Impact of Noise on Nurses in Pediatric Intensive Care Units

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Background Excessive exposure to noise places nurses at risk for safety events, near-misses, decreased job performance, and fatigue. Noise is particularly a concern in pediatric intensive care units, where highly skilled providers and vulnerable patients require a quiet environment to promote healing.

Objective To measure noise levels and noise duration on specialty pediatric intensive care units to explore sources of noise and its effects on the health of registered nurses.

Methods In a cross-sectional pilot study, levels and sources of noise in 3 different specialty pediatric intensive care units were assessed. Fifteen nurses were observed for 4-hour sessions during a 24-hour period. Sound pressure levels (noise) and heart rate were measured continuously, and stress ratings were recorded. Descriptive statistics were calculated for noise (level, source, location, and activity), heart rate, and stress. The Pearson correlation coefficient was calculated to analyze the relationship between heart rate and noise.

Results Mean noise level was 71.9 (SD, 9.2) dBA. Mean heart rate was 85.2/min (SD, 15.8/min) and was significantly associated with noise, unit, within-unit location, nurse sources, and noise activities. The most frequent sources of noise were patients' rooms, care activities, and staff communications.

Conclusions Noise levels in pediatric intensive care units exceed recommended thresholds and require immediate attention through effective interventions. Although noise was not associated with stress, a significant correlation with increased heart rate indicates that noise may be associated with adverse health outcomes. (*American Journal of Critical Care.* 2015;24:377-384)

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Persistent noise disturbs a hospital's healing environment. Noise is particularly evident in intensive care units (ICUs), environments with high-acuity patients and activity and persistent sounds from monitor alarms, mechanical ventilators, and medical staff. Previous research on noise was largely focused on patients' experiences and outcomes in neonatal ICUs (NICUs).[1-5] Minimal research has been done on the impact of noise on health care providers.[6]

In 1974, the Office on Noise Abatement and Control within the US Environmental Protection Agency stated that noise could produce serious physical and psychological stress.[7] In order to protect patients and health care professionals, the agency recommended that sound pressure levels (SPLs) in hospitals should not exceed 45 dBA during the day and 35 dBA during the night. SPLs are measured in decibels, a logarithmic scale such that a 10-dB increase in sound level correlates with a doubling in perceived loudness. The decibel A scale is a frequency-weighted adjustment such that higher frequencies, which cause more hearing damage in humans, are weighted more heavily. The 45-dBA limit was identified to prevent workers from becoming annoyed or unable to carry out normal work duties. A limit of 70 dBA during a 24-hour period would prevent measurable noise-induced hearing loss.[8] The World Health Organization[9] stated that mean values for an 8-hour time-weighted average should not exceed 30 dBA, with peaks no greater than 40 dBA. In studies[1-6] on noise in ICUs, SPLs ranged from 35 dBA to more than 120 dBA, clearly exceeding recommendations.

Hospital sound pressure levels should not exceed 45 dBA during the day, 35 dBA at night.

Elevated SPLs can be attributed to many sources, including monitor alarms, medical equipment, care activities, and staff conversations.[1-3,5,10] In a survey[11] of 100 critical care nurses, the nurses reported that continual beeping alarms were the source of the most noise disturbances. Carvalho et al[2] discovered that the most elevated SPLs were due to conversations among pediatric ICU (PICU) staff members; SPLs were 60 to 70 dBA at baseline and reached a maximum of 120 dBA. The study by Carvalho et al was the first investigation to show that staff behavior and conversations were associated with noise levels. Results of other studies[12,13] have linked the number of staff on a unit, patient behaviors, the number of visitors, and patient acuity to elevated noise levels.

The need for close contact with patients during care places nurses at increased risk for exposure to noise. With nurses typically working shifts of 8 to 12 hours and continually exposed to excessive noise during that time, the duration of exposure could be sufficient to be a health risk. Moreover, a noise greater than 85 dBA for 8 hours can lead to hearing loss.[7,14] Research[8,15,16] on the effects of workplace noise has indicated that noise is a distraction and an interruption to care activities and mental tasks that could lead to medical errors, task inaccuracy (mistakes that do not lead to an actual error), and miscommunication.

