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Patient, Visitor and Staff Perception of Noise in an Intensive Care Unit

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Excellence in specialist and community healthcare
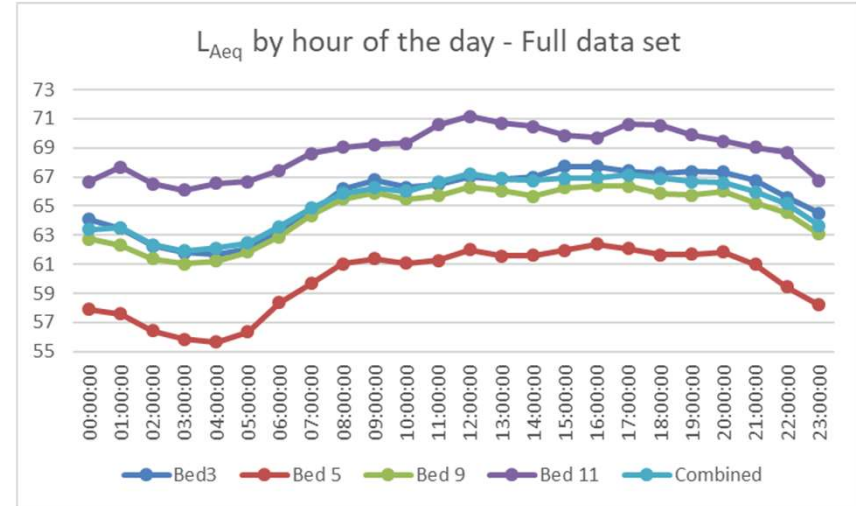
Measuring Sound

- Objective measures
  - Frequency measured in hertz (Hz) – perceived pitch
  - Amplitude measured in decibels (dB) – perceived loudness

- Measuring sound objectively, quantifies sound but does not describe the soundscape

- A soundscape is the auditory equivalent to a landscape[1]
  - Keynote sounds
  - Signals
  - Sound marks

Background

L$_{Aeq}$ by hour of the day - Full data set

World Health Organization

35 dBA   30 dBA   [2]

- Reality: Average L$_{Aeq}$ 65.4dBA[3]
- Increasing linearly by ≈0.4dBA per annum[4]
- Noise is concentrated at the head end of the bed[5]
- Communication is the greatest source of noise during the day and alarms are more prominent at night[6]
- Patients and visitors remember noise as a prominent and sometimes distressing feature of ICU[7-10]
- There are no studies that identify patient, visitor and staff perception of noise in an ICU

Aim
To understand patient, visitor and nursing staff perception of a general intensive care unit soundscape

Methods

- Structured sound diary
  - '*what they could hear*'
  - '*how that made them feel*'
  - '*the most reassuring, annoying and frightening sound*'

- 2-3 entries over 2-3 days to achieve at least six entries

- Patients were offered support to record their entries

- Data were analysed using quantitative and qualitative content analysis to identify the keynotes sounds, signals and sound marks
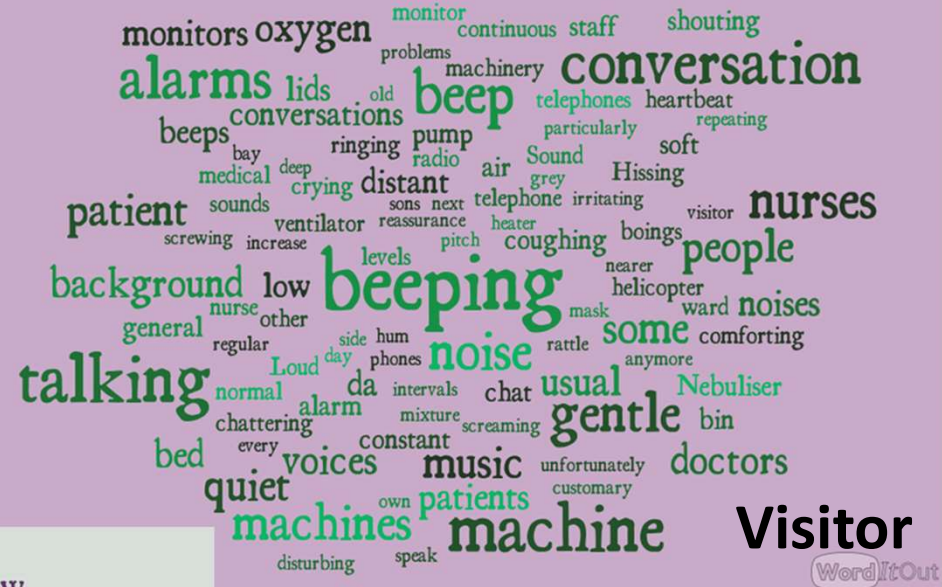
Results

