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Resident Safety: Characteristics Associated With Falling in Ontario Complex Continuing Care

Introduction

Falls are a significant health concern. They represent a financial burden to the health care system: Smartrisk estimates direct health costs related to falls among seniors in Canada to be \$1 billion every year.¹ Falls are also one of the leading causes of serious injury, accounting for almost 30% of all injury hospitalizations and about one-third of in-hospital deaths among people admitted for injuries.² Within continuing care, there is evidence to suggest that a number of residents are admitted to a facility as a result of a fall; in fact, falls are considered an independent risk factor for admission to facility-based care.³

The Canadian Institute for Health Information (CIHI) conducted a focused analysis, using data from the Continuing Care Reporting System (CCRS), to identify which characteristics were associated with a continuing care resident's risk of falling in a facility.

The RAI-MDS 2.0[®] is the foundation assessment for the CCRS and captures a wide range of clinical information, including cognitive and physical functioning, behaviour, medication use, nutritional status, diagnoses, special treatments and procedures. Many of the characteristics and domains assessed in the RAI-MDS 2.0 have been widely reported as risk factors for falls, such as history of falling, cognitive impairment, use of psychotropic medications and use of physical restraints.⁴

Multi-factorial risk assessment has been found to be a successful intervention in prevention of falls.⁵ If the RAI-MDS 2.0, as a multi-factorial assessment, is helpful for predicting falls, clinicians could use this information to quantify the relative risk to their residents on admission and on reassessment. This, in turn, would support development of appropriate interventions for preventing falls in this population. Managers may also use the information to support program and resource planning for at-risk populations.

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Methods

Residents in Ontario complex continuing care (CCC) facilities who were assessed with the RAI-MDS 2.0 in 2005–2006 were considered for analysis. The CCRS captures information on individuals in publicly funded facilities of two types:

- Hospitals that have beds designated and funded as continuing care beds, commonly known across Canada as extended, auxiliary, chronic or complex care beds; and
- Residential care facilities, commonly known across Canada as nursing homes, personal care homes or long-term care homes.

This report was limited to CCRS data from hospital-based care, as the CCRS currently has only a limited amount of data on residential care facilities.

As residents are routinely assessed on a quarterly basis, it was possible to identify their characteristics on one assessment and relate them to health outcomes, in this case falls, reported on the next assessment. Analysis was therefore limited to residents who had a minimum of two assessments. Exclusion criteria were applied, for example, when the resident was discharged and spent time at home between the assessments. The vast majority of excluded residents were those whose hospital stays were too short to allow for two assessments, that is, less than three months. The Technical Notes section at the end of this document provides full details on the inclusion and exclusion criteria. Just over 6,000 residents, or 25% of the Ontario CCC population, were included in the analysis.

A conceptual framework of resident characteristics was developed based on literature reports of fall risk in similar populations. Within each domain of the framework, a preliminary analysis was conducted to measure the association of each characteristic with whether the resident had a fall documented on his or her most recent assessment.

A multivariate logistic regression model was then fitted, using those characteristics from the framework found to have a relationship with falling, to estimate the odds of a fall occurring among residents. As many of these characteristics were associated with each other, the logistic regression model showed which characteristics were independently associated with falling once all the other characteristics in the model had been taken into account. The conceptual framework and characteristics included in the model are illustrated in Table 1.

Table 1. Conceptual Framework for Analysis

Domain	RAI-MDS 2.0 Characteristic Included in the Model
Demographics	Age Gender
Chronic Illness	Arthritis Dementia Depression Hemiparesis Hip Fracture Multiple Sclerosis Parkinson's Disease RAI CHESS Scale Score ⁱ
Sensorimotor Function and Balance	Dizziness Bladder Continence Vision Unsteady Gait ⁱⁱ
ADL Function/Mobility Status	Transfer Status ⁱⁱ Walking Status ⁱⁱ
Cognition and Behaviour	RAI Cognitive Performance Scale Score ⁱ Wandering RAI Depression Rating Scale Score ⁱ
Medications	Antidepressant Use Anti-Psychotic Use Anti-Anxiety Use Hypnotic Use Any New Medication
Exposure/Process Factors	History of Falls Resident Bedfast Use of Bedrails
Service	Resident Left/Changed Facility Between Assessments

Results and Discussion

Eight percent (n = 482) of residents included in the analysis had a fall documented on their most recent RAI-MDS 2.0 assessment. Table 2 lists the characteristics from their previous assessment in which at least one level was found to be significant in the logistic regression analysis (with a p value <0.10). The regression model explained 24% of the variability in the occurrence of falls.

i. See Technical Notes for details.

ii. Unsteady Gait, Walking Status and Transfer Status were combined into one element in the final model.

