

ORIGINAL ARTICLE

Implementation evaluation of a stepped approach to home care assessment using interRAI systems in Ontario, Canada

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Abstract

In Ontario, new home care clients are screened with the interRAI Contact Assessment and only those expected to require longer-term services receive the comprehensive RAI-Home Care assessment. Although Ontario adopted this two-step approach in 2010, it is unknown whether the assessment guidelines were implemented as intended. To evaluate implementation fidelity, the purpose of this study is to compare expected to actual client profiles and care co-ordinator practice patterns. We linked interRAI CA and RAI-HC assessments and home care referrals and services data for a retrospective cohort of adult home care clients admitted in FY 2016/17. All assessments were done by trained health professionals as part of routine practice. Descriptive analyses were used to evaluate congruency between recommended and actual practice. Adjusted cause-specific hazards and logistic approaches were used to examine time to RAI-HC assessment and being a high-priority client. Of 225,989 unique home care clients admitted to the publicly funded home care program, about three-quarters of clients were assessed with the interRAI CA only (27.9% completed the Preliminary Screener only and 46.6% completed both the Preliminary Screener and Clinical Evaluation). There was substantial agreement between the skip logic and completion of the Clinical Evaluation section (Cohen's kappa = 0.67 [95% CI: 0.66–0.67]). One-quarter of clients were assessed with both the interRAI CA and RAI-HC. As expected, RAI-HC assessed clients were older, reported more health needs, and often received home care services for >6 months. Clients in higher Assessment Urgency Algorithm (AUA) levels were significantly more likely to receive a RAI-HC assessment and be assigned to a higher home care priority level; however, 28.3% of clients in the highest AUA level did not receive a RAI-HC assessment. We conclude that the use of the interRAI CA and RAI-HC balances the investment of time and resources with the information and tools to deliver high-quality, holistic, and client-centred care. The interRAI CA guides the care co-ordinator to screen every client for a broad range of possible needs and tailor further assessment to each client's unique needs. We recommend integrating the AUA into provincial assessment guidelines as well as developing a new quality indicator focused on measuring access to the home care system.

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KEYWORDS

access, assessment, care planning, domiciliary care, Home care, quality, screening

1 | INTRODUCTION

In Ontario, Canada, the 14 Home and Community Care Support Services (HCCSS) organisations (formerly Local Health Integration Networks or LHINs) manage access to home and community care services and co-ordinate admission to long-term care homes. Any individual who is covered by the Ontario Health Insurance Plan and has care or support needs that can be met safely in the home environment may be eligible for publicly funded home care services. Services include but are not limited to nursing, personal support, physiotherapy, occupational therapy, and social work and may be short or long term in nature. Care co-ordinators employed by HCCSS assess the person's and family's needs and develop and oversee the care plan. Standardised assessments make it possible to identify needs, track health outcomes, and guide decisions on how to match services to need, and can also be aggregated to evaluate access, effectiveness, and quality of care at the system level.

In Ontario and many jurisdictions around the world, the RAI-Home Care (RAI-HC) or interRAI Home Care (interRAI HC) assessment is used to assess the needs of long-stay home care clients (De Almeida Mello et al., 2015; Fries et al., 2003; Heckman et al., 2013). The RAI-HC/interRAI HC is a standardised, comprehensive, and internationally validated clinical assessment (Carpenter & Hirdes, 2013; Hirdes et al., 2008; Morris et al., 2012). The assessment consists of about 250 items and takes about an hour to complete during an in-home visit. When completed, the assessment produces care protocols, decision support tools, and summary scales to support care planning and monitoring. For home care clients with chronic or complex needs, the ability to detect and respond to care needs across many domains is essential to providing high-quality person-centred care (Pilotto et al., 2017). Yet, while all clients require some needs assessment, not all clients require the in-depth level offered by the RAI-HC/interRAI HC. Clients with short-term or less complex needs may be adequately screened with the interRAI Contact Assessment (interRAI CA) that is briefer, validated for both in-person or phone-based assessment, and produces a limited number of decision support tools such as the Assessment Urgency Algorithm (AUA) that identifies clients who would likely benefit from comprehensive assessment (e.g., RAI-HC/interRAI HC).

Figure 1 illustrates how the interRAI CA and RAI-HC/interRAI HC are used together as the basis of a stepped approach to home care assessment in Ontario. The interRAI CA itself comprises a Preliminary Screener section (9 items) and a Clinical Evaluation section (about 40 items). The Preliminary Screener is used to screen new home care clients for issues with cognitive or physical functioning, shortness of breath, self-rated health, and stability of health conditions. If a client reports any issues, the care co-ordinator is prompted by the computer-guided form to complete the Clinical Evaluation section that asks additional questions about

What is known about this topic

- Standardised assessments are an important part of home care services because they help to identify client and family needs, track health outcomes, and guide decisions on how to match services to needs.
- While all home care clients would benefit from some assessment, not all clients require the level of comprehensive assessment that is appropriate for the most complex clients.

What this paper adds

- Using the interRAI CA as an initial assessment, Ontario's stepped assessment process screens every client for a broad range of health and social needs while also focusing assessment time and resources on the most complex clients.

mood, falls, pain, nutrition, skin condition, and social support (i.e., "step up" to interRAI CA). Information from the brief assessment supports a basic care plan. Clients who are expected to require home care services for >2 months receive the full assessment (i.e., "step up" to RAI-HC/interRAI HC), usually within 2 to 8 weeks (Office of the Auditor General of Ontario, 2015). Additional information and decision support gained from completing the comprehensive assessment is used to tailor and refine the client's care plan. Typically, an intake care co-ordinator completes the interRAI CA and a community care co-ordinator completes the RAI-HC/interRAI HC with the same client.

This stepped approach is designed to match the right level of assessment to the right client at the right time. All clients should receive basic screening for common health and social issues, while relational time and assessment resources are focused on the most complex clients, which is beneficial for those receiving and arranging/providing home care services alike. Existing literature shows that individuals are less likely to seek acute care and more likely to delay residential care when needs and services are well matched (Boland et al., 2017; Punchik et al., 2017). Conversely, individuals with unmet home care needs have higher rates of health service use and institutionalisation and poorer health outcomes (Gilmour, 2018).

