Helping pharmacists to reduce fall risk in long-term care: A clinical tool to facilitate the medication review process

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Falls are a pervasive problem in older people, especially in long-term care settings. Consultant pharmacists are in a position to help reduce fall risk via medication review activities. Our research was designed to test the feasibility of a tool to help pharmacists consistently address falls in their practice.

Les chutes représentent un problème très répandu chez les personnes âgées, en particulier dans les établissements de soins de longue durée. Le pharmacien-conseil peut réduire les risques de chute grâce à ses activités d'évaluation de la pharmacothérapie. Notre étude était destinée à évaluer la faisabilité d'utiliser un outil afin de permettre aux pharmaciens de considérer la problématique des chutes de manière systématique dans l'exercice de leurs fonctions.

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ABSTRACT

Background: One-third to one-half of adults older than 65 fall at least once per year. Fall prevention through medication management requires little effort and has consistently been shown to reduce risk of falls. The objective of this study was to further develop and perform preliminary pilot testing of an algorithm designed to assist consultant pharmacists in systematically identifying medications that might be modifiable, in order to reduce the risk of falls in older adults. We hypothesized that algorithm use would increase the number of fall-related medication change recommendations made to physicians.

Methods: Four consultant pharmacists were trained to use the algorithm during their routine medication reviews over a 3-week period. An informal survey was administered at the end of the study period to assess the algorithm.

Results: Overall, 51% of residents of long-term facilities had 1 or more recommendations for medication changes related to reducing fall risk (range 0-3 recommendations per resident), with an average 0.675 recommendations made per resident. There were more recommendations for men compared with women and for residents receiving more medications, but the number of recommendations did not correspond with age. All 4 pharmacists agreed that the algorithm was useful and worthwhile.

Discussion: The absolute 20% increase in recommendations related to falls supports the study hypothesis. Time was cited as a barrier to using the algorithm, but this should decrease with continued use of this tool.

Conclusion: This preliminary study furthered the development of and confirmed the possible utility and acceptability of a fall risk-reducing algorithm that may be used in practice. *Can Pharm J (Ott)* 2014;147:171-178.

Introduction

Falls are a pervasive problem among older people in the community and in long-term care settings.^{1,2} One-third to one-half of adults over the age of 65 years fall at least once per year, and falls represent 85% of injury-related hospital admissions in this age group.¹⁻³ Falls are especially problematic for those living in

long-term care settings, with a mean of 1.7 (range 0.6-3.6) falls per person-year compared with those living in community settings, who have a mean of 0.65 (range 0.3-1.6) falls per person-year.¹ Injurious falls can be devastating for those who suffer outcomes such as hip fractures (falls account for 95% of all hip fractures among older people in Canada), subsequent partial

KNOWLEDGE INTO PRACTICE

- Medications are common and potentially modifiable contributors to falls in older residents of long-term care facilities.
- Previous studies have shown that discontinuing unnecessary medications can lower fall risk and the number of falls in these residents.
- There is a lack of usable clinical tools to help consultant pharmacists to systematically and consistently address falls as part of their ongoing medication review processes.
- This project provides preliminary evidence of the utility and sustainability of a clinical algorithm designed to help pharmacists consistently address falls as part of their medication review process.
- This tool has the potential to improve the way pharmacists provide care for nursing home residents by lowering medication-related fall risk.

MISE EN PRATIQUE DES CONNAISSANCES

- Les médicaments contribuent souvent aux chutes chez les résidents âgés des établissements de soins de longue durée, or ce sont des facteurs potentiellement modifiables.
- Les études antérieures ont montré que l'arrêt de médicaments superflus peut réduire les risques de chute et le nombre de chutes chez ces personnes.
- On manque d'outils cliniques utilisables pour aider les pharmaciens-conseils à gérer les chutes de façon systématique et uniforme dans le cadre de leurs processus continus d'évaluation des traitements.
- Ce projet a généré des données préliminaires montrant la pertinence et la pérennité de l'usage d'un algorithme clinique destiné à aider les pharmaciens à gérer les chutes de façon systématique dans leur processus d'évaluation des traitements.
- Cet outil pourrait améliorer les soins offerts par les pharmaciens aux résidents des établissements de soins de longue durée en réduisant les risques de chute liés aux médicaments.

