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Innovating medication reviews through a technology-enabled process

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ABSTRACT

Medication reviews are effective in improving the quality of medication use among older people. However, they are conducted to various standards resulting in a wide range of outcomes which limit generalisability of findings arising from research studies. There also appear to be funding and time constraints, lack of data storage for quality improvement purposes, and non-standardised reporting of outcomes, especially clinically relevant outcomes. Furthermore, the coronavirus disease-19 (COVID-19) pandemic has restricted many face-to-face activities, including medication reviews. This article introduces a technology-enabled approach to medication reviews that may overcome some limitations with current medication review processes, and also make it possible to conduct medication reviews during the COVID-19 pandemic by providing an alternate platform. The possible advantages of this technology-enabled approach, legislative considerations and possible implementation in practice are discussed.

1. Introduction

Medication reviews are effective in improving the quality of medication use among older people, especially older individuals in aged care facilities[1,2] and those residing in the community who do not have regular follow-ups with their general practitioners (GPs). Medication reviews are aimed at identifying, resolving and preventing any medication-related problems, and optimising medication use in collaboration with GPs, medical practitioners, other healthcare professionals and patients[3]; the process is patient-centred. Medication reviews form the foundation of national policies and guidelines associated with medication optimisation strategies and intervention studies.[4] These remunerated services include Medication Therapy Management and Medication Regimen Review in the United States of America (USA),[5] Residential Medication Management Review (RMMR)[6] and Home Medicines Review (HMR)[7] in Australia, Medicines Use Review in the United Kingdom,[8] and MedsCheck in Canada.[9] Although regular medication reviews remain an important consideration in geriatric medicine, achieving this goal may pose many challenges.[10]

Increasingly, technology has played a key role in improving productivity in healthcare.[11,12] A systematic review has shown how technology can reduce costs due to time savings and improve individual health outcomes and safety.[13] Importantly, the challenges faced during the coronavirus disease-19 (COVID-19) pandemic has ceased many face-to-face activities and has plummeted many parts of the world into a protracted economic, social and medical crisis.[14] An approach to medication reviews that utilises technology effectively could optimise medication use and encourage continued reviews during the pandemic. To contribute to the growing field of technology, we discuss the potential for incorporating a unique technology-enabled approach to facilitate medication reviews, drawing from international research to highlight shortcomings and consequences of current medication review processes.

2. Limitations with current medication review processes

Medication review processes differ across countries and the variation may introduce a wide range of outcomes. While national practice guidelines often recommend that pharmacists adopt a systematic approach when conducting medication reviews, guidelines usually only offer a 'checklist' approach and recommend a variety of prescribing indicator tools that would aid in the review process.[6,7,15,16] However,

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the individualised nature of medication reviews requires distinctive approaches[17] and may be time-consuming. Barriers, limitations and shortcomings of current medication review processes are summarised in Table 1, with supporting citations and evidence.

Lack of time and funding constraints are barriers to conducting regular medication reviews.[10,18–20] Lack of an efficient process may preclude a medication review from being conducted regularly or when required; this is apparent in aged care settings.[10,19–21] In Australia, an evaluation of the RMMR process reported that the majority (64 %) of Accredited Pharmacists (registered pharmacists accredited by the Australian Association of Consultant Pharmacy or the Society of Hospital Pharmacists of Australia[6]) indicated inefficient record-keeping in aged care facilities, and significant time required to access dispensing histories, contributed to costs associated with RMMRs.[10] The system currently used to identify individuals who are eligible for a medication review has also proven to be costly in terms of time management, because there are costs associated with administrative overheads and the time required to liaise with GPs to clarify issues.[18] Lack of timely reviews have also resulted in rejection of ineligible claims which had been submitted to the government for remuneration.[17] Furthermore, the lack of financial reimbursements in some countries have restricted the frequency of medication reviews, and thus follow-up reviews.[19]

Lack of process integration at an aged care facility may retard an efficient medication review process.[10] Transfers of individuals between aged care facilities and hospitals may result in changes in the prescriber and there is no standardised system in place to ensure that the new aged care facility and GP have access to an individual's previous RMMRs. Similarly, when there is a change in the Accredited Pharmacist who provides the review, it can sometimes be difficult to identify when an individual's medication was last reviewed because the medication review report generated by the previous reviewer may not be located at the facility.[10] In addition, storage of hard copy data is limited and it may be challenging to initiate quality improvement measures to the current medication review process without prior data.[21]