Although Ontario adopted this two-step approach to home care assessment in 2010, it is unknown whether the assessment guidelines were implemented as intended. To evaluate implementation fidelity, the purpose of this study is to compare expected to actual client profiles and care co-ordinator practice patterns. Specifically, we tested the extent that each of the following elements of the planned implementation were met (i.e., congruency between the planned and actual implementation of the interRAI CA and RAI-HC):

2 | METHODS

2.1 | Data source and ethics approval

Ontario Health Shared Services is a government agency that supports HCCSS in part by managing the Client Health and Related Information System (CHRIS). Through the CHRIS applications and associated portals,

Planned implementation—design	Actual implementation—expectation
<ul style="list-style-type: none"> An effective assessment approach should segment the population into increasing levels of client need and risk. 	<ul style="list-style-type: none"> Clients assessed with the Preliminary Screener section only should have the least complex needs (i.e., fewest health needs, mostly focused on time-limited acute recovery). Clients assessed with the RAI-HC should have the most complex needs (i.e., greatest health needs, mostly focused on long-term support).
<ul style="list-style-type: none"> Decision support outputs should be congruent with clinical judgement. 	<ul style="list-style-type: none"> There should be at least substantial* agreement between the computer-assisted skip logic and care co-ordinator decision to complete the Clinical Evaluation section of the interRAI CA. <i>*Substantial is defined as Cohen's kappa ≥ 0.61 according to the benchmarks proposed by Landis and Koch (1977).</i> Higher AUA levels should be associated with greater perceived need for and actual receipt of RAI-HC assessment.
<ul style="list-style-type: none"> Decision support outputs should be used to prioritise earlier assessment for more complex clients. 	<ul style="list-style-type: none"> Higher AUA levels should be associated with shorter time to RAI-HC assessment.
<ul style="list-style-type: none"> Decision support outputs within the assessment system should be internally consistent. 	<ul style="list-style-type: none"> Higher AUA levels (i.e., greater need for comprehensive assessment) should be associated with higher MAPLe levels (i.e., greater priority for home care services).

HCCSS keep track of referrals, complete standardised assessments, create and update care plans, order and bill for home care services and medical equipment/supplies, and apply for long-term care placement, among other functions. Changes made in CHRIS at the local HCCSS level are reflected in real time at the provincial level. The following datasets were used in this study: interRAI CA and RAI-HC assessments, home care referrals, and home care services. All data were anonymised by Shared Services prior to transfer to the University of Waterloo although a real-world linking field was generated to allow client-level merging of the data tables. Use of these data was approved by the Office of Research Ethics at the University of Waterloo (ORE# 18228).

2.2 | Sample

The retrospective cohort comprised of unique Ontario home care clients admitted between April 1, 2016 and March 31, 2017 and met the following criteria: (1) age ≥ 18 years; (2) not residing in a hospital or long-term care home; (3) referred for acute, rehabilitation, maintenance, or long-term supportive services (i.e., not referred for end-of-life or placement services); and (4) assessed with the interRAI CA within 14 days of admission. For every client, the first interRAI CA completed within 14 days of admission and the first RAI-HC completed within 182 days of the interRAI CA assessment date (where available) were retrieved. These time periods would be expected to capture the vast majority of assessments based on reported assessment timelines (Office of the Auditor General of Ontario, 2015). In 5.6% of episodes, clients were discharged as “service plan complete” before receiving any services, and these episodes were excluded from the sample.

2.3 | Assessment Urgency Algorithm

AUA is a decision support algorithm generated from the interRAI CA (Hirdes et al., 2010). AUA ranges from 1 to 6, where higher levels indicate greater need and urgency for a comprehensive follow-up

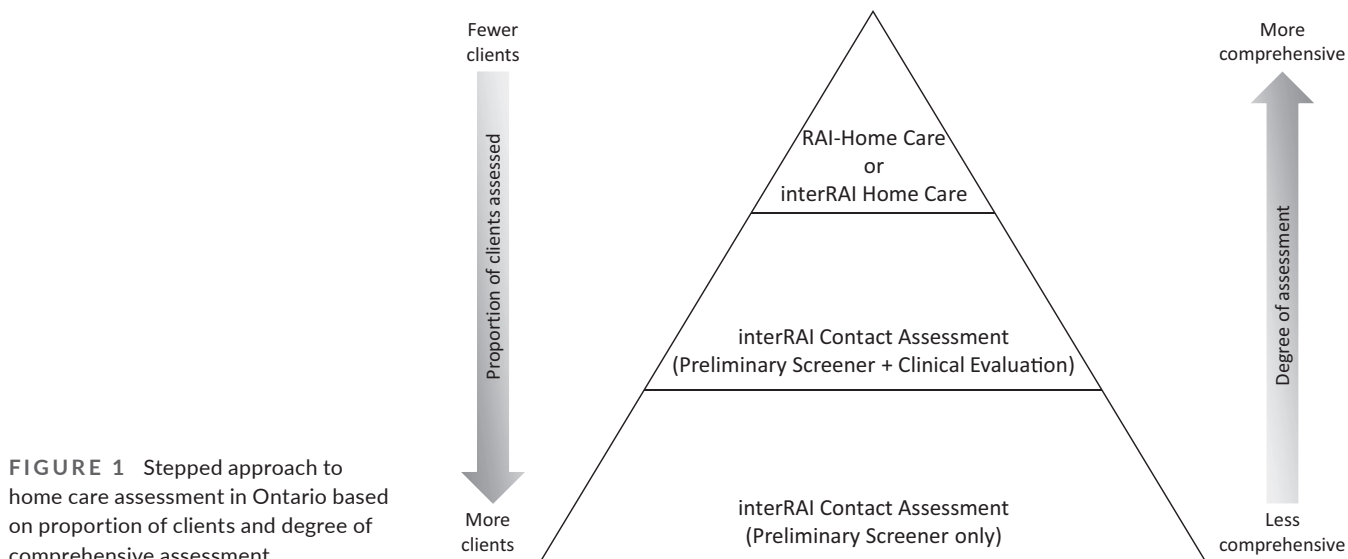


FIGURE 1 Stepped approach to home care assessment in Ontario based on proportion of clients and degree of comprehensive assessment

assessment (Figure 2). In a recent study of frailty measures within the home care population, higher AUA levels were associated with greater odds of death and hospital admission (Sinn et al., 2020). The AUA is not used in current provincial guidelines related to care planning or assessment although some local HCCSS guidelines may suggest using AUA to identify and/or prioritise clients for RAI-HC assessment.