or permanent postfall disability or permanent institutionalization.²

Multiple extrinsic and potentially modifiable risk factors exist for falls, such as environmental factors and medications. The latter should be of particular interest to pharmacists for obvious reasons, as medication-related fall risks are well described in the literature.⁴ Indeed, fall risk is proportional to the total number of medications taken (those taking ≥ 4 medications are at increased risk), and certain medications (e.g., psychotropic medications, blood pressure

lowering medications, etc.) have consistently been associated with an increased fall risk.^{4,5}

In Ontario, the Ministry of Health and Long-Term Care regulations require that long-term care facilities retain a pharmacy service provider (commonly known as consultant pharmacists and hereafter referred to as pharmacists), whose duties include the ongoing evaluation of therapeutic outcomes of drugs for residents and participation in risk management and quality improvement activities.⁶ Thus, in the long-term care setting, there is great potential for pharmacists to contribute to fall risk reduction initiatives by explicitly and systematically considering fall risk in their ongoing resident medication assessments. To our knowledge, prior work in this area has not documented clinical tools that explicitly address fall risk.^{1,4} This is not a trivial consideration, for if pharmacists are not actively considering these issues during their medication reviews, an important opportunity for improving residents' medication regimens beyond the normal medication reviews will be missed. Indeed, ongoing research in long-term care has revealed that among 103 residents who experienced ≥ 1 fall in 1 year, none had any pharmacy notes subsequent to the fall that addressed potentially modifiable medication-related risk factors.⁷ As part of this research, pharmacists acknowledged that they did not routinely consider falls in their review process. An additional and pragmatic finding from this work arose from the pharmacists, as they suggested that a brief flowchart or algorithm would help them to consistently consider falls and identify potentially modifiable risk factors for falls, which in turn could be discussed with the physician.

Various tools exist to classify an individual's risk of falling, yet none represent a user-friendly systematic approach for identifying and mitigating fall risk that could be used by pharmacists in routine practice.^{8,9} Some have described several factors to consider when reducing fall risk through medication management but have not provided a particular systematic approach.⁹ Others have put forth a series of clinical practice algorithms that are of limited utility due to their complexity.¹⁰⁻¹³ There is a clear need for a simple, practice-based tool to help pharmacists in their daily routine. The objective of this pilot study was to further develop an existing algorithm, perform preliminary feasibility testing and obtain preliminary outcomes data.

FIGURE 1 An algorithm to reduce fall risk: Focus on medications

Methods

A preliminary algorithm was developed based on the principal investigator's (C.R-F.) clinical expertise in this area and included additional items identified from the literature. This algorithm (Figure 1) was developed to help pharmacists explicitly consider falls in their review process, identify medications that may increase a resident's fall risk and help guide a general course of action to mitigate this risk. A senior pharmacy student who had been a research assistant in the falls research program from September 2012 to August 2013 performed initial testing of the algorithm with 6 randomly selected residents of a local long-term care facility (3 of whom were known to have experienced a recent fall). Minor modifications were made to the algorithm based on this testing. Four pharmacists known to the investigators were invited to pilot test the algorithm. The investigators met with each pharmacist to review

the algorithm and invite suggestions regarding its content or layout. Additional minor modifications were made as necessary.

