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Electronic Task Management System: A Pediatric Institution's Experience

Daryl R. Cheng[1,2,3,4] Mike South[1,2,3,4]

[1] Department of General Medicine, The Royal Children's Hospital Melbourne, Parkville, Victoria, Australia
[2] EMR Project Team, The Royal Children's Hospital Melbourne, Parkville, Victoria, Australia
[3] Department of Paediatrics, University of Melbourne, Melbourne, Victoria, Australia
[4] Murdoch Children's Research Institute, Parkville, Victoria, Australia

Address for correspondence Daryl R. Cheng, MBBS, MPH, Department of General Medicine, The Royal Children's Hospital Melbourne, 50 Flemington Road, Parkville, VIC 3052, Australia (e-mail: daryl.cheng@rch.org.au).

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Abstract

Background Electronic medical task management systems (ETMs) have been adopted in health care institutions to improve health care provider communication. ETMs allow for the requesting and resolution of nonurgent tasks between clinicians of all craft groups. Visibility, ability to provide close-loop feedback, and a digital trail of all decisions and responsible clinicians are key features of ETMs. An embedded ETM within an integrated electronic health record (EHR) was introduced to the Royal Children's Hospital Melbourne on April 30, 2016. The ETM is used hospital-wide for nonurgent tasks 24 hours a day. It facilitates communication of nonurgent tasks between clinical staff, with an associated designated timeframe in which the task needs to be completed (2, 4, and 8 hours).

Objective This study aims to examine the usage of the ETM at our institution since its inception.

Methods ETM usage data from the first 3 years of use (April 2016 to April 2019) were extracted from the EHR. Data collected included age of patient, date and time of task request, ward, unit, type of task, urgency of task, requestor role, and time to completion.

Results A total of 136,481 tasks were placed via the ETM in the study period. There were approximately 125 tasks placed each day (24-hour period). The most common time of task placement was around 6:00 p.m. Task placement peaked at approximately 8 a.m., 2 p.m., and 9 p.m.—consistent with nursing shift change times. In total, 63.16% of tasks were placed outside business hours, indicating predominant usage for after-hours task communication. The ETM was most highly utilized by surgical units. The majority of tasks were ordered by nurses for medical staff to complete (97.01%). A significant proportion (98.79%) of tasks was marked as complete on the ETM, indicating closed-loop feedback after tasks were requested.

Conclusion An ETM function embedded in our EHR has been highly utilized in our institution since its introduction. It has multiple benefits for the clinician in the form of efficiencies in workflow and improvement in communication and also workflow management. By allowing collection, tracking, audit, and prioritization of tasks, it also provides a stream of actionable data for quality-improvement activities.

Keywords
- electronic task management
- ETM
- electronic health record

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Background and Significance

Electronic task management systems (ETMs) are used in various settings to streamline workflows, manage processes, reduce waste, and improve efficiency. Within health care however, they have been adopted as a method of improving on existing hospital clinical communication tools and their limitations.[1]

This is due to the fact that many health care institutions still adopt a "best-of-breed" clinical communication strategy with a mix of standalone nonelectronic (e.g., whiteboards, written messages) or electronic (pagers, phone) platforms. This results in inefficiencies in the form of limited or missing information in requests or messages, lack of platform integration resulting in interruptions to clinician workflow, lack of visibility or ability to share the overall hospital workload, as well as mismatch between designer and user expectations and therefore greater propensity for human error.[2–7] Furthermore, the use of multiple platforms means siloed information that is not always available at the time of decision making. Failure to provide this information upfront also results in duplicate and time-consuming follow-up to clarify and obtain it.[8] More importantly, this may result in unsafe or delayed clinical decision making.[9]

