Title: Consolidated Medication Review Algorithm to Improve Medications Use in Older Adults: Components, Scoring Scheme and Implementation

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Consolidated Medication Review Algorithm to Improve Medications Use in Older Adults: Components, Scoring Scheme and Implementation

To the Editor:

Medication review algorithms and minimisation frameworks are known to aid reviewers in identifying and discontinuing potentially inappropriate medications, which may otherwise lead older population to harmful events. There have been many algorithms and minimisation frameworks that have been developed to aid to evaluate medication reviews, with each one offering benefits in various settings. In 2007, Pollock et al. proposed an eight-step approach to improve prescribing by family physicians. Scott et al. (2012) further developed the concept proposed by Pollock et al. (2007) to a ten-step framework that aimed to improve medicines use and to reduce the number of inappropriate medications prescribed to older people. Poudel et al. (2015) further condensed the ten-step framework to a four-step algorithm that guides clinicians in reviewing the medications, but it is targeted at frail older patients living in aged care facilities. Many other independent models and algorithms have also been designed. A commonality that exists among all medication review algorithms and minimisation frameworks is that all of them lack scoring scheme to quantify medication review process. In this context, a new consolidated medication review algorithm is being developed.

Consolidated Medication Review Algorithm

Our algorithm is different from the previous algorithms in two ways, first it incorporates the potentially inappropriate medication (PIM) component, second it includes a scoring scheme which correspond to the components in the algorithm (Figure 1). The scores derived from the algorithm will allow for an effective periodical review to observe improvements in medicine use.

Components of an algorithm

The components in our version of medication review algorithm are: ascertain and validate indications of the medications (consult prescriber and credible resources like Micromedex®); identify therapeutic duplications (review complete list of current medications); ascertain the effectiveness of the medications (cross-referenced via objective measurements as per patient records, or obtained via clarification with the respective prescriber); perform a two-stage screening of the medications; 4a. Identify potentially inappropriate medications (consider Tables 2 and 3 of 2015 Beers Criteria, and/ or START/STOPP criteria); 4b. Identify medications to be
used with caution (consider Table 4 of 2015 Beers Criteria\textsuperscript{7}), appropriateness of the dosing regimen (consider Table 5 of 2015 Beers Criteria,\textsuperscript{7} or credible resources, e.g. Micromedex\textsuperscript{®}, and consult prescriber), contraindications (consider resources e.g. Micromedex\textsuperscript{®}), incidence of adverse drug events (consider Table 6 on drug interactions from 2015 Beers Criteria;\textsuperscript{7} ADRs consider Naranjo adverse drug reaction probability scale\textsuperscript{9}), consider continuing, discontinuing or substituting medications (consult prescriber). If the medicine is deemed ineffective for the patient, then the medication is warranted for discontinuation, in which the withdrawal regimen (consider Table developed by Poudel et al.\textsuperscript{1}) or non-pharmacological interventions should be considered.

**Scoring scheme**

The scores are generated in a similar manner like Medication Appropriateness Index (MAI).\textsuperscript{10} According to scoring scheme, appropriate items are scored 0 and inappropriate responses are scored 1. The weighting scheme combines all the criteria, and they are as follows: 3 for indication, effectiveness, use of PIM and drug-disease interactions; 2 for dosage, directions and drug-drug interactions; and 1 for duplication, duration and expense. A higher single score means increased medication inappropriateness (possible score range of 0-21). A medication is deemed inappropriate overall and should be discontinued if the medication scored a rating of 3 or above. The ADR component was excluded from the scoring scheme, mainly due to uncertainty of causality. It may not be feasible to determine the cause of an ADR instantaneously and would require further clarification.

**Implementation**

We implemented this algorithm in a 6-month prospective study among 202 residents aged 65 years and above across 17 aged care facilities in Malaysia (Ethics approval was obtained – Project IDIA422, Research Code, XX University, Kuala Lumpur, Malaysia 349/2016). The proportions of older adults exposed to inappropriate medications detected by our scoring scheme that were not detected by the MAI were 39.7% at baseline, 34.8% at 3-months and 34.3% at 6-months. Conversely the proportion of older adults exposed to inappropriate medications detected by the MAI that were not detected by our scoring scheme were almost none or close to minimal (0.0% at baseline and at 6-months, and 3.5% at 3-months). It is also noteworthy that the incorporation of the PIMs is crucial in a medication review algorithm for the older people as
there are many benefits when PIMs are avoided in this population. The medication review should be objective in nature, also a review with stepwise approach would allow easy implementation.

References
SCREEN ALL MEDICATIONS

IS THERE A VALID AND CURRENT INDICATION?

- YES: IS THERE ANY THERAPEUTIC DUPLICATION?
  - NO: IS THE MEDICATION EFFECTIVE FOR THE CONDITION?
    - NO: PERFORM A TWO-STAGE SCREENING:
      1. IDENTIFY PIMs (TABLES 1 & 2)
      2. IDENTIFY MEDICATIONS TO BE USED WITH CAUTION, CONTRAINDICATIONS, INCIDENCE OF ADEs, & DOSING REGIMEN (TABLES 3-6 & Other Credible Resources)
    - YES: CONSIDER WITHDRAWAL TABLE, AND/OR NON-PHARMACOLOGICAL INTERVENTION
  - YES: CONSIDER STOPPING

- NO: WAS THERE A PREVIOUS TRIAL OF DISCONTINUATION?
  - NO: PROBLEMATIC MEDICATION CONTINUED
    - e.g. withdrawal syndrome
  - YES: IS THE MEDICATION PROVIDING SYMPTOMATIC BENEFIT?
    - NO: SUCCESSFUL, BUT STARTED MEDICATION AGAIN WITHOUT RELEVANT REASON
      - e.g. prescribed by other physician according to previous medication history without checking diagnosis
    - YES: CONSIDER WITHDRAWAL TABLE, AND/OR NON-PHARMACOLOGICAL INTERVENTION

ARE THERE MEDICATIONS THAT NEED SUBSTITUTION?

- NO: CONTINUE MEDICATIONS
- YES: CHANGE TO ALTERNATIVE

LEAST EXPENSIVE CONSIDER NON-PHARMACOLOGICAL INTERVENTION

*ADE COMPRIS DRUG INTERACTIONS & ADVERSE DRUG REACTIONS

**DOSING REGIMEN COMPRIS DRUG INTERACTIONS & ADVERSE DRUG REACTIONS

**DOSING REGIMEN COMPRIS DRUG INTERACTIONS & ADVERSE DRUG REACTIONS