Automated Prospective Clinical Surveillance for Inpatients at Elevated Risk of One-year Mortality Using a Modified Hospital One-Year Mortality Risk (mHOMR) Score

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  • Boehringer-Ingelheim (Canada)
  • Novartis

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### Access to Palliative Care by Disease Trajectory: A Population-Based Cohort of Ontario Decedents

Hsien Seow, Erin O’Leary, Richard Perez, Peter Tanuseputro

<table>
<thead>
<tr>
<th>Setting of PC</th>
<th>Terminal Illness (n=75657)</th>
<th>Organ Failure (n=72363)</th>
<th>Frailty (n=67513)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any palliative care</td>
<td>88%</td>
<td>44.4%</td>
<td>32.4%</td>
</tr>
<tr>
<td>PC in community</td>
<td>68.6%</td>
<td>17.2%</td>
<td>15.1%</td>
</tr>
<tr>
<td>Median days between first PC and death (IQR)</td>
<td>107 (33, 246)</td>
<td>22 (6, 124)</td>
<td>24 (6, 132)</td>
</tr>
<tr>
<td>% of days receiving PC</td>
<td>37%</td>
<td>25%</td>
<td>23%</td>
</tr>
</tbody>
</table>
Why is Early Identification Important?

• Encourages introduction of a palliative approach to care

• Activates proactive care planning and discussions to define goals of care
  • Anticipate needs
  • More thoughtful and meaningful when conducted in an emotionally calm state

• Facilitates access to appropriate resources and supports required to meet patient needs

• Improves patient and system outcomes
  • More positive experience by patient, family and their health care providers
  • Reduced health care costs
  • minimize unnecessary emergency department visits and hospital admissions

Gratitude to Tara Walton and Ahmed Jakda
Early Identification as a Priority in Ontario

Declaration of Partnership (2011):
“Ensure early identification and access to services and supports”

Palliative & End-of-Life Care Provincial Roundtable Report (2016):
“The earlier we can begin delivering palliative services to patients who have been diagnosed with a life-limiting illness, the better for their health”

Gratitude to Tara Walton and Ahmed Jakda
Early ID to Transform Palliative Care in Ontario

OPCN Action Plan:
Action Item C. Enabling Early Identification of People Who Would Benefit from Hospice Palliative Care

Palliative Quality Standard Statement #1: Identification and Assessment of Needs

Gratitude to Tara Walton and Ahmed Jakda
Early Palliative Care for Patients with Metastatic Non–Small-Cell Lung Cancer


- Improved QOL (FACT-L 98 vs. 91.5)
- Less depression (16 vs. 38%)
- Improved survival (11.6 vs. 8.9 months)
Early palliative care for patients with advanced cancer: a cluster-randomised controlled trial

Camilla Zimmermann, Nadia Swami, Monika Krzyzanowska, Breffni Hannon, Natasha Leighl, Amit Oza, Malcolm Moore, Anne Rydall, Gary Rodin, Ian Tannock, Allan Donner, Christopher Lo

- 3 month outcomes
  - Improved satisfaction with care (FAMCARE)

- 4 month outcomes
  - Improved QOL (FACIT, QUAL-E)
  - Improved symptom scores (ESAS)
  - Improved satisfaction with care (FAMCARE)

ASCO Guidelines

• Combined standard oncology care and palliative care should be considered early in the course of illness for any patient with metastatic cancer and/or high symptom burden.
  • Smith et al. J Clin Oncol 2012

• Inpatients and outpatients with advanced cancer should receive dedicated palliative care services, early in the disease course, concurrent with active treatment.
  • Ferrell et al. J Clin Oncol 2016
Does this patient have unmet palliative needs?

Review current care and care planning (From SPICT™):
• Review current treatment and medication so the person receives optimal care
• Consider referral for specialist assessment if symptoms or needs are complex and difficult to manage.
• Agree current and future care goals, and a care plan with the person and their family
• Plan ahead if the person is at risk of loss of capacity.
• Record, communicate and coordinate the care plan.
## Prognostication