Over time, ETMs have found a niche as a tool for nonurgent communication of patient tasks between various clinician craft groups.[10] However, the functionality and sophistication between ETMs remain wide ranging. Some are basic standalone computer programs or secure webpages requiring repetitive input of data such as patient identifiers, free-text requested task, perceived urgency, and contact details by the requestor.[2,4,11] Others attempt to mitigate some of the aforementioned challenges by adding extra functionality such as the ability to prioritize tasks, assignment of tasks directly to an individual or groups of clinicians, as well as providing dynamic and real-time feedback on task status to requestors.[1]

Objectives

The Royal Children's Hospital Melbourne (RCH) is a 350-bed tertiary academic pediatric hospital, with over 52,000 inpatient admissions per year. A standalone ETM had been used at our institution, RCH, for approximately 10 years. The ETM was first introduced in an attempt to improve after-hours nursing to doctor communication and to decrease junior doctor workflow interruption. Due to its success, it was adopted as part of organizational policy/procedure to be used for all nonurgent inpatient medical tasks.

Since an organization-wide electronic health record (EHR) was introduced in April 2016, the previous standalone ETM (a custom-built HTML webpage) was replaced by a custom-built function within the EHR solution with significantly improved functionality. This study aims to examine the usage of the ETM function at our institution over the last 3 years, including evaluation of patterns of usage, types of tasks ordered, and impacts on workflow.

Methods

ETM System

The RCH ETM is a function that was custom built within the institution's EHR (Epic Systems, Verona, Wisconsin, United States). To the authors' knowledge, this is the first example of a fully integrated ETM within an EHR. Although the ETM has some overlap in functionality with handoff and order management systems, it has certain unique features.

First, all clinical users are able to access and use the ETM as an around-the-clock secure streamlined platform for nonurgent inpatient-related tasks, regardless of their clinical discipline (nursing, allied health, medical). It allows communication between individuals and groups, without the need for the requestor to know the name or specific role of the clinician they are contacting. Unlike other orders, ETM tasks appear on specific reports for viewing, and have the ability for clinicians to provide dynamic feedback visible by all staff, not just the requestor, when tasks are completed. They can also be searched, filtered, and categorized to specific areas or departments.

Second, the ETM broadens its focus to include task management for all craft groups, including medical and allied health. This function does not currently exist in most order management systems, as creation of worklists with tasks has been traditionally a nursing feature.

Furthermore, the embedded nature allows users to continue to interact with other components of the EHR. From within a patient's EHR chart, requestors use an identical ordering pathway used for other orders such as laboratory or imaging tests and medication prescriptions. This aims to maximize uptake by embedding the ETM within existing workflows, reducing the need for end-users to learn and use a separate system. Requestors place a task order by selecting from predefined broad task categories (admission, fluid order, medication order, review of patient, etc.) and assigning mandatory priority timeframes (within 2, 4, or 8 hours), contact details, and additional comments (►Fig. 1). For any more urgent tasks (i.e., <2 hours), doctors could be contacted via alphanumeric paging or a VoIP phone system.

By displaying all relevant patient demographic and clinical information together with the task request, the clinician is able to focus on synthesizing and responding accurately and efficiently to the task request rather than a need for duplicate entry of information. This also reduces potential human factor errors such as placing task requests on incorrect patients or providing limited details about clinical context and task. Other features such as task priority assignment and visibility at a single patient or whole institutional level reinforce that safety is a key feature of this ETM.

Once the task has been requested, clinicians and managers are able to view task requests at an individual patient level in their patient record, or at a service or hospital-wide level via lists, dashboards, or reports. Additional visual aids such as task priority are indicated by colored icons and grouping (►Fig. 2). This allows visibility that is customizable for both clinical care and patient flow management. Once tasks are completed, clinicians indicate this directly within the ETM

