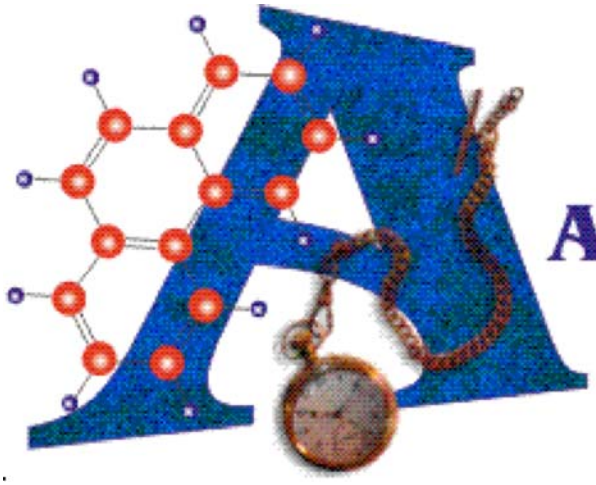


Anaesthesia On-Line ™

AUDIBLE MONITOR ALARM: FRIEND OR FOE?

Osinaike B. B. [1], Amanor-Boadu S. D.[2], Oyebamiji E.O.[1], Tanimowo A[1], Dairo M.D.[3]

1-Consultant/Lecturer , Department of Anaesthesia, Ladoke Akintola University Teaching Hospital, Osogbo, Osun State, Nigeria.

2 - Consultant/Lecturer, Department of Anaesthesia, University College Hospital, Ibadan, Oyo state, Nigeria.

3 – Consultant/Lecturer ,Department of Community Medicine, Ladoke Akintola University Teaching Hospital, Osogbo, Osun State, Nigeria.

Correspondence to: Dr Babatunde B. Osinaike

Department of Anaesthesia,

Ladoke Akintola University Teaching Hospital,

PMB 5000, Osogbo, Osun State, Nigeria.

E-mail- **drosinaike@yahoo.co.uk**

SUMMARY

Background: The increase in variety of equipment available for use in the intensive care unit and theatre has brought about the need to

assess the role played by audible alarm during patient care. To assess the effects of audible monitor alarm on theatre and ICU personnel.

Study design: Questionnaire designed to assess the effects of audible alarms on attention, workload and working memory were administered to theatre and ICU personnel.

Results: Most respondents feel that audible alarm assist their attention; however 30% of surgeons think otherwise. 20% of the respondents feel that their workload is unnecessarily increased by audible alarm; physician anaesthetists make up a quarter of this group. When asked about the need to adjust the monitor alarms, about 60% opined they adjust it to reduce the noise, while the others think it should only be adjusted to support identification of deranged parameters. About 10% of the respondents feel their working memory is affected by the audible alarm; most people in this group are physician anaesthetists.

Conclusions: Though audible monitor alarm is supporting attention of the user; it was incriminated as a cause of distractions, increase in workload and impairment of working memory. There is need to balance those advantages of the alarm system with measures to reduce the complaints of distraction by theatre users. This will make audible alarm in monitors more of a friend than a foe.

Keywords: Theatre, ICU, Monitor, Alarm.

Introduction

Alarms are used anywhere where there is equipment of any kind. They are used to monitor patients, to inform of critical/non-critical events, to let the user know that the equipment is working (or malfunctioning), to indicate that the equipment is self-checking during start up, and so on. Alarms can be found in operating theatres, intensive care units and hospital wards. The increase in variety of equipment available for use in the intensive care unit and theatre has brought about the need to assess the role played by audible alarm during patient care. The aim of various manufacturers of physiologic monitors has been to produce alarms of sufficient volume and harmonics to ensure the user is alerted appropriately. This has led to productions of alarms that emit harsh and unpleasant noise, which is gradually becoming a nuisance to the users [1, 2]

The objective of this study was to assess the effects of audible alarm in monitors on an average Theatre and/or Intensive care unit (ICU) staff.

