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Letter

Reframing Polypharmacy Management in Malaysian Older Adults: The Emerging Role of Artificial Intelligence

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Malaysia is undergoing rapid demographic ageing. In 2024, the proportion of Malaysia's population aged 65 years and over was 7.7 %, up from 7.4 % in 2023 [1]. According to a previous systematic review, nearly half of older Malaysians are exposed to polypharmacy, and approximately one-third receive at least one potentially inappropriate medication (PIM), with associated risks of falls, hospitalisation, and medication non-adherence [2]. These epidemiological realities highlight the increasing clinical complexity faced by pharmacists managing geriatric pharmacotherapy in both institutional and community settings.

Although AI implementation in Malaysian pharmacy practice remains at an early stage, several local developments indicate growing institutional and policy readiness for digital medication management. The potential role of AI in medication review, pharmacovigilance, prescribing optimisation, and pharmacy workflow enhancement within the Malaysian healthcare system was recently highlighted [3]. In parallel, the National Heart Institute (IJN) introduced Malaysia's first outpatient automated dispensing medication system, i-Pharmabot, integrating robotic dispensing and prescription screening to improve medication accuracy and operational efficiency. These developments, together with broader national digital transformation efforts led by the Malaysia National AI Office (NAIO), suggest that Malaysia is gradually building the infrastructure and ecosystem necessary to support future AI-enabled medication optimisation and deprescribing services among older adults.

Internationally, explicit prescribing criteria have become foundational tools for mitigating medication-related harm in older adults. The 2023 American Geriatrics Society (AGS) Beers Criteria provides an updated evidence-based list of medications considered potentially inappropriate in adults aged 65 years and older, including drug–disease interactions, drug–drug interactions, and renal dose considerations [4]. Similarly, the 2023 STOPP/START criteria now comprise 190 validated criteria addressing both inappropriate prescribing and prescribing omissions [5]. While widely endorsed in high-income systems, these frameworks were developed primarily within Western contexts, necessitating contextual adaptation for Malaysian practice.

Therefore, the Malaysian Potentially Inappropriate Prescribing (MALPIP) criteria were developed through a structured Delphi process incorporating national pharmacovigilance data and multidisciplinary expert consensus [6]. In total, the MALPIP tool comprises 169 criteria, including 92 independent PIMs, 42 disease-specific PIMs, and 35 potential prescribing omissions (PPOs). While MALPIP demonstrated a 54.7% overlap with STOPP/START and 38.5% with the AGS Beers Criteria, it diverges significantly to ensure local applicability. Unlike Beers and STOPP, MALPIP explicitly excludes medications unavailable in the Malaysian formulary and integrates real-world national adverse event data. This contextual alignment led to the inclusion of 27 specific medications and four clinical conditions often omitted by international guidelines. Because of these differences, comparative evaluation demonstrated that MALPIP identified a nearly threefold higher prevalence of PIMs compared with Beers and STOPP criteria among older Malaysians [7].

Despite the availability of these structured tools, manually applying an increasing number of prescribing criteria during routine medication review remains cognitively demanding.

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Artificial intelligence (AI) now presents an opportunity to operationalise these frameworks more efficiently, reframing polypharmacy management for Malaysian older adults within pharmacist-led practice.

Risk Stratification and Predictive Pharmacotherapy using AI

Pharmacist-led medication review in many Malaysian settings remains reactive and event-driven, often triggered by hospital admission or evident clinical deterioration. AI introduces the capacity for proactive risk identification through predictive modelling. Machine learning models incorporating composite indices such as the Drug Burden Index have demonstrated significant predictive ability for short-term hospitalisation risk [8]. Longitudinal modelling using algorithms such as CatBoost has further identified multimorbidity and mental health conditions as key determinants of sustained polypharmacy exposure [9]. These findings suggest that structured data analytics can enhance early detection of medication-related vulnerability in older adults.

Embedding such predictive models within electronic prescribing systems would allow automated calculation of anticholinergic burden, sedative load, renal dose appropriateness, and probability of adverse drug reactions. These outputs can generate prioritised patient lists for pharmacist review, enabling targeted intervention before adverse outcomes occur. Rather than replacing clinical judgment, predictive analytics enhance situational awareness and support structured decision-making. This approach may also facilitate a more efficient allocation of limited pharmacist resources toward patients at the highest risk of medication-related harm. Over time, predictive integration could shift manual medication review practice toward anticipatory pharmacotherapy optimisation.

Operationalising Explicit Prescribing Criteria and AI in Clinical Practice

Explicit tools such as the Beers Criteria (AGS Beers Criteria, 2023) and STOPP/START version 3 [5] provide structured guidance but are increasingly extensive and complex. As STOPP/START expands to 190 criteria, manual screening becomes time-intensive and susceptible to variability in interpretation. Conventional rule-based clinical decision support systems have attempted to automate these processes. However, their effectiveness has been undermined by heterogeneity in design, limited contextual integration, and alert fatigue [10]. The growing breadth of criteria reflects scientific advancement but simultaneously increases the cognitive load placed on clinicians. This complexity underscores the need for intelligent filtering mechanisms within routine medication review.

