the sample size is 36. Complete enumeration was carried out in the study.

### ➤ Data Collection Procedure:

Formal permission was obtained from concern authority and internal ethical committee clearance was obtained following this, 36 healthcare professionals were recruited using complete enumeration excluding staff on extended leave, physiotherapists, and occupational therapists. The tool comprises of structured knowledge questionnaire, observational checklist and noise meter mobile application were used. Informed consent was taken from subjects and subject information sheet was provided before recruitment. The level of noise was measured using noise meter apps for 24 hrs for 7 days to elicit the baseline noise level. Adherence to noise level was observed using observational checklist. Awareness of noise control was elicited using knowledge questionnaire after 7 days of measuring the level of noise and observation of the adherence to noise control. Awareness session was conducted and poster for noise reduction was displayed after conducting pre-test. After 7 days of awareness session, noise level was measured using noise meter apps for 24 hours for 7 days. Awareness of noise control was elicited using knowledge questionnaire. Adherence of the noise control was scrutinized using observational checklist.

### ➤ Statistical Analysis and Data Management:

The obtained data was analyzed in terms of objectives of the study by using descriptive statistics and inferential statistics. A master sheet was prepared with the data obtained from the subjects. The data was organized in excel worksheet for tabulation and statistical analysis. The frequency and percentage distribution of subjects according to the baseline variables were calculated. Paired t test was used to compare awareness of the health care professional on noise reduction in ICU before and after educational session. Wilcoxon Signed Rank Test was used to compare adherence of noise reduction strategies before and after intervention.

## III. RESULTS

The present study showed that the age ranges from 21-48 years. 83.33% of the subjects were female and 16.67% were males. Out of 36 subjects, 72% were staff nurses, 11 % were Junior Resident and Nursing Aid and 6% were Senior Resident. 39% of them are having 1-3 years of experience in medical field with 50% having less than 1 year of experience in ICU. None of the subjects have previous exposure to awareness regarding noise reduction in ICU. Adherence to noise reduction strategies was evaluated using observational checklist and noise meter mobile apps. Using Wilcoxon test, there was a significant difference between pre and post intervention at the level of  $p=0.002$ . The sound measurement was divided into four shift – Morning: 8am – 1:00 PM, Afternoon: 2:00 PM – 7:00 PM, Evening: 8:00 PM – 1:00 AM and Night: 2:00 AM – 7:00 AM. The current study shows that there is significant difference in the average sound level before and after intervention at  $p=0.000$ ,  $p=0.001$ ,  $p=0.000$  and  $p=0.000$  respectively. The pre and post average sound level of ICU in the morning was 64.0 and 60.8 respectively and considered as the peak time of noise producing time due to certain factors – doctors round from primary treating team and ICU team, taking over of the nurses and cleaning the units. Awareness regarding noise reduction strategies was done using a knowledge questionnaire with a maximum score of 15. The mean post test score is 12.22 higher than that of the pretest score 8.58. The statistically significant difference is tested with paired t test and the value is -18.375 which is significant at  $p$  value  $<0.001$  level. Thus, this study shows that the noise reduction strategies was effective in improving the awareness.

Table1: Median, Interquartile range, Wilcoxon statistic value and standard deviation of adherence to noise reduction strategies  
n=36

Parameter	Pre-test Median (IQR)		Post Test Median (IQR)		Test Statistic Value	p Value
Adherence	50.74	(17.00, 60.00)	88.89	(70.00, 97.32)	-3.061	0.002*

Table 2: Mean, standard deviation, test statistic value and p-value of noise level in different shifts before and after intervention. n=4

Shift	Pre-Intervention		Post-Intervention		Test Statistic Value	P value
	Mean	SD	Mean	SD		
Morning	64	0.72	60.8	0.43	19.397	<0.001*
Afternoon	63.3	0.69	60.9	0.60	7.689	
Evening	62.9	1.36	59.9	0.90	11.748	
Night	60.9	0.69	58.4	0.65	13.447	