Pharmacists were initially asked to report on the following parameters: 1) baseline number of recommendations related to fall risk reduction (number of fall suggestions/100 medication reviews) and 2) baseline mean time to complete a resident medication review. Each pharmacist was subsequently asked to use the algorithm while completing reviews for at least 20 residents and to record general categories of medication recommendations and patient demographics over a 3-week period. The pharmacists also kept notes regarding the algorithm, including ideas for improvement. At the end of each week, the research assistant contacted the pharmacists to discuss progress. The "effectiveness" of the algorithm was assessed by comparing the baseline frequency of recommendations regarding falls to

TABLE 1 Description of resident medication review features before and during algorithm use

	Pharmacist 1	Pharmacist 2	Pharmacist 3	Pharmacist 4	Total/mean
Baseline proportion of recommendations to lower falls or fall risk, %	29	15	50	35	32
Medication reviews resulting in recommendations to lower falls or fall risk by use of algorithm, %	30	50	100	30	51
Absolute increase attributable to algorithm use, %	1	35	50	−5	18
Relative increase attributable to algorithm use, %	3.4	233	100	−14.3	57
Total number of recommendations with algorithm use/total number of reviews	11/20	12/20	23/17	6/20	52/77 = 0.675/review
Medication reviews with a suggestion (not acted upon) or recommendation with use of algorithm, %	60	60	100	30	63
Average time to complete medication review, min	27.5	12	45	25	27
Average increase/decrease in time to complete medication review using algorithm, min	7.5	2.1	2	2.5	+3.5
% Increase in time using algorithm	27.3	17.5	4.44	10	15

the frequency of recommendations while using the algorithm (primary endpoint was the absolute increase in recommendations attributable to algorithm use). Usability and potential sustainability were assessed by comparing the time it took to complete a medication review at baseline, compared with that while using the algorithm. All quantitative data were entered into a Microsoft Excel database, and analyses consisted of descriptive statistics.

A brief questionnaire was developed by the investigators to address pharmacists' experience with the algorithm (perceived value of algorithm, usability, impact on work flow and suggested changes to the algorithm). Pharmacists were asked to complete this questionnaire at the end of the observation period. Pharmacists were also asked whether they planned to continue using the algorithm, as well as their personal opinion regarding whether using the algorithm was worthwhile and sustainable. Impact on workflow, usability and barriers were also assessed through informal discussion with the pharmacists.

Results

Four pharmacists (1-31 years in practice) participated and completed 77 resident medication reviews (3 pharmacists completed 20 medication reviews and 1 completed 17 reviews) while using

the algorithm. Residents had a mean age of 86 years (60-99 years), 73% were female, and they were receiving an average of 10.4 medications (0-24, median 10 medications).

Pharmacists reported a 32% baseline frequency of recommendations related to falls, with absolute and relative increases of 18% and 57%, respectively, while using the algorithm (Table 1). In addition, there was a relative increase of 63% when additional suggestions were identified that required further investigation by the pharmacist prior to finalizing their recommendations. The absolute number of fall-related suggestions was 52 from the 77 resident medication reviews, with 39 of 77 medication reviews having 1 or more recommendations for medication change(s) related to reducing fall risk (range 0-3 recommendations per resident, Table 1). A slightly higher number of recommendations was made for older residents, irrespective of medication use. On average, 0.86 and 0.61 fall-related recommendations were made per person for men and women, respectively. A trend toward more recommendations was noted as the number of medications used per resident increased (Figure 2), ranging from 0.6 to 1.0 recommendations for those receiving 6 to 10 versus those receiving 16 or more medications.

Types of medication involved are summarized in Table 2. Central nervous system active drugs

FIGURE 2 Average number of recommendations per medication review based on number of medications taken

*N in each column represents the number of residents in each category of number of medications taken.

**Includes prescription, over-the-counter and natural health products.

TABLE 2 Recommendations for medication changes based on medication type as a result of algorithm use

Medication type	Number of recommendations*
Antidepressant	2
Antipsychotic	6
Benzodiazepine	6
Opioid	2
Muscle relaxant	1
Cardiovascular	7
Insulin	3
Analgesics (non-opioid)	3
Sedative/hypnotic	1
Urinary incontinence or anticholinergic agent	4
Vitamin D	9
Calcium	4
Other**	4
Total	52

*n = 77 medication reviews completed with the use of the algorithm.