Table 2. Significant Risk Factors for Falls

Characteristics on Second-Last Assessment	Odds Ratio	95% Confidence Intervals	p	N
Age Group				
85 and over	1.4	0.99–2.00	0.06	1454
75–84	1.5	1.07–2.06	0.02	2043
65–74	1.6	1.12–2.31	0.01	1049
Under 65	1.0	–	–	1510
Walking—Transfer Status Last 7 days				
Walked with steady gait . . .				
. . . and transferred independently	2.0	1.19–3.50	<0.009	313
. . . and transferred with supervision/limited assistance	3.2	1.92–5.23	<0.0001	227
. . . and transferred with extensive assistance/complete dependence	2.5	1.43–4.32	0.001	186
Walked with unsteady gait . . .				
. . . and transferred independently	2.7	1.65–4.54	0.0001	265
. . . and transferred with supervision/limited assistance	3.1	2.16–4.58	<0.0001	583
. . . and transferred with extensive assistance/complete dependence	2.8	1.93–4.02	<0.0001	534
Did not walk . . .				
. . . but transferred independently or with supervision or assistance	2.4	1.70–3.40	<0.0001	927
. . . but transferred with complete dependence/did not transfer	1.0	–	–	3021
Wandered in Last 7 Days				
Yes	1.5	1.08–2.02	0.01	564
No	1.0	–	–	5492
Anti-Psychotic Medication Administered in Last 7 Days				
Yes	1.3	0.99–1.65	0.06	1463
No	1.0	–	–	4593
Hypnotic Medication Administered in Last 7 Days				
Yes	1.5	1.15–1.91	0.003	892
No	1.0	–	–	5164
New Medications Administered in Last 90 Days				
Yes	1.3	1.02–1.59	0.03	1889
No	1.0	–	–	4167
Fell in Last 30 Days				
Yes	5.2	4.18–6.57	<.0001	743
No	1.0	–	–	5313
Use of Bed Rails in Last 7 Days				
No bed rails used	1.1	0.74–1.62	0.65	478
Some bed rails used	1.3	1.02–1.62	0.04	1979
Full bed rails used daily	1.0	–	–	3599
Changed/Left Facility between Assessments				
Yes	1.8	1.37–2.31	<.0001	743
No	1.0	–	–	5313

Risk Factors for Falling

History of falls was, by far, the most significant factor in the analysis. The odds of residents having a fall documented on their last assessment were over five (5.2) times higher for those who had fallen on their previous assessment compared with those who had not fallen. Rubenstein and colleagues found similar results when analyzing a number of research studies that assessed risk of falls.⁶ In 12 of the 13 studies reviewed, history of falling was a significant factor.

Increasing age is often associated with increased risk of falls in the literature; Perell and colleagues' analytic review found at least four studies in which increasing age was a significant factor.⁷ In this analysis, compared with those aged less than 65 years, the odds of falling were around 1.5 times higher for those in each of the three older age groups (65 to 74 years, 75 to 84 years and 85 years and over). It should be noted that the odds for those aged 85 years and over only approached statistical significance ($p = 0.06$).ⁱⁱⁱ When the effects of age and gender were analyzed alone, the odds of falling with increasing age were slightly higher (for example, the odds ratio for the 75-to-84 age group was 2.6). This suggests that the risks often associated with increasing age may in fact be related to other comorbidities that are more common in older age groups.

