

## NOISE ON THE HOSPITAL SETTING: IMPACT ON NURSING PROFESSIONALS' HEALTH

### *Ruído no contexto hospitalar: impacto na saúde dos profissionais de enfermagem*

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#### ABSTRACT

**Purpose:** to analyze the impact of noise on nurses' health in the hospital environment. **Method:** this is a descriptive cross-sectional study, with quantitative analysis of data. 138 nurses of the admission sector were studied. It was held a drawing to define the sectors of hospitalization of the central building. For purposes of study, we used a sound level meter of the type II to evaluate noise levels in selected sectors. For data collection it was used a questionnaire composed of open and closed questions **Results:** the results for noise assessment showed that it ranged between (52,35) dBA and (84, 60) dBA. Studies revealed that most nurses are female (84, 78%) aged between 40 and 49 years old. In relation to the information on noise in the workplace, 76,05% said their workplace is noisy. Regarding the discomfort, 69,57% felt uncomfortable with noise produced in the hospital. The main noise sources were: equipment with alarms (36, 23%), high conversations and laughter (34, 06%) and people movement (18, 12%). The most quoted auditory complaint was tinnitus (14, 49%), extra-auditory irritation (45, 63%) was followed by sleep disturbances, and headache (44, 20%) and low concentration (34, 78%). **Conclusion:** it was concluded that the sound pressure levels measured were higher than recommended, and from several sources. It appears that nurses don't have the needed knowledge about the noise effects on their health, but they expressed discomfort about them.

**KEYWORDS:** Noise Effects; Auditory Perception; Occupational Risks

#### ■ INTRODUCTION

The hospital is presented as the main working environment for nurses. It is necessary to consider that the environment is harmful and can bring serious consequences to the health of this population, given the workers' daily exposure to this admittedly unhealthy environment<sup>1</sup>.

Among the numerous environmental risks that the nursing staff is submitted, the physical agent noise, produced either in the own hospital or externally, can compromise the health of these workers<sup>2-4</sup>.

This daily exposure can have consequences on the physical, mental and psychological states of the subject, generating changes in communication, poor performance, fatigue, stress, illness and work accidents<sup>5-7</sup>.

Who does not remember the classic picture of a woman dressed as a nurse asking people to be quiet? Silence should be a priority in hospitals, but what we see is just the opposite, the noise prevailing and in many situations it presents harmful Sound Pressure Levels (SPL) to health.

According to the World Health Organization (WHO), the noise can disturb the work, rest, sleep and communication in humans and can cause psychological, physiological and simultaneously pathological reactions<sup>8</sup>.

Many hospitals are located in areas exposed to external noise sources such as transit of major avenues, airports, etc.<sup>2</sup>. However, this noise comes not only from the outside of the hospital

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environment, noise is present in the intensive care unit, in patient units, clinics, surgical centers, aisles, and the main causes of noise are the employment of equipment with audible and the performance of the multidisciplinary team, who by not having proper knowledge of the diseases contributes even more with inappropriate behaviors and attitudes, undermining the welfare of their own health<sup>2</sup>.

According to the Environmental Protection Agency from the United States noise levels in hospitals should not exceed 45 dB during the day and 35 dB during night<sup>9</sup>. The World Health Organisation recommends 30 to 40 dBA for indoor hospitals<sup>8</sup>. The Brazilian Standard (NBR) 10152 fixes noise levels compatible with the acoustic comfort in various environments, including hospitals, noise levels measured in decibels range 35-45 dBA in apartments and wards<sup>10</sup>.

Assuming that the noise levels in hospitals are high and can impact the health of nursing professionals, this research aims to analyze the noise levels in the hospital environment and its impact on the health of nurses.

## ■ METHOD

It is a transversal, quantitative and descriptive study which was conducted at a public teaching and research hospital in the city of Curitiba. It works with 518 beds, 400 controlled by the State Secretary of Health, according to information from the hospital management.

It was defined as the study site the central building, due to its diversity of patient care and various specialties and for being the area of greatest activity of the nursing team. The population invited to participate in this study was composed by the nursing staff for being the most numerous category of workers.

