

# Effects of noise pollution on healthcare staff and patients

A White Paper by Megan Short and Andrew Pearson

## 1 Introduction

Hospitals, medical suites and aged care facilities are all subject to noise pollution. More and more research is appearing to demonstrate problem caused by noise, which include:

- high blood pressure and increased heart rate in workplaces,
- increased errors and staff attrition in hospitals, and
- a lack of speech privacy in professional offices and suites.

Noise pollution is also one of the risk factors for staff burnout and negative outcomes for patients.

Further, noise pollution affects healthcare facility compliance with privacy and work health & safety legislation and guidelines. While there are many options to reduce noise, the effectiveness of the method, safety and sustainability issues need to be considered for each space.

## 2 Sources of noise pollution

Noise pollution occurs when there is “unwanted or disturbing sound” – that is, when sound either interferes with normal activities or disrupts or diminishes one’s quality of life. Noise pollution can be external (from outside) or internal (from inside).

In the context of a healthcare facility, external noise includes traffic, deliveries and sirens. Internal noise can include ventilator noise and alarms, suctioning, heart monitor alarms, nebulizers, pulse oximeter tones and alarms, telephones ringing, air conditioning, television, radio, banging, rubbish bin or trolley noises, intercoms, staff bleeps, talking (staff, nurses), visitors, fellow-patients, and general activities.

These sources of noise pollution have varying impacts on patients. However, studies show that staff conversation and alarms seem to be the most disturbing noises when patients try to sleep.

## 3 Negative effects of noise pollution

### 3.1 *Staff Productivity & Errors*

Noise pollution increases the likelihood of mistakes and is one of the risk factors for staff burnout. In a noisy environment, directions can be misunderstood which increases dispensing errors. Further, distracting noise reduces staff concentration and disrupts cognitive functioning. Staff can also suffer the same stress and physiological changes that patients suffer – increased blood pressure and heart rate. All of these problems contribute to a reduction in staff productivity as well as staff and patient satisfaction.

### 3.2 *Patient Health, Wellbeing & Recovery*

When patients stay in hospitals or other healthcare facilities, they have an enhanced awareness of their surroundings. This means that the indoor environment quality is of

particular importance for inducing sleep, recovery and wellbeing. Noise pollution is a problem because it can adversely affect all of these elements.

It is well documented that noise can produce physiological changes. For example, studies in the intensive care unit (ICU) agree that patients exposed to noise pollution have decreased oxygen saturation (increasing need for oxygen support therapy), elevated blood pressure, increased heart and respiration rate, and worsened sleep. Further, there is strong evidence that noise increases stress in adult patients, heightening blood pressure and heart rate. The obvious problem, sleep loss, leads to slower recovery times and greater likelihood of readmission to hospital.

Another consideration is sleep medication. A Dutch study found that patients who used sleep medication for at least 5 days in hospital continued to use the medication at home, whereas those who did not use the medication in hospital did not use it at home.

### **3.3 Privacy considerations**

Another factor in patient comfort is privacy. Where patients feel that their medical information is private, they are more likely to disclose all relevant information to treating doctors or other health professionals. The converse is true, as per this 2001 study finding:

that 5 percent of the patients in curtained spaces reported they withheld portions of their medical history and refused parts of their physical examination because of lack of privacy.

While it may appear that noise pollution would increase patient privacy this is not the case. For example, the pollution itself is often the private conversation between staff or doctor and patient. It is therefore unsurprising that another study found 100 percent of doctors and health care workers committed confidentiality and privacy breaches in the ICU.

## **4 Legal considerations**

### **4.1 Privacy**

Each State and Territory in Australia has its own health records legislation governing the collection and storage of health information. For example, Victoria has the *Health Records Act 2001*, which requires that healthcare providers<sup>1</sup> protect the privacy of personal information. This includes when personal information is collected verbally, for example, when a patient checks in at reception or talks to a doctor during a consultation in a hospital room.

While noise pollution may not directly impact speech privacy, eliminating noise can lead to speech privacy problems, particularly in new or retrofitted sustainable buildings where

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<sup>1</sup> Personal information collected to provide services by any of the following falls within the scope of health privacy legislation: medical practitioners (general practitioners and specialists); dentists; mental health providers; allied health service providers; complementary health service providers; nursing services; private and public hospitals; community health centres; pharmacists dispensing drugs; day procedure centres; pathology services; supported residential services; aged care providers (including nursing homes and hostels, and other service providers); palliative care providers; disability service providers; and other organisations.

typically noise is reduced. It is therefore important that in any design considerations speech privacy and the health provider’s legal obligations are taken into account.

#### 4.2 Work Health & Safety

At the time of writing this paper, each State and Territory in Australia has its own occupational health and safety legislation. However, this legislation is about to change in favour of harmonised legislation, in line with the *Model Work Health & Safety (WHS) Act*.