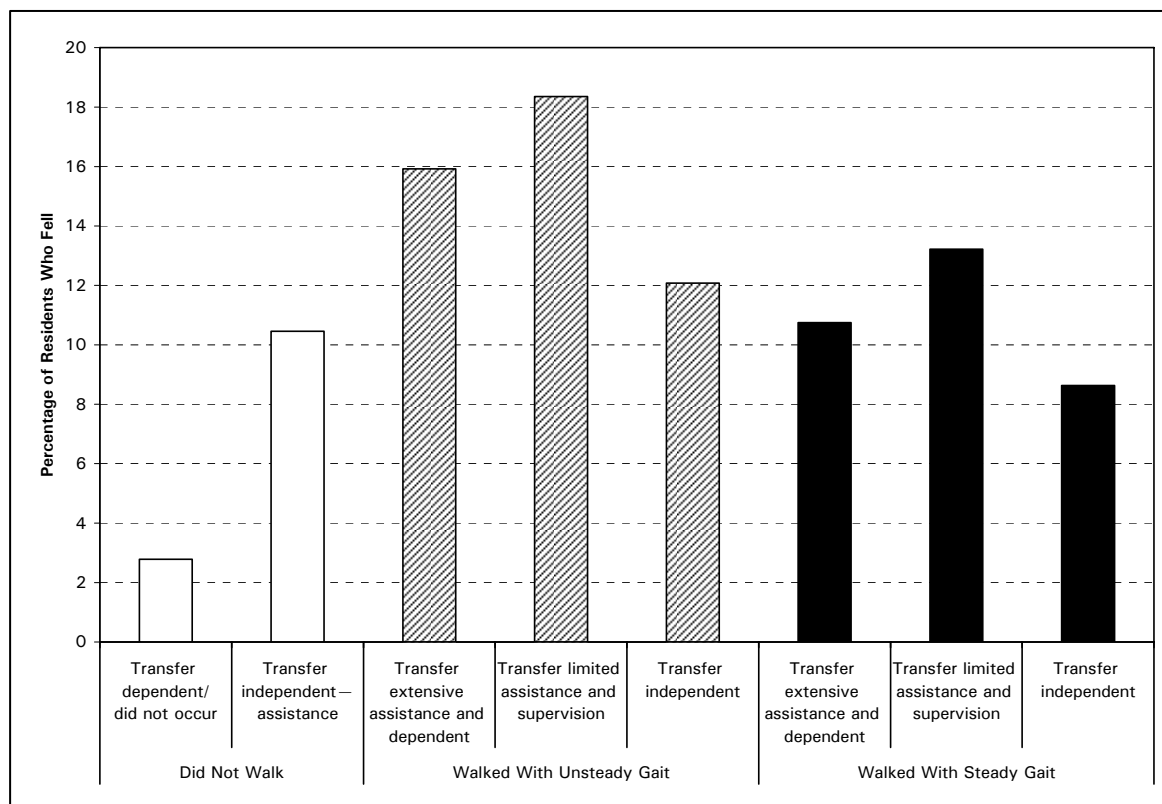
In addition, previous CIHI analysis has shown that the population in Ontario complex continuing care is younger than that found in residential-based continuing care.⁸ As more data are available from the residential care sector, it will be interesting to repeat the analysis to reassess the relationship of age and other characteristics with falling in this larger continuing-care population.

When assessing the relationship between mobility status and falling, the ability to transfer was closely related to the ability to walk. For that reason, these characteristics were combined in the regression analysis and were found to be a significant factor in increasing the odds of falling. The odds of falling were highest for those who walked (steadily or unsteadily), while requiring supervision or limited assistance to transfer (odds ratios were 3.1 and 3.2 respectively).

Figure 1 illustrates the rates of fallers across the continuum of walking and transfer abilities. The highest proportion of residents who fell were those who required supervision or physical guidance to transfer and walked with an unsteady gait (18%). These findings illustrate the risks encountered by residents as they lose their ability to walk and transfer independently. Once residents lose their mobility altogether, the rate of falling drops. Only 3% of those who were dependent and did not walk or transfer had a fall documented on their most recent assessment.

iii. In a separate analysis, the effect of age by itself was analyzed. Under this simplified model the age effect was larger, indicating that the RAI-MDS 2.0 captures information on aspects of functional health that are associated with falling and that are independent of the age of the resident.