A few investigators[6,17,18] have examined the health impact of noise; the effects included increased heart rate, increased perceived stress, annoyance, burnout, and job dissatisfaction. The physiological and psychological health effects of noise on ICU nurses were examined in 2 studies. Ryherd et al[18] investigated how noise contributed to a negative NICU work environment with SPLs exceeding 50 dBA for 90% of the observation time. Among the nurses, 91% thought that noise could adversely affect their work environment, 66% felt irritated and fatigued, 43% admitted concentration problems, and 40% experienced tension headaches.

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Table 1
Categories of noise source, location, and activity documented in the observer log

Source	Location	Activity
Staff communication: staff conversations	Auxiliary rooms: utility, equipment, kitchen/nutrition, medication, automated medication dispensing system	Patient interaction: assessments/interview, rounds, patient and parent education
Communication devices: pager/cell phone, overhead pager	Gathering rooms: break, conference	Employee interactions: employee discussion, shift changes
Door: door open/closed	Outside patient room: work station, front desk, hallway, office	Support: procedures, stocking supplies, medicine administration
In-room equipment: intravenous pumps, monitors, vacuum tube system, television	Patient's room: patient 1, patient 2, patient's room, other, pod	Other: other
Patient/family communication: patient crying or yelling, family conversations		
Other: other, environmental services		

In a study of 11 PICU nurses, Morrison et al[6] found that higher SPLs were related to higher heart rates. Wide variations in the concentration of salivary amylase also occurred with higher SPLs, but the variability was not significant. Other predictors of higher heart rates were higher caffeine intake, less nursing experience, and working a daytime shift.[6]

Although research on noise in the ICU has established that SPLs regularly exceed the recommendations of the US Environmental Protection Agency and the World Health Organization, the literature remains unclear on the sources of noise that contribute to adverse health outcomes among nurses. The purpose of our study was to determine these sources.

Methods

A cross-sectional observational pilot study was used to assess noise, sources of noise, and associations between noise and heart rate and between noise and stress on 3 different specialty pediatric ICUs: NICU, PICU, and cardiac intensive care unit (CICU). Noise and heart rate were measured continuously, and stress, sources, location, and nurse activities were documented.

Participants and Setting

A total of 15 nurses were observed in ICUs at Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio. The NICU was a 4-pod space with up to 7 infants and approximately 24 to 25 nurses. The CICU was a 22-bed unit with 13 to 16 nurses, and the PICU was a 35-bed unit with 23 to 24 nurses. Only nurses who were not scheduled for patient care during the study observation period were excluded. Approval for the study was obtained from the appropriate institutional review board before the start of any research activities.

Measures

Objective measures were used to collect 3 categories of data: noise; noise sources, location, and activities; and heart rate. A noise dosimeter (QuestTechnologies) was used to measure SPLs in decibels, A-weighted, at 1-minute intervals. A noise dosimeter with a microphone was attached to each participant's lapel for 4 hours. Each unit had 6 observation periods of 4 hours each during a 24-hour period.

During each observation period, specific noise sources were tracked by using an electronic log embedded in a personal digital assistant. The investigator-developed log included categories of noise sources, the location of the nurse, and the activity the nurse was engaged in at the time of recording (Table 1). Nurses from each unit assisted in the development of the categories to create a standard log relevant to all 3 ICUs. Heart rates were measured at 15-second intervals by using a heart rate monitor (Actiheart) positioned across the chest of the nurse. Previous activities (eg, challenging patient, patient code) may have affected these baseline measures because not all staff members were observed at the beginning of their shifts.

A noise dosimeter was used to measure noise at 1-minute intervals.

The Specific Rating of Events Scale,[19] a reliable and validated scale designed for the US Army Research Laboratory stress program, was used to measure stress. Participants rated their stress on a scale of 0 (not at all stressful) to 100 (most stress possible) at the beginning of, during (2 hours into) the study, and after observation.