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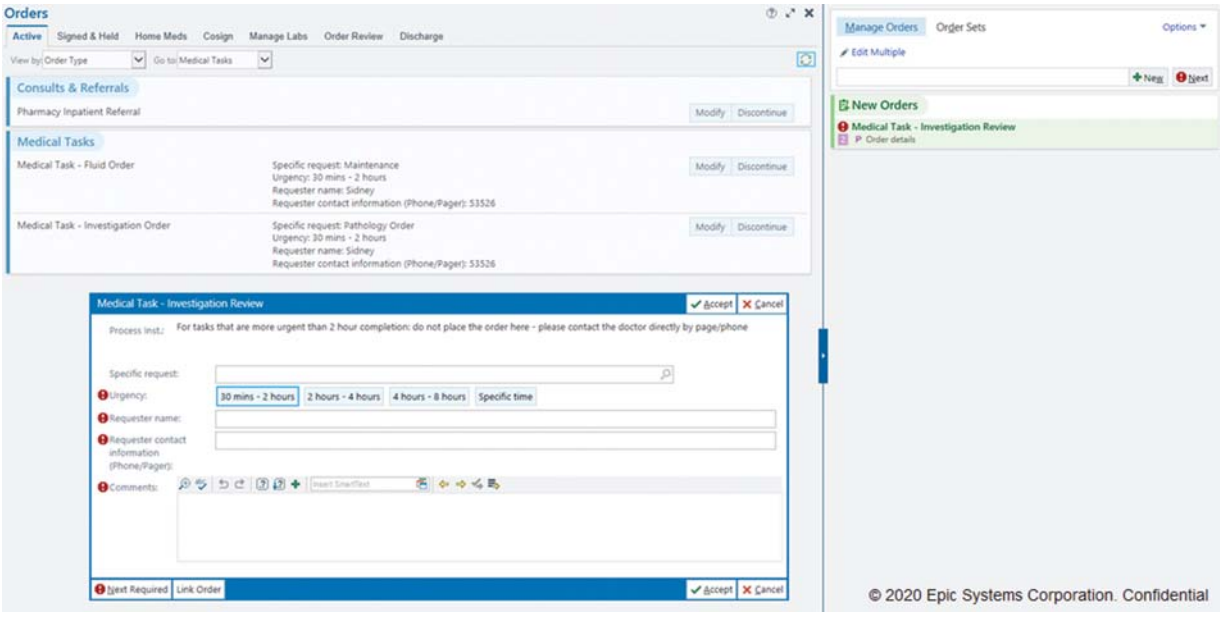

Fig. 1 RCH ETM task order. ETM, electronic medical task management system; RCH, Royal Children's Hospital Melbourne.

