Compliance and noncompliance of environmental variables in a Sterile Processing Department

Conformidades e não conformidades das variáveis ambientais em um Centro de Material e Esterilização

Conformidades y no conformidades de variables ambientales en un Centro de Material y Esterilización

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ABSTRACT: Objective: To verify the compliance and noncompliance with health legislation of environmental variables in a Sterile Processing Department. **Method:** This is an observational and analytical study carried out at the Sterile Processing Department of a regional hospital in a small city of the state of Piauí (Brazil). Data were collected by a checklist in three observations and organized in a table with the presentation of the simple averages. **Results:** We verified that the average extracted from the three observations for the temperature, noise, humidity, and lighting parameters were: reception and cleaning area — 33°C; 58.9 dB; 36.2%, and 62 lux; packaging and sterilization area — 33.3°C; 60.8 dB; 35.5%, and 57.4 lux; and storage and distribution area — 34.2°C; 57.8 dB; 34.3%, and 53.1 lux. **Conclusions:** There are inadequacies between the obtained values and the recommendations of the health legislation, which may reflect production losses as well as physical, mental, and psychological consequences for the workers.

Keywords: Risk management. Occupational risks. Environmental risks. Environmental monitoring. Hospital departments.

RESUMO: Objetivo: Verificar as conformidades e não conformidades à legislação sanitária das variáveis ambientais em um Centro de Material e Esterilização. **Método:** Trata-se de um estudo observacional analítico, realizado no Centro de Material e Esterilização de um hospital regional do interior do Piauí. Os dados foram coletados por meio de um *checklist* em três observações e organizados em tabela com apresentação das médias simples. **Resultados:** Verificou-se que a média extraída das três observações para os parâmetros de temperatura, ruído, umidade e luminosidade foram: área de recepção e limpeza — 33°C; 58,9 dB; 36,2% e 62 lux; área de empacotamento e esterilização — 33,3°C; 60,8 dB; 35,5% e 57,4 lux; e área de armazenamento e distribuição — 34,2°C; 57,8 dB; 34,3% e 53,1 lux. **Conclusão:** Há inadequações entre os valores obtidos e as recomendações da legislação sanitária, o que pode refletir em prejuízos na produção bem como em consequências físicas, mentais e psicológicas ao trabalhador.

Palavras-chave: Gestão de riscos. Riscos ocupacionais. Riscos ambientais. Monitoramento ambiental. Departamentos hospitalares.

RESUMEN: Objetivo: Verificar las conformidades y no conformidades de las variables ambientales en un Centro de Material y Esterilización con la legislación sanitaria. Método: Se trata de un estudio observacional analítico, realizado en el Centro de Materiales y Esterilización de un Hospital Regional del interior de Piauí. Los datos fueron recolectados a través de una lista de verificación en tres observaciones, y organizados en una tabla con la presentación de medios simples. **Resultados:** Se verificó que el promedio extraído de las tres observaciones para los parámetros de temperatura, ruido, humedad y luminosidad fueron: área de recepción y limpieza (33°C; 58,9 dB; 36,2% y 62 lux); zona de envasado y esterilización (33,3°C; 60,8 dB; 35,5% y 57,4 lux); y zona de almacenamiento y distribución (34,2°C; 57,8 dB; 34,3% y 53,1 lux). **Conclusión:** Existen insuficiencias entre los valores obtenidos y las recomendaciones de la legislación sanitaria, lo que puede reflejarse en pérdidas en la producción, así como consecuencias físicas, psíquicas y psicológicas para el trabajador.

Palabras clave: Gestión de riesgos. Riesgos laborales. Riesgos ambientales. Monitoreo del ambiente. Departamentos de hospitales.

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INTRODUCTION

The association between work and health must be seen as a determinant when considering the environmental risks to which workers are exposed in their work routine. Thus, ensuring adequate conditions for workers to perform their tasks characterizes a set of measures aiming to promote and ensure the integrity of the health of these professionals[1].

Taking this into consideration, health issues associated with the work process are divided into two groups: the first highlights those that represent the imbalance between the work environment and the workers' health; and the second refers to chronic health problems related to typical occupational diseases[2].