Procedures

Nurses were recruited by e-mail and in person during staff and shared governance council meetings. Verbal agreement to participate indicated consent. Nurses who had provided consent were randomly selected and scheduled at least 3 days before the observation. Nurses were removed from the selection pool after their observation unless all other scheduled staff declined to participate or had previously participated. The 6 observations of 4 hours

Table 2
Observed sound pressure level, noise source, noise location, and noise activity in intensive care units

Characteristic	Sound pressure level, dBA		
	Mean (SD)	Range	% Time > 75 dBA
Overall	71.9 (9.2)	45-107	35.5
Intensive care unit			
Cardiac	73.8 (7.2)	51-107	39.5
Neonatal	72.8 (7.4)	53-102	33.1
Pediatric	69.1 (11.6)	45-104	32.2
Noise source			
In-room equipment	72.9 (8.6)		
Staff communication	72.8 (9.3)		
Communication devices	71.3 (7.6)		
Doors opening and closing	69.2 (9.7)		
Patient/family communication	68.0 (8.1)		
Other	72.3 (8.8)		
Noise location			
Gathering rooms	81.9 (5.9)		
Auxiliary rooms	72.3 (9.6)		
Patients' rooms	71.3 (8.9)		
Outside room	70.6 (8.8)		
Noise activity			
Employee interactions	73.4 (10.3)		
Support activities	72.0 (8.1)		
Patient interactions	69.6 (7.8)		
Other	69.1 (8.7)		

each were carried out during the day, evening, and night shifts, Monday through Friday. In order to include any variability, the shifts were distributed during an entire week so that measures were not obtained on a particularly noisy day or a quiet day.

Participating nurses were asked for their birth date, height, weight, years of experience, and current stress level. Each participant was then fitted with a cleaned and calibrated noise dosimeter and heart rate monitor. The microphone for the noise dosimeter was attached along the anterior part of nurse's shirt collar.

An observer followed each nurse for 4 hours, documenting noise sources, location, and nurse activity at 5-minute intervals on the noise log. Additionally, observers carried a noise meter to document noise sources when levels exceeded a 75-dBA threshold. The value of 75 dBA was used because the National Institute on Deafness and Other Communication Disorders reported that sounds less than 75 dBA are unlikely to cause physiological damage.[20] Interrater agreement was assessed before data collection. Participants received a $5 gift certificate at the end of observations.

Data Management and Analyses

Because data on noise source, location, and activity were obtained at 5-minute intervals, all other sampling was converted to this rate. Because noise was sampled every minute, a mean of every 5 data points was calculated to obtain a 5-minute sample rate. Heart rate data were collected at 15-second intervals, so the mean of every 20 data points was used as the 5-minute sample rate. Two nurses were observed twice because of the lack of available staff. Only a single randomly chosen observation for each of the 2 duplicates was included in the analyses.

Statistical Analysis

Descriptive statistics were calculated for noise and health outcomes. Because this investigation was a pilot study and the sample size was small, results may not be representative of a larger population. Thus, the choice was made to analyze the data by unit to identify any statistically significant associations or larger effect sizes that would indicate the need for a larger study. The Pearson correlation coefficient was calculated to study the relationship between heart rate and SPLs, and analysis of variance was used to examine differences in noise level and heart rate between the 3 units. Repeated-measure analysis of covariance was used to compare the stress levels between the 3 time points (before, during, and after) and units by using the baseline stress level as a covariate. Tukey-Kramer pairwise comparison adjustment was applied for significant factors. The effect size (Cohen *d*) was computed to estimate the magnitude of the difference. SAS, version 9.3, software (SAS Institute, Inc) and a 2-sided significance level of .05 were used for analysis.

Results

The sample population consisted of 1 man and 14 women. The mean age was 32.6 years (range, 27-43 years). More than 3000 total noise observations were collected on all 3 ICUs. Distributions of age and sex were similar to those of the medical center's inpatient nurse population, which were 11.2% male, 88.8% female, and mean age of 36.0 years. Thus, the sample was representative of all nurses (male to female ratio of 1 to 19).[21]

Sound Pressure Levels

The overall mean SPL was 71.9 (SD, 9.2) dBA; 35.5% of the SPLs were greater than 75 dBA (Table 2). The mean and percentage of time spent at noise levels greater than 75 dBA were slightly greater in the CICU than in the other 2 units. The SPLs in the CICU were significantly higher than those in the PICU (difference, 5.2 dBA; 95% CI, 4.3-6.1 dBA; $P < .001$). The SPLs in the NICU were significantly higher than those in the PICU (difference, 4.6 dBA; 95% CI, 4.3-6.1 dBA; $P < .001$).