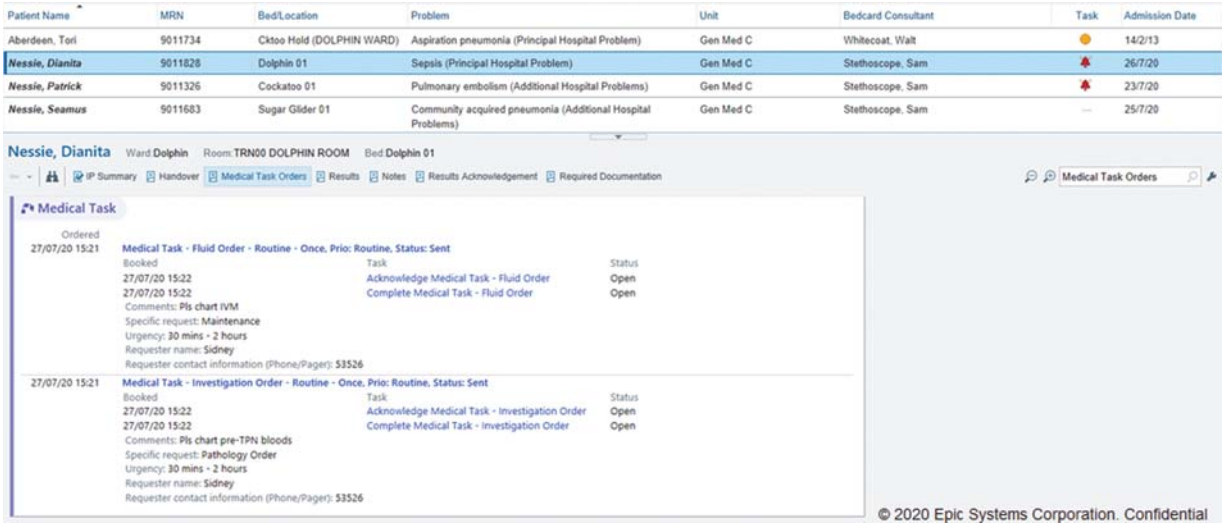

Fig. 2 RCH ETM patient list view (fictitious data). ETM, electronic medical task management system; RCH, Royal Children's Hospital Melbourne.

function and this removes the task from the list and thereby providing feedback to requestors.

Data Extraction and Analysis

ETM usage data from April 2016 (EHR Go-live) to April 2019 were extracted directly from the EHR. Data collected included age of patient, date and timestamp of task request, ward, unit, type of task, urgency of task, requestor role, and time to completion.

Data were grouped into subcategories and analyzed using statistical metrics such as percentage, mean, median, and mode. The study was approved as a clinical audit by the RCH Human Research Ethics Committee (QA/51943/RCHM-2019).

Results

There were 136,481 tasks ordered in the study period, which equates to approximately 125 tasks per day (24-hour period). The most common time of task request was around 6:00 p.m., with the cumulative task number almost four times the expected hourly number of requests. Task placement peaked at approximately 8 a.m., 2 p.m., and 9:30 p.m.—consistent with hospital nursing shift changeover times (►Fig. 3). A total of 63.16% of tasks were placed after-hours (between 5 p.m. and 8 a.m.), where there is a lower number of covering medical staff in the hospital who are responsible for completing these tasks. There was minimal inter-day or inter-month variation between numbers of tasks requested.

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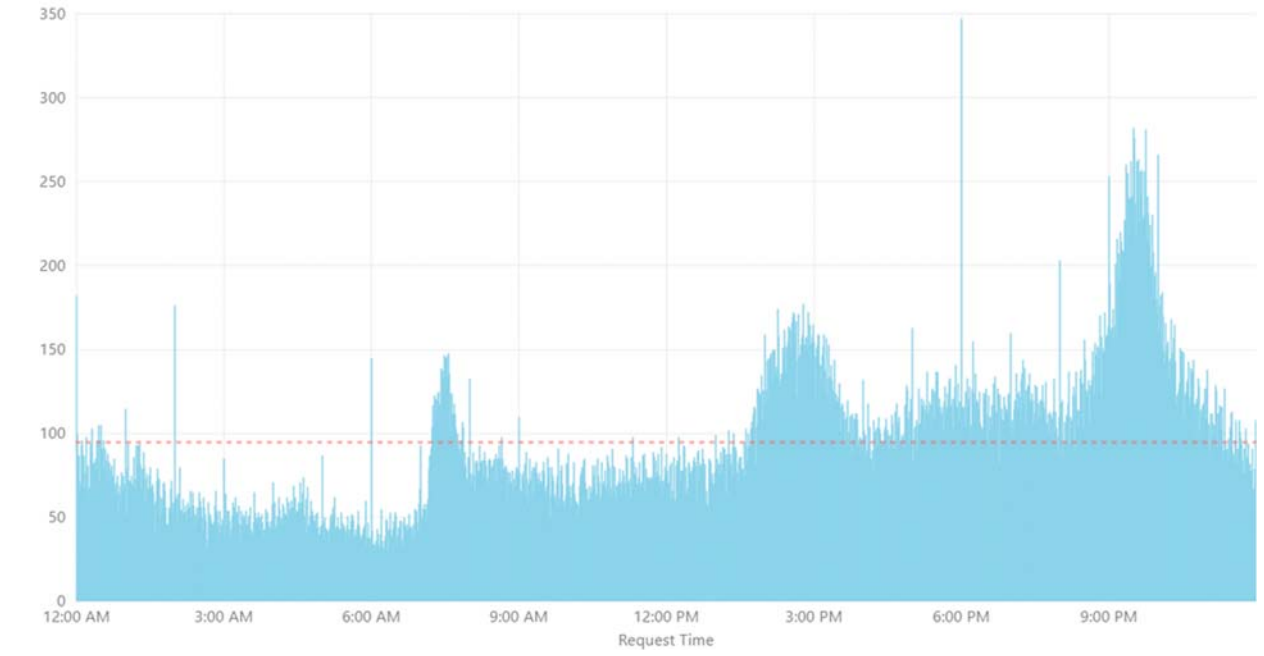

