ORIGINAL RESEARCH

Development and validation of the Medication Regimen Simplification Guide for Residential Aged CarE (MRS GRACE)

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Background: Residents of aged care facilities use increasingly complex medication regimens. Reducing unnecessary medication regimen complexity (eg, by consolidating the number of administration times or using alternative formulations) may benefit residents and staff.

Objective: To develop and validate an implicit tool to facilitate medication regimen simplification in aged care facilities.

Method: A purposely selected multidisciplinary expert panel used modified nominal group technique to identify and prioritize factors important in determining whether a medication regimen can be simplified. The five prioritized factors were formulated as questions, pilot-tested using non-identifiable medication charts and refined by panel members. The final tool was validated by two clinical pharmacists who independently applied the tool to a random sample of 50 residents of aged care facilities to identify opportunities for medication regimen simplification. Inter-rater agreement was calculated using Cohen's kappa.

Results: The Medication Regimen Simplification Guide for Residential Aged CarE (MRS GRACE) was developed as an implicit tool comprising of five questions about 1) the resident; 2) regulatory and safety requirements; 3) drug interactions; 4) formulation; and 5) facility and follow-up considerations. Using MRS GRACE, two pharmacists independently simplified medication regimens for 29/50 and 30/50 residents (Cohen's kappa=0.38, 95% CI 0.12–0.64), respectively. Simplification was possible for all residents with five or more administration times. Changing an administration time comprised 75% of the two pharmacists' recommendations.

Conclusions: Using MRS GRACE, two clinical pharmacists independently simplified over half of residents' medication regimens with fair agreement. MRS GRACE is a promising new tool to guide medication regimen simplification in aged care.

Keywords: medication therapy management, long-term care, geriatrics, drug administration, medication regimen complexity

Introduction

Older people are using increasingly complex medication regimens. The number of people aged 65 years and older who use five or more medications in the USA tripled from 13% to 39% between 1988 and 2010.[1] Residents of aged care facilities, also known as "nursing homes," "long-term care facilities," or "residential aged care facilities,"[2] use an average of four to 17 regular medications.[3] Increasing regimen complexity accompanies increasing polypharmacy, which has been attributed to changing resident mix, better adherence to disease-specific clinical practice guidelines and reluctance to discontinue medications initiated by other prescribers.[4]

Medication regimen complexity is a function of the number of medications, number of medication administration times, multiple or complicated dose formulations, and special instructions for medication administration (eg, to crush tablets, take with food or a specific fluid).[5] Initiatives to reduce the number of medications through "deprescribing" have attracted widespread attention.[6,7] Simplification without altering therapeutic intent of medication regimens is possible through addressing the other factors that contribute to unnecessary complexity, and is of increasing interest.[8–10] Medication regimen simplification has been identified as a priority area for geriatric pharmacotherapy by a panel of international experts.[11] The Victorian Government Department of Health and Human Services has introduced a new quality indicator for "more than four administration times" for aged care services in Victoria, Australia.[12] Recent Australian recommendations for the prevention of injury-related deaths in residential aged care services contain two recommendations (27 and 37) that support the need for medication regimen simplification. Recommendation 37 also recommends the development of standardized procedures to achieve medication simplification.[13]

Although only a small number of residents may self-administer their medications,[2] there are multiple reasons to implement structured and comprehensive approaches to reduce medication regimen complexity in aged care facilities. Complexity is an independent risk factor for hospitalization from aged care facilities and discharge to aged care facilities.[14,15] High complexity is associated with direct costs through time and workload to administer medications, and indirect costs through poorer resident health outcomes.[16,17] Furthermore, unnecessarily complex medication regimens are burdensome and may lead to difficulty adhering to prescribed administration times, increased risk of potentially inappropriate medication use, increased risk of medication administration error, and decreased resident satisfaction.[18,19] Reducing the number of medication administration times has been found to improve health-related quality of life in people with a variety of medical conditions.[20] Despite this, there remains no structured method to guide medication regimen simplification in aged care facilities. The aim of this study was to develop and validate a judgment-based (ie, implicit) tool[21] to facilitate medication regimen simplification in aged care facilities.

Method
Study design
This study was completed in two phases. Phase 1 focused on development of a regimen simplification tool. The developed tool was then validated in phase 2. Qualitative elements of this study in the development phase were reported according to the consolidated criteria for reporting qualitative studies where possible.[22] This study was approved by the Monash University Human Research Ethics Committee (project number 0731). For the validation in phase 2, individual resident consent to review their medication charts was waived by the Monash University Human Research Ethics Committee due to the non-identifiable nature of the copies of the medication charts used.