Hence, all work environments must be mapped as for the risks to workers' health. In this research, we emphasize the Sterile Processing Department (SPD), which represents a unit in health facilities designed to process materials for cleaning, decontamination, sterilization, and distribution of these products in a safe way to be used during hospital clinical procedures[3].

Given the multitude of activities carried out in the SPD of hospitals, this sector is considered to be an environment that favors the exposure of workers to various health risks resulting from monotonous and/or exhausting routines, insufficient number of material and human resources, restricted environment, contact with organic fluids, heat, manipulation of chemicals with exposure to aerosols, equipment that generates noise and heat that may contribute to the triggering of physical and mental health problems[4].

Therefore, considering the characteristics of the work development of the SPD, it is evident that this sector deserves close attention, as factors — such as the quality of the materials, the physical environment in accordance with health surveillance regulations, and quality equipment — directly reflect on the quality of the provided service and the workers' safety in the area[5].

In view of the risk to which health professionals are exposed in an inappropriate work environment, in this study we focus on verifying the environmental requirements for lighting, noise, temperature, and humidity, as they are fundamental conditions for comfort and safety in the work environment.

OBJECTIVES

To verify the compliance and noncompliance with health legislation in a SPD regarding the following environmental variables: temperature, noise, humidity, and lighting.

METHOD

This is an analytical observational study carried out from October to November 2017 at a regional hospital in a small city of the state of Piauí, Brazil, located about 310 kilometers from the capital Teresina. This facility was chosen because it is a reference unit for the macroregion, with the provision of services concerning clinical and surgical conditions of patients from several surrounding municipalities, in addition to being a teaching hospital, with a team composed of professionals from various backgrounds and specialties. Among the support areas that constitute the institution's organizational structure, the SPD was the sector chosen for the research.

The institution's SPD is classified as type II, is directly connected to the operating room, and has a team of six nurses and 15 nursing technicians, who take turns on shifts of one nurse and three nursing technicians per 12-hour shifts. It consists of the following units: reception and cleaning, preparation and packaging, sterilization (containing an autoclave), and storage and distribution of hospital items. The entire sterilization process takes place using moist heat in an autoclave, with high temperatures, and an average of 40 sterilization cycles are carried out per day to meet the demands of the hospital's consumer units. It should be noted that there are no thermal washer-disinfectors or other equipment that are a heat source other than the autoclave.

Data collection was carried out during the month of October 2017, by a checklist containing the items lighting, noise, temperature, and humidity, in the morning and afternoon shifts, on days previously established as appropriate for the researcher's reception in the sector. Three observations were carried out (observation 1: afternoon shift; observation 2: afternoon shift; and observation 3: morning shift), and the intervals between these were two days from the first to the second and six days from the second to the third. Considering that it was an odd number of visits, the chances of collecting repetitive data were lower and, thus, the authors intended to improve data fidelity.

The following equipment was used to assess environmental variables: measuring tape graduated in centimeters to measure the size of the physical space; the Incoterm digital sound level meter, model TDEC100C, to measure the noise level; and a Multifunction Environment Meter 4IN1 to quantify lighting, temperature, and humidity

parameters. It should be noted that all equipment is certified by the National Institute of Metrology, Standardization and Industrial Quality (*Instituto Nacional de Metrologia, Qualidade e Tecnologia* – INMETRO). It is worth noting that all equipment was used according to the manufacturer's instructions.

After collection, the data related to environmental risks were organized in a table, and the simple averages of the three observations carried out for each area were consecutively estimated (Table 1). In compliance with the legal regulations of the research, and considering that there was no collection directly carried out with human beings, this study obtained institutional authorization to be performed by the legal representative of the health facility.

RESULTS

We analyzed the following parameters: temperature, noise, humidity, and lighting. All of them were observed in the different areas of the SPD: reception and cleaning area; packaging and sterilization area; and storage and distribution area.

Regarding temperature, we observed that all areas have a higher temperature than recommended, as the measured averages were: 34.2°C in the storage and distribution area; 33.0°C in the reception and cleaning area; and 33.3°C in the material packaging and distribution area.