Considering the complexity and specificity of some units of the hospital and the time limitations for the study, it was not possible to include all sectors and nurses. For this reason, we used the sampling technique. This study included nursing workers (nurses, practical nurses and nursing assistants) of the central building that met the inclusion and exclusion criteria that follow.

Inclusion criteria: belonging to the category of professional nurse, any genre could participate in the study, being the minimum age of 18 years old; take part in the research, having been working for at least two years in the hospital.

Exclusion criteria: workers on vacation, being on any kind of medical leave, those who did not agree to become research subjects, employees with less

than two years of activity in the hospital and being under the age of 18 years old.

The procedures used to develop the study were divided into three stages. First a raffle was held to define the sample (between 18 units of the central building). 10 hospitalization sectors were randomly selected. In the second stage of the research it was performed the measurement of sound pressure levels (SPL) in the chosen sectors; this measurement was carried out during working hours of the nursing professionals. And in the last step the heads of each drawn sector were verbally invited to participate in the study along with the nursing staff.

### **Step 01: Sample Selection**

We used a raffle which chose some sectors of the central building where it would be carried out an environmental noise assessment and subsequently we interrogated nursing professionals. The selected sectors were: Central of Materials, Pediatrics, Intensive Care Unit (ICU), Traumatology and Orthopedics, Male Clinical Medicine, Female Clinical Medicine, Urology, Cardiac ICU, Chemotherapy, Infectious Diseases and Endoscopy.

### **Step 02: Measurement of the noise level**

The measurement of the noise level was performed by a Technical of Work Safety. This measurement was made in the sectors of the central building of the hospital which were selected in step 01. To measure the noise it was used a sound level meter (SLM) Minipa, MSI Model 1350, Type II, with maximum and minimum record, fast response (FAST) and slow (Slow), and A/C-weighted measurement frequency of 30 to 130 dB dB at three scales: low (LO), medium (MED) and high (HI). Before the start of the survey the instrument was calibrated to monitor continuous sounds, alarms and conversation in the workplace. We opted for the range between 50 dBA –130 dBA. The points assessed in each sector were chosen based on the length of stay of nursing staff on place; the nursing stations and aisle were the places of longer permanence where the professional stayed.

For measurement we did the following procedure: set up a point for measurement at the center of the hall and central nursing station at a height 1.10 meters from the ground. The monitoring was carried out every one minute with ten measurements, totaling 10 minutes of evaluation.

### **Step 03: Characteristics of the sample**

The head nurses of each sector selected in step 1 were verbally invited to participate in the study along with the nursing staff, totaling 259 nurses. The professionals were informed about the study

objectives and oriented in relation to the research protocol.

It was used for data collection, a questionnaire composed of 22 questions with open and closed questions, based on the history of the professionals<sup>11</sup> and adapted for the target population by the author of this study, in order to gather information on nursing professionals. The nursing supervisors were responsible for the delivery of questionnaires to nurses who agreed to participate in the study. The questions were answered individually by them at work upon the release of their immediate supervisor. Data collection occurred from March to August 2010. The study included 138 nurses, 31 nurses (22.46% of the sample), 31 practical nurses (22.46% of the sample) and 76 nurses (55.07% of the sample).

We point out that we did not reach the 259 nursing professionals, for the following reasons:

- The research site is a teaching hospital, where there are several ongoing studies and the nursing worker refuses to participate in some research;
- The workers showed tiredness and lack of interest in participating in research;
- Others did not agree to participate saying they were busy with the assistance procedures.

The study was approved by the Assistance Direction, and Immediate Managers and Coordination of the Nursing Hospital, the research project was reviewed and approved by the Ethics Committee on Human Research from the Hospital de Clinicas from UFPR under registration CEP/HC 2116.011/2010-01, in accordance to Resolution 196/96 of October 10<sup>th</sup> 1996, of the National Health Council in all its stages.

The descriptive analysis data are presented as a distribution (percentage) for characterizing variables.

The correlation between variables, complaints and maximum SPL in the hospital environment was assessed by Spearman correlation coefficient.

The Student t test was used to compare the difference between the average levels of complaints among nursing professionals.

We adopted a significance level of 5% (0.05) for statistical tests.