### Table 4: Summary of point-based models for predicting risk of death among hospital patients

<table>
<thead>
<tr>
<th>Model/study</th>
<th>N (derivation)</th>
<th>Description of derivation cohort (recruitment period)</th>
<th>Cohort; C statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td>Derivation</td>
</tr>
<tr>
<td>Silver Code&lt;sup&gt;3&lt;/sup&gt;</td>
<td>5 457</td>
<td>Patients ≥ 75 yr admitted to medical ward from emergency department (2005)</td>
<td>0.66</td>
</tr>
<tr>
<td>SAFES&lt;sup&gt;5&lt;/sup&gt;</td>
<td>870</td>
<td>Patients ≥ 75 yr admitted to medical ward from emergency department (2001–2002)</td>
<td>0.72</td>
</tr>
<tr>
<td>CARING&lt;sup&gt;7&lt;/sup&gt;</td>
<td>435</td>
<td>All patients admitted to medical service (1999)</td>
<td>0.82</td>
</tr>
<tr>
<td>BISEP&lt;sup&gt;8&lt;/sup&gt;</td>
<td>525</td>
<td>Patients ≥ 70 yr admitted to general medical service (1989–1990)</td>
<td>0.83</td>
</tr>
<tr>
<td>SUPPORT&lt;sup&gt;10&lt;/sup&gt;</td>
<td>9 105</td>
<td>Patients ≥ 18 yr with high-risk admission diagnoses (1989–1994)</td>
<td>–</td>
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<tr>
<td>Levine et al.&lt;sup&gt;11&lt;/sup&gt;</td>
<td>6 534</td>
<td>Patients ≥ 65 yr discharged from general medical service (1997–2001)</td>
<td>0.70</td>
</tr>
<tr>
<td>MPI&lt;sup&gt;12&lt;/sup&gt;</td>
<td>838</td>
<td>Patients ≥ 65 yr admitted to geriatric unit (2004)</td>
<td>0.75</td>
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<tr>
<td>HELP&lt;sup&gt;14&lt;/sup&gt;</td>
<td>1 266</td>
<td>Patients ≥ 80 yr admitted ≥ 2 d for nonelective reasons (1993–1994)</td>
<td>0.74</td>
</tr>
<tr>
<td>Walter et al.&lt;sup&gt;19&lt;/sup&gt;</td>
<td>1 495</td>
<td>Patients ≥ 70 yr discharged from general medical service (1993–1997)</td>
<td>0.75</td>
</tr>
<tr>
<td>HOMR&lt;sup&gt;1&lt;/sup&gt;</td>
<td>319 531</td>
<td>All adults admitted to nonpsychiatric hospital services (2011)</td>
<td>0.92</td>
</tr>
</tbody>
</table>

Note: BISEP = Burden of Illness Score for Elderly Persons; CARING = cancer, admissions and hospital service, direct admission to an intensive care unit (ICU) (1989–1994); C statistic range 0.05%–2.5%.
Functional Impairment

Fig. 1. Kaplan-Meier survival curves by initial PPS.
Functional Impairment

Cancer patients experienced a more precipitous decline in ADL, which started approximately 5 months prior to death. Such decline was associated with where the person died and whether hospice was involved in their terminal care.

Recent public debate has focused on issues of access and abuse of the U.S. Medicare Hospice Benefit. Many have worried that hospice provides only limited access to persons with diagnoses other than cancer, partially because it is so difficult to predict survival in this population. The National Hospice Organization has released clinical guidelines as an aid for which persons should be considered for hospice referral. Attempts to validate these guidelines have raised important concerns regarding their ability to predict death. This uncertainty has taken even more importance with the Office of Inspector General's increased scrutiny of hospice patients surviving longer than 6 months as potentially fraudulent medical care.

Our findings have implications for both of these public policy concerns. We found hospice referral was related to the pattern of functional decline. Among those persons who lost three or more ADL dependencies in the last 5 months of life, nearly one in three utilized hospice services. The rapidity of the functional decline may serve as a cue to the physician, patient, and family that the person is dying. Additionally, the functional decline and resulting diminished quality of life may influence dying persons and their family to accept the explicit trade-off of the hospice (i.e., foregoing active treatment for increased supportive care). However, the majority of patients did not exhibit that classic rapid functional deterioration. If this is true, perhaps the certification process for the U.S. Medicare Hospice Benefit discriminates against those persons with noncancer terminal diagnoses. At each recertification period, a physician must attest to the fact that the patient has an expected 6-month prognosis. Among the evidence that Health Care Financing Administration's fiscal intermediaries look to justify this prognosis is documentation of a functional decline. If recertification is biased against patients with noncancer diagnoses, these patients could be discharged inappropriately from hospice just months or days before death.