Methods

Seventy-five close-ended questionnaires were administered to surgeons (general surgeons, gyneacologists and ENT surgeons), ICU/theatre nurses, physician (senior and junior registrars) and nurse anaesthetists. Effects on attention, workload and working memory were assessed. Analysis was with SPSS version 10.0.

Results

A total of 64 health care professionals made up of 42 males and 22 females responded to the questionnaire. Fifty –five percent (35) were physician anaesthetists, 31.3 %(20) were theatre/ intensive care unit nurses. The surgeon and nurse anaesthetists represented 10.9 %(7) and 3.1 %(2) of the respondents. Most of the respondents (51.6%) work both in the ICU and theatre, and have spent more than two years in their present place of work (Table 1). Most respondents feel audible alarm assist their attention, though 30% of surgeons feel otherwise (Figure 1). Twenty percent of them feel their workload is unnecessarily increased by audible alarm with 25% of physician anaesthetists supporting this view (Figure 2). Working memory impairment was observed by 10% of the respondents (Figure 3). About 60% opined that noise was the commonest reason for adjusting alarm *i.e.* silencing or disabling the alarm, physician anaesthetists make up about 60% of this group.

Discussion

It is obvious that audible alarm in monitors still play an important role in information gathering during patient monitoring. Audible alarms are quite useful. Researches on warnings [3] shows that people comply more readily with auditory than with visual warnings.

In addition, anaesthetists' response time to auditory warnings is faster than to visual warnings [4]. However, the most obvious kinds of problems with alarms are that they are irritating and tend to interfere with tasks rather than helping with them [2].

It is possible to deduce that when noisy alarm signals are reduced or removed, then working memory may be interrupted less often. Removing nuisance (false) alarms may also decrease the number of times the anaesthetist's attention will be directed to the visual display inappropriately, therefore producing fewer interruptions to the anaesthetist and other operating theatre staff. It has been shown that nuisance alarms are the culprit in causing distractions [5]; these are alarms that come up as a result of spurious changes in physiological parameters that are not sustained. Kestin *et a*l [6] showed that alarms heard during 50 separate operations were classified as spurious for 75% of the time and as indicating patient risk only 3% of the time. A more recent study [7] suggests that these false alarm rates may be reducing but, even so, the rate of false alarms is still unacceptably high. A similar study by Block *et al* [8] indicated that most anaesthetists switch off alarms, and the main reason given for doing so is the high false alarm rate. However it is important to note that turning off the alarm during an operation lies outside the designed purpose of alarms and reducing operating theatre noise by turning off the auditory alarm is a two-edged sword. It will reduce the number of nuisance alarms at the cost of

possibly missing informative alarms. The current trend of encouraging anaesthetists not to turn off alarms may help also to encourage them to adjust their alarm settings so that there are fewer false alarms (if they are able to manually adjust them), but this in itself will do nothing to help the problem of irritating, confusing and multiple alarms potentially hindering rather than helping their work. Research by Bliss and colleagues [9, 10] has shown quite clearly that, if an alarm system is perceived to be 90% reliable, people will respond slightly more than 90% of the time. If a system is perceived to be 10% reliable, then they will respond only 10% of the time. Of course, the 10% of the time that they respond to the system is probably not the 10% of the time that the system is signalling correctly, so effectively the alarm system is rendered almost useless when false alarm rates are high [11]. False alarm rates can be improved by using intelligent alarms – alarm system that would only warn when appropriate. Studies have shown that intelligent alarm systems can decrease anaesthetists' response time and improve their performance[12, 13].In view of the recent concerns expressed about the distractions being caused by alarm systems, manufacturers are beginning to work on design of alarms making it more user friendly [11]. Even setting alarm limits more diligently can improve alarm systems significantly[14]. Unless alarms are made to be intelligent and are properly set, then it would be better to get rid of them[15].