## ■ RESULTS

The sound level presented variation of minimum and maximum values, from 52.35 dBA to 81.83 dBA in the aisles and 51.13 dBA to 84.60 at the nursing station, as shown in Table 1.

**Table 1 – Minimum and maximum values measured in the hospital in different places (dB-SPL)**

Place	Aisle SPL min-dB (A)	Aisle SPL max-dB (A)	Nurse Station SPL min-dB (A)	Nurse Station SPL max-dB (A)
Trauma / Ortho	62,52	64,95	61,44	64,06
Male Medical Clinic	62,11	64,64	63,83	65,81
Female Medical Clinic	58,24	68,02	57,54	66,68
Chemotherapy	57,12	65,20	56,93	65,33
Urology	52,59	62,01	51,32	65,21
Infectious Diseases	52,35	61,65	51,13	64,68
Digestive Endoscopy	74,78	81,13	83,15	84,60
CTI	70,49	72,44	63,96	65,23
Nephrology	73,45	77,67	-	-
C. C. materials	-	-	66,30	67,40

Legend: dB = decibel; SPL = sound pressure level

138 nursing professionals answered the questionnaire. Table 2 presents the information of the participants in regards to gender, age and profession. There is a female predominance of 84.78% against 14.49% males. In terms of age, a

total of 49.28% (68) of the subjects were aged from 40-49 years to 23, 19% were 50 years or more. Regarding occupation 55.07% of the sample belongs to the category of nurse assistant and 22.46% to the category of technical nurses and nurses.

**Table 2 – Distribution of nurses according to gender, age and occupation (n = 138)**

<b>Variables</b>	<b>N</b>	<b>%</b>
<b>Gender</b>		
Female	117	84,78
Male	20	14,49
No answer	1	0,72
<b>Age</b>		
Less than 30 years old	4	2,90
30 to 39 years old	32	23,19
40 to 49 years old	68	49,28
50 years old or more	32	23,19
No answer	2	1,45
<b>Occupation</b>		
Nursing Assistant	76	55,07
Nurse	31	22,46
Nursing Technician	31	22,46

A Tabela 3 refere-se à distribuição dos funcionários segundo o tempo de profissão, tempo no local de trabalho, carga diária e carga semanal. Quanto ao tempo de profissão 38,41% dos profissionais de enfermagem tem mais de 20 anos de atividades no referido hospital. A respeito da carga horária diária 69,57% dos profissionais de enfermagem cumprem menos de oito horas/dia. Em relação à carga horária semanal 78,26% cumprem uma carga horária com menos de 35 horas.

Table 3 refers to the distribution of employees according to working time experience, time at this work, daily working hours, and weekly working hours. As for the working time experience 38.41% of nursing professionals have over 20 years of experience in the mentioned hospital. In regards to the daily working hours, 69.57% of nursing professionals work less than eight hours/day. Regarding the weekly working hours 78.26% work 35 hours a week.

**Table 3 – Distribution of nurses according to profession time, time at work, daily working hours, and weekly working hours (n = 138)**

Variáveis	N	%
<b>Profession Time</b>		
Less than 10 years	27	19,57
10 to 19 years	43	31,16
20 to 29 years	53	38,41
30 years or more	15	10,87
<b>Time at present work</b>		
Less than 10 years	78	56,52
10 to 19 years	46	33,33
20 years or more	9	6,52
No answer	5	3,62
<b>Daily Working Hours</b>		
Less than 8 hours	96	69,57
8 hours or more	41	29,71
No answer	1	0,72
<b>Weekly Working Hours</b>		
Less than 35 hours	108	78,26
35 to 39 hours	9	6,52
40 hours or more	16	11,59%
No answer	5	3,62

Table 4 refers to the opinion of nurses regarding the noise in the work environment, annoyance due to the noise and the knowledge of the effects of noise on their health. The analysis of the questionnaires revealed that 76.09% of nurses consider

their work environment noisy. It was identified that 69.57% of the population feel disturbed by the noise in the workplace. It was found that 67.39% of nurses responded that they have knowledge of the effects of noise on their health.