- 29 diaries were completed
  - Patients (n=8)
  - Visitor (n=11)
  - Nurse (n=10)

- Entries varied in size, detail and number
  - Patient n=26
  - Visitor n=79
  - Staff n=56

Word clouds – 'What can you hear?'

Patient

Visitor

Staff

Patients – *'How did this make you feel?'*

- **The sound was generally acceptable to patients when it was seen to be necessary, quiet and reassuring:**

  'OK' (P4), *'unaffected'* (P6), *'reassured, confident, cared for'* (P2)

- **If the noise was not seen to be necessary or was seen to be excessive then patients described noise as:**

  'not pleasant, not nice' (P3), *' it makes you jumpy'*, *'unsettled'* (P7), *'irritable'* (P4)

- **Some phrases suggested the patients were unsettled by the noise:**

  'wondering what they are going to do to me' (P1)

- **If the noise was at night, such as when the cleaner moved chairs and emptied bins:**

  'annoyed, trying to sleep' (P4)

- **Or when a fire exit door by a patient's bed was used multiple times in the night:**

  'It woke me up and frightened me' (P1)

Patients – Reassured, Annoyed, Frightened

- **Reassured by nurses being there or a professional voice of reassurance (59%):**

  '*The voice of the nurse asking if I am OK*' (P5)   '*Nurse doing obs*' (P7)

- **Patients were also reassured by family presence or a quiet environment:**

  '*The voice of my mother*' (P5) and '*my wife*' (P8)

  '*When it's really silent on the ward and I know everything is OK*' (P1)

- **Annoyed by equipment:**

  '*Bin lids*' (P1 & 4)   '*Apron dispenser*' (P1,7 & 8)   '*A machine that goes da, da, da, la ,la*' [humidifier] (P3)

- **Frightening - most frequently associated with a patient in distress (29%):**

  '*Patient screaming*' P4   '*At night-time when I can hear a patient crying*' (P5)

- **Loud and sudden noise (17%):**

  '*I have heard one or two bangs, which makes me have flashbacks*' (P3)

Visitors – '*How did this make you feel?*'

- **Several visitors suggested that the familiar sounds of machinery provided a level of reassurance:**

    'A good level of background noise, whilst not being disruptive, was very calming, actually makes me feel peaceful' (V9)

    '*The normal sounds of the ICU - these are not particularly threatening or disturbing*' (V11)

    'Normal' 'Usual' 'Gentle' 'Fine' or *'Comforting*' (V2,5,9,11&13)

- **Nurses' voices or talking:**

    '*Reassuring' 'Comforting*' or '*Calm*' (V2,4,7,8 &12)   '*Lovely chat and reassurance from nurses*' (V7)

- **Familiarity:**

    'Usual mixture -fast becoming familiar unfortunately' (V11)   'Have a familiarity -which wasn't the case initially' (V7)

- **Visitors also described the sounds, often the same sounds, in a less positive way:**

    *'Irritable'   'Worried'   'Annoyed'   'D*isturbing' 'Scared'   'Anxious'

Visitors – Reassured, Annoyed, Frightened

- **Reassured by the nurses' or doctors' voices (41%):**

  'Background chatter from doctor/nurses, I am reassured that there are people around to help if needed' (V8)

- **Reassured by their loved one's voices (18%) or equipment sound (12.8%):**

  'Husband weakly being able to say a word to me' (V9)

  'Recognition in my father's voice of the fact that he knew we were here and had brought the dog' (V11)

