SYNOPSIS

KEY POINT SUMMARY

OBJECTIVES

Because pharmacists are often subject to uncontrollable and unpredictable noises, the study aimed to determine the effect of ambient sound on the accuracy of pharmacist's prescription filling to determine whether noise adversely affects pharmacists to the point of error, and whether specific characteristics of ambient sound (controllability, predictability, and decibel level) are associated with those errors.

Relationships Between Ambient Sounds and the Accuracy of Pharmacists' Prescription-Filling Performance

Flynn, E. A., Barker, K. N., Gibson, J. T., Pearson, R. E., Smith, L. A., Berger, B. A.
1996 | Human Factors: The Journal of the Human Factors and Ergonomics Society Volume 38, Issue 4, Pages 614-622

Key Concepts/Context

Errors and error rate have been used as outcome measures of the quality of drug distribution that is a function of the interaction between humans, procedures, equipment, and the work environment. Dispensing errors have been measured by observation and occur at rates of up to 24%. Studies show the relationship between errors and the combination of interruptions and distractions, light levels, and prescription workload, as noise. Ambient sound is another factor that has a significant effect on the accuracy of human performance – noise can focus attention through increased arousal (depending on the complexity level); intermittent noise or bursts of noise can decrease performance; and a low level of perceived control over noise can have a negative impact on performance. These ambient noise factors may be associated with error rates in the prescription-filling tasks of pharmacists.

Methods

The study pharmacy was located in a 451-bed not-for-profit medical center with both inpatient and outpatient services. The pharmacy filled an average of 221 prescriptions daily. Thirteen pharmacists participated and were tested for hearing acuity (all results within normal ranges). Technicians were not included as the pharmacists acted as the final check prior to dispensing. Study participants were videotaped as they filled prescriptions during a 23-day period. A study investigator compared each filled prescription with the physician's written order, noted details of deviations, verified with the pharmacist any errors that occurred, and asked the pharmacist to correct the error if necessary. Noise was detected reviewing synchronized videos from two cameras. Thirty-one randomly selected matched pairs of prescription sets (one with errors and one without) were analyzed to compare sound characteristics affecting errors. the pairs were matched based on

DESIGN IMPLICATIONS

The design implications include the consideration for more *controllable* audible stimuli to be introduced into these dispensing areas, while decreasing *uncontrollable* stimuli, such as loudspeakers or waiting room conversations.

the pharmacists and the number of prescriptions in a set. The objective was to compare the mean number of classified sounds (predictable or unpredictable; controllable or uncontrollable; and noise or sound) per minute affecting each prescription set.

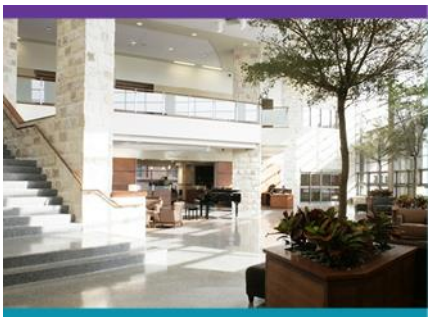
Findings

A within-subjects case control study design was employed to determine whether the frequency of ambient sounds was significantly different when prescriptions with errors, compared with those without errors, were filled. Loudness, in terms of equivalent sound levels (Leq) for each half hour, was analyzed for a relationship to dispensing error rate. A total of 5,072 prescriptions were analyzed with 164 errors detected, for an overall error rate of 3.23%. The results contradict other findings, but the authors indicate effect of noise on performance is difficult to interpret.Findings included:

1. Pharmacists were exposed to fewer *unpredictable* and audible stimuli per minute when they made errors than when they did not make errors (16.5 unpredictable sounds with errors versus 18.0 without).
2. Performance was not affected by *predictable* audible stimuli.
3. There was no effect of the mean number of *uncontrollable* stimuli on performance.
4. Pharmacists were exposed to a slightly higher mean number of *controllable* audible stimuli on sets without errors than on sets with errors (8.13 versus 7.07).
5. The study found that while *noise* had a significant effect, it was related to fewer errors.
6. *Sounds* were not associated with errors.
7. The equivalent sound level (Leq) for each half hour over the study period ranged from 58 dBA to 70 dBA, with a mean of 64.8 dBA. The effect of loudness, when controlling for the pharmacists, started to approach significance ($F(1,13)=2.70$, $p=0.101$). Data suggest the errors increase to a certain sound level and then decrease.
8. The range for the maximum Leq over the study period was 68.5 dBA to 82.0dBA, with a mean of 74 dBA. This did have a significant effect on the dispensing error rate. The overall trend was that as the maximum equivalent sound level per half hour increases, the dispensing error decreased.

Limitations

No limitations were identified by the authors, however, the contradictory findings are worthy of note. The authors indicate that as a field study, it is unclear whether the audible stimuli did not reach the point to which performance diminished, or whether the evaluated dispensing tasks were less complex than those typically



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affected by noise. The authors also indicated the finding are also not surprising, as one paper documented that seven of 58 studies indicated audible stimuli improved performance, while 29 studies indicated diminished performance associated with auditory stimuli.