2.4 | Method for Assigning Priority Levels (MAPLe) Algorithm

MAPLe is a decision support algorithm generated from the RAI-HC (Morris et al., 2012). MAPLe ranges from 1 to 5, where higher levels are associated with long-term care placement and caregiver distress (Hirdes et al., 2008; Mitchell et al., 2015; Sinn et al., 2018). Provincially, HCCSS use MAPLe to inform decisions about eligibility, priority, and allocation of home care services and reassessment frequency. Generally, high-priority home care clients are identified as those in MAPLe 4 (high priority) or 5 (very high priority) (Office of the Auditor General of Ontario, 2012; Sinn et al., 2018).

2.5 | Perceived need for CGA

Prior to completing the interRAI CA (i.e., before the AUA is calculated), the intake care co-ordinator records whether and how urgently the client requires comprehensive, face-to-face assessment based on their clinical judgement. In this study, any response other than "not required" was coded as a perceived need for CGA.

2.6 | Statistical analysis

Clients were sorted into three mutually exclusive groups based on the assessment(s) they received: interRAI CA (Preliminary Screener only), interRAI CA (Preliminary Screener + Clinical Evaluation), and both interRAI CA and RAI-HC. Client and home care episode characteristics were

summarised in frequency tables. Receipt of home care services was defined as receiving any nursing, physiotherapy, occupational therapy, or personal support services within 28 days of the interRAI CA assessment date. To assess population-level segmentation, group frequencies were examined using Chi-Square tests with a significance threshold of 0.05, and further checked with post hoc tests with Bonferroni-corrected thresholds. To assess the congruency between decision support outputs and clinical judgement, Cohen's kappa was calculated between the skip logic and completion of the Clinical Evaluation section and interpreted using the benchmark ranges proposed by Landis and Koch (1977). For each AUA level, the proportion of clients perceived to require comprehensive assessment by the intake care co-ordinator and the proportion of clients who were assessed with the RAI-HC by the community care co-ordinator were reported. To assess whether higher AUA levels were associated with earlier assessment, time to RAI-HC assessment was examined using Kaplan–Meier curves and additionally, a cause-specific hazard model to account for competing events (i.e., clients discharged due to death, long-term care admission, or hospitalisation >14 days). Time-dependent covariates were used to verify the proportionality assumption. Finally, to assess whether the AUA and MAPLe were internally consistent, a logistic model was used to calculate the odds that a client assessed with the RAI-HC would be identified as a high-priority client (i.e., MAPLe 4 or 5). Both models were adjusted for age, sex, and HCCSS. We used SAS software version 9.4 for all analyses (SAS Institute Inc.).

3 | RESULTS

In Ontario FY 2016/2017, there were 225,989 unique home care clients admitted to the publicly funded home care program for acute, rehabilitation, maintenance, or long-term supportive services and assessed with the interRAI CA. The median time between referral initiation and the CA assessment date was 2 days (90th percentile was 7 days). About three-quarters of clients were assessed with the interRAI CA only (27.9% completed the Preliminary Screener only and 46.6% completed both the Preliminary Screener and Clinical Evaluation), while 25.5% received both the interRAI CA and RAI-HC.

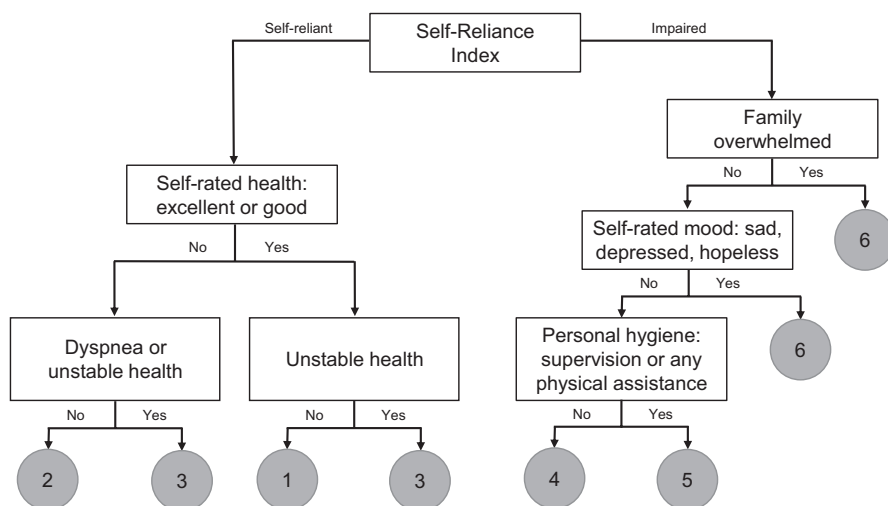


FIGURE 2 Schematic of the Assessment Urgency Algorithm. Adapted with permission from Hirdes et al., 2020

Table 1 summarises the client and home care episode characteristics of the sample. Clients who completed the Preliminary Screener only were more likely to be younger than 65 years (62.9% vs. 29.8%), not female (55.0% vs. 44.3%), and receive nursing services (96.4% vs. 52.7%). Clients who were additionally assessed with the Clinical Evaluation section of the interRAI CA often received nursing (56.6%) and/or therapy (48.4%) services. In contrast, clients assessed with the RAI-HC were more likely to be referred for maintenance (44.1% vs. 5.9%) or long-term supportive (31.6% vs. 4.0%) reasons, receive personal support services (56.1% vs. 3.8%), and continue receiving services beyond 2 months (81.6% vs. 35.2%). Clients assessed with the RAI-HC were the least likely to receive nursing services (45.6% vs. 71.5%). Completing the service plan or pathway was the most common reason for discharge regardless of the assessment group.

