

Noise Pollution on Wards in Iringa Regional Hospital, Tanzania

Anna A. Moshi, Kulwa M. Philimoni and Stelyus L. Mkoma

Department of Physical Sciences, Faculty of Science,
Sokoine University of Agriculture (SUA), P.O. Box 3038, Morogoro, Tanzania

Abstract: High levels of noise in hospitals may interfere with patient care services, the doctor-patient relationship and medical education activities. This study aimed to assess the noise level on wards in Iringa regional hospital and identify the noise sources. Sound levels were recorded in all wards in the hospital using a Digital Sound Level Meter. The measured mean equivalent sound pressure levels (L_{Aeq}) and standard deviation were 57.49 ± 2.87 dBA, 59.00 ± 1.04 dBA and 58.56 ± 1.71 dBA during the morning, afternoon and the evening measurements respectively. The highest mean L_{Aeq} (63.39 dBA) and maximum (71.43 dBA) noise level during measurement time was observed in paediatric ward and the lowest mean L_{Aeq} (56.05 dBA) and minimum readings (50.29 dBA) in the Tuberculosis ward. These observed noise levels exceeded the recommended Tanzania Bureau of Standards (30-40dBA) and World Health Organisation (30-40dBA) guidelines for hospitals. This study conclude that there is noise pollution problem in Iringa regional hospital and the important contributor to baseline noise levels in wards are conversations of patients and nurses, overcrowding of patient's relatives, television and screaming of children. The peak noises were contributed to other sources, such as bin lids slamming and emotional outbursts. However, is should be noted that noise was not perceived as the main cause of discomfort by patients. The study recommend that there is a need for noise monitoring for an optimal hospital environment and the study of the influence of noise on the quality of care and the performance of staff is needed.

Key words: Hospital environment • Noise level • Noise Pattern • Source

INTRODUCTION

Noise being a major component of dynamic space, is one of the most invasive aspects of the hospital environment. Patients and their families are exposed to sounds overheard through walls and curtains. Conversations among patients, staff and visitors, sounds of doors and phones make up the "sound environment" which is a risk to healthcare. Whether by accident or incident, the accumulation of noise and unwanted distraction adds up to a negative physiological and psychological healthcare experience and also affects patients' performance especially on their sleep quality [1]. Noise pollution can cause annoyance and aggression, hypertension and high stress levels. High noise level can contribute to cardiovascular effects and exposure to moderately high levels during a single eight hour period causes a statistical rise in blood pressure and increase in stress and vasoconstriction [2].

Environmental noise present in hospitals all over the world is a common stressor and is recognized as a serious health hazard and not just as a nuisance. The World Health Organization has drawn up guidelines to promote a community noise management plan and to reduce the effects of noise exposure on health. According to these guidelines, the recommended noise levels in hospital areas should be 35-40 dBA in the daytime and 30-40 dBA in the evening and the acceptable noise levels in indoor spaces (dwellings) are set to 35 dB, whereas limits are set to 30 dBA for bedrooms to avoid sleep disturbances [3].

In most of the developing countries, indoor noise pollution can be remarkably different from that of developed countries due to difference in economic and development status which eventually lead to unique sources and features of indoor noise pollution in these countries. In Tanzania, noise level measures have been taken on various environment [4,5] and unfortunately, there is less attention given to noise pollution in hospital

Corresponding Author: Stelyus L. Mkoma, Department of Physical Sciences,
Faculty of Science, Sokoine University of Agriculture (SUA), P.O. Box 3038, Morogoro, Tanzania,
Tel: +255 23 260 3404, E-mail: stelyusm@gmail.com or mkoma@suanet.ac.tz.

environments. The present study was undertaken to assess noise levels, pattern and sources on wards in Iringa regional hospital.

MATERIALS AND METHODS

The study was conducted at a 365 bedded regional hospital with a bed occupancy rate of 95% and a daily attendance of about 200 outpatients. The hospital is located on the main road in the heart of Iringa municipal (113,300 inhabitants), adjacent to the Iringa market, Iringa regional court, Police central station, Iringa prison and prison quarters. The working personnel on wards and departments were informed about the study by the regional medical officer, but no special order was given regarding noise caution. Also the study was conducted after the approval of the research protocol by Sokoine University of Agriculture (SUA), Urban Iringa district authorities and hospital management. Sound levels in 13 places inside the hospital were recorded using a Digital Sound Level Meter. The readings are in Decibel, A-weighted (dBA) units representing the sound level measured with the A-weighting network on the sound level meter. This instrument incorporates a type-1 microphone and records sound ranging from 50 to 110 dBA with a sensitivity index of ± 0.5 dBA. Fast impulse mode was used to record the readings. For measurement, the sound meter was placed at body level, at least 1.0m from walls and about 1.5m from the windows. A total of 7 readings in one day were taken at two hours intervals between successive recordings. Observations were done in one week (Monday to Sunday) during the morning