Table 3
Noise frequency for various locations, activities, and sources

General			>75 dBA		
Category	Frequency	%[a]	Category	Frequency	%[a]
Noise source			Noise source		
Staff communication	324	57.5	Staff communication	125	62.8
In-room equipment	71	12.6	Doors opening and closing	38	19.1
Doors opening and closing	66	11.7	Communication devices	12	6.0
Patient/family communication	49	8.7	Patient/family communication	5	2.5
Communication devices	26	4.6	In-room equipment	4	2.0
Other[b]	27	4.8	Other[b]	15	7.5
Noise location			Noise location		
Patients' rooms	365	62.7	Gathering rooms	139	69.8
Outside rooms	157	27.0	Patient's room	36	18.1
Gathering rooms	39	6.7	Outside rooms	18	9.0
Auxiliary rooms	21	3.6	Auxiliary rooms	6	3.0
Noise activity			Noise activity		
Support activities	215	38.3	Employee interactions	151	75.9
Employee interactions	210	37.4	Support activities	18	9.0
Patient interactions	42	7.5	Patient interactions	0	0.0
Other[b]	95	16.9	Other[b]	30	15.1

[a] Because of rounding, not all percentages total 100.

[b] Other: General ambient noise when no other sound was present (eg, air conditioning, white noise), office equipment (eg, fax, copier, printer), keyboard strokes or clicking of the mouse, objects falling to the floor, running faucet or flushing toilet, sneezing, music, trash can (eg, throwing away items, kicking), chest tube drainage systems, chairs scooting across the floor.

Noise Source, Location, and Activity

The loudest noise sources (Table 2) were in-room equipment (mean, 72.9 dBA) and staff communications (mean, 72.8 dBA). The loudest location was gathering rooms (mean, 81.9 dBA) during employee interactions (mean, 73.4 dBA). The most frequent noise source (Table 3) was staff communication (57.5%) in patients' rooms (62.7%) during support activities (38.3%).

SPLs exceeding 75 dBA most often were due to staff communication (62.8%) in gathering rooms (69.8%) during employee interactions (75.9%).

Mean Heart Rate and Correlations with SPLs

Mean heart rate was significantly higher in the NICU than in the CICU and the PICU (Table 4). Overall, heart rate was positively correlated with SPL ($r = 0.19$; $P < .001$; Table 5). Noise and heart rate were significantly associated in the NICU and the PICU, by patient/family communication, staff communication, and in-room equipment; in patients' rooms; and for all measured nurse activities.

Mean Stress Levels for Nurses

Nurses' stress level did not differ significantly among the 3 units (Table 6). However, some effect sizes ranged from moderate to large, especially among the 3 time points ($d > 0.8$), indicating that the nonsignificant results might be due to the low statistical power and small sample size.

Table 4
Observed nurses' heart rate in the 3 intensive care units

	Nurses' heart rate, beats per minute		
Intensive care unit	Mean (SD)	Median (interquartile range)	Range
Neonatal	94.6 (16.7)	92 (83-104)	67-184
Cardiac	81.4 (12.3)	83 (72-91)	53-106
Pediatric	81.4 (15.3)	80 (71-91)	52-179
Overall	85.2 (15.8)	84 (75-94)	52-184

Discussion

The aim of this pilot study was to measure SPLs and noise sources in specialty pediatric ICUs. When noise sources and the potential impact of noise on nurses' health are known, targeted interventions and behavioral changes can be implemented to reduce high levels of noise.

Noise Levels

All 3 units had excessively high mean noise levels (>68 dBA), and more than a third of the time the mean levels were greater than 75 dBA. Keep in mind, the minimum level of 45 dBA is the threshold that protection agencies[9,22,23] recommend for mean sound levels. Other, more achievable standards, as suggested by White,[24] recommend that

Table 5
Correlation between general sound pressure level and nurses' heart rate by units and noise sources, locations, and activities

Characteristic	*r*	*P*
Overall	0.19	<.001
Intensive care unit		
Neonatal	0.26	<.001
Pediatric	0.12	<.001
Cardiac	-0.03	.71
Noise source		
Patient/family communication	0.45	<.001
Communication devices	0.39	.07
In-room equipment	0.24	.03
Staff communication	0.18	.001
Doors opening and closing	0.06	.58
Other	0.29	.14
Noise location		
Patients' rooms	0.32	<.001
Gathering rooms	0.26	.11
Outside rooms	0.15	.05
Auxiliary rooms	0.04	.87
Noise activity		
Patient interactions	0.46	<.001
Support activities	0.19	.004
Employee interactions	0.15	.03
Other	0.30	<.001