Phase 1: development of the medication regimen simplification tool
A modified nominal group technique (NGT) was used to develop the medication regimen simplification tool. NGT is a structured process to explore a research question, clarify ideas, and gain consensus among experts.[4,23,24] An expert panel was convened in October 2016. The panel was purposefully selected to comprise health professionals with practical experience in aged care and consumer representation. Potential panelists were identified through their clinical leadership roles and with the assistance of an organization that provides aged care services. Potential panelists were approached by email with a short statement of the purpose of the meeting. The panel was held at an aged care facility and moderated by two pharmacist researchers with experience using NGT (JSB and JS).

Following introductions, the facilitators introduced the concept of medication regimen complexity and the aim of the session. The focus was specifically identified as simplifying the existing regimen, rather than discontinuing medications. The panel was divided into two multidisciplinary pairs and one group of three. This approach was chosen to encourage collaboration and sharing of perspectives. Firstly, each pair and group of three generated and presented an exhaustive list of factors to consider when deciding whether a medication regimen could be simplified. Secondly, these factors were grouped into themes through moderated discussion with the full panel. Thirdly, each multidisciplinary pair or group of three was assigned a theme by facilitators, and separately tasked with formulating question or statement prompts that could be incorporated into an implicit tool. The panel discussed all the questions and statements for duplication, feasibility, and priority, and the final key questions for the tool were determined. Discussion points were transcribed during the session.

Each multidisciplinary pair and group of three applied the draft simplification tool to identify opportunities for simplification for a sample medication regimen listed on a

non-identifiable medication chart of a resident of an aged care facility. The panel performed an initial face validity check and discussed the ordering of the prompts and saturation of factors important to consider for regimen simplification. The tool was refined by investigators, taking care to capture all ideas generated at the meeting. The five prioritized factors were formulated as questions and circulated to the full expert panel for endorsement.

Phase 2: validation of the medication regimen simplification tool

The validity of the developed tool was established by comparing the proportion of residents in a sample whose regular medications could be simplified (eg, any change to the administration time, route of administration, or use of combination or extended release preparations) when the tool was applied by two people independently.

Sample selection

A stratified random sample of 50 residents from a census sample of 439 residents from 10 Australian aged care facilities were used to validate the developed tool. Non-identifiable medication administration charts were collected as part of an earlier unrelated study undertaken by the research team. The random sample in the present validation study was selected from medication charts for residents with two or more medication administration times (n=432) because there was no scope to reduce the number of administration times for residents with one administration time.

Clinical and medication data

The medication charts had standard dose administration times of pre-breakfast, breakfast, mid-morning, lunch, mid-afternoon, tea, evening, and settling. The name, strength, dose, dose form, route, administration time, and start date were recorded for each medication. Resident age (in years), allergies, medical diagnoses, and any notes pertaining to medication administration were also recorded.

Application of the medication regimen simplification tool

Two clinical pharmacists (A and B) were introduced to the concept of medication regimen simplification and the developed tool. The two clinical pharmacists independently applied the developed tool to the non-identifiable medication charts. The clinical pharmacists had three and ten years' experience performing medication reviews for residents of aged care facilities, respectively. A working relationship

between the clinical pharmacists did not exist prior to this study. When applying the simplification tool, the pharmacists were instructed to assume each resident's medication regimen had already been reviewed for clinical appropriateness. The pharmacists also assumed that the resident and facility would be willing and able to accommodate any recommendation. The pharmacists manually noted details of any recommended changes (medication name, form, route, dose, administration time, and any required monitoring or follow up), and reasons for not being able to simplify a medication regimen (if applicable).

Statistical analysis
Primary outcome measure

The agreement between two users of the developed tool when applied to a sample of residents whose regular medications could be simplified was established using inter-rater reliability analysis using Cohen's kappa. A dichotomous variable of "able to simplify the medication regimen" and "not able to simplify the medication regimen" was used. The inter-rater reliability was considered slight if between 0.0 and 0.2, fair if between 0.21 and 0.4, moderate if between 0.41 and 0.6, substantial if between 0.61 and 0.8, and almost perfect if between 0.81 and 1.0.[25,26] To assist interpretation of kappa, the maximum attainable kappa was also calculated.[27] Average proportions of agreement for positive and negative responses, and raw percentage agreement were also reported to support interpretation.[25] Microsoft Excel (2013) (Microsoft Corporation, Redmond, WA, USA) and SAS v9.4 (SAS Institute, Cary, NC, USA) were used for data analysis.

