

Staff and patient perceptions of noise in SA hospitals – a pilot study

CA van Reenen

Council for Scientific and Industrial Research (CSIR), Built Environment Unit, Pretoria, South Africa

Correspondence: Ms Coralie van Reenen, CSIR, PO Box 395, Pretoria, 0001, South Africa.
e-mail: cvreenen@csir.co.za

ABSTRACT

Background: Noise in hospitals can negatively affect users. Guideline noise levels for hospital wards are stipulated by the World Health Organization (WHO) and a South African National Standard (SANS). Studies show that few hospitals comply with the guidelines but limited research in South Africa means that conditions in local hospitals are unknown. The objective of this pilot study was to compare measured noise levels with guideline and perceived noise levels in general hospital wards.

Methods: Measured and perceived noise levels were assessed, using data obtained from sound level meter readings and questionnaires, respectively, in four hospitals.

Results: None of the hospitals complied with the guidelines, with an average $L_{eq,24hr}$ of 53.4 dBA. Yet, most users did not perceive the environment to be excessively noisy. At two of the hospitals it emerged that noise is more disturbing for staff than for patients.

Conclusions: The results did not yield the predicted perceptions of noise in hospitals. Further research on a larger sample is required to confirm findings, particularly pertaining to the difference in perceptions between staff and patients.

Keywords: hospital noise, perceived noise, noise measurements, equipment noise

INTRODUCTION

Environmental noise can affect humans physiologically and psychosocially,¹⁻⁴ impacting negatively on health and work performance.² In a hospital context, noise can negatively influence patient and staff outcomes, such as patient recovery time and staff burn-out,³ and should be monitored and controlled.

The World Health Organization (WHO) recommends an equivalent continuous sound pressure level over a 24-hour period ($L_{eq,24hr}$) of not more than 30 dBA in hospital wards.² This is a commonly referenced guideline internationally. In South Africa, the South African National Standard, SANS 10103:2008,⁵ stipulates a level of 35 dBA in wards.

Few hospitals world-wide comply with the WHO recommendations.^{6,7} In South Africa, little research has been done regarding noise levels in hospitals. Findings show that neonatal intensive care units (ICUs) exceed

the guideline recommendation.^{8,9} However, no research in general ward spaces exists.

The objective of this pilot study was to compare measured noise levels with guideline levels, and with perceived noise levels, in general hospital wards in South Africa.

METHODS

Four hospitals (A, B, C and D) were randomly selected from 18 public and private general hospitals in the area for this study. All hospitals were in the City of Tshwane Metropolitan area. At each hospital, a multi-bed general ward with comparable caseloads and clinically similar patients was selected by convenience for the study.

Ward noise levels were measured over a 48-hour period, using a Class 1 integrating sound level meter, suspended above head height in the centre of the room. Using these measurements, the typical $L_{eq,24hr}$, as well as the daytime ($L_{eq,day}$) and night-time ($L_{eq,night}$) levels were calculated for each site.

Perceived noise levels and sources were determined through questionnaires. Approximately 100 patients (± 60) and nursing staff on 12-hour shifts (± 40) in the wards were asked to participate. Staff, such as doctors, spending short, non-continuous periods in the ward, were excluded. Eighty-three questionnaires were collected (33 staff members and 50 patients). Participants' opinions

Table 1. Equivalent continuous sound pressure levels (L_{eq})

Hospital	24-hour L_{eq} (dBA)	Night-time L_{eq} (dBA)	Daytime L_{eq} (dBA)
A	49.4	38.0	51.6
B	53.7	44.4	55.7
C	56.8	52.1	58.1
D	53.9	49.6	54.9
Average	53.4	46.0	55.1

of the noise level were categorised as 'Not too noisy' or 'Too noisy'. Perceived noise sources were categorised as 'Not disturbing' or 'Disturbing'.

Consent from each hospital and the CSIR Research Ethics Committee was obtained and all individual participants completed the questionnaire voluntarily. The data were analysed for significant associations using Fisher's exact test and Pearson's chi-square test.

RESULTS

Measured noise levels

The $L_{eq,24hr}$, $L_{eq,night}$ and $L_{eq,day}$ levels for each site are recorded in Table 1. Levels were similar in all four wards, with the $L_{eq,24hr}$ levels ranging from 49.4 dBA to 56.8 dBA, which is above the WHO and SANS 10103 recommendations. Even the lowest $L_{eq,night}$ value was above the recommended level.

Perceived noise

Considering the combined sites, the distribution of opinions did not reflect the measured noise levels, as would have been expected, with most participants (63) responding 'Not too noisy'. However, there was a significant difference ($p = 0.0001$) in the opinion distribution per site, indicating possible presence of site-specific factors.

Collectively, there was a significant association ($p = 0.004$) between the user category (staff or patient) and the perceived noise, with more staff members responding 'Too noisy' than expected. The staff-patient distribution of opinions at hospitals C and D showed no significant association between perceived noise and the user category. However, there was a significant association at hospitals A ($p = 0.009$) and B ($p = 0.044$), with more staff members responding 'Too noisy' than expected.