Each level of assessment was significantly associated with greater health needs, such that clients assessed with the Preliminary Screener only had the lowest prevalence of health status indicators and clients assessed with the RAI-HC had the highest prevalence (all pairwise comparisons $p < 0.0001$). For example, cognitive impairment was detected among 0.4%, 8.9%, and 32.2% of clients assessed with the interRAI CA (Preliminary Screener only), interRAI CAI (Preliminary Screener + Clinical Evaluation), and RAI-HC, respectively. Likewise, the percentage of clients requiring help with personal hygiene was 0.6%, 11.0%, and 32.5%, respectively. Clients assessed with the RAI-HC were significantly more likely to report issues covered in the Clinical Evaluation section, including recent falls (47.0% vs. 25.1%), sad or depressed mood (19.0% vs. 12.1%), and caregiver distress (39.5% vs. 13.0%).

Figure 3 illustrates the clear segmentation of assessment groups based on the AUA. Nearly all (97.0%) clients assessed with the Preliminary Screener only were in the lowest AUA level. Clients who were additionally assessed with the Clinical Evaluation section had a more even distribution across AUA levels, where 50.3% were in the middle AUA levels. Clients assessed with the RAI-HC were the most likely to populate the highest AUA levels, where 14.1% and 39.8% (vs. 4.5% and 7.5% overall) were in AUA 5 and 6, respectively. There were 0.9% clients with missing AUA values.

To evaluate “stepping up” to the full interRAI CA, **Figure 4** depicts the level of agreement between recommended and actual completion of the Clinical Evaluation section. If the client reported any health issues in the Preliminary Screener, the care co-ordinator was prompted to complete the Clinical Evaluation section. Otherwise, the care co-ordinator was prompted to skip the section. Actual completion/non-completion matched the built-in skip logic in 84.6% of cases (Cohen's kappa = 0.67 [95% CI: 0.66–0.67]). If the skip logic was overridden as indicated by the grey columns in **Figure 4**, the more likely scenario was that the intake care co-ordinator completed the Clinical Evaluation despite not being prompted by the computer-guided form. Among these clients, 9.9% (3096 of 31,354) were subsequently assessed with the RAI-HC.

To evaluate “stepping up” to the RAI-HC, **Figure 5** depicts the percentage of clients who were perceived to require comprehensive assessment and the actual percentage who received the RAI-HC

assessment. Each increase in AUA level was associated with more clients being perceived by the care co-ordinator to require comprehensive assessment, ranging from 2.9% of clients in the lowest level to 78.1% in the highest level ($p < 0.0001$). A similar trend was observed between AUA and receipt of RAI-HC assessment, where 3.7% of clients in the lowest level and 64.4% in the highest level were assessed with the RAI-HC ($p < 0.0001$). Overall, actual receipt/non-receipt matched the perceived need for RAI-HC in 85.0% of cases (Cohen's kappa = 0.48 [95% CI: 0.48–0.49]). Where there was disagreement, the care co-ordinator perceiving the client's need for comprehensive assessment but the client not receiving the RAI-HC assessment was the more likely scenario across all AUA levels except AUA 1. For instance, 8.8% of clients in AUA 2 were perceived to require comprehensive assessment but did not receive the RAI-HC assessment, compared to 5.3% receiving the RAI-HC but had not been perceived to require it.

While **Figure 5** did not account for cases in which follow-up assessment may not have been possible, **Figure 6** applies censoring to competing events defined as clients who were discharged due to death, long-term care admission, or hospitalisation. In general, the occurrence of competing events increased for each AUA level. After accounting for 7.3% of clients who had died or been admitted to long-term care or hospital, 28.3% of clients in AUA 6 were either still receiving home care services after 180 days or had been discharged without being assessed with the RAI-HC. Likewise, 42.0% of clients in AUA 5 had not been assessed with the RAI-HC that were not explained by competing events.

To investigate priority for receiving RAI-HC assessment, time-to-assessment was regressed on AUA in a cause-specific hazard model with a 7-day observation period and adjusted for age, sex, and HCCSS (**Table 2**). At all AUA levels, clients in higher AUA levels had significantly higher rates of RAI-HC assessment (all reference comparisons $p < 0.0001$). Even at higher AUA levels, significant differences in hazard rates persisted in adjacent levels (all adjacent comparisons $p < 0.0001$). Within the first week, the rate at which clients in AUA 6 were assessed was 19.14 times higher than clients in AUA 1, but also 1.11 times higher than clients in AUA 5.

Lastly, to evaluate the consistency of the clinical decision support system, the occurrence of high or very high MAPLe priority levels was regressed on AUA in an adjusted logistic model among clients receiving RAI-HC assessment (**Table 3**). At all AUA levels, clients in higher AUA levels had significantly higher odds of being identified as a high-priority client (all reference comparisons $p < 0.0001$). For clients in AUA 5 or 6, the odds of being identified as a high-priority client were approximately twice that of clients in the lowest AUA level. Significant differences in odds persisted in adjacent levels (all adjacent comparisons $p < 0.0001$ except between AUA 2 and 3).

4 | DISCUSSION

Comprehensive assessments are necessary for organising and delivering individualised, effective, and safe home care services. While

TABLE 1 Client and home care episode characteristics among newly admitted home care clients