Regarding noise in the SPD, we observed that none of the three areas are in accordance with what is recommended by the Brazilian Ministry of Health (*Ministério da Saúde* – MS), considering that the minimum measured average value was 57.8 dB and the maximum was 60.8 dB. This maximum value can be explained by the fact that, in the packaging and sterilization area, noise varies according to the operation of machines and, therefore, at times of greater productivity, noise levels are higher.

As for humidity, only the reception and cleaning area was in accordance with MS standards, with an average of 36.2%. The other evaluated areas were in noncompliance, as humidity above 40% should be maintained in these areas.

The MS recommends approximately 80 lux of lighting as ideal for the three areas of the SPD; and, according to the collected data, none of the areas reached this parameter, all with lighting lower than expected. The storage and distribution area is the least luminous (average of 53.1 lux), whereas the reception and cleaning area, despite not meeting the ideal standards, is the most luminous (average of 62 lux). It is noteworthy that we observed the presence of natural lighting only in the environment intended for the preparation of materials (packaging and sterilization).

DISCUSSION

The temperatures found in the SPD work areas do not comply with what is considered satisfactory, considering that in

Table 1. Description of the environmental variables (temperature, noise, humidity, and lighting) of the Sterile Processing Department. Picos (state of Piauí), Brazil, 2017.

Variable	Area	1st observation	2nd observation	3rd observation	Average
Temperature (°C)	1	33.4	33.1	32.6	33.0
	2	33.8	33.6	32.6	33.3
	3	34.1	34.7	33.8	34.2
Noise (dB)	1	57.1	59.4	60.3	58.9
	2	58.8	59.8	64.2	60.8
	3	56.9	55.6	60.8	57.8
Humidity (%)	1	36.2	35.0	37.4	36.2
	2	33.9	36.7	35.8	35.5
	3	35.6	32.4	35.0	34.3
Lighting (lux)	1	62.3	60.6	63.2	62.0
	2	56	54.0	62.1	57.4
	3	53	52.4	54.0	53.1

Caption: area 1: reception and cleaning; area 2: packaging and sterilization; area 3: storage and distribution.
Source: Research data.

all areas a temperature above the standards required by the MS (between 18°C and 25°C) was verified, which may compromise the comfort and health of workers — which, indirectly, may reduce productivity[3].

According to a study conducted in California (USA)[6], exposure to high temperatures may increase the risk of injury to workers and there is evidence that excessive heat may favor the proliferation of microorganisms and thus compromise the quality of sterilized items; therefore, the reduction of heat sources in the sterilization and storage areas must occur, by using powerful exhaust fans and air conditioning with a filtration system, thus generating a more comfortable and safe environment[7].

According to the standards recommended by the MS[3], windows must be high and closed when temperature is maintained by air conditioning; when opened, they must be high and protected with nylon. Even in sterilization areas, where there are machines that generate heat, this temperature must be maintained (between 18°C and 25°C)[8].

Regarding noise, authors of a study conducted at two reference hospitals located in the city of Caruaru (state of Pernambuco, Brazil) showed that, among the risks perceived by SPD professionals, exposure to noise is present in 89.2% of workers, only second to the risk of fire (91.9%). Moreover, the researchers observed that noises can cause hearing loss, stress, sleep disorder, and frequent headache[9].

Authors of another study conducted at the SPD of a large, philanthropic hospital located in the city of São Paulo (state of São Paulo, Brazil) verified, in their results, that the areas of autoclave sterilization (92.3 dB), low-temperature sterilization (91.6 dB), cleaning (93 dB), and instrument preparation (91.5 dB) had intense noises[10].

Excessive noise on a permanent basis can cause disorders such as significant changes in mood and in the ability to concentrate on actions performed by human beings. The Brazilian National Standards Organization[11] allows sound pressure levels between 30 dB and 50 dB in hospital environments. Taking this into consideration, some simple and urgent measures must be implemented, such as: keeping the door of the material preparation area closed, carrying out frequent rotations on employees' work shifts and advising them on the importance of using hearing protection, clarifying the physical and psychological effects that exposure to high sound pressure levels can cause, and lowering the sound level of the doorbell present at the place[12,13].

