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Background - Problems and "The Why"

Delirium is acute confusion characterized by inattention, disorganized thinking and symptoms that fluctuate over the course of minutes to hours. It may also present with altered levels of consciousness (anything from obtundation to hypervigilance), mood dysregulation (depression, anxiety, giddiness), psychosis (visual hallucinations, delusions) and sleep-wake reversal. Delirious patients often look their best cognitively between the hours of 0700 and noon. Delirium is a medical emergency but 50-80% of cases go undetected by medical staff (Kales, Geriatric Psychiatry 2003).

People with delirium experience longer intensive care unit (ICU) stays, longer periods of mechanical ventilation (Salluh, BMJ 2015) and longer hospital stays. Delirium puts people at greater risk of falling in the hospital and developing significant dysphagia that affects their nutrition. They incur 2.5x higher health care costs (Leslie, Arch Int Med 2008). The 1-year mortality from a single episode of delirium is 35-40%, roughly the same as sustaining a hip fracture later in life (Inouye, NEJM 2006). Most importantly, delirium is preventable (Inouye, NEJM 1999).

Delirium is always a multifactorial condition that develops when patient-specific risk factors and situation-specific stressors collide. Common patient factors include advanced age, functional/cognitive impairment, sensory impairments and untreated depression. Common situation-specific stressors include acute illness, dehydration/holding nutrition, surgery, acute pain and medications. There are a number of commonly used, high-risk medications that directly increase the risk for developing delirium in the right setting. This list includes medications used often in the hospital — antihistamines, steroids, muscle relaxants, certain opioids, benzodiazapines and antiemetics.

We at OHSU conducted a 30-day review of CAM (Confusion Assessment Method — a delirium screening assessment) results in all adult patients admitted to either an ICU or one of 13 acute care units, looking for patients that had developed delirium after 48 hours in the hospital and how long they remained CAM positive. This limited the scope to patients that could have benefitted from more careful curation of their medications during their admission. We found six unique patients that met this definition for a total of 18 cognitive-related avoidable days per 30-day period. This sample corresponds to 72 cases of hospital-acquired delirium at OHSU per year for a total of 216 cognitive-related avoidable days per year.

If even a portion of these cases could be prevented, these bed-days could be freed up for other patients and save the costs incurred to payers, patients and the health system.

Mission Control

Mission Control is an inter-professional team and central point for managing inpatient capacity in real time that grew out of persistent strains on bed availability. The team includes administrators, providers, nurses, transfer center and bed placement specialists along with a robust data infrastructure that tracks real-time capacity and barriers to inpatient throughput. In concert with GE Healthcare, this data is displayed in a series of tiles, described by the Mission Control team as: "You can think of a tile like an application. Each one serves a specific purpose. For example, one tile is used to help staff understand the current cross-institution capacity picture, while another tile is focused on identifying and removing discharge barriers."

Over two years, a series of tiles focused on various discharge barriers have been developed, entirely focused on logistical barriers like procedure delays.

Approach

Development of the Medications + Delirium Tile

Logistical delays are not the only barriers to smooth inpatient transit. There are multiple opportunities in clinical care for a tile to highlight hurdles that aren't solely logistical. Hospital-acquired delirium is a significant complication and barrier to care for many older acute care patients at OHSU. In thinking further about this issue, high-risk medications were highlighted as a major feeder for delirium that may lend itself to a Mission Control tile.

Adults (Age 50+)

Figure 1

Tile inclusion criteria:

- Most recent CAM assessment positive **AND**
- Patient currently on high-risk medication **AND**
- Admin instruction do not say *"Cabinet Override"*

Alert stop:

- New CAM assessment result negative **OR**
- High-risk medication discontinued **OR**
- Patient discharged

We convened a team of experts — providers from Psychiatry and Geriatrics, pharmacists, nurses and experts from GE Healthcare — to create the logic for the tile (see Figure 1).