Most medication reviews are conducted in the presence of the individual (patient); however, this may prove to be a major barrier in current circumstances of the COVID-19 pandemic. Not all healthcare settings may have integrated information about medications, and as such medication reviews may not be conducted regularly without patient interaction, especially when an individual is newly transferred to an aged care facility, or when an initial review needs to be conducted for community-dwelling individuals. Regular and follow-up medication reviews may also be affected during this pandemic, resulting in poor optimisation of medications.

Outcome measures in studies that aimed to test the effectiveness of medication reviews as well as new medication interventions are heterogeneous and non-standardised.[21–23] Furthermore, most outcomes reported are not clinically relevant,[21,23] such as number of recommendations made by pharmacists and those that were accepted by the GPs; these outcomes may not be translated to practice. Health outcomes such as quality of life, adverse drug events, falls among older people and hospital admissions remain crucial health outcomes that should be reported to aid in quality improvement initiatives for medication reviews.

The barriers to conducting medication reviews highlighted are likely to have influenced the outcomes in medication review studies, resulting in non-significant findings. However, non-significance does not preclude the importance of medication reviews.[23] Despite the limitations with current medication reviews, the majority of stakeholders, i.e. pharmacists (90 %), GPs (60 %) and aged care home staff (75 %), reported positive health outcomes among older people as a result of medication changes identified during medication reviews.[10]

Table 1
Limitations of current medication review processes.

Limitations of current medication reviews	Description
Checklists which lead to variations in processes[6,7,15–17]	Commonly used guides and national practice guidelines often include a 'checklist' approach about aspects to consider during a medication review, and recommend prescribing indicator tools that may provide information Lack of a systematic and structured process may prevent identification of medication-related issues The individualised nature of medication reviews may be time-consuming depending on the approaches adopted by each pharmacist
Time constraints[10,19–21]	Multiple documentation and records in aged care facilities that need to be accessed before a review is conducted affects the overall time taken for pharmacists to conduct the reviews, thus increasing associated costs The system to identify individuals who are eligible for a review is costly in terms of time management, and often result in rejection of ineligible claims which had been submitted to the government for remuneration
Funding constraints[10,17–21]	There are costs associated with administrative overheads and the time required to liaise with general practitioners to clarify issues Lack of financial reimbursement restricts the frequency of medication reviews and the failure to provide follow-ups
Process integration at an aged care facility[10]	There is a lack of support to ensure that an individual enrolled at an aged care facility for the first time and their general practitioners have access to an individual's previous medication review report during transfers of individuals that results in changes in treatment provider If there are changes in the reviewing pharmacist, there may be difficulties identifying when an individual was last reviewed as the medication review report generated by the previous reviewer may not be located at the aged care facility
Data storage for quality improvement[21]	Storage of hard copy data is limited and may prevent the initiation of quality improvement measures to the current medication review processes
Inability to conduct face-to-face medication reviews during the COVID-19[a] pandemic	The COVID-19 pandemic has made it challenging to conduct face-to-face medication reviews; furthermore, not all healthcare settings may have integrated individual information about medications. This may preclude reviews from being conducted, especially when an individual is newly transferred to an aged care facility, or when an initial review needs to be conducted for community-dwelling individuals
Outcomes reported in studies that assess medication reviews[21–23]	Reporting of non- standardised health outcomes, i.e. heterogeneity of outcome measurements There is a lack of reporting of clinically relevant outcomes

[a] COVID-19: Coronavirus disease-19.

