mHOMR: the acceptability of an automated mortality prediction model for timely identification of patients for palliative care

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INTRODUCTION

Patients with non-cancer serious illnesses are under-recognised and receive palliative care only in the final weeks of life, if at all.[1] The modified Hospitalised-patient One-year Mortality Risk (mHOMR) tool is a computer-based mortality prediction tool that accurately identifies patients at risk of 1-year mortality and is a feasible alternative to healthcare provider (HCP)-dependent models.[2] Briefly, the tool uses data from the electronic health record to calculate an mHOMR score for each new hospital admission. The alert only notifies the lead physician, suggesting they refer the patient topalliative care and does not provide the actual score.[2] In this study, we sought the perspectives of patients, family members, and HCPs to identify acceptability of mHOMR as a mortality risk tool. Together, these two studies represent the feasibility and acceptability components of the implementation outcomes (IO) framework.[3]

METHODS

Previously we reported the development and feasibility of mHOMR (see Wegier *et al*[2] for more details). Alongside the feasibility study[2] we collected qualitative data from November 2016 to May 2017 pre-implementation and from June to October 2017 post-implementation at two quaternary hospitals in Toronto, Canada. We used a postpositivist, qualitative content methodology[4] and consecutively recruited: (1) English-speaking patients admitted to a medicosurgical ward with an mHOMR score >0.21 (ie, >21% risk of death in 12 months) and (2) HCPs who admitted patients with an mHOMR score >0.21 or were involved in advance care planning or goals of care (GOC) discussions with these patients. Substitute decision makers were recruited if a patient could not consent. In-person interviews with patients and caregivers and phone interviews with HCPs were conducted before and after implementation of mHOMR. We followed semistructured interview guides (Interview guides can be found here: https://osf.io/34dcm/?view_only=4eefb31c12404d55aec2ff697054f25d) asking about challenges to initiating a palliative care approach and both expectations and experiences with mHOMR. Interviews were conducted by an experienced qualitative researcher with a PhD in anthropology (GE) and were recorded, transcribed verbatim, and anonymised. Three coders (PW, SSa, SSu) analysed the data using MaxQDA,[5] with at least two coders coding each transcript; SSa coded every transcript. Analysis was done using an iterative inductive and deductive qualitative content analysis.[4] Findings from before and after implementation were compared and no noteworthy differences were found. In the event of disagreement, consensus was reached through discussion.

RESULTS

Of 80 participants screened, patients (n=22), caregivers (n=15), residents (n=3), administrative staff (n=3) and physicians (n=21) participated (n=64, 80% participation rate). Median interview length was 12 min (IQR=13). Forty-nine participants replied to the question 'Do you find this tool acceptable?'; answering yes (71%, n=35), no

Table 1 Representative quotes

Perceived facilitators	
Providing context to the patient	PT08: 'So that [the doctor] can be fully informed. Because he doesn't know necessarily what's going on. He may later on down the line at some point. But he needs something now so that it can affect if he sees the patient at that point.' FM07: 'And if the doctor… You know, if there's an extra awareness somewhere, I think that's not a bad thing.' PHYS06: 'Sometimes you can't see the forest from the trees. So, you see just this acute illness which is clearly a reversible illness, and you forget to put in context of what's happened to them in the last year or two because you're so focused on keeping them alive in this context.'
Acting as a reminder	PHYS13: 'But it was certainly useful to at least, you know… If I weren't aware of the likely increased risk of mortality and the need for discussions around, you know, goals of care then this at least reminded me.' PHYS06: 'It's a reminder. It's not a command. It's a very reasonable thing. There will be sometimes where [it's] a younger person who's been in and out waiting for a transplant, then you'd say, "no, that's not appropriate," they really want the transplant. As long as it's not mandated, I think it's a very good thing to have a reminder.'
Confirmation of gestalt	PHYS18: 'It wasn't any kind of a surprise when I saw it in terms of when I saw that this patient had an elevated one year mortality risk and knew who the patient was. It was always pretty concordant and pretty much fit with what I would have expected.'
Supporting clinical uncertainty	RES03: 'I don't have the same exposure that say someone who's done this for 40 years would have. So, I think that's the first thing as a resident for sure. Like we've only seen 10 patients with this condition. So, we just don't have the experience that when they have this, this and this, it's for sure that they're not going to live through it, versus like, oh, they can.'
Perceived barriers	
Situation and context	
Alert timing	RES02: 'I wonder if there was a specific time in the week. You know, before morning rounds at some point, or afternoon rounds, where we got all of the patients for that week or on that current day or whatever, to be able to more effectively assess it as a team.'
Who receives the alert	PHYS12: 'No, the residents don't get [the messages], I get them in the morning. There's no problem with it going to the residents, but I would think there would be more bang for its buck if it went to the coordinator of the bullet rounds. In other words, the nurse who was running it.'
Alert information	RES02: 'The information given is just "this patient has an elevated risk of mortality" in whatever time period. As far as I know, I don't think you give me the actual percentage increase risk. I can appreciate there's a line between providing too much information versus providing some information. Personally, I think it would be better to have a bit more clarity about what exactly is the mortality risk. When I use risk scores clinically, it's not just necessarily the final number, but what components contribute to that [score] that gives you a bit of detail about what you're kind of concerned for.'
Alert fatigue	PHYS09: 'I think it has potential as long as… When I attend on medicine, I get almost 100 emails a day with patient issues and email strings and being cc'd. I think as long as we can efficiently set [the notifications] up, I think it's a great idea.'
Redundancy and irrelevancy	PHYS02: 'I guess the issue is we try and think about this and have a discussion with every patient. Have I been surprised when someone has done poorly or done well despite what I've thought? Occasionally, but not too often, to be honest.'
Dealing with immediate and pressing issues	PHYS07: 'The inpatient stay often is very compressed. They're in the hospital, they're getting treated, and then they're home. And so, there is not time during the inpatient stay to address these things.'
Unsure about appropriate next steps	RES02: 'It would have been nice to have some sort of actionable items, because while the information is good to know, I was never really sure what to do with it. It's like, great, my patient has an elevated one year mortality risk. What can I do about that? What do I do with this information?'
Limiting patients' agency to make care decisions	FM04: 'The other opposite side of this would be that if a doctor thinks that there's no hope then they would stop trying and would not give as good a care as they maybe could have if they didn't know this information. So, information could actually be good or bad.' PHYS12: 'It depends how people interpret what to do with [the alert]. It's a statistic what your mortality is going to be, but every patient has an individual course. And so I guess the concern is how it's interpreted by various healthcare workers in terms of what this really means and what we should be offering to people, and whether it's going to be seen as something that we shouldn't be offering active treatment because of an actuarial risk that may not play out in an individual person.'