% (n)	Clients assessed with interRAI CA only			Clients assessed with both interRAI CA and RAI-HC	p value
	Preliminary Screener only n = 63,013	Preliminary Screener + Clinical Evaluation n = 105,384			
Client socio-demographics					
Age group					<0.0001
18 to 44 years	26.1 (16,449)	8.6 (9064)	2.7 (1543)		
45 to 64 years	36.8 (23,166)	28.6 (30,159)	13.5 (7732)		
65 to 74 years	19.7 (12,399)	25.2 (26,566)	18.2 (10,452)		
75 to 84 years	12.4 (7841)	23.7 (24,923)	32.4 (18,651)		
≥85 years	5.0 (3158)	13.9 (14,672)	33.4 (19,214)		
Sex					<0.0001
Female	45.0 (28,345)	53.8 (56,707)	59.1 (34,027)		
Living arrangement					<0.0001
Lives alone	20.3 (12,759)	26.1 (27,468)	34.5 (19,880)		
Lives with family member(s)	76.9 (48,428)	68.2 (71,850)	57.6 (33,175)		
Lives with others, not family	2.9 (1826)	5.8 (6066)	7.9 (4537)		
Home care episode characteristics					
Primary service goal at intake					<0.0001
Acute	96.3 (60,698)	45.9 (48,331)	9.0 (5200)		
Rehabilitation	2.5 (1571)	39.0 (41,056)	15.3 (8828)		
Maintenance	0.9 (548)	8.9 (9408)	44.1 (25,372)		
Long term supportive	0.3 (196)	6.3 (6589)	31.6 (18,192)		
Home care services received					
Any nursing services	96.4 (60,714)	56.6 (59,688)	45.6 (26,243)		<0.0001
Any therapy (OT/PT) services	3.4 (2142)	48.4 (50,952)	71.0 (40,903)		<0.0001
Any personal support services	0.3 (204)	5.9 (6263)	56.1 (32,332)		<0.0001
Discharge reason (among discharged clients)					
Service plan complete	92.8 (58,006)	80.1 (83,168)	37.1 (17,028)		<0.0001
Died	1.1 (701)	6.7 (6932)	18.9 (8690)		
Hospitalised >14 days	0.8 (498)	3.5 (3590)	13.2 (6059)		
Admitted to long-term care	<0.1 (18)	0.3 (262)	12.0 (5512)		
Other ^a	5.2 (3255)	9.5 (9875)	18.8 (8617)		
Length of stay (among discharged clients)					
0 to 1 month	49.0 (30,633)	33.0 (34,220)	5.7 (2604)		<0.0001
1 to 2 months	22.4 (13,983)	27.8 (28,909)	12.7 (5835)		
2 to 6 months	22.6 (14,097)	30.0 (31,181)	37.6 (17,279)		
>6 months	6.0 (3765)	9.2 (9517)	44.0 (20,188)		
Client health status indicators					
Impaired in cognitive skills	0.4 (276)	8.9 (9356)	32.2 (18,517)		<0.0001
Help needed with personal hygiene	0.6 (375)	11.0 (11,581)	32.5 (18,738)		<0.0001
Help needed with bathing	1.8 (1113)	36.2 (38,179)	70.7 (40,722)		<0.0001
Shortness of breath	1.8 (1119)	33.4 (35,228)	45.8 (26,367)		<0.0001
Poor self-rated health	0.3 (177)	7.3 (7720)	12.2 (7006)		<0.0001

TABLE 1 (Continued)

% (n)	Clients assessed with interRAI CA only		Clients assessed with both interRAI CA and RAI-HC	p value
	Preliminary Screener only n = 63,013	Preliminary Screener + Clinical Evaluation n = 105,384		
Unstable health patterns	2.3 (1460)	41.7 (43,900)	69.7 (40,157)	<0.0001
Recent fall(s)	^b	25.1 (26,438)	47.0 (27,073)	<0.0001
Sad or depressed mood	^b	12.1 (12,703)	19.0 (10,961)	<0.0001
Caregiver distress	^b	13.0 (13,676)	39.5 (22,772)	<0.0001

^aIncludes needs met by community support service agency, transfer to other HCCSS, client request, other reasons.

^bItem not available in Preliminary Screener section.

FIGURE 3 Distribution of the Assessment Urgency Algorithm, by assessment group

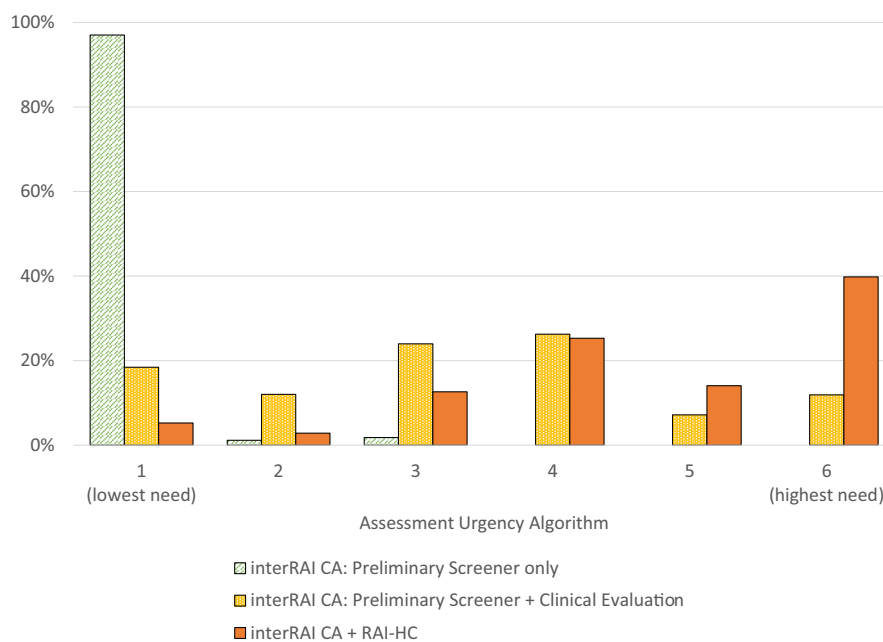
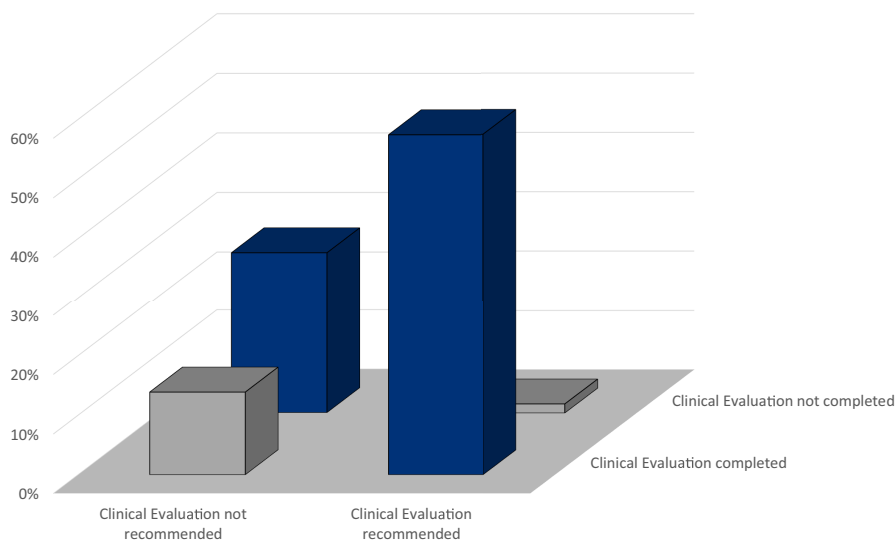