Conclusion

Audible monitor alarm is playing its role in supporting attention of the user; however limitations observed with the use include unnecessary distractions, increase in workload and impairment of working memory. Nevertheless, these limitations should never be an excuse to turn off audible alarm in monitors; the user must strive to balance the obvious advantages of using monitor alarms with reduction in the adverse consequences. Finally, standardisation of alarm sounds for various physiological changes will also help in addressing some of the problems currently encountered with the use of alarms. Manufacturers will be obliged to meet the requirements of new standards.

References

1. Cropp AJ, Woods LA.(1994) Name that tone: the proliferation of alarms in intensive care units. Chest . **105(4)**, 1217-1220.

2..Donchin Y, Seagull FJ. (2002) The hostile environment of the intensive care unit. Curr Opin Crit Care. **8**, 316–20

3. Wogalter MS, Young SL.(1991) Behavioural compliance to voice and print warnings. Ergonomics . **34**, 78–89.

4. Morris RW, Montano SR.(1996) Response times to visual and auditory alarms during anaesthesia. Anaesth Intensive Care. **24**, 682–4.

5. Seagull FJ, Sanderson PM. (2001) Anesthesia alarms in surgical contexts: An observational study. Hum Factors. **43(1)**, 66-77.

6. Kestin IG, Miller BR, Lockhard H .(1988) Auditory alarms during anaesthesia monitoring. Anesthesiology. **69**, 106–9.

7. Block FE, Schaaf C. (1996) Auditory alarms during anaesthesia monitoring with an integrated monitoring system. Int J Clin Monit Comput. **13**,81–4.

8. Block FE, Nuutinen L, Ballast B. (1999) Optimisation of alarms: a study on alarm limits, alarm sounds, and false alarms, intended to reduce annoyance. J Clin Monit Comput . **15**, 75–83.

9. Bliss JP, Gilson RD, Deaton JE. (1995) Human probability matching behaviour in response to alarms of varying reliability. Ergonomics. **38**, 2300–12.

10. Bliss JP, Dunn MC. (2000) Behavioural implications of alarm mistrust as a function of task workload. Ergonomics. **43**, 1283–300.

11. Edworthy J, Hellier E . (2005) Fewer but better auditory alarms will

improve patient safety .Qual Saf Health Care. **14**, 212-215

12. Westenskow DR, Orr JA, Simon FH, et al. (1992) Intelligent alarms reduce anaesthesiologists' response time to critical faults. Anesthesiology. **77**, 1074–9.

13. Schoenberg R, Sands DZ, Safran C. (1999) Making ICU alarms meaningful: a comparison of traditional versus trend-based algorithms. J Am Med Inform Assoc Suppl. 379–83.

14. Bolsona JF, Altaba C, Maull E, et al. (2001) Are auditory warnings in the intensive care unit properly adjusted? J Adv Nurs, **35**, 402–6.

15. Beydon L .(2001) Do away with alarms or make them intelligent? Ann Fr Reanim 2001. **20**, 667–8.

Table 1. Respondent's characteristics

Gender	**Male 42(65.6%)** **Female 22(34.4%)**
Profession	**Theatre & ICU Nurses 20 (31.3%)** **Nurse anaesthetist 2(3.1%)** **Physician anaesthetist 35(54.7%)** **Surgeon 7(10.9%)**
Place of work	**Theatre 26(40.6%)** **ICU 5(7.8%)** **Both 33(51.6%)**
Period of work	**≤ 1 year 4(6.3%)** **Above 1 yr -2years 16(25.0%)** **Above 2years 44(68.7%)**