Figure 1. Residents Who Fell by Transfer and Walking Status



These results are well supported in the literature. Lord and colleagues found that the risk of falling was different if residents were separated according to their standing balance and ability to rise from a chair.⁹ Although the overall rate of falls reported was substantially higher in Lord’s study compared to the current analysis, a similar pattern of risk was identified: 81% of residents who could rise from a chair, but could not stand unaided fell, whereas only 48% of those who could neither stand unaided nor rise from a chair experienced a fall. Similarly, Thapa and colleagues found that the incidence of injurious falls in non-ambulatory residents was less than half that of ambulatory residents.¹⁰ Close monitoring of residents who continue to be mobile in transfers and walking, while experiencing loss of independence, may be a critical strategy for fall prevention in this population.

The preliminary analysis showed that the use of physical restraints was not associated with an increased risk of falling. However, residents who had partial bedrails applied were at an increased risk compared to those with daily use of full bedrails (odds ratio of 1.3). Restraints and bedrails are often thought to pose a risk to residents if they attempt to climb out of the restraint or over/through the bedrail. Although the findings of this analysis suggest residents using partial bedrails may be at higher risk of falling, further analysis is warranted to better understand the determining factors for the use of bedrails, in particular full bedrails.

Analysis in Brief

Taking health information further

Problems with cognition and behaviour are common in the continuing care sector and are also often reported to be associated with falls in the literature.^{7,9} In this analysis, measures of cognitive performance (the RAI Cognitive Performance Scale), and measures of depression—including diagnosis of depression, use of anti-depressant medication and the RAI Depression Rating Scale—were not found to be significantly associated with residents falling. Residents who wandered were found to be more likely to fall; 19% of residents who wandered had a fall documented, compared with only 7% of those who did not wander.

Residents who left the facility between assessments also had increased odds of having a fall documented (odds ratio 1.8) on the most recent assessment. Only those residents who remained within the health care system between their two assessments were included in the analysis (see Technical Notes for details). These residents may have been discharged to another health care setting for a variety of reasons, including both planned stays such as elective surgery and unplanned stays due to an emergent event such as illness or even a fall. The reasons for discharge to another facility are not explicitly documented on the assessment, limiting the analysis of these events.

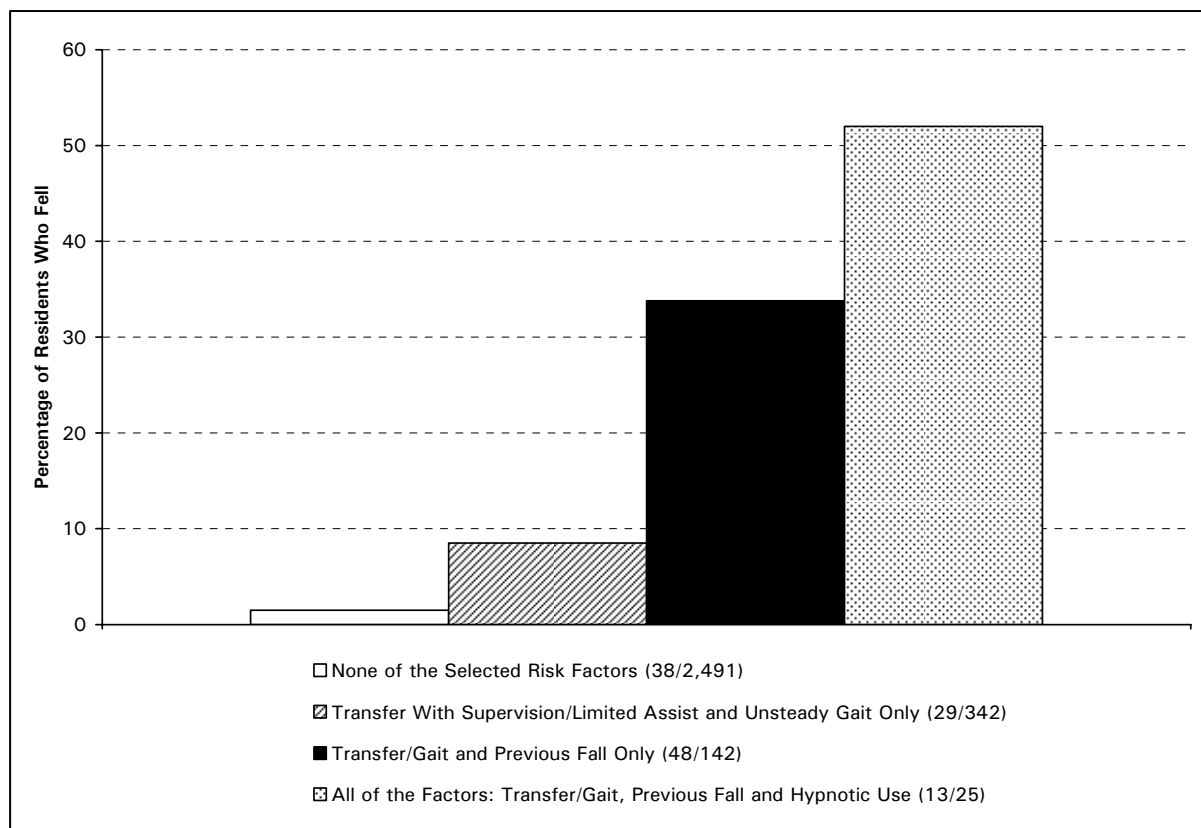
Several variables related to the use of medications were found to be significant. The use of hypnotics increased the odds of a fall being documented, as did the introduction of any new medication over the last 90 days (odds ratios 1.5 and 1.3 respectively). The use of anti-psychotics approached statistical significance. The preliminary analysis showed that 12% of residents on a new medication experienced a fall on the subsequent assessment, compared to only 6% in residents without new medications. Psychotropic medications are widely reported as risk factors for balance impairment and falls.⁴ Opportunities to review all medications, and in particular the use of any psychotropic medications, may facilitate the fall risk management process.