hours between 06:00 and 11:00 hours, in the afternoon hours between 12:00 and 15:00 and in the evening hours between 16:00 and 19:00 hours. The parameter universally used in the discussion of noise pollution is the equivalent continuous noise level (L_{Aeq}) expressed in dB(A), which is the mean rate at which energy is received by the human ear during the period monitored. The other variables obtained were the maximum (L_{max}) and minimum (L_{min}) noise levels recorded at each place.

RESULTS AND DISCUSSION

Sound Levels on Wards: Table 1 shows mean equivalent continuous noise level, minimum and maximum reading for individual wards, reception and mortuary during the measurement periods. Overall, on all monitored wards the mean equivalent sound pressure levels (L_{Aeq}) were 57.49 ± 2.87 dBA, 59.00 ± 1.04 dBA and 58.56 ± 1.71 dBA during the morning, afternoon and the evening measurements respectively.

The highest mean L_{Aeq} (63.39 dBA) and maximum (71.43 dBA) noise level during all measurement time was observed in paediatric ward during afternoon measurement and the lowest mean L_{Aeq} of 56.05 dBA in the morning measurement and minimum readings of 50.29 dBA during the afternoon measurement was observed in the Tuberculosis ward (in this case mortuary is not considered as a ward). The emotional outbursts of the children and activities of mothers, nurses' activities and ward cleaners might have contributed to the observed noise level on paediatric ward. Another reason for the high levels of noise in paediatric ward is its location near

Table 1: Mean and standard deviation, minimum and maximum values (dBA) of noise levels on wards and other areas in Iringa regional hospital

Places	Morning (0600-1100hrs)				Afternoon (1200-1500 hours)				Evening (1600-1900 hours)			
	L_{Aeq}	SD	Min	Max	L_{Aeq}	SD	Min	Max	L_{Aeq}	SD	Min	Max
Reception	58.67	4.22	50.90	66.43	61.71	0.81	51.64	71.14	59.68	2.58	50.93	68.43
Prenatal Ward	56.90	2.83	50.62	63.19	61.32	0.15	51.36	71.29	61.18	0.45	51.93	70.21
Postnatal Ward	58.19	3.61	51.10	65.29	59.25	1.67	51.14	67.36	59.43	4.04	51.29	67.57
Labour Ward	56.19	2.00	50.95	61.43	57.43	1.92	51.21	63.64	57.96	0.45	51.64	64.29
Male Surgery Ward	57.62	3.80	50.81	64.43	59.14	3.43	50.79	67.50	59.00	1.72	51.57	66.43
Male Medicine Ward	56.45	2.60	51.05	61.86	57.57	1.11	51.14	64.00	57.11	1.97	51.07	63.14
Paediatric ward	61.62	2.57	51.57	71.67	63.39	1.67	52.00	71.43	61.25	3.18	52.29	70.43
Female Surgery ward	57.90	2.52	51.05	64.76	59.00	1.11	51.14	66.86	58.39	2.47	51.00	65.79
Female Medicine Ward	56.07	2.55	50.81	61.33	58.79	0.71	50.93	66.64	58.25	1.26	51.43	65.07
Intensive Care Unit	56.24	1.99	50.76	61.71	57.68	0.05	51.07	64.29	58.43	1.41	50.86	66.00
Tuberculosis	56.05	2.75	50.57	61.52	57.00	0.30	50.29	63.00	56.68	0.66	50.43	62.43
Gynecology Ward	59.38	2.82	52.14	66.62	60.21	0.51	51.79	68.64	60.86	1.31	53.21	68.50
Mortuary	56.05	3.07	50.71	61.38	54.46	0.05	51.00	58.64	53.11	0.76	50.93	55.79
ALL	57.49	2.87	51.00	63.97	59.00	1.04	51.19	66.49	58.56	1.71	51.43	65.70

SD, Standard deviation

Table 2: The mean L_{Aeq} (dBA) measurements for each ward and their confidence intervals