**Other = 1 each for initiation of iron, initiation of oral antihyperglycemic, decreasing vitamin A intake and changing timing of donepezil dose.

comprised 33% (17/52) of the recommendations, as did calcium, vitamin D and “other,” while cardiovascular drugs comprised 13% (7/52), with smaller numbers for other medications. Recommendations for calcium and vitamin D were to initiate, increase a dose or change a dosage form, whereas other recommendations were more likely to decrease doses or discontinue medications.

Addition of the algorithm to the pharmacist's routine resulted in a small increase in time to complete medication reviews, with an average increase of 3.5 minutes per review (Table 1). Overall, the pharmacists found use of the algorithm to be feasible (Table 3). When asked what could increase their level of confidence, they suggested referencing literature within the algorithm and creating an addendum with a list of high-risk medications and alternative agents for use with the algorithm. Pharmacists were asked how using the algorithm affected their medication review process, and they responded 1) reviewed history of falls more often, 2) cited falls as reasons for recommendations made to physicians, 3) allowed for a more systematic assessment of falls, 4) increased confidence in the thoroughness and comprehensiveness of fall assessments, 5) increased cognizance of time spent on resident medication reviews, and 6) increased time spent on reviews. Learning to use the algorithm and knowing where to locate information such as fall history at different facilities were noted as barriers by 3 pharmacists. One

TABLE 3 Feasibility of using algorithm in daily practice ($n = 4$ pharmacists)

	Yes	No	Maybe	Other comments
Was the time to complete the algorithm worthwhile?	4			
Was the time to complete the algorithm acceptable in terms of sustainability?	4			
Do you think you made more recommendations regarding falls as a result of the algorithm?	3		1	
Did you think about falls more as a result of using the algorithm?	3			
Will you continue to use the algorithm?	3			Don't need paper copy, incorporated process into their medication review process.
Was information to answer each item accessible?	4			
How confident were you in using the algorithm to make recommendations?	Very confident	1		
	Mostly confident	2		
	Somewhat confident	1		
	Not confident			

pharmacist stated that the tool was less useful for residents who had fallen 6 to 12 months ago, as in such cases the fall had been fully assessed and issues were presumably already resolved. Another pharmacist commented that the most significant benefit of the algorithm was changing his or her thinking process to include falls at the forefront of the medication review process.

Discussion

Our findings suggest that a brief algorithm designed to assist pharmacists in considering a resident's fall history and identify potentially modifiable medication-related risk factors for falls is helpful in routine practice, as shown by a 57% relative increase in fall reduction recommendations by pharmacists over a 3-week period. Moreover, use of this algorithm appears to be feasible and sustainable over time, as the incremental time required to use it in practice was minimal and

feedback from users was largely positive. Furthermore, all pharmacists stated they would continue to use the algorithm in some way in their practice.

Not surprisingly, residents receiving more medications were more likely to have recommendations made to reduce fall risk. The largest proportion of recommendations related to reducing fall risk were with cardiovascular medications, followed by psychotropic medications, both of which are consistent with the literature.⁴ In addition, the largest number of recommendations related to preventing falls involved the addition of vitamin D, followed by calcium.

To date, the potential for pharmacists to lower fall risk in the nursing home setting has not received much attention.^{9,14} In a recent review, however, Cooper and Burfield⁹ provided pragmatic suggestions and guidance for pharmacists for fall prevention, including a 1-page fall risk assessment instrument that details common fall

risk factors and assigns an overall score to the patient. Those at moderate or high risk for falls are flagged for pharmacist intervention. As can be seen from Figure 1, we have taken a somewhat different approach to this pervasive clinical problem, which aside from common risk factors (e.g., medications, orthostatic hypotension, pain, etc.) explicitly addresses important issues such as temporal relationships between medication changes and subsequent falls, questions to help assess current medication regimens and appropriate daily intake of vitamin D and calcium.