The relative humidity of the air is of great importance for the SPD, as humidity lower than 30% can have consequences for the professionals' health such as allergic and respiratory complications due to dry mucous membranes, nosebleeds, dry skin, fatigue, and eye irritation[14].

Conversely, high humidity (>60%) can increase the chances of contamination of processed materials with fungi and bacteria, given the possible damage to the sterile barrier (packaging) and, consequently, contaminate the products after sterilization[15].

In this study, we verified humidity between >30% and <40% in all areas of the SPD, which is acceptable for the reception and cleaning area. However, the packaging and sterilization and storage and distribution areas require humidity above 40%, as recommended by the MS[3].

Inadequate lighting in the work environment causes harm to the workers' health. There is evidence that this factor can affect both the employees' health and performance of tasks; in addition to interfering with their productivity, it can also cause work accidents. The work environment must be a place that brings comfort and safety, in such a way that the user can feel and perceive it, considering that an environment that provides this may be able to eliminate potential stress factors[16,17].

The color of the light also affects productivity, reducing efficiency between 40% and 60% when using warm light lamps compared with the use of cold light lamps. Although poor lighting (below 60 lux or above 500 lux) does not cause permanent damage to vision, it can cause a certain degree of tiredness, irritation, and even tearing. Both the excess and the lack of lighting can lead to visual discomfort, in addition to causing dry eyes[17,18].

Thus, according to our results, we verified poor lighting (<60 lux) for most areas, with the exception of the reception and cleaning area, which had an average of 62 lux. These numbers evidence that this SPD has low levels of lighting, which may cause some discomfort to professionals who work in this environment: insomnia, malaise, headache, among others, in addition to affecting the workload and thus compromising productivity[18].

Therefore, an inadequate work environment, in addition to producing physical, mental, and psychological consequences for the worker, affects its public — and in the case of health, it directly interferes with patient safety. Thus, valuing the quality of life of professionals by improving the

work environment is imperative to guarantee the health of those involved.

CONCLUSION

When analyzing the environmental variables in a SPD, we observed that all areas have temperature values above the recommended, noises in all sectors are in noncompliance with the standards, lighting is inadequate to carry out daily tasks, and humidity is partially within the required standards, considering that only one of the three areas (reception and cleaning) achieved the expected result. It should be noted that the limitation of this study is that only three observations were carried out in a single unit, which prevents data generalization.

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None.

CONFLICT OF INTERESTS

The authors declare no conflict of interests.

AUTHORS' CONTRIBUTIONS

CPLN: Project Management, Data Curation, Research, Methodology. VSA: Data Curation, Research, Methodology. LLA: Writing – original draft, Research, Methodology. FGFP: Project Management, Data Curation, Writing – review & editing.

REFERENCES

1. Alves WC, Silveira RS. The importance of the safety of nursing workers in the work environment in the prevention of occupational risks. Res Soc Dev. 2022; 11(5): e5711527811. http://dx.doi.org/10.33448/rsd-v11i5.27811

2. Silva JPC, Ferreira LS, Almeida BLF. Os impactos das atuais condições de trabalho na saúde do trabalhador: o trabalho sob a nova organização e o adoecimento dos trabalhadores e das trabalhadoras atendidos no Cerest/JP. Braz J Dev. 2019;5(11):23206-20. https://doi.org/10.34117/bjdv5n11-042

3. Brasil. Ministério da Saúde. Agência Nacional de Vigilância Sanitária. Resolução nº 15, de 15 de março de 2012. Dispõe sobre requisitos de boas práticas para o processamento de produtos para saúde e outras providências. Brasília: Diário Oficial da União; 2012.

4. Paulino VC, Araujo BRR, Chaves BJP, Sales MLXF, Soares NSCS, Souza SVO, et al. Worker's health in a material and sterilization center: an integrative review. International Journal of Development Research. 2021;11(9):50572-75. https://doi.org/10.37118/ijdr.22909.09.2021.