Places	L_{Aeq}	SE	95% CI lower	95% CI Upper
Reception	60.02	0.56	60.02	61.14
Prenatal Ward	59.80	0.23	59.57	60.03
Postnatal Ward	58.96	0.62	58.34	59.58
Labour Ward	57.19	0.29	56.9	57.48
Male Surgery Ward	58.59	0.59	58.00	59.18
Male Medicine Ward	57.04	0.43	56.61	57.47
Paediatric ward	62.09	0.40	61.13	61.93
Female Surgery ward	58.43	0.30	58.13	58.73
Female Medicine Ward	57.7	0.23	57.47	57.93
Intensive Care Unit	57.45	0.37	57.08	57.82
Tuberculosis	56.58	0.25	56.33	56.83
Gynecology Ward	60.15	0.31	59.84	60.46
Mortuary	54.54	0.26	54.28	54.80
ALL	58.35	0.37	57.98	58.72

Table 3: Mean L_{Aeq} (dBA) for each time period

Time	L_{Aeq}	SE	95% CI lower	95% CI Upper
Morning	57.49	0.57	56.92	58.06
Afternoon	59.00	0.21	58.79	59.21
Evening	58.56	0.34	58.22	58.59

Morning-time, the readings were taken between 06.00 – 11.00; Afternoon-time, the readings were taken between 12.00 – 15.00; and Evening-time, the readings were taken between 16.00 – 19.00.

the entrance corridor and on road side. This high noise level could slow down the recovery of sick children [6] and might contribute to undesirable physiological and behavioural effects on the children admitted [7]. The lowest noise level observed in the Tuberculosis ward was due to restricted entrance to visitors. It should be noted that reception and mortuary at some measurements time showed high and low noise levels respectively. The high noise levels observed at the reception were due to conversation of the heavy inflow of patients especially during the afternoon measurement and television sound. The lowest levels observed in the mortuary was because the area is mostly deserted and is located at the far end of the hospital away from wards and road way. Also most of times there were no activities and therefore no noise from the emotional outbursts of the relatives of the deceased.

The permissible noise limits in any building used as hospital as recommended by Tanzania Bureau of Standards (TBS) is 45 dBA during the daytime and 35 dBA during the night [8]. The World Health Organisation (WHO) guidelines state that, on hospital wards, noise levels should not exceed 35-40 dBA during the daytime and 30-40 dBA in the evening [3]. In the present study, the mean equivalent noise levels observed on wards exceeded the recommended TBS and WHO guidelines for hospitals. The major contributor to baseline noise levels on hospital wards were conversations of patients and nurses, television and screaming of children while peak

noises were consistently attributable to other sources, such as emotional outbursts and bin lids slamming.

The mean L_{Aeq} measurements for each ward and their confidence intervals show that Tuberculosis ward and the mortuary area tended to be the quietest while paediatric ward and the reception area the loudest (Table 2). It can also be observed in Table 3 that morning is the quiet time and the loudest time is the afternoon but there was some interaction whose magnitude of the difference between the measurements time varies by ward hence difference noise levels. The high turnover and incessant conversations of visitors overcrowding on wards during the morning and evening hours are the main contributor to the observed noise levels. However, traffic and ward activities during the afternoon hours are additional source of the increased noise levels at this time of the day.

Noise Pattern: The hourly patterns of noise revealed high noise levels in paediatric ward than in other wards for most of the measurement times (Figure 1). The results also shows that in all wards high noise levels during the day were observed during visitors time which are 06.00, 12.00 and 18.00 hours. The daily trends of L_{Aeq} mean values and standard deviation on wards are shown in Figure 2. Most wards show no clear trend of noise levels from Monday to Sunday, but somewhat high levels during all days were observed in paediatric ward and low noise levels in tuberculosis ward.