The active medication triggering the alert does not need to have been administered to the patient order to flag on the tile; an active order alone will suffice. The tile looks to users as below:

1

List of all alerts, including patient name, unit/room, length of time since alert fired.

2+3

Exact medication(s) triggering the alert and status (ie., ordered, given, etc.) (see Figure 2)

Users can activate a variety of filters to tailor the list to their specific needs. Each alert can be resolved by one of three methods: Discontinue the triggering medication, snooze for an individualized period of time or dismiss entirely. The snooze option is meant to allow extra time for the provider and clinical pharmacist to evaluate and discuss. The dismiss option acknowledges that there are scenarios in which the high-risk medication is appropriate for that patient and their circumstances and is intended to be used when this conclusion is reached after thoughtful discussion.

Two clinical pharmacists beta-tested the tile alert in both the ICU and acute ward setting and provided feedback on the design and usability that were incorporated into the tile function.

Adult Medication List

- Diphenhydramine
- Hydroxyzine
- Magic Mouthwash
- Scopolamine
- Amitriptyline
- Nortriptyline
- Lorazepam
- Diazepam
- Alprazolam
- Cyclobenzaprine
- Tizanidine
- Baclofen
- Morphine IV
- Fentanyl IV
- Promethazine
- Meclizine
- Zolpidem
- Famotidine
- Proclorperazine

Figure 2

Lessons Learned

Limitations to the Development Process

In our ideal vision, the alert logic would help stop a high-risk medication from being given to anyone at risk for delirium and not just those who are already screening positive for delirium. Despite there being a standard nursing delirium risk assessment in the admission database, we learned it is rarely completed and would not be a useful metric on which to base this alert (see Figure 3).

Though regular CAM screening does recognize those people with acute cognitive changes, it misses those at risk that may not yet have demonstrated those changes. This is a ripe time during hospitalization for thoughtful intervention, but the foundations do not yet exist for easy recognition of these patients at our hospital. In the course of our development discussions, we agreed that this population needed to be out of scope for this iteration of the tile until a better set of markers are available.

Operationalizing the Tile in Existing Clinical Workflows

Tile alerts are meant to be a "nudge" to interprofessional teams in real time as they are caring for vulnerable patients. As such, they need to be timely, deliver useful clinical information and slide easily into existing workflows to augment overall care delivery. The first two priorities were major foci during the tile development process but the third priority came to the forefront as we shifted energy to how these alerts would fit into real-world work.

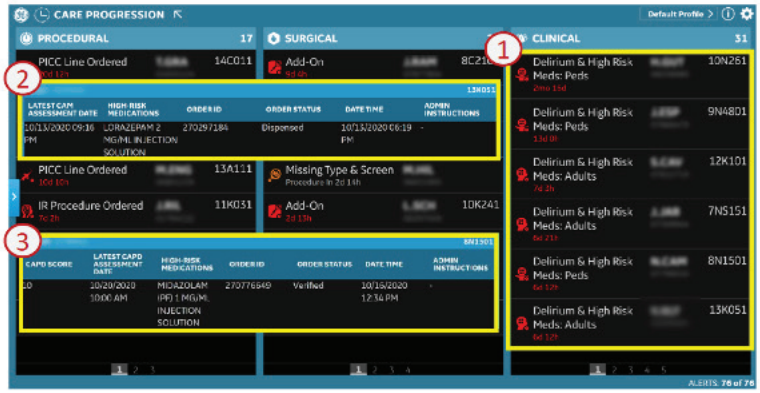

Figure 3

While the tile gathers information from Epic, it does not send information back to Epic. This means that, without a dedicated flow of information to the provider and clinical pharmacist, team members need to expend separate, dedicated effort to review the tile in addition to Epic charts. Given the existing work culture at OHSU, we recognized this as a heavy lift to undertake, especially during a global pandemic where workflows were changing every day.

There are reliable interprofessional rounds on multiple units every day, where each patient's status and needs are considered by the entire team as the patient moves through their stay. These rounds were recognized as an opportunity to embed the tile into daily care routines, but these rounds do not happen reliably on every unit.