Fig. 3 Task order count/frequency by time (minute). Red dotted line denotes median tasks per point in time.

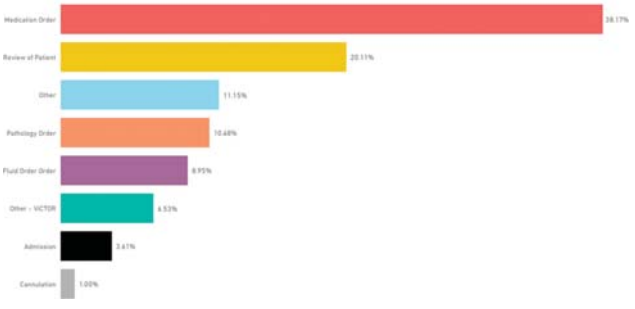

Fig. 4 Task orders by type.

The most common medical tasks were medication, pathology, and observation parameter modification orders (known as ViCTOR), as well as request for review of patients (►**Fig. 4**). ViCTOR contains predefined vital sign parameter targets adjusted for age and aids clinicians in recognizing patient deterioration.

The ETM was most highly utilized by surgical units compared with medical specialty units. Departments with the highest volume of tasks were cardiology/cardiac surgery, oncology services, pediatric surgery, and general medicine. The distribution of types of tasks ordered in these high-volume units varied significantly (►**Fig. 5**).

The majority of tasks were ordered by nurses for medical staff to complete (97.1%). The majority of tasks (77.1%) were classified by requestors as high priority (to be completed within 2 hours), although only 77.4% of all tasks were marked as completed within their requested timeframe. Irrespective of timeliness, all tasks were eventually completed by clinicians, with a significant proportion (98.8%) of tasks marked as complete on the ETM, indicating a high level of closed-loop feedback after tasks were requested.

Discussion

As demonstrated in this study, an integrated ETM improves clinician workflows and enhanced clinician communication and efficiency. Previous studies have demonstrated improvement in workflow efficiency and quality of communication secondary to the autocompletion of requester details and time requested as well as mandating specification of task urgency.[4,12] The addition of real-time in-platform text messaging and the ability to visualize the hospital's workload were also shown to enable appropriate dynamic redistribution of work and thus increase staff satisfaction.[2,11]

Clinical Communication

The pattern of ETM usage reflects widespread adoption and use for nonurgent clinical communication between nurses and doctors. This is evidenced by the spread of tasks across all wards and departments at our institution as well as minimal inter-day or -month variation between requests. Furthermore, the large majority of tasks marked as completed indicates that the system is both effective in providing closed-loop feedback, which reduces safety risk,[13,14] and also forms a key platform for nurse–doctor clinical communication throughout the organization.