Considering the incidence of falls in the nursing home setting and the prevalence of potentially modifiable medication-related risk factors, it is crucial that pharmacists make a conscious effort to consider these issues as part of their ongoing medication reviews. By doing so, their ability to lower residents' fall risk by addressing such issues should increase over time. In turn, it would be expected that these important contributions would improve resident outcomes by lowering the incidence of falls. It is also possible that such advances may help improve pharmacists' overall clinical skills and confidence, all of which are important to continuing efforts to improve the quality of cognitive services provided by pharmacists, leading to increased professional satisfaction.

Novel and pragmatic methods or tools to assist pharmacists in their daily practice are integral to improving medication use and reducing medication-related fall risk in older people in a sustainable manner. Although recent systematic reviews have highlighted the limited effectiveness of pharmacist consulting services on long-term care resident outcomes,^{15,16} by rationally and systematically improving how pharmacists provide clinical consulting services to this population, it should be possible to effect positive change in resident outcomes. In terms of fall reduction strategies in particular, there are 2 salient considerations for pharmacists: 1) the paucity of studies demonstrating the effectiveness of medication modification interventions aimed at reducing falls or fall risk in older people and 2) the limited sustainability of studies using complex interventions with highly trained research teams.^{9,17-19}

Time was cited as a limiting factor by 3 of the 4 pharmacists. When one is implementing new processes or protocols, there is an expected increase in time to complete tasks during the learning phase. In theory, the pharmacist should already be assessing the items included in the

algorithm; thus, the algorithm is meant to help the pharmacist perform the assessment in a systematic and more time-efficient manner. Pharmacists explicitly acknowledged that use of this tool allowed for a more systematic assessment of falls, supporting this assertion. While time has also been previously cited as a barrier to the implementation of fall-related interventions, it is likely that with long-term follow-up, the new process will become easily engrained in the workflow and time may ultimately be conserved. Furthermore, the goal of improved patient safety through reduced fall risk should take priority over time to complete medication reviews and all viable potential solutions should be explored in order to optimize medication use in older people.

In some cases, pharmacists identified potential suggestions to lower fall risk but did not immediately make recommendations. Reasons for deferred suggestions included residents being monitored by a specialist, the need for further clinical information or deferring the recommendation until a formal meeting with the resident and caregiver could take place. Although our findings are preliminary, 2 additional observations were noteworthy. First, 1 pharmacist suggested limited usefulness of the algorithm for residents who had fallen 6 to 12 months ago, as in such cases the fall would have been fully assessed and issues resolved. Such an assertion assumes that the current postfall assessment and care are seamless, with no room for improvement, yet data suggest that this is not the case.⁷ For example, in a study assessing fall data from 103 residents of a long-term care facility, potentially modifiable risk factors were noted to persist well beyond the incident and no evidence could be found to suggest that clinical issues beyond the acute injury were addressed.⁷

Second, it was suggested that the instrument be modified to add a list of high-risk medications and alternative agents to these medications. It would appear that further efforts are thus required in terms of additional training for pharmacists to address these issues.

Limitations

Limitations to this pilot project include the small number of pharmacists, self-reported estimates of baseline fall suggestion parameters, the lack of formal psychometric testing of the algorithm and the use of surrogate measures of success (i.e., clinical recommendations vs falls). The observation

period for this project was only 3 weeks; thus, the longer term feasibility of using this instrument needs to be assessed. Participants' feedback suggested that additional refinement around areas such as alternate medications and how to discontinue medications would be useful additions. Future work by our group will be conducted to address these issues and test the instrument in a larger sample of pharmacists.

Strengths

The instrument was developed and designed with input from the end-users (i.e., consultant pharmacists), which likely contributed to its usability in practice. Minimal training was required to orient pharmacists to the use of this

instrument, and it is possible that with continued use the process will become second nature, thus potentially minimizing the extra time needed for future reviews.