Secondary outcome measures

A secondary analysis was conducted for simplification that included a decrease in administration times. The inter-rater agreement for ability to decrease the number of regular administration times per day was calculated separately. All recommendations for and barriers to simplification were analyzed descriptively.

Sample size calculation for validation phase

To detect with 80% power a Cohen's kappa value of 0.8 against a null hypothesis value of 0.4,[25] the minimum required sample size was estimated to be 42 residents.[27] A probability of simplification of 0.5 was assumed, based on a previous proportion of older people with medication regimens that could be simplified.[28] A random number generator was used to select the final sample of 50 residents.[29] The final sample contained the same proportion of residents with each number of dose administration times as the census sample.

Results

Phase 1: development of the simplification tool

Eleven people were approached to participate in the expert panel meeting. Two people declined an invitation to participate due to travel. Two people who agreed to participate did not attend the meeting. Seven people attended the expert panel meeting (five male and two female members). Panel members had experience in prescribing, reviewing, administering or receiving medications in aged care (a general medical practitioner [GP, or family physician], a clinical pharmacologist, a geriatrician, two medication review pharmacists, a nurse practitioner, and a consumer advocate).

During the five-hour meeting, the expert panel generated 52 ideas in small groups. Investigators grouped these ideas into three broad themes: 1) environment/system (eg, multiple prescribers, continuity of care, a single "gate keeper" for the overall regimen); 2) resident/carer (eg, variation in symptoms with time, patient preference and understanding of medications); and 3) medication/regimen (eg, size and presentation of solid oral dose forms, medication absorption profile). A series of question or statement prompts were generated by further small group work. When applied to a medication chart, the panel were able to use the prompts to simplify the medication regimen. The prompts and the initial tool were assessed to have good content and face validity, respectively, after application to a sample medication chart from an aged care facility. The initial prompts were condensed into five questions for the final tool: the Medication Regimen Simplification Guide for Residential Aged CarE (MRS GRACE) and an accompanying explanatory statement (Box 1; see Figure S1 for full explanatory statement).

Phase 2: validation of the simplification tool

Of the 50 residents included in the validation phase, the mean age (±SD) was 82.3±9.8 years and 76% were female (n=38).

Box 1 Medication Regimen Simplification Guide for Residential Aged CarE (MRS GRACE)

Consideration can be given to administering all medications at the same time each day unless the following apply:

1. Is there a resident related factor that precludes simplification?
2. Is there a regulatory or safety imperative that precludes simplification?
3. Is simplification likely to result in any clinically significant drug–drug, drug–food, or drug–time interactions?
4. Is there no alternative formulation available that can support less complex dosing?
5. Is simplification likely to result in any unintended consequences for the resident or facility?

Residents took a mean (±SD) of 9.9±4.2 regular medications. In total, residents in the validation sample took 491 regular medications. The most frequent number of regular administration times per day was four (34%, n=17), while 14% (n=7) of residents had two administration times per day, 26% (n=13) had three, 16% (n=8) had five, and 10% (n=5) had six or more (Figure 1).

Each pharmacist identified opportunities and made recommendations for simplification for 30/50 and 29/50 residents' medication regimens (Figure 1A). There were 22 residents who both pharmacists agreed could have simplified medication regimens, and 13 residents' medication regimens that both pharmacists agreed could not be simplified. Simplification recommendations were made for all residents with five or more administration times (Figure 1A). Three quarters of simplification recommendations were to move an administration time without changing the dose administered (Table 1). The raw agreement between pharmacists was 70%. The proportions of positive and negative agreement were 75% and 63%, respectively. The pharmacists had fair agreement regarding simplification of medication regimens (Cohen's kappa=0.38±0.13, 95% CI 0.12–0.64). The maximum obtainable kappa statistic was 0.96.

Each pharmacist decreased the number of regular administration times for 23/50 residents, of which 18 were for the same residents (Figure 1B). Both pharmacists eliminated one administration time for 21 residents, and two administration times for two residents (not the same residents). Neither pharmacist was able to recommend simplification for residents with two administration times. The pharmacists had moderate agreement regarding decreasing administration times only (Cohen's kappa=0.48±0.12, 95% CI 0.24–0.72).