The functional decline displayed in Figure 1 may have implications for physicians' ability to state a prognosis of 6 months or less. Fox and colleagues found that when using a narrow window of prognostic certainty for determining whether persons with COPD, CHF, and end-stage liver disease will die in the next 6 months,
Gold Standards Framework/Prognostic Indicator Guidance (GSF/PIG) Tool

1. Surprise Question (?)
   • Would you be surprised if this patient died in the next 12 months?*

2. General Indicators of Decline
3. Specific Clinical Indicators

The Gold Standards Framework Centre In End of Life Care CIC, 2011.
Would you be surprised if...
The “surprise question” for predicting death in seriously ill patients: a systematic review and meta-analysis

James Downar MDCM MHSc, Russell Goldman MD MPH, Ruxandra Pinto PhD, Marina Englesakis MLIS, Neill K.J. Adhikari MDCM MSc

• 16 studies- 11621 patients
• Sensitivity 67%, Specificity 80.2%
• LR+ 3.4, LR- 0.41, PPV 37%
• Better performance in cancer (LR+ 4.2)
• Very poor in non-cancer (LR+ 2.7, LR- 0.53)

Other problems with the SQ and PIG

• Kappa poor to fair (0.18-0.41)
• Poor response rate when applied to multiple responders
• ”Screening” tool?
  • Up to 83% of patients SQ+ve
  • Up to 77% of patients PIG+ve
• NICE no longer recommends SQ as screening tool in UK
  • Dropped from SPICT

Yarnell et al. [Abstract] Presented at CCCF 2015.
Identifying a dying trajectory- Ideal State

• Accurate
  • False positives- poor allocation of limited resources, alert fatigue
  • False negatives- untreated suffering

• Not provider dependent
  • Individual providers unreliable

• Seamless integration with current workflow
  • “BIG DATA”
  • Administrative, Symptoms
Automated Trigger Tool

- Hospital One-year Mortality Risk (HOMR)
  - Highly accurate ($c=0.89-92$)
  - Derived and validated in Ontario, Boston, Alberta (retrospective data)
  - Uses simple administrative data

Abstract

We recently derived and internally validated a patient One-year Mortality Risk (HOMR) model. Error bars indicate 95% confidence intervals.

Background:

We determined patient status alive or dead 1 year after admission to hospital. We included patient demographics (age, sex and living status at admission) and hospital service, direct admission to an intensive care unit and whether the admission was an urgent or nonurgent issue. The HOMR score was calculated using routinely collected health administrative data to predict long-term survival among hospital admissions.
## Variations of HOMR

<table>
<thead>
<tr>
<th>HOMR (c=0.90-0.92)</th>
<th>mHOMR (c=0.89)</th>
<th>HOMR Now! (c=0.92)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Age</td>
<td>Death Risk (Life Tables)</td>
</tr>
<tr>
<td>Sex</td>
<td>Sex</td>
<td>Sex</td>
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<tr>
<td>Home O2</td>
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<td>Admitting Diagnosis</td>
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<tr>
<td>Charlson Comorbidity Index</td>
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<td>Charlson (previous admission)*</td>
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<tr>
<td>Admitting Service</td>
<td>Admitting Service</td>
<td>Admitting Service</td>
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<tr>
<td>Urgent 30d readmission</td>
<td>Urgent 30d readmission</td>
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<tr>
<td># ED visits in past 12m</td>
<td># ED visits in past 12m</td>
<td># ED visits in past 12m</td>
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<td>Adm by ambulance past 12m</td>
<td>Adm by ambulance past 12m</td>
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<tr>
<td>Living Status (Home, LTC, etc)</td>
<td>(Living Status)</td>
<td>Living Status (Home, LTC, etc)</td>
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<tr>
<td>Admission Urgency/ Ambul.</td>
<td>Admission Urgency/Ambul.</td>
<td>Admission Urgency/Ambul.</td>
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<td>Direct to ICU</td>
<td>Direct to ICU</td>
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HOMR as Prospective Trigger

• Data entered on admission
  • “Invisible” process
• Adjustable threshold depending on response
  • More sensitive for scalable interventions
  • More specific for resource-limited interventions
• Auditable
• Objective
HOMR as Prospective Trigger- Feasibility

• Specific threshold
  • Sens 59%, Spec 90%
  • LR+ 5.9, LR- 0.46
  • Site #1- 19 pts/d (15.8% of admissions)
  • Site #2- 7 pts/d (12.2% of admissions)