**Table 4 – Distribution of the answers according to the opinion of the nursing professionals as noise in the hospital environment (n = 138)**

Questions	N	%
<b>Is your workplace noisy?</b>		
Yes	105	76,09
No	32	23,19
No answer	1	0,72
<b>Does the noise in the workplace bother you?</b>		
Yes	96	69,57
No	39	28,26
No answer	3	2,17
<b>Are you aware of the problems the loud noise can cause?</b>		
Yes	93	67,39
No	41	29,71
No answer	04	2,90

All nurses reported the existence of sources of noise in the workplace, which were identified by means of open questions and are shown in Table 5. The generating source that produced the most noise

are the equipment with alarms 36.23%, followed by loud conversations and laughter 34.06% followed by moving people 18.12%.

**Table 5 – Sources of noise in the hospital according to the nursing professionals (n = 138)**

<b>Situations of noise</b>	<b>N</b>	<b>%</b>
Equipment with alarm	50	36,23
Loud conversations and laughter	47	34,06
People Moving	25	18,12
Infusion pump	22	15,94
Telephone	21	15,22
Bell	20	14,49
Printer / computer	16	11,59
Boiler	13	9,42
Television	13	9,42
Reverse osmosis	12	8,70
Child crying	09	6,52
Radio	07	5,07
Laundry	06	4,35
Noisy toys	05	3,62
Slamming Doors	04	2,90
Dragging mobile	04	2,90
Gospel prayer	02	1,46
Do not know	02	1,45
Elevators	01	0,72
Pushing the stretcher	01	0,72
Street	01	0,72

NOTE: % calculated on the number of subjects

Table 6 shows the distribution of the frequency of symptoms or complaints caused by noise reported by nursing professionals. It's been mentioned several complaints by the same nursing staff, being 45.65% irritability, sleep disturbances and headache 44.20% the most prevalent. Tinnitus is a symptom reported by nursing professionals which causes too much trouble. In this study the prevalence of this complaint was of 14.49%.

Table 7 shows the average number of complaints of nurses in relation to minimum and

maximum values from SPL measured in the hospital environment. To compare the average number of complaints it was selected the service of digestive endoscopy with higher NPS (81.13 dBA and 84.60 dBA) with an average of 4.84% of complaints and infectiology service with NPS (61.65 dBA and 64.68 dBA) the average number of complaints was 3.5%. The application of the Student t test identified ( $p = 0.1847$ ) and this difference was not considered statistically significant between the average number of complaints.

**Table 6 – Distribution of the frequency of symptoms or complaints caused by noise according to the nurses (n = 138)**

Questions	N	%
Irritability	63	45,65
Sleep alterations	61	44,20
Headache	61	44,20
Low concentration	48	34,78
Gastric changes	40	28,99
Discomfort	25	18,12
Jitters	24	17,39
No complaints	23	16,67
Tinnitus	20	14,49
Vocal fatigue	20	14,49
Dizziness	11	7,97
Blocked ear	11	7,97

**Table 7 – Relationship between the average number of complaints from nurses and maximum values of SPL measured in the hospital in different places (dB-SPL)**

Place	Aisle SPL max dB (A)	Nurse Station SPL max dB (A)	Average N. of complaints
Digestive Endoscopy	81,13	84,60	4,8
Cardiac ICU	60,00	68,00	4,7
Urology	62,01	65,21	4,3
Infectious Diseases	61,65	64,68	3,5
Male Medical Clinic	64,64	65,81	3,4
Pediatrics	71,00	68,00	3,4
Female Medical Clinic	68,02	66,68	2,7
CTI	72,44	65,23	2,7
Chemotherapy	65,20	65,33	1,3
Trauma / Ortho	64,95	64,06	1,0
Chemotherapy	65,20	65,33	1,3
Nephrology	77,67	-	-
C. C. materials	-	67,40	-

Legend = dB = decibel; SPL = sound pressure level

## ■ DISCUSSION

It is noteworthy that during the literature review it was found few studies on noise levels focusing on hospital environment and its effects on the health of nurses.

Thus, in the following discussion, references are made to studies addressing the Intensive Care Unit, Neonatal Intensive Care Unit and Surgical Center, where it was performed most of the research on noise in the hospital.