FIGURE 4 Level of agreement between recommended and actual completion of the Clinical Evaluation section of the interRAI CA



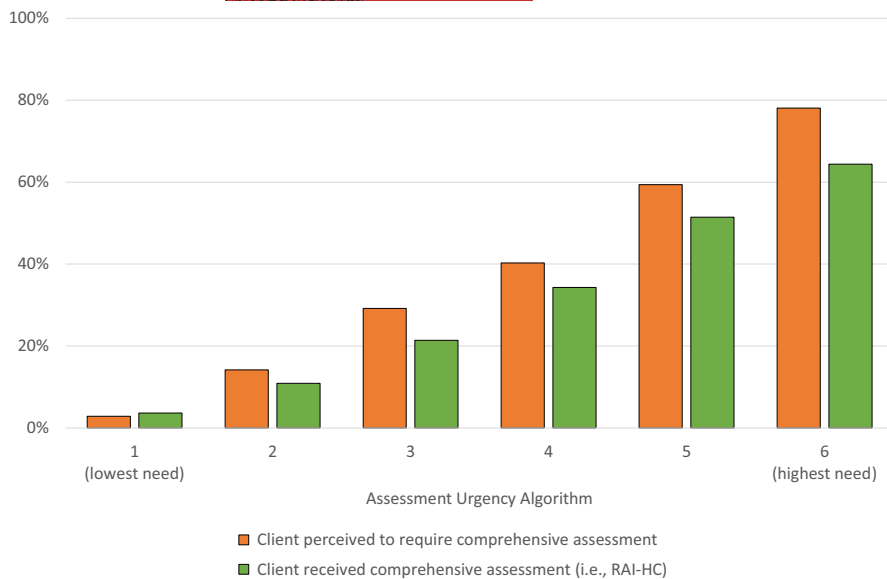


FIGURE 5 Levels of perceived need for and receipt of RAI-HC, by Assessment Urgency Algorithm

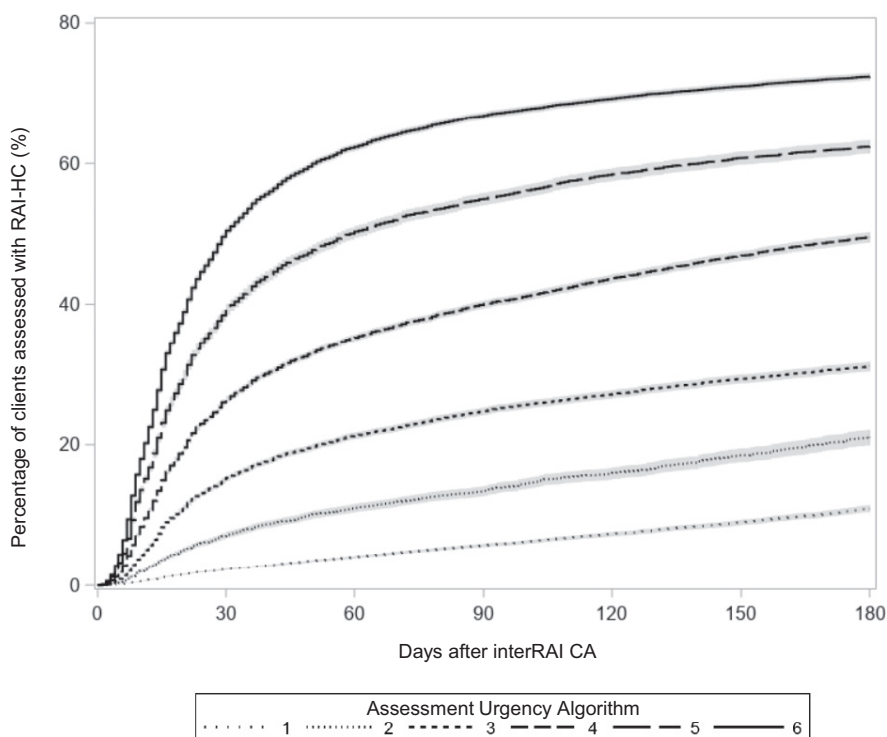


FIGURE 6 Time to RAI-HC assessment after interRAI CA, by Assessment Urgency Algorithm

many international home care programs have adopted the RAI-HC/interRAI HC as the assessment standard, Ontario uses the interRAI CA as an initial step to identify clients who may benefit from the more comprehensive RAI-HC/interRAI HC assessment. Drawing upon the concepts of population health management, this stepped approach is designed to match the right level of assessment to the right client, proactively identify and address client needs, and focus relational time and assessment resources on the most complex clients.

An effective assessment approach should segment the population into increasing levels of client need and risk: In FY 2016/17, Ontario's public home care system admitted nearly a quarter million

home care clients for acute, rehabilitation, maintenance, or long-term supportive services. About one-quarter were assessed with the Preliminary Screener only, one-half were assessed with both the Preliminary Screener and Clinical Evaluation (i.e., full interRAI CA), and one-quarter received both the interRAI CA and RAI-HC. As expected, clients assessed with the Preliminary Screener only were represented in the lowest AUA levels, received mostly nursing services, and were discharged as service plan complete within a few weeks or months. In contrast, clients assessed with the RAI-HC were most likely to report cognitive and functional health needs as well as other issues covered in the Clinical Evaluation section, including recent falls, sad or depressed mood, and caregiver distress.