Painting a Picture of Risk

In many cases, residents will have more than one risk factor for falls. Analyzing the combined effect of multiple risk factors may be of interest to clinical and management teams as they set priorities for interventions and risk management.

Figure 2 illustrates the potential of analyzing the impact of residents having multiple risk factors. In this example, factors related to mobility status and medication use were included, as well as history of previous falls. Mobility status and medication use were chosen, as they may be routinely monitored and affected by clinical interventions.

Figure 2. Painting a Picture of Risk



The likelihood of experiencing a fall increased dramatically as the number of risk factors increased: from 2% of residents without any of the factors illustrated (no previous fall, did not use hypnotics, did not walk and were dependent in transferring) to 52% for residents with all the risk factors (transferred with supervision or physical guidance and walked with an unsteady gait, a previous fall reported and used hypnotics). Although there were few residents (n = 25) with all of the risk factors analyzed in this example, the risk that they would experience a fall in the next quarter was substantial.

Analysis in Brief

Taking health information further

Residents with the mobility risk factor and with a previous fall reported, but who had not used hypnotics, had a high likelihood of falling: a third (34%) of residents in this group fell. This group represented a small proportion of the overall resident population (2%), but the fallers in this group accounted for 10% of all the fallers identified in the analysis.

Understanding the relative risks of the residents with different combinations of risk factors, together with the frequency with which residents with those risk combinations occur in facilities, has the potential to inform the development of effective fall- and injury-prevention programs. Although residents with multiple risk factors are at a substantial risk of falling, they represent only a small proportion of all fallers. In fact, among these high-risk groups the focus may be on injury prevention as the facility's ability to completely eliminate the risk of falling may be limited. To prevent the largest number of falls, a facility's fall-prevention strategy may be directed towards preventing falls among the wider group of residents identified as being at lower levels of risk.

Analysis in Brief

Taking health information further

Conclusion

This Analysis in Brief explores factors associated with falling in hospital-based continuing care. Findings suggest that a number of key factors are associated with increased risk of falls, including history of previous falls, mild to moderate limitations in mobility status, increasing age and the use of some psychotropic or new medications.

The RAI-MDS 2.0 permits identification of residents with multiple risk factors who may be at a substantial risk of falling. As the RAI-MDS 2.0 is a primary assessment used by clinicians to assess their residents, it holds significant potential for real-time use in assessing risk of falls to inform individual care planning. Clinical teams and managers could also use the findings to inform a balanced approach to managing organization-wide fall risk with injury prevention, particularly in those residents who present with multiple identified risks.

This analysis was limited to the complex continuing care sector in Ontario. Thus, the findings may not be fully representative of the entire continuing care population in Canadian residential and hospital-based care. As pan-Canadian implementation of the CCRS continues, the reporting system will be an increasingly rich and comprehensive data source to support further analysis across the continuum and across the country. Fall prevention is a complex puzzle; using CCRS data to assess risk may be one piece of that puzzle.