  'The relaxing sound of my sons restful breathing with the nebuliser attached' (V6)   *'Heart monitor, it's very soothing (*V10)

- **Annoying sounds, were most likely the alarms (24%):**

  'The one that makes the da da da di da noise' [humidifier] (V11)   *'A high pitched alarm going on for ages'* (V10)

- **Frightening sounds related to patients perceived to be in distress either from human sound (14.7%) or alarms (14.7%) being triggered:**

  'The old gentleman's screams and [patients name] *alarm' (*V6)   *'Alarms from other patients'* (V8)

  'My sons heart monitor sounded an alarm which was a very frightening moment' (V13)

- **Other frightening sounds came from loud, unexpected noises:**

  'The fire alarm' (V9)   *'Helicopter landing -became very loud, very suddenly'* (V9)   *'A loud bang at one point- something fell/dropped elsewhere'* (V7)

Staff – 'How did this make you feel?'

- **Commenting on doctors speaking loudly at the desk at night:**

  '*Annoyed as keeping patients awake*' (NB5-1)

- **The act of being asked to complete a diary highlighted the issue of noise:**

  '*I feel that there is a possibility that this may be too noisy for unwell patients. However, the noise is due to work related patient care*' (NB5-2)

  '*Didn't notice aprons, trays and packets until I listened for it, however feed pump and pump alarms very loud and annoying*' (NB5-4)

- **Frustration when they can hear a monitor alarm in a bed space where staff are present:**

  '*Why does the nurse behind the curtains not do something about the alarm – frustrated*' (NB6-3)

  '*Irritated especially as I see the nurse pressing the mute button and not resolving the problem*' (NB7-1)

Staff – Reassured, Annoyed, Frightened

- **Nurses are reassured by similar sounds to visitors and patients:**

  '*Sound o*f [a] *nurses voice reassuring a patient when they were frightened*' (NB5-2)

  'H*earing conversation between a nursing colleague, the patient and relatives at the bed space next to my patient, everyone sounded happy'* (NB5-3)

- **They also describe as do visitors, the background sounds in the unit:**

  'Airflow through the ventilator is calming' (NB5-1)   '*Optiflow noise is very relaxing*' (NB6-1)   '*Sound of silence*' (NB5-4)

- **Nurses are generally annoyed by the noise related to the equipment alarms (57.7%)**

  '*IV pump*' (NB5-1, B5-3 & B7-1), '*Feeding pump*' (NB5-4, B6-2, B7-1)

- **Where noise impacts on their care:**

  '*The hissing of the Optiflow was very annoying, it is constant and very close to the patient and myself. I struggled to hear my patients voice over this noise and felt that I had to speak louder to be heard by the patient*' (NB5-3)

  '*Raised voices -doctors, MDT, not aggressively just the amount of voices all talking at the same time*' (NB6-2)

- **Nurses generally relate frightening sounds to patient related events:**

  '*Monitor alarms -red alarms e.g. on desaturation*'   (NB5-4) '*Asystole alarm of the monitor*' (NB6-1) *Ongoing ventilator alarms'* (NB6-4)

  '*Patient coughing violently*' (NB6-3)   '*Patient calling help me*' (NB7-1)

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Keynote sounds, signals and sound marks

- Keynote sounds - typified the space
  - Staff conversation
  - Mattress pump
  - Gaseous sounds - deliver the background 'hum' of the unit, these latter sounds are perhaps the unconscious sounds of the unit
- Signals -foreground sounds
  - Alarms in particular the cardiac monitor, the ventilator, fluid and syringe pumps
  - Patient noise
- Sound marks - described as culturally important sounds
  - Beeps of the monitor
  - Medical bleeps

Conclusions

- The diary was a successful means of identifying potential keynote sounds, signals and sound marks of an intensive care unit for use in a larger soundscape study

- Patients, nurses and visitors described similar sounds including conversation, equipment noise and alarms however these descriptions were subtly different

- Many sounds characterised in the literature as negative i.e. 'loud', identified by objective measures, may be reported as reassuring by patients, visitors and staff

- The context of the sound appears to be the main identifier as to whether a sound is described as reassuring, annoying or frightening

Any questions?

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