Besides providing a platform where nursing–medical requests could be communicated as part of organizational norm, there was also a small but steadily growing utilization of the ETM for allied health–medical and medical–medical communication. This indicates that over time the platform is not only growing in scope to encompass multicraft-group

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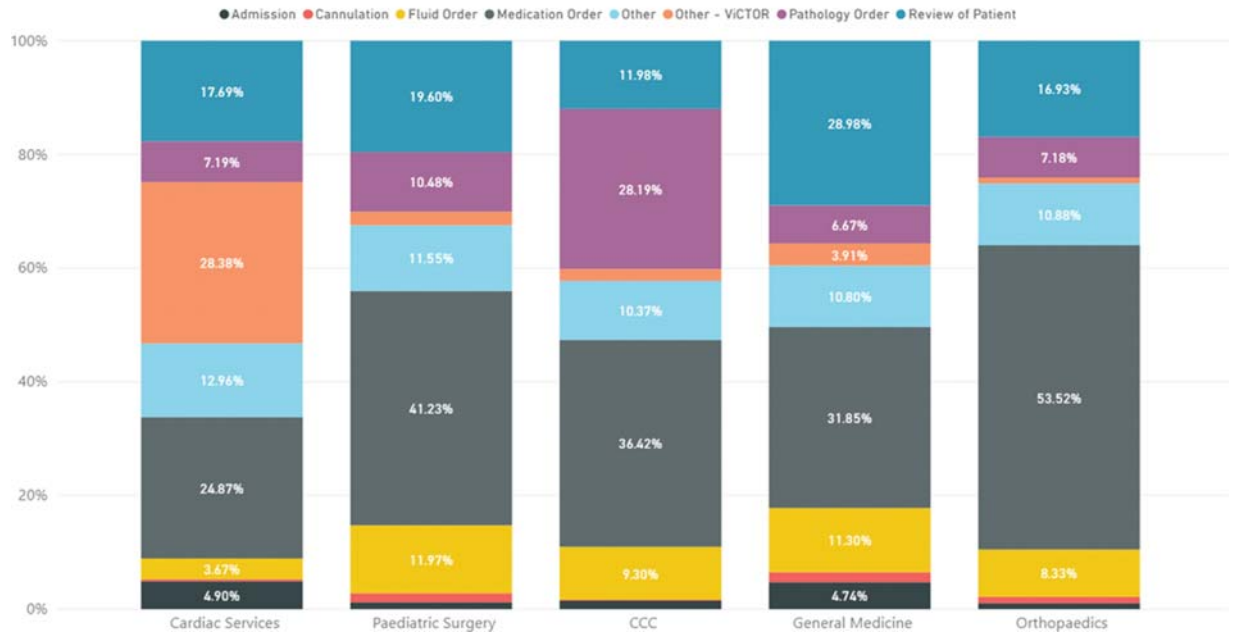

Fig. 5 Top five units/departments by order count.

communication, but also has become embedded as part of the clinical communication platform matrix at RCH.

Clinical Workflows and Efficiency

By creating a digital record of task requests, the ETM enables a timeline and map of tasks, decisions taken, and responsible clinicians associated with each one. This key feature sets ETMs apart from using other tools such as handoff or order management, and is particularly important to ensure accountability for clinical decisions and patient safety.[12]

The majority of tasks placed (79.81%) are administratively related (e.g., renewal of a standing medication order) that do not require immediate action or direct patient review. This highlights the place and importance of ETM within clinician workflow as a key repository of nonurgent tasks for medical staff, which can be addressed in a timely and appropriate fashion without adding to the cognitive load of clinicians, or disrupting and distracting them from other urgent tasks they are engaged in. By having real-time remote access to the ETM within the EHR at any time, this also allows many of these tasks such as fluid or medication orders to be completed "on the fly" at a remote terminal when appropriate/convenient for the clinician. This has anecdotally significantly streamlined and improved clinician efficiency and satisfaction.

The ETM's integration with existing clinical workflow is demonstrated by the time-based peaks in frequency of task ordering. These are patterned around nursing shift changes, as well as evening handover between day and after-hours junior medical staff (between 5 and 5:30 p.m.). This is likely a result of an active review of patient information during the handover period—with subsequent task requests for outstanding items not yet completed. The number of tasks increases in the after-hours period (►Fig. 3), where there is less physical medical staff presence, and where covering doctors may be more likely to be asked to complete outstanding requests from the during-hours home team.