When classified by the anatomical therapeutic chemical (ATC) main group, nervous system medications were the most frequently implicated in recommendations (ATC group N) (Figure 2). Paracetamol was the most frequently implicated drug in this class (n=10/60 and 8/46 recommendations). Twelve percent of nervous system medications could be simplified (n=19/144 and 17/144). Cardiovascular medications (ATC group C, eg, atorvastatin, furosemide) had the highest level of disagreement, with pharmacists A and B recommending simplification for 19% and 9% of cardiovascular medications (n=16/85 and 8/85 medications), respectively.

All barriers to simplification noted during the validation were possible barriers identified during the development phase. Barriers related to medication, resident, and facility factors. Medication factors included frequent dosing of medications for Parkinson's disease, and time-specific administration of medications due to behavior or
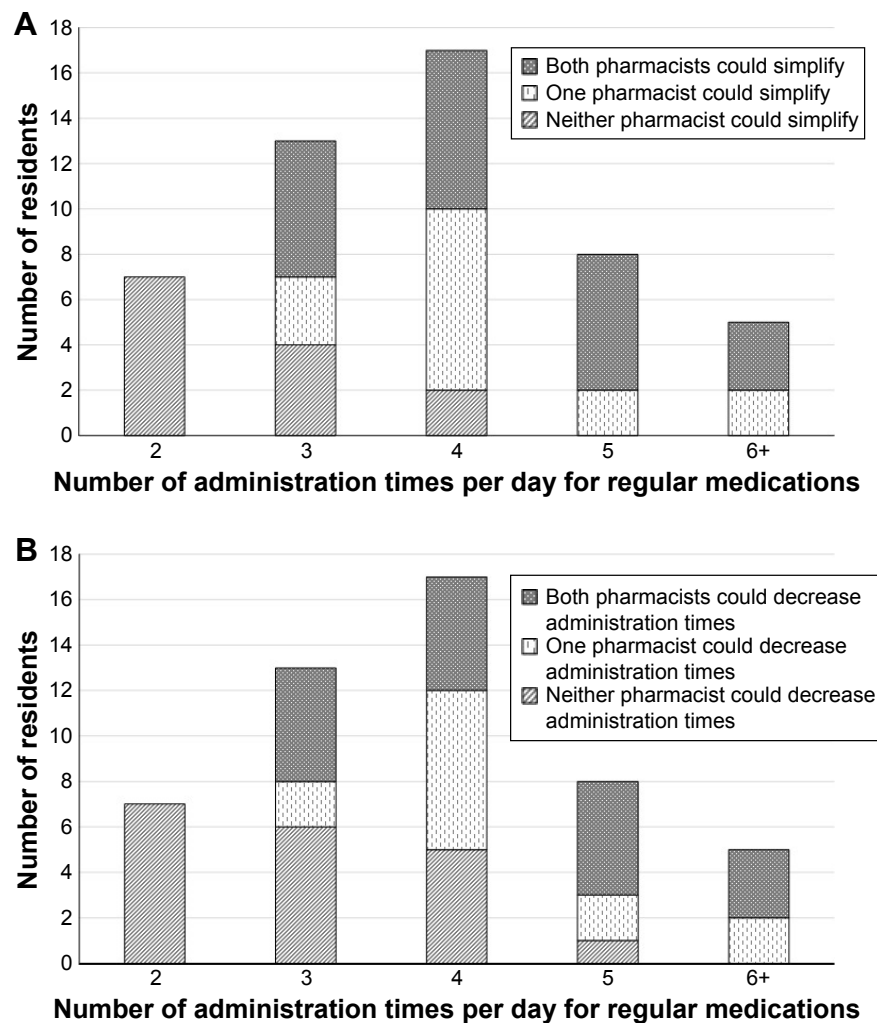
Figure 1 Agreement and ability to (**A**) simplify and (**B**) decrease regular administration times for residents in the validation sample, stratified by number of administration times per day for regular medications.

symptomatic management. Examples of resident related factors were swallowing difficulty, and existing anxiety about taking multiple tablets. Facility related barriers included special administration procedures surrounding controlled analgesic medications and warfarin.