• Qualitative
  • Some enthusiasm from staff, minimal concern from patients
  • NO EMAILS!
HOMR as Prospective Trigger- Feasibility

### Group or Variable

<table>
<thead>
<tr>
<th></th>
<th>Phase 1 (no notification)</th>
<th>Phase 2 (notification)</th>
<th>P value for difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD)</td>
<td>83.8 (7.9)</td>
<td>83.0 (7.8)</td>
<td>0.3&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Length of Stay, median (IQR)</td>
<td>5 (6)</td>
<td>6 (7)</td>
<td>0.8&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>“No CPR” order on admission, n (%)</td>
<td>79 (40%)</td>
<td>75 (38%)</td>
<td>0.7&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Proportion with PC consult or documented early GOC discussion

<table>
<thead>
<tr>
<th></th>
<th>Site 1 - integrated notification, n (%)</th>
<th>Site 2 - email notification, n (%)</th>
<th>P value for difference</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>20 (20)</td>
<td>53 (53)</td>
<td>0.02&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>35 (35)</td>
<td>45 (45)</td>
<td>0.26&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

- 89% Survived to hospital discharge
- 227/401 patients admitted (56.8%) with frailty-related condition
- 94/401 patients admitted (23.5%) chronic organ failure condition
- 80/401 patients admitted (20%) with cancer-related condition
Qualitative Results

• Some physicians found prompts helpful, others expressed concerns of redundancy/frequency
  • “As long as it’s not mandated, I think it’s a very good thing to have a reminder.”
  • [The notifications] would be most useful if they gave me information that I wasn’t already aware of. [...] And I suppose if there was a patient who I didn’t really think was at significantly high risk, and then, you know, this score tells me that they have a very high risk of dying in some short period, that might alter my approach.

• Patients and family hoped mHOMR would prompt more communication with physicians
  • “Notifications might benefit those who were less vocal in advocating for themselves.”
HOMR as Prospective Trigger- PC Needs

• Surveyed pts identified by HOMR tool
  • Severe Symptoms (ESAS Score >6)
  • Desire to speak to MD about ACP (ACP Engagement Tool)

• Comparison of different HOMR thresholds
  • HOMR >0.21 (Sens 59%, Spec 90%)
  • HOMR >0.10 (Sens 83%, Spec 77%)
HOMR as Prospective Trigger- PC Needs

- 76% agreed to complete questionnaire
- 91% patients, 9% family/SDM
- 10 week enrollment on general internal medicine ward:
  - HOMR threshold >0.10 flagged 22.6% of admissions
  - HOMR threshold >0.21 flagged 8.5% of admissions

<table>
<thead>
<tr>
<th>Illness Trajectory</th>
<th>HOMR &gt;0.10 (n=201)</th>
<th>HOMR &gt;0.21 (n=75)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancer</td>
<td>73 (36%)</td>
<td>18 (24%)</td>
</tr>
<tr>
<td>Organ Failure</td>
<td>64 (37%)</td>
<td>30 (40%)</td>
</tr>
<tr>
<td>Frailty</td>
<td>40 (20%)</td>
<td>26 (35%)</td>
</tr>
<tr>
<td>Other</td>
<td>14 (7%)</td>
<td>1 (1%)</td>
</tr>
</tbody>
</table>
HOMR as Prospective Trigger- PC Needs

<table>
<thead>
<tr>
<th>Unmet PC Need (n=186)</th>
<th>HOMR score 0.10-0.21</th>
<th>HOMR score &gt;0.21</th>
<th>P value for difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESAS Symptom score &gt;6 (%)</td>
<td>62</td>
<td>77</td>
<td>0.03</td>
</tr>
<tr>
<td>Desire to speak to MD about ACP (%)</td>
<td>82</td>
<td>74</td>
<td>NS</td>
</tr>
<tr>
<td>Either (%)</td>
<td>94</td>
<td>91</td>
<td>NS</td>
</tr>
</tbody>
</table>
HOMR as Prospective Trigger- PC Needs

For every 100 admissions to GIM

- HOMR >0.10
- HOMR >0.21
Conclusion

• Feasible and acceptable
• Identifies a small # of patients with high burden of unmet needs
• Preferentially identifies neglected groups (e.g. frail)
• Versatile- can adjust sensitivity based on capacity
• Possibly effective for changing care
  • Utility if connected to specific intervention- results pending
• Future direction
  • QI tool to drive specific interventions
Questions?

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