Clinical Workload and Practice

By mapping task requests from across the organization, the ETM enabled assessment of hospital-wide medical staff workload and resources, as previously reported by Marshall et al.[4] By providing robust time-based data, redistribution of medical staff resources to provide extra support in "hotspot" areas could be considered. Covering medical staff may also be able to plan their shift workflows around these peak task periods or hospital areas. Subsequent impacts could then be compared and adjusted as appropriate based on trends. This analysis was not previously available or possible when tasks were requested via either the standalone ETM or alphanumeric paging systems due to data inaccuracy and availability.

Mapping of tasks also allowed us to notice trends in work practice. The top five units, by task ordering frequency, placed over 60% of all task orders. This corresponds to units with a high inpatient census and patient complexity, rather than a reflection of increased staff volume. The ETM data have helped to identify ways to improve clinician efficiency specifically in these areas.

For example, the high number of medication, pathology, and fluid order reconciliation tasks requested by nursing staff after-hours likely reflect practices during regular patient rounds that may significantly increase the workload of covering medical staff working after-hours. Specifically, surgical departments have a higher percentage of medication order task requests compared with medical departments (►Fig. 5). These are usually postoperative medications, which may not always be charted at the time of procedure. ETM has enabled understanding of these "upstream" practice patterns—which can then be leveraged for optimization by ensuring that

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routine postoperative orders such as analgesia become a mandatory part of any postoperative order-set within our EHR. This in turn would have a downstream effect to alleviate the number of ETM tasks.

A similar situation in the oncology department, where patients require routine pathology orders as part of their treatment protocol, resulted in a higher than average pathology order request rate. Rather than increasing clinician workload and cognitive load with repetitive task requests, existing order-sets were redesigned to include these orders.

Another trend was observed related to patients in the cardiology ward, where a significant proportion of tasks relates to altering acceptable oxygen saturation targets for patients. At our institution, any patient with a saturation below a standardized target range is flagged for a mandatory medical emergency team call unless a specific order is placed to alter these targets. This is particularly common for the cardiac patient cohort compared with other hospital patients due to underlying congenital heart disease conditions resulting in lower saturation targets. Again, instead of nursing staff having to request this each time via the ETM, preemptively including orders for altered saturation targets for appropriate patients at the time of admission would reduce the need for redundant and duplicate workflows.

Limitations and Future Improvements

As a retrospective audit in a single institution, there are challenges regarding the generalizability of these findings due to specific institutional factors outside the ETM, such as communication platforms, staff hours, distribution, and numbers that can affect task requests placement and completion. Nonetheless, the principles learnt from a large volume of data including workflow and communication efficiencies may be applicable to other institutions.

There are also limitations in function with the current ETM such as the lack of task delegation to individual providers and ability to access the ETM via mobile devices. As individual clinicians start to gravitate toward use of their own devices for multiple purposes including secure communication, these functionalities become more important.[7] Given that our ETM is a function within the EHR, there are developments currently in the pipeline to enable these features. At the time of writing, functionality allowing doctors to "acknowledge" tasks prior to completion has been implemented and is being evaluated.

Conclusion

An ETM function embedded in our EHR has been highly utilized in our institution since its introduction. It has multiple benefits for the clinician in the form of efficiencies in workflow and improvement in communication and also workflow management. By allowing collection, tracking, audit, and prioritization of tasks, it also provides a stream of actionable data for quality-improvement activities.

Future refinements to functionalities that enable mobile functionality and notifications will further enhance and embed ETMs as an important part of clinical communication methodology.

Clinical Relevance Statement

Many health care institutions adopt a "best-of-breed" strategy with a mix of notification, pager, and phone platforms for clinical communication—all with variable penetrance and efficacy. An embedded ETM EHR has significant benefits including collection, audit, and prioritization of tasks. ETMs allow for improved clinical communication but also evaluation of impacts on workflow and workload.

