

Patient Safety Tip of the Week

March 7, 2017 Nested Interruptions

Interruptions and distractions are significant factors contributing to errors in any industry and in patient safety events in healthcare (as well as unintended events in your everyday life!). Our multiple columns on the scope and impact of interruptions and distractions in healthcare are listed at the end of today's column.

Recovery from interruptions requires keeping in your short-term memory several things:

- What were the tasks you have left incomplete?
- Reorienting to the incomplete task(s)
- Where did you leave off in that task?

Previous research also shows that study participants were always slower to resume the primary task when they were interrupted during the middle of a subtask than when interrupted between subtasks ([Monk 2004](#)).

But one concept we've never discussed is that of **"nested" interruptions**. Workers in multiple industries are often interrupted during a task, move on to another task, and then get interrupted again. They thus have to remember where they left off in not just one task but in several tasks. This obviously leads to vulnerability to errors. While we often tout our ability to multitask as a positive talent that improves our efficiency, that **multitasking** also makes us more prone to make errors. Unintended consequences of interruptions include not only making errors but also performing redundant work.

Human factors researchers have delved into how interruptions impact various task performances. A recent study showed that the scope of interruptions and distractions is even more complicated ([Sasangohar 2017](#)). These researchers noted that ICU nurses are often interrupted from one task to perform another task and that interruptions in the second task are also frequent. That results in nurses having to resume not just one task where they left off but having to resume multiple tasks at varying stages of completion, a classic example of **"nested" interruptions**.

They hypothesized "that nested interruptions tax the working memory even more than just performing multiple secondary tasks sequentially because the nurse would have to encode in working memory the resumption goals for both the primary and the interrupted secondary tasks". So they performed a laboratory study with 30 ICU nurses performing an electronic order-entry task under three interruption conditions:

1. Baseline (no secondary task during the interruption period)
2. Serial (performance of two tasks one after the other during the interruption period)

3. Nested (performance of two tasks during the interruption period, one of which was also interrupted)

Their results confirmed that the nested interruptions resulted in significantly longer primary-task resumption lag and less accurate task resumption compared with both the serial interruption and baseline conditions.

While a primary goal should be to minimize interruptions and distractions, we need to recognize that some interruptions may be unavoidable (and some even positive) and take steps to **mitigate the impact** of such interruptions on tasks. And we clearly need ways to recognize all the tasks needing completion, not just the one most recently interrupted.

One such mechanism for mitigation is use of technology to help us return to our previous task(s). As we write this column we are often interrupted by numerous external sources (phone calls, comments from others, etc.) and internal sources (other topics popping up, coffee or bathroom breaks, etc.). For example, we may suddenly think about something we want to include in a separate column on a related or even different topic. We jump to that other draft column but then have to return to the original column. Thank goodness we usually have a blinking cursor that helps reorient us to where we had left off! And some word processors allow you to re-open a saved document to the location you had most recently left off when saving that document. And if we are really meticulous, we'll leave a bookmark of some sort to redirect us to where we left off. But even using these technological tools to help mitigate the impact of interruptions there is often a cascade of events (just as we see in virtually all serious patient safety events) that can lead to unwanted consequences. For example, a power failure can in seconds overcome all those safety barriers you just put in place.

So why not use technology to mitigate the impact of interruptions in healthcare? For example, virtually all EHR's (electronic health records) and CPOE (computerized physician order entry) or e-prescribing or related IT systems have automatic time out protocols built in. That means that after x minutes of inactivity the user is automatically logged out. The technology exists that would allow for a text message to be sent to the user at the time of automatic time out indicating that some activity may have gone unfinished and then put that user on the appropriate screen once they log back in.

Such use of technology might well be beneficial in reducing interruption-related errors related to computerized functions. But what about other tasks? Nurses already utilize a number of **behavioral mechanisms** to mitigate the impact of interruptions. An excellent 2010 observational study of ICU nurses ([Grundgeiger 2010](#)), using a mobile eye tracker to measure the task resumption lag and other parameters, found that in 37.6% of all interruptions, nurses used a behavioral strategy to reduce or avoid individual prospective memory demands. For example, nurses sometimes decided to finish primary tasks before attending to the interrupting task. In other instances, nurses **used artifacts** such as syringes, cables, equipment for blood samples, or blood gas analysis result sheets in their hands while attending to the interrupting task (the artifacts being part of the primary task that needed to be resumed). And sometimes nurses placed **reminders** in an obvious

position to help them resume the interrupted primary task later, such as putting utensils to take a blood sample on the medication desk. They also observed some general strategies nurses used to remind themselves about forgotten interrupted tasks. Examples include scanning the top of the bed area while washing hands, looking at places where artifacts are generally placed, accessing the clinical information system, or writing paper notes.

Their data suggests that nurses remembered documentation tasks more frequently than expected without applying a behavioral strategy and less frequently by holding an artifact but if medication tasks or cleaning up tasks were interrupted, a task artifact was held in the hand while serving the interruption more frequently than expected.

Some other factors were related to lags in resumption of tasks. Length of the interruption had a significant positive correlation with resumption lags (longer interruptions result in longer resumption times). And context cues were important. It was anticipated that if an interrupting task required the nurse to change location and leave the context in which the goal was encoded, resumption lags would increase because the contextual cues are missing. Indeed, they found that such change of context had a significant effect on resumption times, likely because “the context change may have changed environmental cues, which in turn may have triggered retrieval of task demands other than the to-be resumed task, causing longer resumption times”.