Conclusion

This pilot project furthered the development of and confirmed the potential utility and acceptability of an algorithm to reduce the risk of falls through medication review. Future work is needed to validate the algorithm and test its usefulness. Assuming that the algorithm proves successful at increasing recommendations related to fall risk, a study evaluating the incidence of falls before and after implementation of the algorithm would firmly establish its value. ■

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References

1. Becker C, Rapp K. Fall prevention in nursing homes. *Clin Geriatr Med* 2010;26:693-704.
2. Scott V, Wagar B, Sum A, et al. A public health approach to fall prevention among older persons in Canada. *Clin Geriatr Med* 2010;26:705-18.
3. Gruneir A, Bell CM, Bronskill SE, et al. Frequency and pattern of emergency department visits by long-term care residents—a population-based study. *J Am Geriatr Soc* 2010;58:510-17.
4. Boyle N, Naganathan V, Cumming RG. Medication and falls: risk and optimization. *Clin Geriatr Med* 2010;26:583-605.
5. Cranwell-Bruce LA. The connection between patient falls and medication. *Medsurg Nurs* 2008;17:189-91; quiz 192.
6. Ontario Regulation 79/10: Long-Term Care Homes Act, 2007. Available: www.e-laws.gov.on.ca/html/source/regs/english/2010/elaws_src_regs_r10079_e.htm#BK138 (accessed January 9, 2014).
7. Rojas-Fernandez CH, Brown SG, D'Avernas J. Opportunities for quality improvement in long term care (LTC): medication related contributors to falls among older residents of a retirement community. Presented at the American College of Clinical Pharmacy's Annual Meeting, Hollywood, FL, October 21-24, 2012.
8. Bergman-Evans B. Evidence-based guideline: improving medication management for older adult clients. *J Gerontol Nurs* 2006;32:6-14.
9. Cooper JW, Burfield AH. Medication interventions for fall prevention in the older adult. *J Am Pharm Assoc* (2003) 2009;49:e70-82; quiz e83-84.
10. Quigley PA. Clinical practice algorithm: medication management to reduce fall risk in the elderly, part 1. *J Am Acad Nurse Pract* 2007;19:625-6.
11. Bulat T, Castle SC, Rutledge M, et al. Clinical practice algorithms: medication management to reduce fall risk in the elderly—part 2, summary algorithm. *J Am Acad Nurse Pract* 2008;20:1-4.
12. Bulat T, Castle SC, Rutledge M, et al. Clinical practice algorithms: medication management to reduce fall risk in the elderly—part 4, anticoagulants, anticonvulsants, anticholinergics/bladder relaxants and antipsychotics. *J Am Acad Nurse Pract* 2008;20:181-90.
13. Bulat T, Castle SC, Rutledge M, et al. Clinical practice algorithms: medication management to reduce fall risk in the elderly—part 3, benzodiazepines, cardiovascular agents and antidepressants. *J Am Acad Nurse Pract* 2008;20:55-62.
14. Huang AR, Mallet L, Rochefort CM, et al. Medication-related falls in the elderly: causative factors and preventive strategies. *Drugs Aging* 2012;29:359-76.
15. Geurts MM, Talsma J, Brouwers JR, et al. Medication review and reconciliation with cooperation between pharmacist and general practitioner and the benefit for the patient: a systematic review. *Br J Clin Pharmacol* 2012;74:16-33.
16. Forsetlund L, Eike MC, Gjerberg E, et al. Effect of interventions to reduce potentially inappropriate use of drugs in nursing homes: a systematic review of randomised controlled trials. *BMC Geriatr* 2011;11:16.
17. Blalock SJ, Casteel C, Roth MT, et al. Impact of enhanced pharmacologic care on the prevention of falls: a randomized controlled trial. *Am J Geriatr Pharmacother* 2010;8:428-40.
18. Tinetti ME, Kumar C. The patient who falls: "it's always a trade-off." *JAMA* 2010;303:258-66.
19. Pit SW, Byles JE, Henry DA, et al. A quality use of medicines program for general practitioners and older people: a cluster randomised controlled trial. *Med J Aust* 2007;187:23-30.