Table 6
Nurses' stress ratings before, during, and after study

Intensive care unit	No. of nurses	Before	During	After
		Stress level, mean (SD)		
Neonatal	5	28.0 (22.8)	31.0 (26.1)	16.0 (16.7)
Pediatric	5	14.0 (6.5)	23.0 (16.4)	15.0 (12.8)
Cardiac	5	34.0 (20.4)	33.0 (19.2)	26.0 (11.4)
Overall	15	25.3 (18.9)	29.0 (19.9)	19.0 (13.8)
		Effect size, *d*		
Before vs during			1.17	
Before vs after			1.39	
During vs after			2.02	
Cardiac vs neonatal		0.28	0.09	0.70
Cardiac vs pediatric		1.32	0.56	0.91
Neonatal vs pediatric		0.84	0.37	0.07

background noise levels not exceed 50 to 55 dBA and that intermittent noise levels not exceed 70 dBA. Despite recommendations, our current findings and other research[1,4] have shown that these levels are difficult to attain, much less maintain. Morrison et al[6] found that recommended levels have not been achieved since 1997. The results of Darbyshire and Young[4] were similar. In their study, mean SPLs always exceeded 45 dBA and were 52 to 59 dBA for 50% of the time in adult ICUs. Other investigators[2,6,25,26] found SPLs ranging from 59 to 96 dBA in PICUs.

In our study, SPLs in the CICU and the NICU were significantly higher than those in the PICU. This difference may be due to the remodeling of the PICU with laminate plank flooring, specifically for noise reduction. The floors in the other 2 ICUs were vinyl composite tile. Our results suggest that flooring may have a nearly 5-dBA impact on the mean noise levels.

Noise Sources, Location, and Activities

In our current study, an observer followed nurses and documented sources of noise, the location at which the noise occurred, and the nursing activity taking place in a coordinated effort with measurements from the personal dosimeter. In previous studies, researchers placed a noise meter in various locations of the hospital or unit (eg, centrally located or adjacent to the central station, on walls or ceilings or both)[2,4] or did not state the location of measurement devices.[27] Placing the noise meter along the anterior part of the nurse's shirt collar allowed a specific understanding of noise from the nurse's perspective[18]; that is, following the pathway during the natural course of work.

For SPLs exceeding 75 dBA, our results indicate that the top general sources of noise were also the most frequent. Staff communication and noise from equipment are the most prevalent sources of noise in PICUs that hospitals struggle to eliminate.[2,27] Equipment may be consistently causing noise so that staff, patients, and patients' families must raise their voices to be heard. Reduction in equipment alarms may improve communication, particularly at the patient's bedside where equipment is typically located. However, a balance must be obtained without compromising patient safety. Closing doors is a commonly used practice to help reduce in-room noise; however ICU patients can be exposed to more noise with closed doors, presumably because most noise emanates from equipment within the room.[28]

Location and activity data indicated that the nurses spent the majority of time inside or directly outside patients' rooms, interacting with staff or carrying out patient support activities. However, noise exceeded 75 dBA primarily in gathering rooms (break rooms or conference rooms). If the SPLs in the latter 2 locations exceed 75 dBA, then the reprieve staff seek, the information exchange, and/or decision making desired may be difficult to achieve because of the high noise levels. Additionally,

employee interactions, the major activity occurring at or above noise threshold levels, indicate that the implementation of behavioral modifications would be an effective means of noise reduction.[27]

Noise and Health

The mean heart rate, overall and per unit, did not exceed the normal range of 60/min to 100/min.[29] However, heart rates for NICU nurses were significantly higher than those of nurses in the CICU and the PICU. The significant, albeit small, association between heart rate and noise[6] may be an explanation for this phenomenon (SPLs in the CICU and the NICU were significantly higher than those in the PICU). Of interest, we found significant correlations between heart rate and SPLs for being in a patient's room, communication with staff, communications between patients and patients' families, and during all nursing activities, indicating that direct care may be a confounding factor for this finding.