Discussion

To our knowledge, MRS GRACE is the first tool to assist clinicians to identify opportunities to simplify medication regimens in aged care facilities. Taking medications is a burden for both staff and residents in aged care facilities,

Table 1 Frequency of each type of recommendation to simplify medication charts

Type of recommendation to simplify	Pharmacist A n=60 (%)	Pharmacist B n=46 (%)	Example
Change of an administration time with no change in dose at each administration time	47 (78.3)	34 (73.9)	Atorvastatin 20 mg 1 evening to 1 tea
Change of an administration time with a change in dose at an administration time (same total daily dose)	13 (21.7)	12 (26.1)	Spironolactone 25 mg 1 breakfast and 1 mid-afternoon to 2 breakfast
Change in strength of formulation given (same total daily dose)	0 (0)	3 (6.5)	Sertraline 50 mg 1 breakfast and 1 evening to 100 mg 1 breakfast
Change of formulation	7 (11.7)	4 (8.7)	Paracetamol 500 mg IR 2 breakfast, 2 lunch, 2 tea and 2 evening to paracetamol 665 mg MR 2 breakfast, 2 mid-afternoon and 2 evening
Total unique recommendations	60	46	

Note: Recommendations could have been counted in more than one category if applicable.
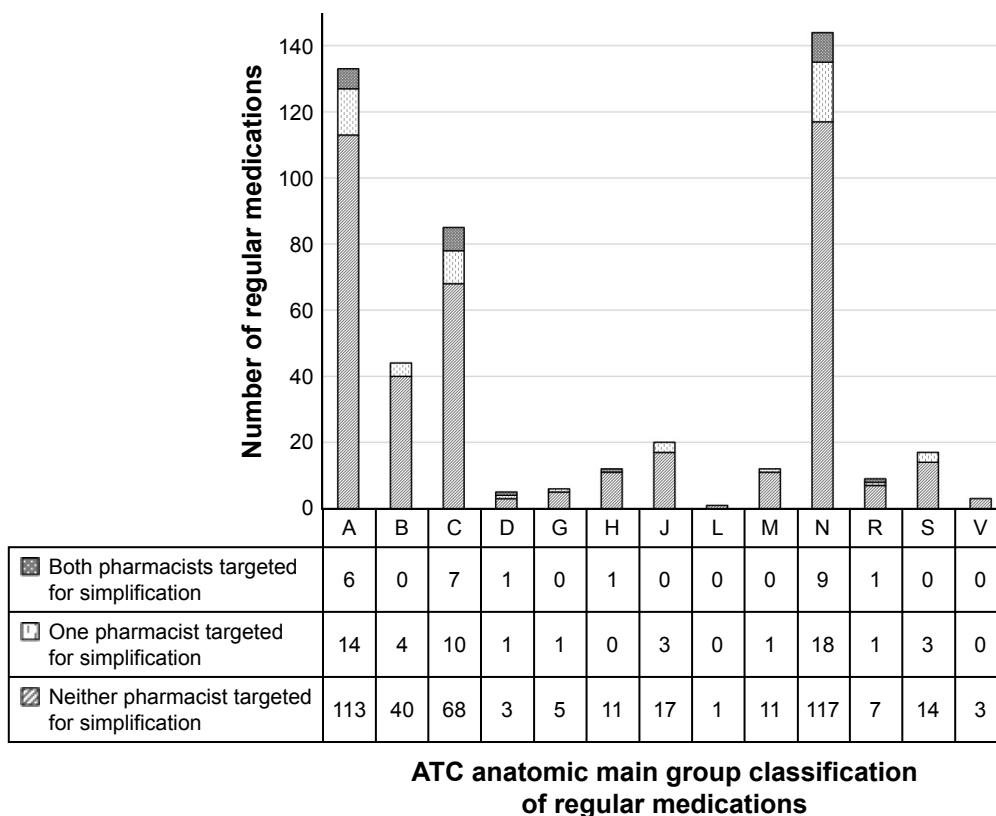**Abbreviations:** IR, immediate release; MR, modified release.

