Can You Multitask? Evidence and Limitations of Task Switching and Multitasking in Emergency Medicine

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Emergency physicians work in a fast-paced environment that is characterized by frequent interruptions and the expectation that they will perform multiple tasks efficiently and without error while maintaining oversight of the entire emergency department. However, there is a lack of definition and understanding of the behaviors that constitute effective task switching and multitasking, as well as how to improve these skills. This article reviews the literature on task switching and multitasking in a variety of disciplines—including cognitive science, human factors engineering, business, and medicine—to define and describe the successful performance of task switching and multitasking in emergency medicine. Multitasking, defined as the performance of two tasks simultaneously, is not possible except when behaviors become completely automatic; instead, physicians rapidly switch between small tasks. This task switching causes disruption in the primary task and may contribute to error. A framework is described to enhance the understanding and practice of these behaviors. [Ann Emerg Med. 2016;68:189-195.]

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INTRODUCTION

Interruptions that cause breaks in task contribute to medical errors and risk potential harm to patients.[1,2] Interruptions are common in the emergency department (ED) and each increases the risk of task incompletion.[3,4] Although emergency physicians often consider themselves to be effective and efficient multitaskers, evidence indicates that multitasking does not exist in the way that physicians have historically assumed.

The theory behind task switching, a clinical model demonstrating task switching, and the limitations of human performance as they apply to simultaneous task management will be explored to better understand the process of task switching in the ED. In accordance with this literature, we will offer suggestions for how physicians can heighten their awareness of interruptions or breaks in task, as well as methods for handling interruptions to maintain efficient and safe patient care. Finally, we will explore the critical importance of modeling and teaching trainees how to task switch more effectively, as well as education methods for doing so.

Definitions and Theory

Physicians use both multitasking behavior, defined as the simultaneous performance of two discrete tasks, and task switching, defined as changing between two separate tasks, sometimes rapidly.[5] It is likely that task switching is the more common and accurate description of typical physician behaviors in the ED. The term *task switching* is used for the purpose of this article. We additionally use terminology including *interruption* (a type of task switching in which the original task is returned to after a brief switch) and *break in task* (in which a new task is started as a result of the task switch).[4] Effective clinical task switching and efficient clinical task switching are behaviors that optimize task completion while minimizing additional cognitive load.

Evidence in Emergency Medicine

Although much of the literature in business and human factors engineering has focused on decreasing task switching behavior by decreasing external distractions, in the ED there are generally few options for reducing or eliminating the multiple, simultaneous demands that compete for a clinician's attention. Research in emergency medicine has focused on frequency and type of interruption. In 2000, Chisholm et al[3] demonstrated that during a clinical shift, physician interruptions occurred a mean of 31 times in 180 minutes. This landmark study established the frequency with which interruptions draw an emergency physician's attention away from his or her primary task. Further work by Chisholm et al[6] showed that emergency physicians experience more interruptions than office clinicians and

manage more patients. Emergency physicians also task switch more than physicians on the wards despite that ward physician work accounts for more total tasks. The nature and complexity of work and individual physician factors affected clinician strategy in both settings.[7] A study evaluating the association of interruptions experienced by emergency physicians and task completion times and rates showed that tasks that were interrupted were less likely to be completed than uninterrupted tasks (18.8% versus 1.5%). Interrupted tasks were completed more quickly than uninterrupted ones. The authors hypothesized that physicians shortened the primary task to compensate for the interruption and to make up time, potentially hurrying to complete the task by taking shortcuts, not fully completing some aspects of the task. Each of these has the potential to increase medical errors and subsequent risk to patients.[8]

There are a number of different types of interruptions in the ED related to the diversity of personnel and variable communication behaviors and expectations. For example, in one emergency medicine study, nursing interruptions of attending physicians tended to be shorter than interruptions by residents, although nursing interruptions occurred more frequently and accounted for more total interruption time. When residents interrupted faculty, a break in task (eg, going to evaluate a patient after a resident presentation) was more likely to result.[9] In another study examining interruptions of ED practitioners, postgraduate year two residents were interrupted less frequently than postgraduate year three residents or faculty. The authors theorized that this was because junior physicians cared for fewer patients.[4]

All of these studies highlight the need for emergency medicine–specific tools to address the reality of task switching and its effects in clinical practice. Communication-related issues, including interruptions, are a frequently cited issue contributing in the root cause analysis of sentinel events that result in adverse patient outcomes.[1] The actual effect of interruptions and task switching is uncertain because interruptions are one component of many that may contribute to adverse outcomes.[2,10,11] The ability to effectively task switch is a skill that is assumed and expected to develop during emergency medicine training.[12] Understanding how physicians task switch is foundational for successful emergency medicine practice and to improve individual clinical practice and teach this critical skill.

HOW THE BRAIN TASK-SWITCHES: A MODEL AND IMPLICATIONS FOR SAFETY IN THE EMERGENCY DEPARTMENT

For larger task completion in a complex or demanding environment, the brain divides the task into smaller, discrete

components. For the purposes of this model, we consider the first task to be the primary one and any additional task a secondary one, without regard to relative importance of an activity. Components of two larger tasks may be performed separately in sequence, which is often perceived as the two larger tasks being performed simultaneously because completion of the smaller components intermixes. This can lead to a high rate of task incompletion because of incomplete or inadequate performance of all necessary steps to accomplish one of the primary, larger tasks.[13] The risk of incompletion of a task is also increased by interruptions, making return to a partially completed task even more difficult.

The frequency of task switching and multitasking is uncertain. Observable interruptions noted in clinical settings are only a portion of the total number of interruptions that occur. For every interruption from an external source, it is estimated that there is at least one more "internal" interruption occurring in which the practitioner's mind "moves" to a new task rather than being interrupted by an external stimulus.[14,15] Such internal interruptions can also contribute to a lack of completion of physicians' primary activities, ie, recalling the need to review a test result or enter an order and moving to this task while engaged in another primary task.[16] Regardless of whether external or internal, interruptions reduce the overall accuracy of tasks being performed and increase the rate of error when tasks are performed.[17-19]

Behavioral research suggests that, despite having the knowledge of potential negative consequences, humans are unable to stop changing focus between multiple tasks.[20,21] External interruptions can be reduced (eg, by disabling e-mail pop-ups, closing the office door, turning off telephones); however, these options are often not available or practical in the ED.[22] Therefore, emergency physicians need to understand the basis and behaviors of task switching and multitasking to consciously improve their ability to return to and complete tasks.

Cognitive Load Theory

Human memory consists of both working, or short-term, memory and long-term memory. Working memory can process only a finite number of new information elements at one time, usually limited to two to seven items, whereas the capacity of long-term memory is virtually unlimited.[11] Therefore, the characteristics of working memory serve as an important limit to learning and recall of new information, as well as information processing. Cognitive load describes the mental processing requirements that affect the use of limited working memory. There are three types of cognitive load, or the mental effort being used by working memory: intrinsic,