Noise levels found in this study showed minimum and maximum values, ranging from 52.35 dBA to 84.60 dBA, respectively (Table 1), confirming the results found in studies of hospital noise<sup>12-14</sup>.

Despite the noise assessment had not reached the tolerance limit of 85 dBA for eight hours of daily exposure, established by NR-15, the noise levels obtained may cause extra-auditory effects, sleep disturbances, fatigue, irritability and harm concentration, sometimes leading to distraction and error<sup>13</sup>.

*Os níveis de ruído avaliados estão acima dos valores recomendados pela Associação Brasileira*

*de Normas Técnicas (ABNT), NBR 10152/1987, que recomenda 35 dBA e 45 dBA como níveis de ruído aceitáveis para diferentes ambientes hospitalares*<sup>10</sup>.

The evaluated noise levels are higher than recommended by the Brazilian Association of Technical Standards (ABNT) NBR 10152/1987, which recommends 35 dBA and 45 dBA as acceptable noise levels for various hospital environments<sup>10</sup>.

According to the NR-17, in environments where tasks are performed which require constant attention or intellectual request, the sound pressure level should not exceed 60 dBA. Therefore, the noise level is also rated above recommended for jobs that require concentration and intellectual demand, as in the practice of nursing professional, where several tasks performed by nursing staff are considered complex.

Table 1 shows that the sector with the highest NPS was the Digestive Endoscopy Service. This probably occurred due to the presence of the hood, which is connected at the time of disinfecting materials. Furthermore, another aspect that may have contributed is the fact that the service is near the hospital laundry.

The sound pressure levels (SPL) in the hospital are not controlled and no guidance is directed to this population, despite a Hearing Conservation Program (PCA) be established by the hospital. Currently the Specialized Safety Engineering and Occupational Medicine (SESMT) of the hospital consist of a labor nurse, nursing technician and a doctor. There is no phonoaudiologist in the staff.

As for nursing professionals involved in the study, there is a female predominance, which demonstrates that the nursing profession is still being developed mainly by women (Table 2). This research coincides with other national and international studies, in which nursing is composed mostly of women<sup>15-17</sup>.

In terms of age (Table 2), there is a tendency to the aging of nursing professionals. The presence of nurses with an older age in public services suggests the stability of employment and wages guaranteed by public service<sup>18</sup>.

Another highlight is the predominance assistant nurse (Table 2).

The low number of nursing technician within the hospital is justified because most nursing assistants consist of technicians who were not promoted and continue to be paid as a nursing assistant. In the studied institution, the promotion takes place through public tender, the institution expects from the nurse more knowledge than performing procedures at work, thereby reducing the number of these professionals in hospitals<sup>19,20</sup>.

Regarding the time working at the institution (Table 3) the fact that 38.41% of nursing professionals have over 20 years of exercise in the hospital, suggests the existence of a stable structure of the organization. The low turnover presented in the hospital is related possibly to the stability in public service, salary commensurate with the regional situation and working hours (30 hours weekly).

Regarding the participants' perception of noise in the hospital (Table 4), it was observed that they consider the workplace noisy and get bothered by the noise and have some knowledge about the effects of noise. However, some nurses seem accustomed to intense noise levels in hospitals, especially in ICU<sup>21</sup>. In this research it was found that the hassle for nursing professionals is an important and stressful and should not be disregarded. For being an unwanted sound, the noise has characteristics of bothering, irritating, decreasing the ability to focus and changing the behavior and attitude of the individual<sup>22</sup>. The main sources of noise in the workplace reported by participants (Table 5) are similar to other studies, whereby the sources that produce more noise were the employees themselves who work there especially the nursing staff, not just the equipment alarms<sup>13,14,23</sup>.

There is need for a change in the behavior of the nursing staff. It is necessary to perform a preventive and educational program focused on the health and noise reduction of the nursing staff.

It was observed in the present study, that the majority of nurses reported more than one symptom or complaint, after the workday (Table 6). Although the noise level found in different areas of the hospital has not submitted association with the complaints of professionals, the noise in hospitals is above the recommended levels, which can lead to physiological and psychological alterations harmful to patients and staff<sup>2</sup>.