TABLE 2 Adjusted hazard ratios for RAI-HC assessment within 7 days after interRAI CA, by Assessment Urgency Algorithm

Assessment Urgency Algorithm level	Adjusted hazard ratio (HR; 95% CI) compared to reference level (e.g., AUA 6 vs. AUA 1)	Adjusted hazard ratio (HR; 95% CI) compared to adjacent lower level (e.g., AUA 6 vs. AUA 5)
1 (lowest need)	Reference, i.e., 1.00	--
2	4.28 (3.44–5.32) ^{***}	4.28 (3.44–5.32) ^{***}
3	9.90 (8.47–11.58) ^{***}	2.31 (1.92–2.79) ^{***}
4	14.88 (12.84–17.26) ^{***}	1.50 (1.38–1.64) ^{***}
5	17.33 (14.85–20.21) ^{***}	1.16 (1.08–1.26) ^{***}
6 (highest need)	19.14 (16.54–22.15) ^{***}	1.11 (1.03–1.19) ^{***}

Note: Adjusted for age in years (HR 1.02 [1.01–1.02]), female sex (HR 1.05 [1.00–1.10]), and HCCSS (ranging from HR 0.56 [0.48–0.66] to HR 1.05 [0.96–1.15]).

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.0001$.

TABLE 3 Adjusted odds ratios (95% CI) of being in high or very high MAPLE priority level at time of RAI-HC, by Assessment Urgency Algorithm

Assessment Urgency Algorithm level	Adjusted odds ratio (OR; 95% CI) compared to reference level (e.g., AUA 6 vs. AUA 1)	Adjusted odds ratio (OR; 95%) compared to adjacent lower level (e.g., AUA 6 vs. AUA 5)
1 (lowest need)	Reference, i.e., 1.00	--
2	1.22 (1.08–1.39) ^{***}	1.22 (1.08–1.39) ^{***}
3	1.33 (1.21–1.46) ^{***}	1.09 (0.97–1.22)
4	1.63 (1.50–1.77) ^{***}	1.23 (1.16–1.30) ^{***}
5	2.15 (1.96–2.35) ^{***}	1.32 (1.25–1.39) ^{***}
6 (highest need)	2.60 (2.39–2.83) ^{***}	1.21 (1.15–1.28) ^{***}

Note: Adjusted for age in years (OR 1.02 [1.01–1.02]), female sex (OR 0.80 [0.78–0.83]), and HCCSS (ranging from OR 0.98 [0.90–1.07] to OR 1.71 [1.58–1.85]).

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Characteristics of the home care episode also differed significantly, where 44.0% of RAI-HC assessed clients continued to receive home care services beyond 6 months and 30.9% were eventually discharged due to death or long-term care placement (vs. 7.9% and 4.8% among non-RAI-HC assessed clients). Although just one-quarter of the home care population received RAI-HC assessment, we estimate that they accounted for 80% of total assessment time. In other words, the most comprehensive level of assessment was reserved for clients with the most complex and chronic health needs.

Decision support outputs should be congruent with clinical judgement and produce minimal false positives and negatives: In Ontario, skip logic is built into the software implementation of the interRAI CA to guide “stepping up” to the full interRAI CA. Based on Cohen's kappa of 0.67 and applying the benchmarks proposed by Landis and Koch (1977), we conclude there is substantial agreement between the skip logic and completion of the full interRAI CA. Where there was disagreement, it was much more common for the care co-ordinator to complete the Clinical Evaluation section without prompting by the computer-guided form. Among these clients, only one in 10 were subsequently assessed with the RAI-HC. Thus, care co-ordinators occasionally identified care needs not picked up by the Preliminary Screener, although this was a relatively rare

occurrence (approximately 1.4 of every 100 cases). This provides empirical evidence that the assessment process accurately identifies true negative cases (i.e., clients who do not require additional comprehensive assessment).

In contrast, while there is no automated decision support for “stepping up” to the RAI-HC, the AUA flags the presence of cognitive or functional impairment and issues with personal or family coping and, thus, is designed to identify clients at greater need for comprehensive follow-up assessment. We found a strong positive relationship between AUA and both the level of perceived need for and actual receipt of RAI-HC assessment. Among clients in AUA 6, 78.1% were perceived to require comprehensive assessment by the intake care co-ordinator and 64.4% were assessed with the RAI-HC within 6 months.

Decision support outputs should be used to prioritise earlier assessment for more complex clients: Although the AUA is not used in current provincial assessment guidelines, we found that higher AUA was significantly associated with shorter time to RAI-HC assessment. Within the first week following the interRAI CA, clients in AUA 6 were assessed at 19.14 times the rate of clients in the lowest AUA level. This finding offers empirical evidence that community care co-ordinators are prioritising clients

for RAI-HC assessment based on client needs and risks identified by the intake care co-ordinator during the interRAI CA as part of the assessment process.

Decision support outputs within the assessment system should be internally consistent: One of the strengths of the interRAI assessment system is the use of standard items and common domains across instruments, such that the AUA from the interRAI CA and the MAPLe from the RAI-HC can be used to communicate about urgency and priority throughout the home care episode. In this study, we found that each increase in AUA level was associated with significantly higher odds of being in a high or very high MAPLe level. Given that HCCSS use MAPLe to inform decisions about priority and allocation of home care services and that past research has demonstrated the positive relationship between MAPLe and long-term care placement and caregiver distress, the use of these outputs supports a common and coherent approach to identify clients who are likely to benefit from long-term home care services.

Together, these results illustrate the successful implementation of the interRAI CA and RAI-HC in Ontario's publicly funded home care program. As a standardised comprehensive assessment system, these assessments support care co-ordinators' decisions about where and how to allocate assessment resources in a way that builds on clinical judgement and past assessment. Each of the assessments operate as a minimum data set that can be joined together, starting with the Preliminary Screener section of the interRAI CA. Taking the cognitive domain, for example, the Preliminary Screener asks about the presence of any cognitive impairment, the Clinical Evaluation section asks about any recent changes in cognitive status, and the RAI-HC adds more granularity by stratifying the degree of cognitive impairment and probing for indicators of delirium and other memory problems.

In many ways, the stepped assessment approach can be thought to mirror the stepped care model with which clinicians will already be familiar. The basic principle of the stepped care model is that clients should be offered the most effective and least resource-intensive treatment that is judged to meet the client's needs and goals (Von Korff & Tiemens, 2000). Likewise, clients should be offered the most effective and least burdensome level of assessment that captures their needs, strengths, and preferences. Just as home care services are provided on the basis of need, so should clinical assessments.