Figure displaying "Number of regular medications" on the y-axis (0 to 140) and "ATC anatomic main group classification of regular medications" on the x-axis, with the following data table:

	A	B	C	D	G	H	J	L	M	N	R	S	V
▩ Both pharmacists targeted for simplification	6	0	7	1	0	1	0	0	0	9	1	0	0
▯ One pharmacist targeted for simplification	14	4	10	1	1	0	3	0	1	18	1	3	0
▨ Neither pharmacist targeted for simplification	113	40	68	3	5	11	17	1	11	117	7	14	3

Figure 2 Agreement and ability to simplify regular medications in medication regimens of residents in the validation sample, categorized by Anatomic Therapeutic Chemical (ATC) main group classification.
Abbreviations: A, alimentary tract and metabolism; B, blood and blood forming organs; C, cardiovascular system; D, dermatologicals; G, genito-urinary system and sex hormones; H, systemic hormonal preparations, excluding sex hormones and insulins; J, anti-infectives for systemic use; L, antineoplastic and immunomodulating agents; M, musculoskeletal system; N, nervous system; R, respiratory system; S, sensory organs; V, various.

with many residents resisting medications. Reducing the number of times a day that the stress of taking medications occurs has benefits for both staff and residents. Furthermore, the residents can benefit from the opportunity costs that arise from freeing up nursing time from unnecessarily frequent medication administration. This tool provides a standardized approach to regimen simplification which may counteract the variability that may already be present in clinical pharmacist and other medication reviews for consistent results.

The scope for simplification of medication regimens in aged care facilities is substantial, despite pharmacists regularly performing similar clinical work and undergoing accreditation to perform full medication reviews. The medication charts used in the present study were from aged care facilities where clinical pharmacists conduct Australian Government funded residential medication management reviews (RMMRs).[2] Therefore, it would appear that further simplification is possible even among recipients of medication review. MRS GRACE may serve as a prompt and reminder for pharmacists or physicians when conducting medication management reviews.

A wide range of stakeholders were consulted in the development of MRS GRACE. At the beginning of the development phase, our panel of experts generated a comprehensive list of distinct factors. Although a number of concepts were subsequently considered peripheral to regimen simplification, concepts judged important to optimizing medication regimens were incorporated into the explanatory statement where relevant. Examples included ensuring the accuracy of medication records, recognizing that residents may have multiple prescribers with different treatment priorities and the need to ensure continuity across transitions of care. The expert panel recognized that regimen simplification is distinct from "medication reconciliation" and "deprescribing",[30] although successful simplification is dependent on first obtaining an accurate medication list and ensuring all medications are clinically indicated. The incorporation of all relevant aspects identified contributed to face validity of the developed tool.

MRS GRACE was purposefully developed as a judgement-based, or implicit, tool.[21] Implicit tools, such as the Medication Appropriateness Index (MAI), avoid making

recommendations for specific medications or situations.[31] Clinicians are thereby able to use it in different aged care settings and across different countries because the tool prompts evaluation of each individual facility's protocols and processes. The implicit format was considered the most appropriate for older people living in aged care facilities, due to its flexibility and the lack of evidence to inform prescribing in this setting.[32,33] This also means there is no single ideal "solution" as to how a medication regimen may be simplified. MRS GRACE includes in the explanatory statement some further guidance should clinical knowledge be limited (eg, consult a pharmacist for full range of formulations). Therefore, although agreement calculated by Cohen's kappa was fair, the higher raw agreement demonstrates that the tool is effective in aiding pharmacists to simplify medication regimens. The similar proportion of positive and negative agreements also indicates a lack of bias during interpretation and application of the tool.

While highly mobile, implicit tools rely on the user having good pharmacological knowledge and familiarity with different product formulations. For example, to effectively consider question 4 "Is there an alternative formulation that can support less complex dosing?", clinicians must combine knowledge of available formulations with knowledge of each resident's ability to use alternative formulations (eg, due to swallowing difficulties that require medications to be crushed). While MRS GRACE was validated by two pharmacists, it was piloted during the expert panel meeting by a range of different health professionals. The expert panel perceived that application of MRS GRACE could be undertaken by any health professional group with the knowledge required to apply the implicit tool in their context.

The expert panel identified and the validation study subsequently confirmed that medication regimen complexity may be unavoidable for various reasons. This may be due to the medication itself. "Time critical" medications, such as short-acting insulins or medications for Parkinson's disease, may cause harm or reduced efficacy if administration is early or delayed.[34] Other reasons relate to the resident. Some residents may prefer to spread their medications over multiple administration times rather than take all medications at the same time each day. The expert panel recognized that, "Is there a resident related factor that precludes simplification?", was considered an important first prompt to elucidate whether residents desire a simplified medication regimen. However, a specific list of medications or reasons that preclude simplification is not included in the tool as there may be cases where barriers can be addressed at the discretion of the clinician.