Another study by Sasangohar and colleagues ([Sasangohar 2015](#)) found that ICU nurses spent about 50% of their time conducting medium-severity tasks (e.g., documentation), 35% conducting high-severity tasks (e.g., procedure), and 14% conducting low-severity tasks (e.g., general care). They found that the rate of interruptions with personal content observed during low-severity tasks was higher than the rate during high- and medium-severity tasks, suggesting that interrupters might have evaluated task severity before interrupting. The authors propose that increasing the transparency of the nature and severity of the task being performed may help others further modulate when and how they interrupt a nurse and that, rather than try to eliminate all interruptions, mitigation strategies should consider the relevance of interruptions to a task or patient as well as their urgency.

There is one such high-severity task for which such transparency is often already used: medication administration. The nursing activity perhaps most studied with regard to interruptions is medication administration and there have been multiple studies aimed at reducing such interruptions during medication administration. A recent study in a large teaching hospital in Australia looked at the impact of a ‘Do not interrupt’ bundled intervention to reduce non-medication-related interruptions to nurses during medication administration ([Westbrook 2017](#)).

The Westbrook study confirmed a very high rate of interruptions during medication administration. At baseline, they found a rate of 57 interruptions for every 100 medication administrations and 87.9% of the interruptions were not related to medication administration. The majority of the interruptions were from other nurses and pertained to

other patients. Interestingly, requests from patients and social interruptions each accounted for only about 10% of interruptions.

The bundled intervention in the Westbrook study consisted of:

1. Wearing a “Do not interrupt” vest when preparing or administering medications
2. Interactive workshops to identify barriers and enablers to intervention use
3. Brief standardized education for clinical staff (eg. physicians, allied health professionals)
4. Patient information regarding the importance of the “Do not interrupt” concept
5. Reminders (stickers, posters, etc.) for healthcare workers, patients, visitors not to interrupt

Results of the intervention showed modest reductions in interruption rates. The average rate of interruptions was reduced from 56/100 to 38/100 administrations on the intervention units compared with little change on the control units. Most of the reduction was from reducing interruptions from other nurses. There was no change in interruptions from patients.

The study did not report medication error rates. However, it used data from other studies to extrapolate the potential reduction in medication administration errors and estimated that rate as 1.8%. They noted that compared unfavorably to the literature reduction in medication errors of 14% by implementation of an electronic medication administration record.

The post-intervention survey of nurses was particularly telling. While most nurses recognized the importance of interruptions on medication errors, a surprising number expressed their opinion they did not think the intervention should continue. Many noted that donning and wearing the vest was cumbersome and led to longer durations for medication administration.

As we’ve noted before, it is not enough to simply use a reduction in interruptions as the primary outcome measure in such studies. And it’s not even enough to measure reductions in medication errors as the only outcome. We must measure other patient safety outcomes as well. That is because not all interruptions have negative impacts. Clearly some interruptions are important and have a positive impact on patient safety. In the Westbrook study the majority of interruptions were by other nurses and pertained to questions about other patients. Presumably, some of those interruptions would be expected to have had a positive impact on those other patients.

In our November 8, 2016 Patient Safety Tip of the Week “[Managing Distractions and Interruptions](#)” we noted a study which sought to help differentiate the “good” interruptions from the “bad” ones ([Myers 2016](#)). They found that, on average, nurses were interrupted every 11 min, with 20.3% of their workload triggered by interruptions. Those figures are comparable to most other studies on nursing interruptions. They then developed a statistical model which showed that alarms and call lights returning nurses’ attention to the patient outside the patient room are beneficial, while interruptions in the

patient room are generally detrimental. Beneficial interruptions are those that return the nurse's focus to the patient and those supporting patient-clinician and clinician-clinician communications. A previous study by Sasangohar and colleagues also identified the inconsistencies in the way interruptions are defined and categorized potential sources of negative and positive interruptions ([Sasangohar 2012](#)).

Our November 8, 2016 Patient Safety Tip of the Week "[Managing Distractions and Interruptions](#)" summarized many of the interventions that have been implemented to minimize or mitigate impact of interruptions and distractions. And we again refer you back to the article by Flynn et al ([Flynn 2016](#)) that did an excellent job of summarizing the literature on interruptions and their impact on medication administration and chronicling those interventions which are evidence-based.

Prior Patient Safety Tips of the Week dealing with interruptions and distractions:

- August 25, 2009 "[Interruptions, Distractions, Inattention...Oops!](#)"
- November 3, 2009 "[Medication Safety: Frontline to the Rescue Again!](#)"
- December 15, 2009 "[The Weekend Effect](#)"
- May 4, 2010 "[More on the Impact of Interruptions](#)"
- October 12, 2010 "[Slowing Down in the OR](#)"
- March 8, 2011 "[Yes, Physicians Get Interrupted Too!](#)"
- July 31, 2012 "[Surgical Case Duration and Miscommunications](#)"
- August 28, 2012 "[New Care Model Copes with Interruptions Better](#)"
- November 27, 2012 "[Dealing with Distractions](#)"
- April 16, 2013 "[Distracted While Texting](#)"
- May 21, 2013 "[Perioperative Distractions](#)"
- July 1, 2014 "[Interruptions and Radiologists](#)"
- November 2014 "[More Radiologist Interruptions](#)"
- March 17, 2015 "[Distractions in the OR](#)"
- July 21, 2015 "[Avoiding Distractions in the OR](#)"
- August 30, 2016 "[Can You Really Limit Interruptions?](#)"
- November 8, 2016 "[Managing Distractions and Interruptions](#)"

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