The most frequent 'Disturbing' sources were medical equipment and alarms, and corridor traffic, although only 37.5% and 34.4% of all participants found these disturbing, respectively. Amongst patients, the highest-ranked perceived sources were, first, medical equipment and alarms (17.8%) and, second, talking (14.3%). Amongst staff members, the highest-ranking sources were corridor traffic (61.2%), and medical equipment and alarms (68.1%).

DISCUSSION

This study was viewed as a test study for the necessity and methodology of future in-depth noise studies in South African hospitals with the ultimate goal of determining whether hospital design guidelines should change to improve the acoustic environment.

Although the noise levels in the selected hospitals exceeded the WHO and SANS 10103 guidelines,^{2,5} most users were not disturbed by environmental noise. This calls to question the origins, interpretation and applicability of the guidelines.



The WHO guidelines are set for the lowest critical health effect which, in hospital wards, is sleep disturbance². However, this pilot study highlights the possibility that patients in general wards are not as disturbed by noise as would be expected, while nurses seem to experience noise disturbance.

The reasons for staff-patient differences in noise perceptions were not investigated, although a possible cause could be the influence of medication or the period of exposure. There is a relationship between length of hospital stay and acoustic comfort.¹⁰ Staff, who are considered as long-term occupants, experience more noise-exposure than patients, who are short-term occupants.

The main noise sources identified (corridor traffic, medical equipment and alarms, and talking) are user-generated, rather than infrastructure-related. This is challenging to mitigate since it relates to daily activities, functions and behaviour. The SANS 10103 guideline value refers to buildings with services under normal operation but excludes noise produced by activities.⁵ Thus, the Standards does not effectively address noise in occupied spaces.



Limitations

The sample was small but sufficed for the purpose of this pilot study. The impact of noise disturbance on patients' and staff outcomes (such as recovery period and stress levels) was not assessed in this study, and the possible influence of gender, socio-economic background, age or medical condition on the perception of noise was not considered.

CONCLUSION AND RECOMMENDATIONS

Although the measured noise level in the selected wards was high, this was not evident in the user perception of noise. This highlights the need to critically assess the guidelines.

Staff and patients perceived noise differently, with staff experiencing greater disturbance. The most common sources of noise were user-generated noises.

Research on the impact of noise on hospital staff and patients in South Africa is limited in scope¹¹ and this study highlights the need for further investigation in terms of outcomes and appropriate working noise levels. These findings should be confirmed through further studies with a larger group. Noise mitigation in terms of design, behaviour and equipment should also be investigated.

ACKNOWLEDGEMENTS

The following persons are gratefully acknowledged for their assistance in the field research, research guidance and statistical analysis: Prof. PT Vosloo, Dr PJ van Staden, Joyce Jordaan, Sheldon Bole, Claire du Trevou, Nsindiso Hlatshwayo, and Mokete Mokete. The funding and support of the CSIR is acknowledged.

DECLARATION

There are no conflicts of interest in this research.

LESSONS LEARNED

- Noise may have more impact on staff than patients in a hospital ward environment
- Measured noise levels do not necessarily reflect the noise perceived by individuals
- User-generated noise (equipment, traffic, talking) is a major contributor to noise in hospital wards

REFERENCES

1. Seideman MD, Starndrin RT. Noise and quality of life. *Int J Environ Res Publ Health*. 2010; 7(10):3730-3738.
2. Berglund D, Lindvall T, Schwella D. *Guideline for community noise*. Geneva: WHO;1999.
3. Basner M, Babisch A, Brink M, Clark C, Janssen S, Stansfeld S. Auditory and non-auditory effects of noise on health. *Lancet*. 2013; 6736(13):1-8.
4. Pohl J. *Building Science concepts and applications West Sussex*: Wiley; 2011.
5. South African National Standards. SANS 10103. The measurement and rating of environmental noise with respect to annoyance and to speech communication; 2008. Available at <https://www.sabs.co.za/Standard-Sales/> (accessed 19 Jan 2015).
6. Busch-Vishniac I, West J, Barnhill C, Hunter T, Orellana D, Chivukula R. Noise levels in Johns Hopkins Hospital. *J Acoust Soc Am*. 2005; 118(6):3629-3645.
7. MacKenzie DJ, Galbrun L. Noise levels and noise sources in acute care hospital wards. *Build Serv Eng Res Technol*. 2007; 28(2):117-131.
8. Nathan LM, Tuomi SK, Muller AMU, Kirsten GF. Noise levels in a neonatal intensive care unit in the Cape metropole. *SAJCH*. 2008; 2(2):50-53.
9. George K, Khoza-Shangase K, Neille J. A study investigating sound sources and noise levels in neonatal intensive care units. *SAJCH*. 2014; 8(1):6-10.
10. De Giulì V, Zecchin R, Salmaso L, Corain L, De Carli M. Measured and perceived indoor environmental quality: Padua Hospital case study. *Build Environ*. 2013; 59:211-226.
11. Folsher LL, Goldstein LN, Wells M, Rees D. Emergency department noise: mental activation or mental stress? *Emerg Med J*. 2015; 32(6):468-473.