\* Significant

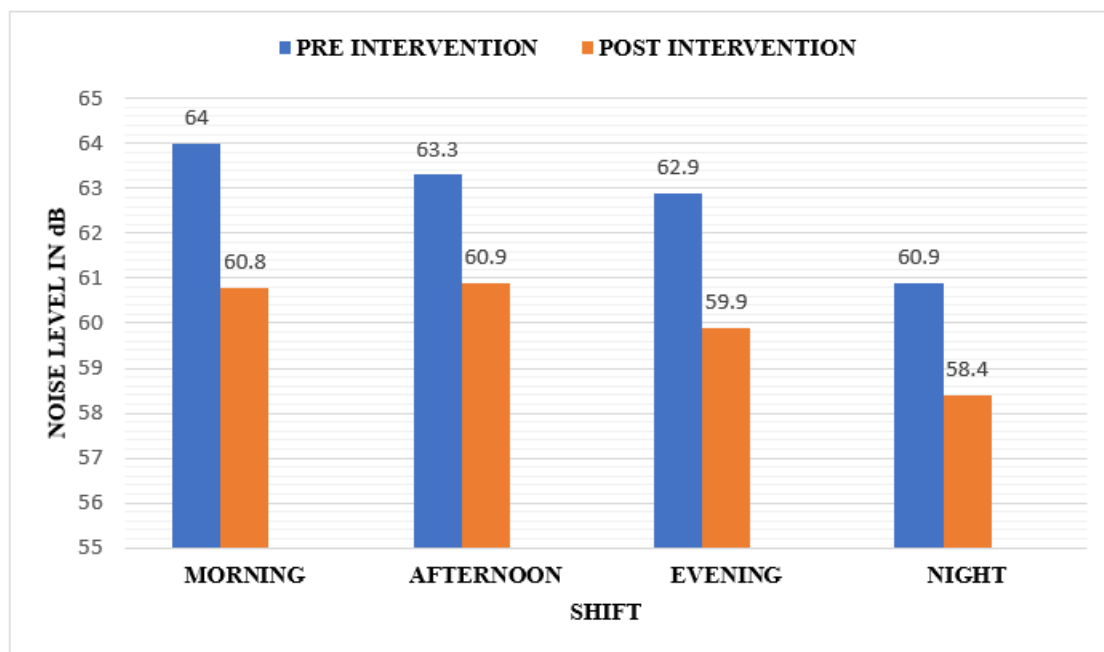


Fig 1: Comparison of sound level in dB before and after intervention in different shifts

Table 3: Maximum score, mean, standard deviation, paired t test value and p value of awareness regarding noise reduction among health care professionals. n=36

Variables	Maximum Score	Pre-Test Mean (SD)	Post Test Mean (SD)	Test of Significance	p-value
Knowledge	15	8.58	12.22	-18.375	<0.001*

\*Significant

#### IV. DISCUSSION

The study subjects in the present study consisted of 36 subjects out of which 88.33% were females and 16.67% were males. Majority of the subjects were staff nurses (72.22%), nursing aide and Junior resident (11.11%) and senior resident (5.56%). In the present study, 38.9% have 1-3years of experiences in health field out of which 50% of the subjects are having < 1 year of experience in ICU with a mean age of 25.33 years. A similar study was done in Bagcilar Turkey where study findings shows that 80.8% were female and 69% person where nurses among the healthcare professional A similar study was done in Spain in 2018 shows 50% were nurses, 26% were physician and 24% were pharmacists, nursing assistants and unit secretaries. 57% had worked in ICU for more than 3 years.

The present study revealed the pre observation median percentage of adherence to noise reduction strategies was 50.74 and increased in post observation median percentage to 88.89. Thus, the result shows that there is a statistically significant before and after intervention in adherence to noise control of the health care professional at the level of p=0.002. A study was done in 2013 in Turkey shows that observation of health personnel behavior in reducing the noise was statistically significant at p<0.005 after the education programmed.

The sound level in ICU revealed that the mean average sound level in ICU before intervention was 62.78 with standard deviation of. The comparison of pre and post sound level shows that the mean average sound level reduced from 62.78 to 59.97. It shows that there is a significant reduction in overall sound level in ICU after intervention. A similar

study done in Busch-Vishniac et al in 2005 discovered that the mean noise level in hospitals ranged from 57 dB-A to 75 dB-a during day to 42 dB-A to 60 dB at night, with ICUs reaching 90 dB.

The sound measurement was divided into four shift – Morning: 8am – 1:00 PM, Afternoon: 2:00 PM – 7:00 PM, Evening: 8:00 PM – 1:00 AM and Night: 2:00 AM – 7:00 AM. The current study shows that there is significant difference in the average sound level before and after intervention at  $p=0.000$ ,  $p=0.001$ ,  $p=0.000$  and  $p=0.000$  respectively. The pre and post average sound level of ICU in the morning was 64.0 and 60.8 respectively and considered as the peak time of noise producing time due to certain factors – doctors round from primary treating team and ICU team, taking over of the nurses and cleaning the units. A study done in the year 2018 in Spain shows that the average sound level was 54.09 dB with max 104.2 dB and a minimum value 45.9 dB. Afternoon work shift were significantly louder than the morning and night shifts ( $p<0.001$ )

The awareness evaluation revealed that the mean pretest score was 8.58 with maximum score of 15. The comparison of pre and post awareness score shows that the mean score increases from 8.58 to 13.22. There is a statistically significant difference in the average awareness before and after intervention at  $p=0.000$  level of significance. Thus, this study shows that noise reduction strategies was effective in improving the awareness. A similar study was done in 2020 among 203 ICU nurses in Jordan shows that the mean knowledge score is 10.08 out of 21. 54.1% showed low scores of knowledges (<59%) and 1.6% nurses showed high score of knowledge (80-100%)

## V. CONCLUSION

We found in our study that there was a statistically significant difference in adherence to noise reduction as well as in awareness of health care personnel regarding noise control before and after the intervention. We also found a statistically significant difference between maximum and minimum sound level before and after intervention in all the shift. Hence, our current study indicates that the teaching session and poster display on noise reduction measures encouraged the HCP to maintain a reduced noise level in the ICU.

## FUTURE SCOPE

Our study will enable the nurses to understand the need for maintaining the standard of noise level in ICU and also will motivate the nurses to update the knowledge regarding noise in ICU. Further studies can be done in a larger population. The result of this study can be utilized in nursing administration to provide data base for developing nursing standards, protocols and manual to capture noise control as a quality indicator of ICU as well as, it will encourage the ward in-charge to conduct periodical ward meetings to evaluate and reinforce the staff. It will also help in nursing research by providing evidence for clinical research. In nursing education, it can be used to give orientation to novice nurse

and nursing students to maintain noise level in ICU and to teach the impact of noise pollution to patients and staffs in ICU. It can be replicated in other ICUs and OTs with larger group of health care professional to generalize and validate the findings and can be conducted to determine the effect of noise on physiological changes in patients and staffs.

## LIMITATION OF THE STUDY

The study is limited to an Indian setting and further studies can be done in a larger population in an Indian ICU set up.

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