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Brief Reports

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THE EFFECT OF NOISE DISTRACTION ON EMERGENCY MEDICINE RESIDENT PERFORMANCE DURING INTUBATION OF A PATIENT SIMULATOR

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☐ Abstract—Background: The environment in the Emergency Department (ED) is chaotic, and physicians are expected to perform procedures amongst distractions. Objectives: Our aim was to prospectively determine the effects of various levels of noise distraction on the success and time to successful intubation of a simulator. Methods: Forty-five Emergency Medicine, Emergency Medicine/Internal Medicine, and Emergency Medicine/Family Medicine Residents were studied in background noise environments of <50 decibels (noise level 1), 60–70 decibels (noise level 2), and of >70 decibels (noise level 3). Residents attempted three intubations on a simulator in succession, with three randomized noise levels. Time, in seconds, to intubation was measured in each of the successful intubations. Generalized linear models were employed to examine associations between noise level and time to intubation by attempt. Results: Time to intubation decreased with each attempt (median = 25.9, 17.9, 14.4 for attempt numbers 1, 2, and 3, respectively). Decibel noise level was not associated with time to intubation ($p > 0.6$) or success rate ($p > 0.1$). Attempt number did not modify the association between noise and time to intubation (p-for-interaction = 0.16). Conclusion: Noise level did not have an effect on time to intubation or intubation success rate, suggesting that noise levels in the ED do not affect provider ability to perform procedures. However, knowing that increased noise levels increase stress and impair the ability to communicate with team members, further study needs to be done to definitively conclude that noise does not affect provider performance in the ED setting. © 2016 Elsevier Inc.

☐ Keywords—simulation; airway; noise distraction; procedural performance; resident education

INTRODUCTION

Noise is often an unavoidable aspect of health care working environments (1). The Environmental Protection Agency (EPA) recommends that the average hospital working environment noise not exceed 45 decibels (EPA 1974), however, studies have shown that peak noise levels in health care settings are often well above this recommendation (2–4). For frame of reference, a quiet room is 40 decibels, normal conversation 60 decibels, a ringing telephone 80 decibels, an ambulance siren 120 decibels, and a jet engine taking off, 150 decibels of noise (5).

In the emergency department (ED) setting, significant spikes in noise levels occur every minute (2). Noise increases stress and interferes with effective communication of physicians (6). One study found that 84% of sentinel events were caused by communication errors (7).

To safely perform many high-risk procedures in the ED setting, a significant amount of provider concentration and communication is required. Much of the prior research on the topic of provider distraction addresses cognitive distractions, and a couple of studies address auditory distractions (8–12). A study by Szafranski et al. (2009) found that surgical residents who had

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trained in a quiet environment made more cognitive errors and were less efficient when exposed to auditory distractions when compared with those who had trained in a noisy environment (11). In addition, when compared with visual and vibratory distractions, auditory distractions proved to be the most impactful on performance. In contrast, a study by Moorthy et al. (2004) found no difference in time to complete surgical skills when subjected to three different noise levels, and concluded that providers could “block out” auditory distractions (12).

Currently, in emergency medicine (EM), the effect of auditory distraction on procedural time and success is not known. The aim of this study is to prospectively determine the effects of various levels of noise distraction on EM residents’ success rate and time to intubation in a simulated environment.

METHODS

Twenty-nine EM, nine Emergency Medicine/Internal Medicine (EM/IM), and seven Emergency Medicine/Family Medicine (EM/FM) residents who had all completed the same introductory airway course during their intern year were prospectively enrolled in the study. The study took place within the hospital’s Virtual Education and Simulation Training (VEST) Center. A standardized background hospital noise audio recording was created by a hospital audiovisual specialist and was projected via speakers into the VEST center room during simulated intubation attempts. The noise recording consisted of both intermittent and continuous beeping in various tones and a blood pressure cuff inflating and deflating periodically. The decibel level was standardized by a noise dosimeter (Heavy Duty 600; Ex Tech Instruments, Waltham, MA) to achieve the desired noise level for each stage.

Each resident performed an intubation of a simulator (iStan; CAE Healthcare [formerly METI], Sarasota, FL) using a STORZ brand C-MAC video laryngoscope (Karl Storz GmbH & Co., Tuttlingen, Germany). The residents were exposed to the following background noise levels: <50 decibels (noise level 1), 60–70 decibels (noise level 2), and over 70 decibels (noise level 3). Noise level 1 was our control group as it was the quietest level we could obtain with a lower bound of 35 decibels. The upper bound of the noise level 3 group was 90 decibels. Each individual resident served as their own control and performed intubation of the simulator in all three of the noise levels, but the order in which they experienced them was randomized. The residents used the video laryngoscope as a direct laryngoscope, and a sole observer watched the C-MAC video screen in real time to record time to endotracheal tube passing through the vocal cords. Time to intubation (computed as endpoint time – time zero) was measured in seconds by a standard stopwatch. Time zero was defined as the moment the resident picked up the laryngoscope blade, and the endpoint time was defined as the observer’s view of the tip of the endotracheal tube passing through the cords on the C-MAC video screen. If this action was not performed in 120 s, time was stopped. One hundred twenty seconds was used as the time limit for successful intubation in each stage because the average time to intubation has been found to be 89 ± 35 s for direct laryngoscopy with a Macintosh blade (13). If the esophagus was accidentally intubated, then the observer asked the resident to re-attempt the intubation as long as they had not exceeded the maximum time limit of 120 s for the stage. After the study was complete, the residents were surveyed regarding their previous experience with intubating in the clinical setting.

Differences in the average time to intubation by attempt (first, second, or third) were examined using the Kruskal-Wallis rank-sum test due to the fact that time to intubation had a right skew. Median times and interquartile ranges were computed. Chi-squared tests were used to examine difference in the proportion of successful intubation rates across the three attempts. Time to intubation was then normalized using a logarithmic transformation due to its long right skew. A generalized linear model was employed to examine the impact of noise level on log intubation times over the three time periods. The number of attempts was included as a covariate within this model. Finally, possible effect modification by number of attempts was examined by including an interaction term between the number of attempts and time to intubation in the model. A sample size of 39 residents was needed to detect a medium effect size of 0.5 at an alpha level of 0.05 and a power of 90%. Data were analyzed using Stata version 12.1 (StataCorp LP, College Station, TX), and a p-value < 0.05 was used to determine statistical significance. Institutional Review Board approval was obtained from the hospital.

RESULTS

A total of 45 EM, EM/IM, and EM/FM Residents completed the study. The residents were equally divided by year, with 16 (35%) in their first postgraduate year, 16 (35%) in their second postgraduate year, and 13

Table 1. Number of Intubations Previously Performed in Clinical Setting by Postgraduate Year (PGY)

	<5	5–10	10–20	>20
PGY-1*	50%	25%	12.5%	12.5%
PGY-2	0%	0%	12.5%	87.5%
PGY-3	0%	0%	0%	100%

*p < 0.01.