This also increases the generalizability of MRS GRACE, as medications or reasons that preclude simplification may also be country-specific.

MRS GRACE prompts users to evaluate barriers to simplification through the wording "clinically significant" in question 3. In the validation phase, this was a source of disagreement. For example, one pharmacist considered that the falls risk associated with administering mirtazapine at dinner outweighed the potential benefit of administering mirtazapine with residents' other dinner medications, and therefore did not suggest changing bedtime administration times. The "clinically significant" judgement was also a source of simplification recommendations through correcting common medicine misconceptions. A recurring example in the validation was moving the administration time of atorvastatin. The misconception was that statins should be taken at night to increase drug efficacy. However, while short-acting statins are slightly but significantly more effective if taken at night, long-acting statins (eg, atorvastatin) are effective at any time.[35]

Limitations

In developing the tool, a limitation was that we were unable to consult with residents directly to ascertain resident related factors prioritized as important to residents taking medication regimens. We instead engaged a resident advocate to contribute to the development of MRS GRACE. However, the resident perspective would also be considered when deciding whether to implement the identified opportunities for simplification, a step that may often be outside the scope of MRS GRACE.

In the validation phase, agreement was measured between two pharmacists despite the tool not being specifically targeted for pharmacist use. Clinical information about the resident that may impact on decision making was not available and pharmacists A and B were unable to speak with residents, caregivers or facility staff. Therefore, it was not possible to fully consider the resident perspective or facility resources section of the simplification tool (questions 1 and 2, respectively), or clarify any unintended consequences that the simplified medication regimen may have (question 5). This may have decreased agreement as disagreement between the pharmacists in the validation phase may be resolved in practice by consulting the prescriber or care manager in the aged care facility.

There was also no scope to assess the clinical appropriateness of the simplified regimen, or if a prescriber would have accepted and implemented the simplification

recommendations generated as a result of using the tool. While the safety of the regimen is the ideal measure, it is very difficult to quantify. We used inter-rater reliability as an adequate surrogate marker, assuming that the pharmacists applied the tool as intended, to simplify medication regimens without sacrificing safety.

Future directions

Simplification could be undertaken as a stand-alone activity, or as part of comprehensive medication review programs and geriatric assessments undertaken by physicians and pharmacists in aged care facilities. However, further research is needed to explore possible differences and similarities in application of the tool by different health professionals. It may also be appropriate to use MRS GRACE following medication reconciliation on admission to aged care facilities, or after returning from hospital. The panel suggested that a single "simplification champion" could act as a "gate keeper" to take responsibility for coordinating regimen simplification in aged care facilities at these times. Research to understand uptake of simplification recommendations, and impact of medication simplification on outcomes for residents and aged care providers, is currently underway in an ongoing randomized controlled trial (SImplification of Medications Prescribed to Long-tErm care Residents [SIMPLER]).[36]

Conclusion

By applying MRS GRACE, two clinical pharmacists independently simplified two-thirds of residents' medication regimens with fair agreement. MRS GRACE is a validated tool that may be adopted by clinicians and aged care providers as a standardized approach to simplification and may reduce the burden of medication administration for aged care providers.