For additional information on the Continuing Care Reporting System (CCRS) and additional CCRS publications, please contact ccrs@cihi.ca or visit the CCRS website at www.cihi.ca/ccrs.

References

1. Smartrisk, *The Cost of Falls* (2004), [online], cited October 24, 2006, from <<http://www.smartrisk.ca/ContentDirector.aspx?tp=675>> .
2. Canadian Institute for Health Information, *Health Care in Canada 2004* (Ottawa: CIHI, 2004), p. 63.
3. M. E. Tinetti and C. S. Williams, "Falls, Injuries Due to Falls, and the Risk of Admission to a Nursing Home," *New England Journal of Medicine* 337 (1997): pp. 1279–84.
4. Registered Nurses' Association of Ontario, *Prevention of Falls and Fall Injuries in the Older Adult (Revised)* (Toronto: RNAO, 2005).
5. L. Z. Rubenstein, A. S. Robbins, K. R. Josephson, B. L. Schulman and D. Osterweil, "The Value of Assessing Falls in an Elderly Population. A Randomized Clinical Trial," *Annals of Internal Medicine* 113, 4 (1990): pp. 308–16.
6. L. Z. Rubenstein and K. R. Josephson, "The Epidemiology of Falls and Syncope," eds. R. A. Kenny and D. O'Shea (Philadelphia: Saunders and Co., 2002).
7. K. L. Perell, A. Nelson, R. L. Goldman, S. L. Luther, N. Prieto-Lewis and L. Z. Rubenstein, "Fall Risk Assessment Measures: An Analytic Review," *Journals of Gerontology* 56A, 12 (2001): p. M761–M766.
8. Canadian Institute for Health Information, *Facility-Based Continuing Care in Canada, 2004–2006: An Emerging Portrait of the Continuum* (Ottawa: CIHI, 2006).
9. S. R. Lord, L. M. March, I. D. Cameron, R. G. Cumming, J. Schwartz, J. Zochling, J. S. Chen, J. Markaroff, Y. Y. Sitoh, T. C. Lau, A. Brnabic and P. N. Sambrooks, "Differing Risk Factors for Falls in Nursing Home and Intermediate-Care Residents Who Can and Cannot Stand Unaided," *Journal of the American Geriatrics Society* 51 (2003): pp. 1645–50.
10. P. B. Thapa, K. G. Brockman, P. Gideon, R. L. Fought and W. A. Ray, "Injurious Falls in Nonambulatory Nursing Home Residents. A Comparative Study of Circumstances, Incidence, and Risk Factors," *Journal of the American Geriatrics Society* 44 (1996): pp. 273–78.

Technical Notes

1. Inclusion Criteria for Analysis

Table 3 illustrates which residents were included in the analysis.

Table 3. Inclusion Criteria for Analysis

Ontario Complex Continuing Care Residents	Number	Percentage
Active residents in 2005–2006	24,303	100.0
Residents assessed in 2005–2006	18,372	75.6
Residents with minimum of two assessments	6,603	27.2
Residents excluded*	547	2.3
Residents included in analysis	6,056	24.9

*Residents were excluded for the following reasons:

- If the resident was comatose on second-last assessment, as many of the characteristics assessed are not applicable when a resident is comatose.
- If the assessments were less than 31 days apart, and the resident was coded as having fallen in last 30 days on both assessments, as, based on the element definitions, it is impossible to determine if the same fall is being reported twice.
- If the assessments were more than 165 days apart, as the time between assessments was considered to be too long to link the characteristics to the reported fall.
- If the resident left the facility between assessments and was either discharged to or readmitted from home, as any fall reported could have occurred outside the health care system.
- If sex coded was “other.”
- If vision or diagnosis information was not available.

2. Glossary of Terms

RAI Cognitive Performance Scale (CPS): an outcome scale derived from the RAI-MDS 2.0, designed to measure levels of cognitive impairment.

RAI Depression Rating Scale (DRS): an outcome scale derived from the RAI-MDS 2.0, designed to identify, measure and screen for signs and symptoms of depression.

RAI Changes in End-Stage Disease, Signs or Symptoms Scale (CHES): an outcome scale derived from the RAI-MDS 2.0 that measures illness acuity and medical complexity.