3. Adopting technology in medication reviews

The use of technology is being implemented in healthcare in various ways. Ventola (2014) reviewed the use of mobile devices and apps for

healthcare professionals that have provided many benefits, including increased access to point-of-care tools which are proven to support improved clinical decision-making and patient outcomes.[24] Interestingly, the use of technology in clinical pharmacy services were implemented as early as 2012.[25] "Telepharmacy" is defined as using communication technology and electronic information for the provision and support of comprehensive pharmacy services particularly when distance separates participants.[26] In the context of "telepharmacy", Cole et al. (2012) concluded that "telepharmacy" represented a potential alternative to on-site pharmacist medication reviews in rural hospitals, and reaffirmed the importance of continued medication reviews.[25] "Telepharmacy" also contributes to "telehealth", a term that is used extensively in healthcare and which is defined as the delivery of various healthcare services at a distance via the use of technology.[27]

A potential solution to the limitations of current medication review processes would be to encourage use of "telepharmacy" and further innovate the medication review process through our unique technology-enabled approach. This comprises three fundamental components: *content knowledge, a guided framework* and *technology* in an approach we propose as a technology-enabled medication review process.

Firstly, content knowledge is essential and can be achieved through various accreditation and training programs available for conducting medication reviews. For example, in Australia, only Accredited Pharmacists are remunerated for conducting medication reviews.[6] Secondly, while current medication review guidelines[6,7] provide lists of common medication-related issues, this approach could be augmented using a guided framework. For example, an algorithm or minimisation framework could expedite the process when pharmacists conduct medication reviews, with the answer to one question leading to the next option that has to be considered[28,29]; this may aid the decision-making process during medication reviews.

Finally, coupled with knowledge gained from being trained to conduct medication reviews[6,15,16] and utilising a guided framework, technology has the potential to improve the efficiency and effectiveness of medication reviews and could, for example, be adapted to focus specifically on older people.[2,28,29] Technology in the form of a computerised decision support system (CDSS) can ensure that a comprehensive review is conducted in a timely and cost-efficient manner. Cresswell and colleagues (2012) define CDSS as a software application utilising patient data, a database of clinical knowledge, and 'conditional' logic, for instance 'if-then' and 'do while', to produce patient-specific recommendations related to healthcare.[30] Their review paper provides evidence on improved practitioner performance and patient outcomes with the use of CDSS.[30] In this article the term CDSS refers to the technological aspects of our proposed innovation.

CDSS is based on three aspects: level of integration, data entry, and user engagement.[30] Medication reviews could be 'integrated' with other clinical information systems such as electronic health records, rather than being 'stand-alone manual processes'. Essential individual data can be inputted into the system via transfer from clinical information systems, or by electronic transmission from medical devices. The medication review system should have 'active' user engagement; the CDSS provides the user with real-time information to assist in decision-making at the point-of-care[31]; this may include a list of references and resources to aid in decision-making and could be further supplemented with existing mobile apps that aid in clinical decision-making. CDSS has proven effective in supporting prescribing-related and guideline-based decisions; for example, CDSS alerts the user to inappropriate medication doses and contraindications which are two major components of a medication review.[28,30] When medication reviews are conducted in person (face-to-face), pharmacists are able to use the CDSS to conduct the reviews after interviewing patients for their input about medication-related issues and management, while considering other aspects of patient characteristics such as their preferences, attitudes, beliefs, goals, and life expectancy, end-of-life care and frailty. To encourage a patient-centred approach when face-to-face interactions are limited, phone calls or video calls can be organised to interview patients; this feature could be built into the CDSS.

An example of how a technology-enabled medication review could be used is illustrated in Fig. 1.[3] The first step involves an assessment conducted by a GP with the patient or their carer, to determine the need for a medication review, followed by a referral from the GP to an Accredited Pharmacist. The pharmacist would first interview the patient or their carer. Being an Accredited Pharmacist, they have sufficient content knowledge. The guided framework to aid in decision-making about optimal medication use is embedded within the CDSS including a medical/medication history and other relevant information. The pharmacist would provide their recommendations to the GP for consideration and would conduct follow-ups to ensure implementation of changes if these are required.[3]

4. Potential advantages of a technology-enabled medication review process

Table 2 summarises potential advantages that may overcome limitations of current medication review processes. Firstly, use of this process may allow for a systematic and structured medication review as the incorporation of a stepwise guided framework will facilitate a systematic medication review process[20,28,29]; automatic prompts for medication monitoring parameters will also ensure that all aspects of a medication review are completed. Our technology-enabled medication review process may also be time-saving as consolidation of individuals' information and medication history could negate unnecessary documentation thus speeding the process and allowing for more reviews to be conducted in a shorter period. Pharmacists will then have an opportunity to perform quality improvement initiatives with the 'additional' time, such as counselling patients on appropriate use of medications and conducting audits of reviews. Furthermore, incorporation of essential information in the system about eligibility for medication reviews could translate into cost savings as GPs and pharmacists can easily submit claims for reimbursement of the service.