5. Miranda AR, Pinheiro MG, Silva ER. O processo de trabalho no centro de material e esterilização: percepção da equipe de enfermagem. Revista Recien. 2019;9(27):33-45. https://doi.org/10.24276/rrecien2358-3088.2019.9.27.33-45

6. Park RJ, Pankratz N, Behrer AP. Temperature, workplace safety, and labor market inequality [Internet]. Germany: Institute of Labor Economics; 2021 [cited on Feb. 10, 2023]. Available from: https://docs.iza.org/dp14560.pdf

7. Freire EMR, Martinez MR. Diagnóstico situacional: ferramenta de auxílio em gestão da qualidade. Rev Enferm UFPE. 2014;8(5):1405-12. https://doi.org/10.5205/reuol.5863-50531-1-ED.0805201440

8. Associação Brasileira de Enfermeiros de Centro Cirúrgico, Recuperação Anestésica e Centro de Material e Esterilização. Diretrizes de práticas em enfermagem perioperatória e processamento de produtos para saúde. 8ª ed. São Paulo: SOBECC; 2021.

9. Aquino JM, Barros LP, Brito SA, Ferreira EB, Medeiros SEG, Santos ER. Centro de material e esterilização: acidentes de trabalho e riscos ocupacionais. Rev SOBECC. 2014;19(3):148-54. http://dx.doi.org/10.4322/sobecc.2014.023

10. Gatti YAM, Sousa CS, Acunã AA, Ferreira ER, Montes KM. Noise intensity and raising awareness of the nursing team at the materials and sterilization center. Rev SOBECC. 2020;25(4):197-203. https://doi.org/10.5327/Z1414-4425202000040002

11. Associação Brasileira de Normas Técnicas. Norma brasileira. ABNT NBR 10152 de 2017 versão corrigida de 2020. Acústica — níveis de pressão sonora em ambientes internos a edificações [Internet]. Rio de Janeiro: ABNT; 2020 [cited on Feb. 10, 2023]. Available from: http://www2.uesb.br/biblioteca/wp-content/uploads/2022/03/ABNT-NBR10152-AC%C3%9ASTICA-N%C3%8DVEIS-DE-PRESS%C3%83O-SONORA-EM-AMBIENTES-INTERNOS-E-EDIFICA%C3%87%C3%95ES.pdf

12. Passos PS, Fiorini AC. Perception and effects of noise in employees of a university hospital. Res Soc Dev. 2022;11(2):e51211225998. https://doi.org/10.33448/rsd-v11i2.25998

13. Guerra LP, Andrade LMV, Joner DC, Strozzi D. Home measures against low air humidity which may alleviate health problems. Einstein (São Paulo). 2021;19:eAO5484. https://doi.org/10.31744/einstein_journal/2021AO5484

14. Carvalho AA, Girondi JBR, Sebold LF, Amante LN, Alvarez AG, Waterkemper R. Melhores práticas de reprocessamento de produtos para saúde. Revista SOBECC. 2021;26(4):238-45. https://doi.org/10.5327/Z1414-4425202100040007

15. Lazari TA, Silva DA, Cardoso DAS, Soares WGP, Martinez GLF. The quality of lighting in the hospital work environment as a factor in the performance of health professionals. Braz J of Bus. 2021;3(4):3362-9. https://doi.org/10.34140/bjbv3n4-039

16. Lima AVP, Noda L, Souza JF, Leder SM. O impacto das janelas na percepção visual em ambientes de escritórios no clima tropical quente e úmido. Ambient Constr. 2022;22(4):137-54. http://dx.doi.org/10.1590/s1678-86212022000400632

17. Silva LMM. Iluminação no ambiente de trabalho visando o conforto ambiental. Rev Especialize On-line IOPG. 2016;12(1):1-15.

18. Associação Brasileira de Normas Técnicas. Norma brasileira. ABNT NBR ISO/IEC 8995-1 de 2013: Iluminação de ambientes de trabalho [Internet]. Rio de Janeiro: ABNT; 2013. [cited on Jan. 15, 2023]. Available from: http://paginapessoal.utfpr.edu.br/vilmair/instalacoes-prediais-1/normas-e-tabelas-de-dimensionamento/NBRISO_CIE8995-1.pdf/view