Multiple Choice Questions

1. Limitations in current clinical communication platforms often include:
   a. Missing information in message requests
   b. Incorrect or inaccurate information in communication
   c. Ability to prioritize or triage tasks/messages
   d. Interruptions in doctor/nursing workflow

   Correct Answer: Option c is the correct answer. Most clinical communication platforms focus on transmission of messages from one party to another, with no ability to prioritize tasks. This is an important feature of ETMs which allow clinicians to appropriately triage their work tasks.

2. As a clinical communication tool, ETMs are currently best utilized for:
   a. Nonclinical communication between hospital staff
   b. Communicating emergency/urgent reviews of patients
   c. Case conferences with family members of patients
   d. Nonurgent clinical patient tasks for completion

   Correct Answer: Option d is the correct answer. ETMs have been designed for nonurgent clinical tasks related to specific patients to be completed by clinicians. They are not the safest, most effective, or useful tool for a, b, or c.

Protection of Human and Animal Subjects

There were no human subjects involved in the project.

Authors' Contributions

D.R.C. developed the concept for the study. D.R.C. and M.S. were involved in the audit and development of the ETM tool. D.R.C. and M.S. were involved in the drafting, editing, and proofing of the manuscript.

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None.

Conflict of Interest

None declared.

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References

1 Ongenae F, Vanhove T, De Backere F, De Turck F. Intelligent task management platform for health care workers. Inform Health Soc Care 2017;42(02):122–134

2 Whitehead NJ, Maharaj ON, Agrez M. A computer-based task management system for junior medical officers during after-hours shifts. Med J Aust 2014;200(02):79–80

3 Patel R, Reilly K, Old A, Naden G, Child S. Appropriate use of pagers in a New Zealand tertiary hospital. N Z Med J 2006;119(1231):U1912

4 Marshall S, Warren B, Roodenburg O, et al. An electronic task management (ETM) system for after hours hospital work and subsequent socially mediated effects of task completion. Proc Hum Factors Ergon Soc Annu Meet 2016;60(01):566–570

5 Gabow PA, Karkhanis A, Knight A, Dixon P, Eisert S, Albert RK. Observations of residents' work activities for 24 consecutive hours: implications for workflow redesign. Acad Med 2006;81(08): 766–775

6 Wu DTY, Vennemeyer S, Brown K, et al. Usability testing of an interactive dashboard for surgical quality improvement in a large congenital heart center. Appl Clin Inform 2019;10(05):859–869

7 Przybylo JA, Wang A, Loftus P, Evans KH, Chu I, Shieh L. Smarter hospital communication: secure smartphone text messaging improves provider satisfaction and perception of efficacy, workflow. J Hosp Med 2014;9(09):573–578

8 Wu RC, Lo V, Morra D, et al. The intended and unintended consequences of communication systems on general internal medicine inpatient care delivery: a prospective observational case study of five teaching hospitals. J Am Med Inform Assoc 2013;20(04):766–777

9 Trebble TM, Hansi N, Hydes T, Smith MA, Baker M. Process mapping the patient journey: an introduction. BMJ 2010;341:c4078

10 Weigl M, Müller A, Zupanc A, Glaser J, Angerer P. Hospital doctors' workflow interruptions and activities: an observation study. BMJ Qual Saf 2011;20(06):491–497

11 Seddon ME, Hay D. Task Manager: an innovative approach to improving hospital communication after hours. N Z Med J 2010; 123(1324):57–66

12 Foo E, McDonald R, Savage E, et al. Mobile task management tool that improves workflow of an acute general surgical service. ANZ J Surg 2015;85(10):760–765

13 Dalal AK, Roy CL, Poon EG, et al. Impact of an automated email notification system for results of tests pending at discharge: a cluster-randomized controlled trial. J Am Med Inform Assoc 2014; 21(03):473–480

14 Georgiou A, Lymer S, Forster M, et al. Lessons learned from the introduction of an electronic safety net to enhance test result management in an Australian mothers' hospital. J Am Med Inform Assoc 2014;21(06):1104–1108

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