A once-off investment in the design and implementation of the proposed system would offset long-term costs associated with unnecessary documentation and the related expenses (administrative overheads). A more efficient process for medication reviews may reduce direct costs associated with the use of unnecessary pharmacotherapy and potentially inappropriate medications (PIMs), and the indirect costs of treating adverse effects.[32]

The use of the proposed technology-enabled medication review approach may facilitate process integration at aged care facilities and other healthcare settings, including the potential for storage of medication review reports and associated data which would allow for continuity of care and medication management. Individuals' data would have to be integrated as per privacy and ethical policies, and allow GPs and staff to have easy access to medication records, including to identify previous reviews and to facilitate regular reviews. Data access by policymakers could lead to improvement in systems and processes, for audit purposes, and education and research, encouraging inter-professional discussion and collaboration. Our technology-enabled medication review process which consolidates individuals' information will be particularly useful during the current COVID-19 pandemic that restricts physical interaction. Our CDSS have an in-built feature for phone and video calls to interview patients about their medications.

To encourage homogeneity in outcome measures of medication review intervention studies, our proposed system will allow researchers to select from a list of outcomes that can standardise the reporting of outcome measures for interventional studies[33]; this will also facilitate the reporting of clinically relevant outcomes and could assist in improvements which may lead to changes in policy and guidelines.