This study also revealed potential areas for improving the efficiency and quality of the assessment process. First, there may be opportunities to reduce assessment time. In this study, care co-ordinators elected to complete the Clinical Evaluation section every one out of three times they were prompted to skip the full interRAI CA. Although care co-ordinators are encouraged to override the skip logic when appropriate, it may be worth examining whether there are any misconceptions or reasons behind initiating additional assessment for those who may not need it, and applying the findings to deliver targeted education to care co-ordinators. Second, we recommend integrating the AUA into provincial assessment guidelines. In this study, AUA was strongly positively correlated with both perceived need for and actual receipt of comprehensive assessment. However, we also found that 42.0% of clients in AUA 5 and 28.3% of clients in AUA 6

were discharged without being assessed with the RAI-HC (even after accounting for competing events) although their AUA level indicated some degree of impairment and possible issues with personal or family coping. Failure to follow up with identified needs may contribute to current gaps in access to home care, such as the Canadian Community Health Survey 2015/16 finding that 9.8% of Canadians reported their home care needs were only partially met (Gilmour, 2018). Third, we recommend developing a provincial quality indicator based on the new assessment guidelines, specifically, the proportion of clients in the highest AUA levels receiving a RAI-HC assessment within 1–2 weeks. In this study, clients in AUA 5 or 6 had higher odds of being assessed sooner than clients in lower AUA levels; still, only 14.1% of clients in AUA 5 or 6 were assessed within the first week. At the time of writing, Ontario Health Quality publicly tracks the median number of days that new home care clients wait to receive nursing and personal support services (Health Quality Ontario, 2020). Although wait times are useful indicators of access among clients for whom services are arranged, exemplary performance on these indicators can still mask problems of access to home care more broadly. For instance, a client in AUA 5 could have their wound care needs met in a timely manner by short-term nursing services, while at the same time, other needs such as low mood or depressive symptoms might not be properly identified and addressed in the care plan until weeks later. Introducing this quality indicator would formalise the expectation that individuals identified to have possible issues with personal or family coping should be prioritised for comprehensive assessment, given the inherent urgency about responding to their ability to manage.

Notably, Ontario is not the only jurisdiction to create a stepped home care assessment process based on the interRAI suite. In New Zealand, home care clients are screened as “non-complex” and “complex” and then assessed accordingly with the interRAI CA and interRAI HC (Parsons et al., 2018). Clients originally identified as “non-complex” but screened into higher urgency levels (i.e., AUA 4+) would go on to receive the interRAI HC (interRAI New Zealand, 2019). In Belgium, the BelRAI Screener was developed as an intake home care assessment as part of the Belgian implementation of the interRAI assessment system (Vermeulen et al., 2015). Like the interRAI CA, the BelRAI Screener is compatible with the interRAI HC and guides the assessor to consider whether a client requires a comprehensive assessment. Many of the same domains are covered in both intake assessments. The main difference is that the interRAI CA collects mostly binary information while the BelRAI Screener offers the same expanded response options as the full assessment. For instance, the interRAI CA has just yes/no response options for the physical functioning questions while the BelRAI Screener has eight graded response options. Future research should compare the advantages and disadvantages of the two approaches.

4.1 | Strengths and limitations

This study's main strength is the use of census-level data that can be generalised across Ontario's publicly funded home care population;

however, several limitations should be noted. This analysis excluded clients who did not receive any services during their home care episode, but it is equally important to ensure that these individuals' needs were assessed and adequately met. Second, although the analysis accounted for some of the reasons why a client would not have received a RAI-HC assessment, this study did not identify clients who may have received other comprehensive assessments at follow-up, including the interRAI Palliative Care and interRAI Community Mental Health instruments. It is also important to acknowledge that 100% of timely RAI-HC follow-up may not be a realistic expectation. A care co-ordinator may intend to complete the RAI-HC, but circumstances such as the client requiring emergency care on the day of the scheduled assessment or the client or family declining a home visit may arise. In recent years, care co-ordinators' caseloads have increased in both the number and complexity of clients (Office of the Auditor General of Ontario, 2015), meaning that more complex clients may be assessed more urgently at the expense of lower complexity clients. Finally, future qualitative research should be conducted to better understand the assessment experiences of clients, families, and care co-ordinators.

5 | CONCLUSIONS

As expected, increasing levels of assessment were associated with higher AUA levels, which in turn were associated with greater likelihood of perceived need for comprehensive assessment and actual receipt of RAI-HC assessment, shorter time to RAI-HC assessment, and higher MAPLe priority levels (among those receiving a RAI-HC assessment). Use of the interRAI CA and RAI-HC balances the investment of time and resources with the information and tools to deliver high-quality, holistic, and client-centred care. At its core is the interRAI CA that guides the care co-ordinator to screen every client for a broad range of possible needs and tailor further assessment (i.e., RAI-HC) to each client's unique needs. This approach establishes a health and social safety net for all clients, regardless of how they enter the home care system (e.g., hospital or community), why they seek services (e.g., rehabilitation or long-term support), or how long they receive services. We expect that clients are more confident that their health needs are being recognised, providers are more likely to incorporate the assessment results into care planning, and in the long run, the home care system is effectively keeping people healthy and safe in the community. However, we also identified a substantial proportion of clients in the highest AUA levels who were discharged without receiving a RAI-HC assessment. We recommend integrating the AUA into provincial assessment guidelines as well as developing a new quality indicator focused on measuring access to the home care system.

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CONFLICT OF INTEREST

CJS and JWP declare that they have no competing interests. JPH, VMB, and GAH are Fellows of interRAI (JBH is also a Board Member), but they have no financial or other competing interests with interRAI.

AUTHORS' CONTRIBUTIONS

All authors reviewed and approved the manuscript for submission. The following CRediT statement summarises each of the author's contributions: CJS: Conceptualisation, Methodology, Data curation, Formal analysis, Writing (original draft), Writing (review and editing), Visualisation; JPH: Conceptualisation, Methodology, Resources, Writing (review and editing), Supervision, Funding acquisition; JWP: Conceptualisation, Writing (review and editing); VMB: Conceptualisation, Writing (review & editing); and GAH: Conceptualisation, Writing (review and editing).

DATA AVAILABILITY STATEMENT

Access to the datasets supporting the findings of this study is available upon reasonable and justifiable request from the Canadian Institute for Health Information (<https://www.cihi.ca/en/access-data-and-reports/make-a-data-request>).

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