A counterintuitive outcome was the low self-reported stress levels, although, using the same survey we did, Morrison et al[6] had similar results in a PICU (ratings, 0-88; median, 9.5). The normal mean heart rate and low stress levels may indicate that critical care nurses have either developed effective coping strategies to counteract the effects noise or are unaware of the impact noise has on stress levels and do not acknowledge that they are stressed.[12,30,31]

Conclusions

Our results confirm previous research findings[1,27] that SPLs in ICUs often exceed recommended thresholds. With the increase in complexity in patient care and in technology required to treat changes in medical conditions, this trend is unlikely to subside. ICU nurses are in a unique position to institute change by leading noise-reducing interventions, participating in teams to design new units or redesign existing units, and influencing shared-governance councils to change policy and practice. However, reasons for making and sustaining change must be meaningful to nurses and administrators in order for continued engagement and success in noise-reduction strategies. Therefore, serious efforts must be made to improve nurses' knowledge of the effects of excessive exposure to noise. Education is lacking[12] on the adverse impact of excessive noise on patients (decreased wound healing, sleep deprivation, cardiovascular stimulation, ICU psychosis, decreased auditory and central nervous system development and function)[12,28,32-34] and on care providers' health[6,11,18,35] and performance.[36] Without an improved understanding of the risk of noise exposure, reduction efforts will have little or no effect on lowering SPLs.[4,37]

Limitations

We acknowledge the limitations due to the small sample size; this investigation was a unique observational pilot study linking SPLs to a variety of environmental sources. A larger scale study requires increases in human and hospital resources. Therefore, the lack of a significant association with stress may have been due to the small sample size and low statistical power. Inclusion of overall area noise measures and objective stress measures with advanced analyses with controls for potential confounders can be applied in future studies. Finally, resource constraints limited observation to a 24-hour period for each unit. Longer observations may allow greater data collection, providing more information on noise sources and variability. The category of Other in the noise sources figured prominently in the results, prompting the future need for explicit documentation of these sources in addition to the predefined categories. Furthermore, the adverse effect of noise on heart rate and ultimately on the health of the nurses could not be totally understood because of the small sample size. A large longitudinal study with longer periods of observation is needed to determine the adverse health outcomes due to noise.

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None reported.

eLetters

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EBR Evidence-Based Review

Evidence-Based Review and Discussion Points

By Ronald L. Hickman, RN, PhD, ACNP-BC

Evidence-Based Review (EBR) is the journal club feature in the *American Journal of Critical Care*. In a journal club, attendees review and critique published research articles: an important first step toward integrating evidence-based practice into patient care. General and specific questions such as those outlined in the "Discussion Points" box aid journal club participants in probing the quality of the research study, the appropriateness of the study design and methods, the validity of the conclusions, and the implications of the article for clinical practice. When critically appraising this issue's EBR article, found on pp 377-384, consider the questions and discussion points outlined in the "Discussion Points" box. Visit **www.ajcconline.org** to discuss the article online.

The intensive care unit (ICU) is a healing environment that is often plagued with disturbingly high levels of noise. The exposure to environmental noise generated by monitors, mechanical ventilators, and even other health care professionals often goes unnoticed by critical care clinicians, but it can have injurious effects on their health. Despite the effects of environmental noise on the health of critical care clinicians, a significant proportion of previous noise research in the ICU has primarily focused on patient or family outcomes. There are few studies that have examined the impact of ICU noise on the health of critical care clinicians.

To examine the effects of ICU noise on the health of critical care nurses, the authors conducted a cross-sectional observational study among nurses in pediatric ICUs. The authors collected data on ICU noise levels, sources of noise, and the relationship between ICU noise levels and the health outcomes of critical care nurses (ie, heart rate and perceived stress). A total of 15 critical care nurses from 3 pediatric ICUs participated in this study. Data were collected using a heart rate monitor, a noise dosimeter, and a measure of self-reported stress. Each participant was observed by a data collector to document noise sources and the participant's activities during each observation recorded.

The findings of this study confirmed ICU noise levels that exceeded recommended thresholds and an association between heart rate and ICU environmental noise level was determined. The most frequent sources of ICU noise found were in-room noise, patient care activities, and staff conversations. The authors conclude that the elevated levels of noise in the

Investigator Spotlight

This feature briefly describes the personal journey and background story of the EBR article's lead investigators, discussing the circumstances that led them to undertake the line of inquiry represented in the research article featured in this issue.