RES, resident; PHYS, physician; FM, family member; PT, patient.

(12%, n=6) and unsure (16%, n=8). Those who found mHOMR unacceptable emphasised situational challenges, whereas acceptable responses emphasised the advantages of an automated approach. Facilitators and barriers for mHOMR uptake are reported with illustrative quotes in table 1.

Perceived facilitators

Patients and caregivers perceived an advantage to their HCPs receiving a mortality prediction alert via mHOMR. Physicians felt similarly, stating the information provided context to the patient in front of them. Since mHOMR does not mandate any actions, HCPs valued receiving information while preserving judgement in care decisions. HCPs discussed the benefit of reminders or confirmations of their gestalt impression of patients' potential palliative needs. Residents discussed the value of mHOMR as sometimes they lacked the clinical experience required to identify patients with an elevated risk of mortality.

Perceived barriers

When deploying the alerts, HCPs felt it was important to consider the situation and context. Some preferred

alerts at specific times and directed to specific HCPs, such as the nurse leading rounds or residents on call. Some HCPs indicated the mHOMR alert itself did not include enough information about how the score was calculated. Alert fatigue was another common concern. Some physicians who felt they were already aware of the patient's elevated mortality risk were concerned about redundancy of the alert. Physicians felt it was critical to address immediate and pressing issues (ie, the reason for the acute admission) over long-term care needs. Others felt mHOMR alerts added to their gestalt but felt unclear about appropriate next steps. Both physicians and patients voiced concerns over whether mHOMR would limit patients' agency to make care decisions.

DISCUSSION

This is the first qualitative study to demonstrate acceptability of using an *automated* mortality prediction tool to support care decisions in a hospital setting. Our findings are not surprising given that presumed acceptability rates, as evidenced by acceptance of a palliative care triggering mandate, among automated mortality prediction tools have been shown to be high.[6–8] Previous research highlights the acceptability of patient and/or clinician-reported prognosis tools in both community and hospital settings.[9–12] Reasons for this are similar to our findings, that it helps to provide context to patients[9 13] and that it is individualised.[13] Given the manpower required to implement self-report tools, the acceptability of automated tools is promising since clinicians have poor recognition of end of life (EOL)[1 14] and report limited capacity,[8 14] which often thwarts these conversations upstream. This is concerning since having conversations about EOL has been found to increase patient agency and satisfaction at EOL.[15] Automated models, such as mHOMR, may contribute to increasing the number of these upstream conversations,[16] thus improving quality of care at EOL.

Aligning the acceptability of this study with the commonly used Hexagon tool,[17] which uses six criteria to assess acceptability within implementation sciences, we see that there is an obvious (1) Need and (2) Fit for mHOMR in the organisation. Regarding (3) Resources, (4) Capacity, and (5) Evidence, participants discussed few concerns. Primarily, the lack of ability to address the alerts as a result of capacity and concerns about needing to focus on acute needs over long-term concerns likely reflects a broader issue driving late adoption of a palliative approach to care, where more urgent issues justify delaying this discussion. With respect to (6) Readiness, participants reported tension between the desire for more information surrounding patients' conditions and concern over agency in care decisions.

Regarding limitations, we were unable to collect demographic data or mHOMR scores of participants. However, given the consecutive enrolment and high degree of participation, our sample should be representative of patients who may be seen on a medicosurgical ward with an mHOMR score of >0.21. Second, some participants were unable to provide a large period of their time, resulting in a short average interview duration. While this work is still in the early phases, the feasibility study showed promise that the alert leads to changes in clinical practice and so future research will aim to scale up the use of this tool to better assess the remaining IOs.

This study, combined with Wegier *et al*'s[2] study, represents two components of the IO framework proposed by Proctor *et al*.[3] Taken together, the mHOMR tool is feasible and is acceptable, the results are promising to continue to assess implementation. Future research will continue to look at ideal implementation conditions, as dictated by the IO framework.

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Contributors JD conceived the study and developed the protocol. PW, SSa and SSu led the drafting of the manuscript. All authors contributed to data collection and/or analysis and interpretation, revising the manuscript, and approved the final version submitted for publication.

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