Acknowledgments

Disclosure

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Supplementary material

Medication Regimen Simplification Guide for Residential Aged CarE (MRS GRACE):
Explanatory statement and specific instructions
The purpose of this validated tool is to identify opportunities to reduce unnecessary complexity in medication regimens. Simpler medication regimens may increase residents' satisfaction and are easier for carers to administer. Consider undertaking a full medication reconciliation and review before applying this simplification tool to ensure all current medications are listed and appropriate. Identification of a "simplification champion" responsible for the medication regimen may assist in implementing the simplest regimen. These processes may also help to inform simplification. Please note: the term "simpler medication regimens" refers to regimens that have fewer administration times, decreased pill burden and/or fewer routes of administration. Consideration can be given to administering medications at the same time each day unless the following apply:
Question 1: Is there a resident related factor that precludes simplification?
Definition Resident related factors include individual needs and preferences, and cannot be generalized. Resident needs refers to factors related to cognitive and functional status. Resident preferences refers to lifestyle or comfort factors of taking a medication regimen. **Instructions** Clinicians should engage in an open and respectful discussion to elucidate the resident's needs and preferences. Consultation with the resident, the resident's family and other health professionals may also be of assistance in determining whether needs and preferences can be accommodated to allow simplification. Medical conditions, such as dementia, may influence the approach to simplification. **Examples** Simplification may not be appropriate if the resident: • prefers to have more frequent administration times if it means less tablets at each administration time • has difficulty swallowing whole oral formulations or requires medications to be crushed, precluding some modified-release formulations • had a previous adverse drug event that would limit simplification options (for example, a previous reaction to once daily atenolol may restrict options for simplification of twice daily metoprolol) • wishes but cannot be supported to self-administer medications in a simplified regimen.
Question 2: Is there a regulatory or safety imperative that precludes simplification?
Definition A regulatory imperative refers to aspects of medication ordering, storage, and administration that must comply with laws and regulations. A safety imperative refers to any aspect of medication ordering, storage, and administration that occurs in order to reduce risk of medication misadventure. These are generally facility level factors. **Instructions** Medication administration is often determined by legislative requirements. Individual facilities may have policies dictating medication administration times, equipment and/or personnel. Refer to relevant local authorities for clarification. **Examples** Simplification may not be feasible if the facility cannot accommodate: • administering opioid analgesics or other controlled medications in the same medication round as other medications due to legal requirements • having qualified staff available to administer medications via a variety of routes and to administer medications that may not be able to be packed in a dose administration aid in the same medication round (for example, to apply topical medication).

Figure S1 (*Continued*)

Question 3: Is simplification likely to result in any clinically significant drug–drug, drug–food, or drug–time interactions?

Definition

Drug–drug interactions occur when co-administration of two or more medications results in changes to the pharmacological effect of any of the medications.

Drug–food interactions occur when administration of a medication with or without food results in changes to the pharmacological effect of the medication or results in clinically significant side effects.

Drug–time interactions occur when there is a clinically significant change in medication efficacy related to changing the time of day the medication is administered. Drug–time interactions may also occur due to certain side effects of a medication that would limit normal daily activities.

Instructions

Not all drug interactions will preclude simplification. Clinical judgement should be exercised to determine if the interaction can be accommodated. Prescribers and facility managers may need to be consulted to determine feasibility.

Examples

There may be ways to accommodate simplification despite "medication myths":
- increased laboratory monitoring in the initial period (for example, when changing administration of thyroxine from before breakfast to with breakfast).

Simplification may not be appropriate where:
- there are two medications that must have separated dose administration times due to pharmacokinetic interaction (for example, bisphosphonates and calcium and/or iron supplements)
- the resident experiences significant nausea if the medication is not given with food
- there are lifestyle limiting diurnal or nocturnal side effects (for example, giving a sedative medication in the morning)
- a condition has effects that must be managed with medication at specific times (for example, Parkinson's disease or behavioral disturbance related to specific daily activities).

Question 4: Is there no alternative formulation available that can support less complex dosing?

Definition

Medications can be available in a variety of dosage formulations and can be administered via different routes.

Instructions

Simpler medication regimens generally have as few different routes of administration as possible. However, administering the same dosage form multiple times a day may be easier than administering different dosage forms at the same time of day. Consult references or pharmacists for a full range of products that are available.

Examples

Simplification may not be possible if there are no:
- long-acting or controlled-released formulations
- combination products
- alternate dosing regimens (for example, monthly instead of daily vitamin D).

Question 5: Is simplification likely to result in any unintended consequences?

Definition

Changing any part of a medication regimen may have consequences for the resident or facility staff that may not be immediately clear. Medication regimens that appear simpler on the medication chart do not necessarily translate to medication regimens that are simpler to administer in practice.

Instructions

Consider all persons who will be involved in the simplified medication regimen and what will be required to ensure the new regimen is successfully implemented and received. Consult prescriber or facility manager for guidance. Special attention may need to be given to people with dementia as it may be more difficult to assess changes and identify adverse outcomes among people with dementia.

Examples

Simplification may not be desirable if it would result in a need to:
- perform additional invasive monitoring (for example, more frequent blood tests)
- increase time spent on administration (for example, changing from a daily oral medication to a weekly patch may require more nursing time to apply and monitor patch adhesion)
- increase the level of qualification needed for staff administering the medication regimen (for example, changing formulation may preclude administration from a dose administration aid)
- increase the overall cost of the medication regimen if alternative medications or formulations are more expensive for the resident or facility.

Figure S1 The Medication Regimen Simplification Guide for Residential Aged CarE (MRS GRACE): explanatory statement and specific instructions.

→ Video abstract

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