COMPARISON OF ALPHABETICAL VERSUS CATEGORICAL ARRANGEMENT OF MEDICATIONS FOR ORDER ENTRY IN AN ELECTRONIC ANESTHESIA RECORD SYSTEM

Anil Marian, MD; Franklin Dexter, MD, PhD; Michael Todd, MD; Peter Tucker; Frank Scamman, MD
University of Iowa Hospitals & Clinics, Iowa City, Iowa

Introduction: Anesthesia records are different from other medical records because many data are recorded in a brief period by an individual who is engaged in vital tasks other than data entry. An especially demanding task is the recording of administered intravenous medications. The electronic anesthesia record should be designed and configured to facilitate the accurate and prompt recording of 6-10 drugs administered coincidentally. To help us choose between options implementable in EPIC, we performed multiple systematic searches for experimental and observational studies of impact of display format for medication entry rate and found none. We therefore did a Quality Improvement project within our department. Clinicians completed a task of selecting medications form a simulated environment similar to EPIC's Anesthesia Intraop module.

Methods: Two display formats were modeled on screens proposed for use with EPIC. Anesthesiologists and CRNAs were directed to select and enter a list 25 different medications into mock records in 2 minutes. We evaluated which format/layout resulted in the most rapid completion of the data-entry task with the fewest errors. One layout had medications arranged in an alphabetical arrangement. The other had medications arranged in a categorical arrangement. From the results of this Departmental QI project we designed the EPIC Intraoperative Anesthesia Record.

To gather the information to assess speed and accuracy, we developed a web-based application utilizing ASP.net, jQuery and SQL Server to conduct an experiment. Subjects were divided into 3 groups; 1) <1 yr clinical experience 2) 1-3 yrs clinical experience 3) 4 or more years of clinical experience. 60 providers participated in the experiment, 20 in each group. Subjects were handed an Apple iPad with the application preloaded. Once they clicked the Start Trial button, they had 120 seconds to find and tap drugs. Each subject completed three trials using each of the two templates. Each trial contained the same drugs but in a different sequence. After completing three trials, the subjects were given another interactive demonstration but with the other template. They then completed an additional three trials but using the other template. The drugs displayed in the same order for corresponding trials between the different templates. The number of drugs they could select in each trial and the number of errors was electronically stored in a database with no provider identifiers. The total time commitment for each subject was one session of approximately 20 minutes.

Results: For assessment to guide EPIC implementation, the overall difference in numbers of drugs entered was compared between alphabetical and categorical groups during the 3rd trial. Analysis was by Student's paired t-test. During the first trial, alphabetical provided an average of 3.1 more drugs entered (95% CI 1.8 to 4.4, $P < 0.0001$). This result was expected since categories need to be learned. By the third trial, categorical had mean 5.6 more drugs entered (95% confidence interval 4.5 to 6.8, $P < 0.0001$). Numbers of drugs entered was more for categorical when analyzed by years of clinical experience: 0 years mean 6.1 more ($N = 20$, $P < 0.0001$), 1-3 years mean 5.8 ($N = 20$, $P < 0.0001$), and 4+ yr mean 5.0 ($P < 0.0001$). There was no difference in error rates between groups at either the first ($P = 0.54$) or third trials ($P = 0.53$). The 5^{th} and 95^{th} percentiles of pairwise differences in error rates were -2 and +2 (i.e., symmetric, suggesting that not only on average but outlier providers there are no difference in error rates).

Conclusion: Based on these findings, categorical was used for implementation. As results were extreme, we expect that they would apply to other organizations.