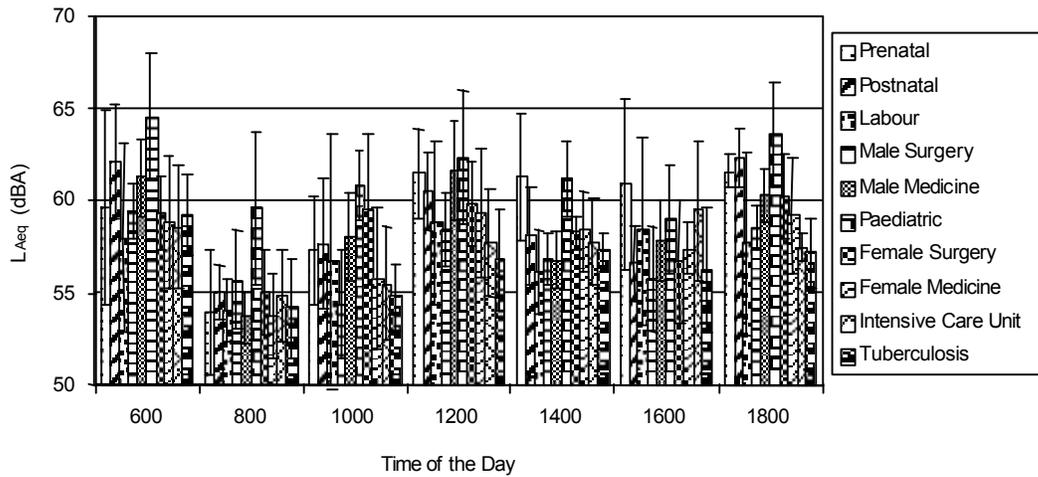


Fig. 1: Hourly mean and associated standard deviation (dBA) of noise levels on wards during the study period in Iringa regional hospital

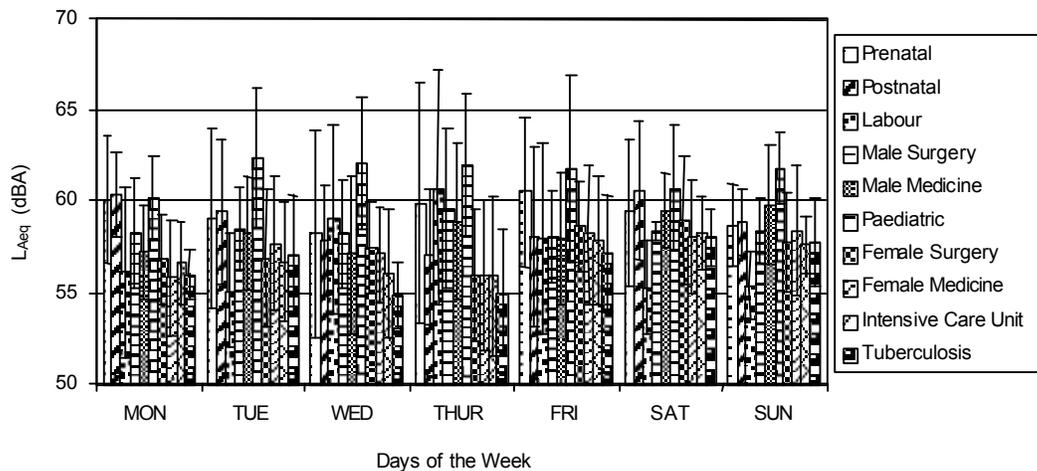


Fig. 2: Daily mean and associated standard deviation (dBA) of noise level on wards during the study period in Iringa regional hospital

Noise in a public hospital is unavoidable but at the same time, long-term noise exposure is regarded as a health hazard because it has deleterious physical and psychological effects [2]. Hospital patients require a congenial environment free from toxic levels of noise. The mean equivalent noise levels (L_{Aeq}) found in this study was similar to sound levels found elsewhere in other healthcare settings [7, 9-11]. However, small differences mostly reflected the disparities among countries in the working schedules, number of staff and ward architectural layouts. Therefore, our study adds information about the noise level status in Iringa regional hospital environment and highlights the need for implementation of noise reduction strategies. It should be noted that the physical status of wards [12], proper site location for hospitals,

municipal planning, traffic, equipment selection and maintenance are also necessary for the reduction of hospital noise.

CONCLUSION

This study shows that there is noise pollution problem on wards in Iringa regional hospital environment which can cause interferences with the doctor-patient relationship and patient care services. The measured noise levels were found to be higher than TBS and WHO acceptable limit on hospital buildings. It is observed in this study that conversations of patients and nurses, overcrowding of patient's relatives, television and screaming of children are important contributor to

baseline noise levels on wards. However, peak noises were contributed to other sources, such as bin lids slamming, emotional outbursts and mobile phones. Therefore, these results will be of help to planners and policy makers in the Iringa municipality and there is a need for regular noise monitoring so as to establish an optimal hospital environment.

ACKNOWLEDGEMENT

We thank the Sokoine University of Agriculture for granting special research fund for the first author. The authors also acknowledge the assistant and help in logistics of Dr. Oscar Gabone, Iringa regional medical officer and Dr. Mjemah, the Head, Department of Physical Sciences (SUA).

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