In order to best meet the needs of busy clinical teams, we identified the need for a real-time page as a top priority to effectively operationalize this alert and garner acceptance from end users. The answer to this need was dynamic paging, a tile function that is currently being built out. This is the next big step in rolling out the tile alert to our clinical care teams, anticipated to be completed by the end of 2021. Our development team has delayed rolling out the tile alert widely out of a realization that we have one opportunity to make a positive first impression and the critical need for users to see this as a work and time saver that supports safe patient care, rather than "one more task" in already busy days.

> "**Acceptability** is key."

Outcomes

Pilot test: 10K Neurosciences Unit

OHSU's Neurosciences division was concurrently working to improve its delirium prevention and treatment and requested to pilot the tile as part of this focus. 10K Neurosciences is a relatively closed unit — a stable pool of nursing staff, a single clinical pharmacist and only two provider teams — and they have daily interprofessional rounds involving case management and social work to highlight needs and barriers to smooth transit through patients' stays. The 10K team embedded the tile into daily

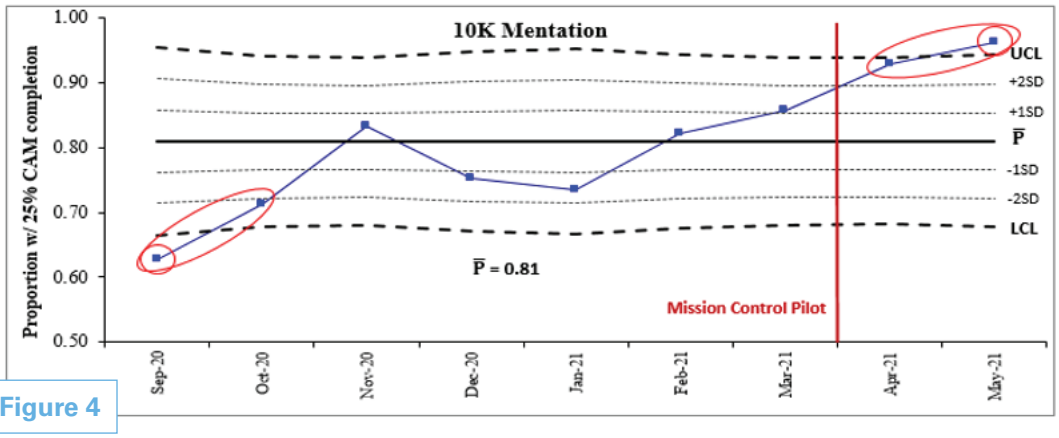

Figure 4

interprofessional rounds for six weeks in spring 2021 and data on patient and health-system level outcomes were measured in the six weeks before the pilot and during the pilot. During this time, there were no other novel interventions being deployed and no alternate explanations for the changes.

Notable findings in brief include:

- 1.4 days reduction in length of stay.
- 1 day reduction in ICU length of stay.
- 27% reduction in hospital charges.
- 34% increase in discharges to home.
- 23% reduction in discharges to skilled nursing facilities.
- 14.5% reduction in restraint-days.
- 48.5% reduction in antipsychotic doses given.

In addition, there was a notable improvement in the rate of completed delirium screening that we believe was an unanticipated byproduct of new importance placed on accurate screening that flowed from use of the tile. The Figure 4 control chart illustrates the changes seen.

Next Steps

Dynamic paging will be completed by the end of the year and once built, the plan is for a second pilot with the Medicine teams. Dynamic paging is critical for the success of this second pilot as Medicine patients and teams are geographically spread out across the hospital and don't always have the benefit of daily interprofessional rounds.

"A "just-in-time" nudge to the right provider and pharmacist, even if they are spread out, is a critical piece in the feasibility, acceptability and success of the tile alert for this population. **This is a critical next step on the road to this alert going live hospital wide."**