Figure 1. Effects of audible alarms on attention

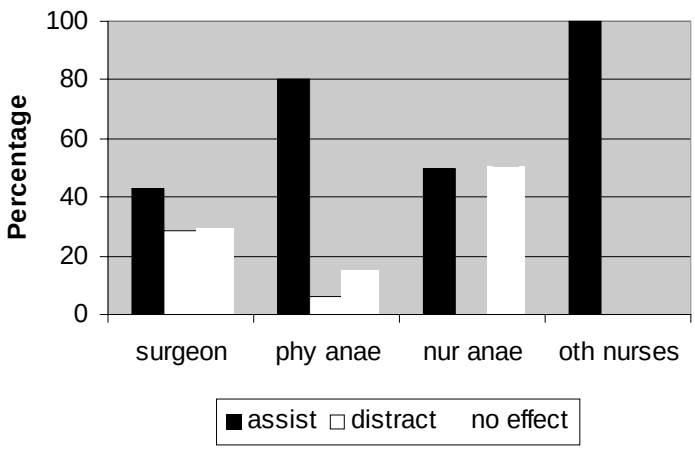
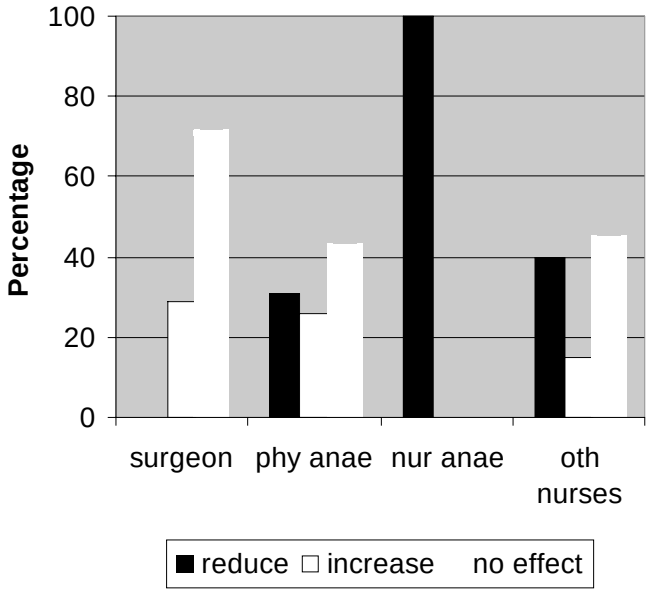
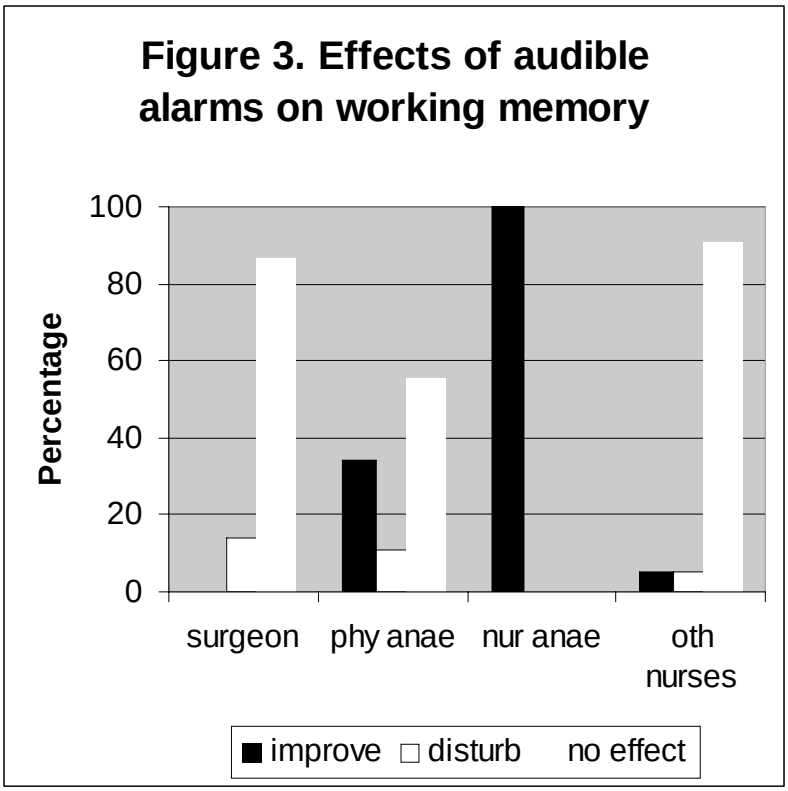


Figure 2. Effects of audible alarms on workload





Anaesthesia On-Line ™

http://www.priory.com

First Published June 2006