For most States, this new legislation will mean increased obligations in respect of worker health and safety. The Model WHS Act requires businesses (including all healthcare facilities) to observe due diligence requirements. What this means in respect of noise pollution, is that healthcare facilities need to carefully consider noise as a factor in design.

#### 4.3 Australian Standards

Acoustic privacy is required in all healthcare facilities. Further, the Australian Standards recommend maximum noise levels in health buildings (listed in Table 1).

**Table 1:**

HEALTH BUILDINGS	Recommended design sound level dB(A)		Recommended Reverberation time
	Satisfactory	Maximum	
Type of occupancy/ activity			
Casualty Areas	40	45	0.4 to 0.6
Corridors & Lobbies	40	50	0.4 to 0.6
Consulting rooms	40	45	0.4 to 0.6
Wards	35	40	0.4 to 0.7
Waiting rooms, Reception areas	35	50	0.4 to 0.7

These values are a pipe dream in a typical hospital where the average sound level is 72dB during the day and 60dB overnight – a staggering 57dB more than the typical hospital in the 1960s. However, the recommendations can be met with the right design and materials.

### 5 Solving noise problems

#### 5.1 Acoustic principles

The acoustic ABC principles – “Absorb”, “Block” “Cover” – are a useful way to consider reducing noise pollution. For example, sound can be *absorbed* by acoustic panels, single rooms *block* more noise than curtained multi-patient rooms, and acoustic sound masking *covers* noise with ambient sound. If all three elements are incorporated into healthcare design, many of the problems of noise pollution will be reduced if not eliminated.

However, preventative measures like behaviour modification are just as important when addressing noise pollution.

## **5.2 Behaviour modification**

Modifying staff behaviour can have a positive impact in respect of noise pollution. Reducing noise pollution can be as easy as reducing PA paging or sending silent messages, training staff to converse quietly or closing doors before conversing.

Simple changes like wearing soft-soled shoes, replacing noisy materials with quiet materials – for example plastic rather than metal bins – and padding medical chart holders can all decrease noise. Similarly, turning off unnecessary alarms or at least answering all alarms quickly can reduce noise pollution and eliminate a major source of sleep loss and patient discomfort.

Staff training can also focus on awareness of noise – for example, encouraging an attitude where squeaky doors are noticed and fixed, unnecessary equipment is switched off and ring tones are set to vibrate. Some hospitals have a “quiet time” protocol where medication schedules are adjusted to avoid waking patients and noise monitoring devices like traffic lights alert staff when noise is too loud – encouraging them to speak softly at night.

## **5.3 Personal noise reduction or noise cancellation equipment in hospitals**

Provision of ear muffs, ear plugs and noise cancellation headphones can assist patients reduce the effects of noise. Studies conducted in respect of ear muff and ear plug use concluded that patient sleep improves in noisy hospital environments when such devices are used.

Recently, the authors supplied noise cancellation headphones to hospital patients who self-reported that distracting noises like snoring and low-frequency noises were significantly reduced, although this can only be considered anecdotal evidence.

## **5.4 Acoustic treatments**

Acoustic panels and other absorptive materials, door seals, low-reverb flooring and wall coverings can all assist in absorbing or blocking noise pollution. Similarly, eliminating or at least minimizing reflective surfaces can assist by ensuring that reverberation is minimized when noise does occur. In studies where high performance sound-absorbing ceiling tiles were used, patients slept better, were less stressed and reported greater satisfaction.

However, it is important that bacteria-resistant materials are used, as traditional sound absorption materials often fail to meet hospital requirements in respect of ease of cleaning, bacteria resistance and flammability.

## **5.5 Acoustic sound masking**

Acoustic sound masking is the “Cover” of the acoustic ABCs, and on its own can solve many of the noise pollution problems – a boon for cost effective retrofits. For example, a recent literature review found that sound masking has the most significant effect in promoting ICU patients’ sleep compared with acoustic absorbers, earplugs/earmuffs or behavioural modification.

There are additional advantages to acoustic sound masking, specifically energy efficiency and speech privacy. For example, an acoustic sound masking system typically uses a very low wattage, with some systems running through a whole hospital with the same amount of energy as one desktop PC.

Acoustic sound masking works by generating unobtrusive sound waves. This imperceptibly increases the level of background sound in the space, masking intrusive noise and ensuring that speech is private. The space itself appears quieter because intrusive sound and intelligible speech are masked. It is important to choose a sound masking system that is randomized so that the sound does not become distracting like white noise.

## 6 Conclusion

Noise pollution has quantifiable negative effects on healthcare staff and patient recovery, and can impact upon the legal obligations of healthcare facilities. However acoustic sound masking and other acoustic treatments can eliminate or ameliorate these problems in a sustainable and cost effective manner.

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