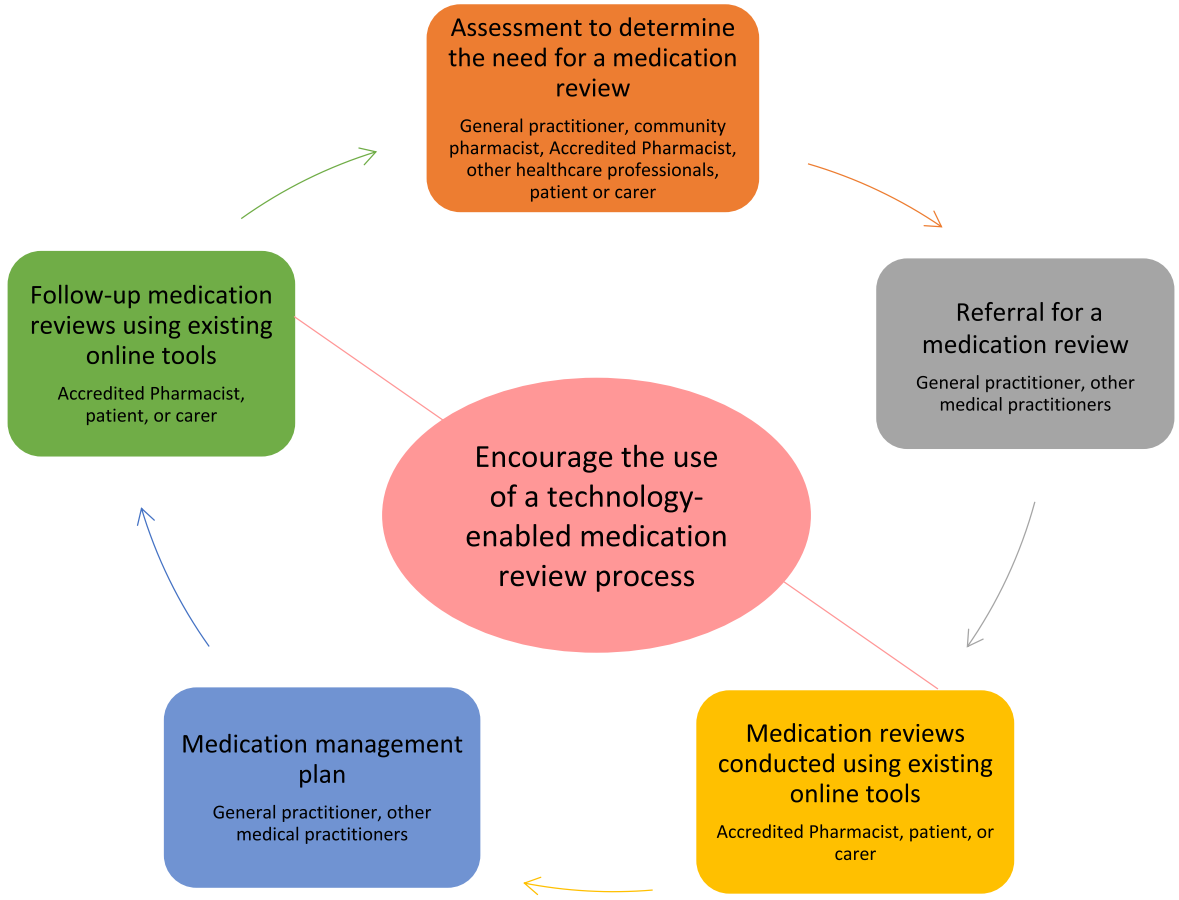

Fig. 1. A general overview of the medication review process in Australia (adapted from the Guidelines for comprehensive medication management reviews 2020).[3]

5. Potential drawbacks of a technology-enabled medication review process

While technology has the potential to improve and enhance the medication review process, there are some disadvantages including the initial set-up costs of CDSS.[34] Funding for a new technological system could be limited; for example, depending on whether the organisation is non-profit, which tend to have higher investments in technology, or for-profit, which look to reduce costs.[35] The software and hardware of technological systems have to be upgraded and/or replaced in a timely manner. Disruption in workflow may cause loss of productivity due to end-users including aged care facility staff, GPs and pharmacists, learning and adopting a new system.[34]

Concerns of privacy and security need to be addressed. The confidentiality of individuals' information during technology-enabled medication reviews must be maintained regardless of the process of how the CDSS is integrated with health records; the safety and security of data should not be compromised. Additionally, the technology-enabled medication review process may potentially mitigate the risk of using PIMs, thereby reducing the incidence of adverse drug events and subsequent hospitalisations. However, the reverse may also occur as poor design of the interface, for example, and could lead to errors and unintended consequences.[36]

Overall, it is important to consider the pros and cons of implementing a new system; a systematic approach of implementing the new system could mitigate or minimise potential issues.

Furthermore, one has to consider a technological approach in the context of policy and practice.

6. Policy and practice

The concept of a technology-enabled medication review process is consistent with government initiatives in some countries. In the USA, for example, recent support for adopting technology was the result of the Health Information Technology for Economic and Clinical Health Act; this was enacted as part of the Recovery and Reinvestment Act of 2009 which had approved a US$19 billion-program to encourage the adoption of technology, particularly electronic health records in hospitals and clinics.[37]

Prior to the implementation of the technology-enabled medication review process, it is important to develop and refine a guided framework such as the consolidated medication review algorithm to improve medication use in older people proposed by Thiruchelvam et al. (2018). This stepwise decision making-process framework aims to reduce the use of PIMs among older people. It was used among older community-dwelling Malaysians,[28] and could be used as a basis for developing a guided framework within the CDSS for medication reviews.

When the guided framework has been computerised, one must determine the effectiveness and ease of use of the technology. The Technology Acceptance Model (TAM) is a theoretical model that was developed as an extension of the Theory of Reasoned Action and the Theory of Planned Behaviour. The TAM comprises two components, i.e. perceived usefulness and perceived ease of use[38]; IT is 'more adopted' if it is more useful, and it is 'more accepted' if it is easy to use.

If a feasibility study demonstrates high user acceptance, this may expedite the introduction of the new technology-enabled medication review service within healthcare settings. Uptake and acceptability can be guided by Rogers' Diffusion of Innovations Theory that suggests new services are unlikely to be immediately or uniformly used across a target

Table 2
Potential advantages of a technology-enabled medication review process.