Irritability mentioned by 45.65% of the participants in this study often have continuous effect in the body, since its action is perceived after the stoppage or noise mitigation. This is because the exposure happens at high frequency noise, which indicates a precursor to hearing loss to sounds in this frequency. The low concentration and irritability are the group of organic effects of second category (physiological of attention)<sup>24</sup>.

As for the sleep disturbances reported (Table 6) it is known that exposure to noise during the day can change the sleep quality hours later, interfering with the performance of individual tasks, especially those that require concentration and skill<sup>25-27</sup>.

We found other complaints such as poor concentration, gastric changes, nervousness and discomfort. All these findings confirm the observations made by

other researchers, which describe that noise can cause poor concentration, gastrointestinal changes, discomfort and dizziness<sup>26</sup>.

The tinnitus is a symptom reported by nursing professionals that causes a lot of discomfort (Table 6). This finding is supported by some studies that also reported tinnitus as one of the main complaints in subjects exposed to noise<sup>25-29</sup>.

The presence of headache was also reported by the nursing staff. In another study it was found complaints of headache in workers exposed to noise and vibration<sup>28</sup>.

Given the above, it is suggested that the results found in this research be disseminated to the nurses, to the heads of service, to the general direction and the Specialized Safety Engineering and Occupational Medicine (SESMET) so that they try to promote improvements in the hospital.

It is also necessary to implement a program of Health Promotion (education and prevention), focused on the overall health and hearing for all hospital workers. It is recognized that it is extremely important to carry out the maintenance of equipment cited as noisy.

## ■ CONCLUSIONS

This study led to the following conclusions:

- The noise in the hospital environment ranged from 52.35 dBA to 84.60 dBA above the level recommended by ABNT (10152/1987) and WHO (1985) for this place. The noise sources were most prevalent: the equipment with alarms (36.23%); loud conversations and laughter (34.06%) and the movement of people (18.12%).
- The most mentioned auditory complaint was tinnitus (14.49%), and extra auditory was irritation (45.63%), followed by sleep disturbances and headache (44.20%) and low concentration (34.78 %).
- Nursing professionals consider that the hospital in which they work is very noisy (38.4%); report feeling annoyed by noise (69.57%), but they believe that the noise in the hospital is not able to harm health (58.70%).

## RESUMO

**Objetivo:** analisar os níveis de ruído no ambiente hospitalar e o seu impacto na saúde dos profissionais de enfermagem. **Método:** trata-se de um estudo transversal, de caráter descritivo, com análise quantitativa de dados. Constituíram-se sujeitos do estudo 138 profissionais de enfermagem dos setores de internação. Foi realizado um sorteio para definir os setores de internação do prédio central. Para fins de estudo, utilizou-se um decibelímetro do tipo II para avaliar os níveis de ruído nos setores selecionados. Para a coleta de dados foi utilizado um questionário composto de perguntas abertas e fechadas. **Resultados:** os resultados referentes à avaliação do ruído demonstraram que o mesmo variou de 52,35 dBA a 84,60 dBA. Os estudos revelaram que a maioria dos profissionais de enfermagem é do gênero feminino (84,78%) e está na faixa etária entre 40 e 49 anos de idade. Em relação às informações sobre o ruído no ambiente hospitalar, 76,05% afirmam que seu ambiente laboral é ruidoso. Em relação ao incômodo, 69,57% se sente incomodado com o ruído produzido no ambiente hospitalar. As principais fontes de ruído citadas foram equipamentos com alarmes (36,23%); conversas altas e risadas (34,06%) e movimentação de pessoas (18,12%). A queixa auditiva mais citada foi o zumbido (14,49%), e a extra-auditiva foi a irritação (45,63%), seguida de alteração do sono e dor de cabeça (44,20%) e baixa concentração (34,78%). **Conclusão:** conclui-se que os níveis de pressão sonora mensurados foram acima do recomendado e decorrem de fontes diversas. Constata-se que os profissionais de enfermagem não possuem conhecimento dos efeitos do ruído na saúde e manifestam desconforto em relação aos mesmos.

**DESCRIPTORIOS:** Efeitos do Ruído; Percepção Auditiva; Riscos Ocupacionais

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