Nancy Daraiseh, PhD, is an industrial engineer and scientist at the Cincinnati Children's Hospital Medical Center in Cincinnati, Ohio. She has more than 15 years of experience in pediatric and adult care with a focus on occupational safety, human factors, and ergonomics that influence the experiences of patients and their families. Using a multidisciplinary approach, Daraiseh and the study's coauthors sought to understand the impact of workplace noise on the health and psychological well-being of critical care nurses.

Nancy Daraiseh

As an occupational safety and health scientist, Daraiseh's primary focus is on changing environments of care to promote healing and health. She says there are many aspects of the work environment, such as layout, lighting, and temperature regulation, that are more challenging for clinicians to modify; however, she believes critical care clinicians can implement changes that reduce environmental noise levels. Her advocacy for noise reduction in the ICU has resulted in an expanded view of the impact of environmental noise, from viewing it as a challenge that solely affects patients to exploring its impact on critical care nurses.

Daraiseh says the researchers were initially concerned that participation in the study would be low because nurses would not want to be observed. "However, we found that most nurses were not only willing to participate, but were also willing to be observed without notice," she says. An unforeseen success for Daraiseh and her coauthors was how eager and excited nurses were to be involved in their research.

ICU contributes to adverse health outcomes for critical care nurses and effective noise reduction strategies are needed.

Information From the Authors

Nancy Daraiseh, PhD, lead author on this article provides additional information about the study. She comments that the study goal was to contribute to the literature on ICU noise research, highlight the impact of ICU environmental noise on the health of critical care nurses, and provide evidence to assist future noise reduction efforts.

According to Daraiseh, the lack of research examining the effects of environmental noise on the health of critical care nurses was the primary motivation for this study. "Nurses are exposed to excessive levels of environmental noise when providing care to critically ill patients, but we know very little about the cumulative effects of environmental noise on the health of nurses working in these ICUs," she says.

The excessive environmental noise in ICUs is an occupational health concern for critical care nurses. Daraiseh points out that critical care nurses are repeatedly exposed to environmental noise that exceed recommended thresholds for prolonged periods of time and little has been done to remedy this. "Exposure to high noise levels found in our study and others are likely to affect nurses' productivity and impair their ability to effectively make decisions, regulate emotions, and perform vital skills needed to ensure quality care," she notes. Daraiseh suspects that examining the effects of noise in the ICU on the health of critical care nurses will lead to noise reduction efforts that will positively affect the health of nurses and their critically ill patients.

Implications for Practice

The author encourages readers of the *American Journal of Critical Care* to consider strategies for noise reduction to enhance the health of patients and clinicians. She adds, "Based on our work, strategies such as quiet rooms and specified quiet times are reasonable and may effectively abate noise levels."

About the Author
Ronald L. Hickman is an assistant professor, Case Western Reserve University, and an acute care nurse practitioner at University Hospitals Case Medical Center, Cleveland, Ohio.

According to Daraiseh, future noise research in the ICU would benefit from mixed methods that examine subjective and biological markers of the stress, longer observational periods, and long-term consequences of noise exposure on the health of critical care nurses. Critical care nurses are in a unique position to help change organizational and unit culture by advocating for noise reduction to enhance the quality of patient care and the health of all employees working in an ICU.

eLetters
Now that you've read the article, create or contribute to an online discussion on this topic. Visit **www.ajcconline.org** and click "Submit a response" in either the full-text or PDF view of the article.

Discussion Points

A. Description of the Study
- ❑ What are the major concepts of the study?
- ❑ What is the purpose of the study?

B. Literature Evaluation
- ❑ What are the recommended Environmental Protection Agency thresholds for sound in the hospital?
- ❑ What is the state of the science on environmental noise regarding the outcomes of health care professionals?

C. Sample
- ❑ Who was eligible to participate in this study?
- ❑ How many participants were included in this study?

D. Methods and Design
- ❑ What is the research design and how often were data collected?
- ❑ How often were noise measurements conducted?

E. Results
- ❑ What were the major findings of this project?
- ❑ How can you use the findings of this project to improve the quality of your nursing care?