Potential advantages of technology-enabled medication reviews	Description
Systematic and structured medication review process	Incorporating a guided framework that is stepwise in approach will facilitate a systematic and structured process Identification of important medication-related problems will ensure that optimal decisions are made about continuing, discontinuing or substituting a medication, and potentially prevent the prescribing cascade which is associated with an increase in number and cost of medications A computerised stepwise process which includes automatic prompts for medication monitoring parameters ensures that all aspects of a medication review are completed, thus increasing efficiency of the medication review process
Time-saving	Consolidation of individuals' information in a CDSS may negate unnecessary documentation and could speed the process thereby saving cost; this would allow more reviews to be conducted. Quality improvement measures that pharmacists can perform during the 'additional' time they may have available: • Counsel individuals on appropriate use of their medications • Conduct regular medicine/drug utilisation reviews and/or audits • Analyse outcomes from medication reviews regularly to identify any gaps in guidelines and frameworks Incorporation of essential information about individuals' eligibility for medication reviews saves time; this translates into cost savings as claims can be easily submitted to the government for reimbursement Decision-making tools integrated with individuals' information in long-term care will ensure that reviews are conducted with maximum efficiency
Cost-saving	An investment in a robust, technology-enabled process that integrates information such as medical histories, medical charts, dispensing data, and medication review reports, will negate the need for unnecessary documentation (administrative overheads). Discussions with GPs may not need to be face-to-face when the necessary information is available online. This may offset long-term costs that are associated with the current system Costs associated with unnecessary and potentially inappropriate medications, and treatment of their adverse effects, can be saved through a once-off investment in a systematic and structured system that will allow regular reviews to be conducted when required
Integration of the process at aged care facilities and other healthcare settings	A system that is well-integrated with individuals' data as per privacy and ethical policies will ensure that all general practitioners and aged care facilities have easy access for continuity of care; this will ensure that medication reviews are initiated and follow-ups are done when necessary. This will also ensure treatment is not changed or stopped inappropriately
Data storage for quality improvement	The use of CDSS will record outcomes and generate reports from reviews; data can be useful for: • Confirming when previous reviews had been conducted to ensure reviews are regularly conducted when indicated, and to prevent over-provision of medication reviews • Use by policy-makers for audit purposes based on the stored data which will allow for continuous improvement in the review process • Education and research purposes • Ensuring a technology platform is available to strengthen inter-professional collaboration during medication review feedback discussions and meetings
Medication optimisation during the COVID-19[a] pandemic	Integration of individuals' information could ensure that regular medication reviews are conducted even during the COVID-19[a] pandemic when face-to-face interactions during medication reviews may be restricted. This would allow for regular medication reviews and initiation of new reviews for individuals requiring reviews for the first time, thus optimising medications and avoiding the incidence of medication-related problems
Outcomes reported in intervention studies using medication review processes	Allowing researchers to select from a list of outcomes will allow for standardisation of outcome measurements to conduct meta analyses that can provide conclusive statements about the medication review interventions used in research, leading to effective changes in the medication review process A system that integrates technology with a guided framework and content knowledge may facilitate the reporting of clinically relevant outcomes, as the list of outcome measures can be pre-determined. This may allow more effective reporting

[a] COVID-19: Coronavirus disease-19.

population.[39] Providing incentives may assist; for example, the Economic and Clinical Health Act in the USA provided financial incentives to physicians and hospitals to adopt and implement technology.[37]

In the context of clinical implications, the previous decade has seen a dramatic increase in prescribing, posing a burden to healthcare systems.[40] Deprescribing can be achieved via medication reviews which promote appropriate polypharmacy, decrease the use of PIMs, and aid in identification of potential and real drug-related adverse events; deprescribing also offers opportunities to promote medication adherence. The technology-enabled medication review process may increase the use and effectiveness of the service to achieve optimal use of medications for older people, particularly the frail, and especially during the current COVID-19 pandemic.

7. Conclusion

It is time to facilitate change and embrace what technology has to offer to improve appropriate use of medications. There is 'positive potential' associated with medication reviews, and the technology-enabled medication review approach could improve processes in developed and developing countries, and may be particularly useful during and post the COVID-19 pandemic.

Author statement

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Declaration of competing interest

The authors declare that there is no conflict of interest.

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