Emerging evaluations of large language models suggest strong performance in identifying potentially relevant deprescribing criteria, although limitations remain in calibrated therapeutic reasoning and management of ambiguous scenarios [11]. Meanwhile, incorporating the Malaysian developed MALPIP deprescribing logic into AI-enabled platforms [7] may offer a locally contextualised approach that aligns automated screening with local prescribing realities. Automated high-speed filtering can identify candidate PIMs while preserving pharmacist authority over final clinical decisions. In such a model, AI functions as a structured analytical layer, while pharmacists are responsible for contextual interpretation, which incorporates patient-specific considerations, shared decision-making, and deprescribing planning.

Integration into Pharmacist-Led Geriatric Medication Review Services

The clinical value of AI depends on seamless incorporation into established pharmacy workflows. Evidence from interventional studies demonstrates that embedding electronic deprescribing support within routine clinical care can significantly improve deprescribing effort for older adults in institutional settings [12]. These findings indicate that structured digital tools can positively influence prescribing behaviour in polypharmacy management when aligned with existing review processes. Implementation must therefore prioritise workflow compatibility rather than technological novelty. Effective integration requires alignment with local documentation systems and interdisciplinary communication pathways.

Within Malaysian practice, AI-generated outputs may be integrated into ward-based medication reconciliation, pharmacotherapy review and optimisation, Home Medication Review Programme, Geriatric Medication Therapy Adherence Clinic (GMTAC) services, medication review at long-term care facilities, and community pharmacy medication therapy management targeting the elderly. Structured summaries including PIM flags, drug burden indices, and monitoring prompts can enhance consistency and efficiency in untangling complex polypharmacy without disrupting established documentation practices. Such integration supports standardisation while maintaining professional autonomy. Nonetheless, pharmacist oversight remains central to therapeutic prioritisation, communication with prescribers, and medicolegal integrity.

Beyond individual encounters, AI enables aggregation of prescribing data for quality improvement purposes. In low- and middle-income healthcare systems, digital fragmentation and interoperability constraints remain significant implementation barriers [13]. In the Malaysian context, many healthcare institutions are still in the early stages of electronic health

record (EHR) adoption, and digital infrastructure across public and private sectors remains uneven.

Malaysia's digital healthcare landscape remains heterogeneous, with substantial disparities between the public and private sectors. While many private institutions have progressed toward integrated digital systems and smart hospital infrastructures, public healthcare facilities often continue to face resource limitations, phased implementation challenges, and reliance on legacy platforms. A major barrier to AI implementation is the limited interoperability between Hospital Information Systems (HIS) and Electronic Medical Records (EMR). Although national initiatives such as the Total Hospital Information System (THIS) and Malaysia Health Information Exchange (MyHiX) were introduced to facilitate data integration, implementation challenges have restricted seamless inter-institutional data sharing.

To navigate these interoperability barriers, integrating AI decision-support modules directly into the national Pharmacy Information System (PhIS) used across public facilities offers a pragmatic starting point. Moving forward, strengthening technical readiness by establishing seamless interfaces between PhIS and broader HIS/EMR platforms, standardising data protocols, and leveraging national frameworks like THIS and MyHiX for secure information exchange will be essential to enabling safe and effective AI integration into routine clinical workflows

Population-Level Quality Improvement and System Learning through AI

Beyond individual encounters, AI enables the aggregation of prescribing data for quality improvement purposes in polypharmacy management. In low- and middle-income healthcare systems, digital fragmentation and interoperability constraints remain significant implementation barriers [13]. Despite these limitations, structured data capture provides opportunities for institutional benchmarking and performance monitoring concerning PIMs. Data-driven analytics can identify systemic prescribing patterns, such as specific drug classes driving polypharmacy in older adults that may not be visible at the individual case level. Such insights can inform targeted educational and governance interventions.

Aggregated prescribing indicators could facilitate monitoring of PIM prevalence trends among the elderly, evaluation of deprescribing impact on geriatric readmission rates, and identification of recurrent high-risk prescribing clusters inherent in polypharmacy. These applications align with the quality improvement intent underlying the Beers Criteria [4], STOPP/START framework [5] and MALPIP framework [7]. Extending these frameworks into dynamic governance tools enhances their relevance within evolving healthcare systems. AI thus serves as a clinical support mechanism and an instrument for continuous system learning. When responsibly implemented, population-level analytics may strengthen medication safety oversight by specifically advancing polypharmacy management for Malaysian older adults.

Moving forward

The integration of AI into geriatric pharmacy practice in Malaysia offers a valuable opportunity to further enhance predictive, structured, and scalable medication optimisation. While international frameworks such as the AGS Beers Criteria [4] and STOPP/START criteria [5] provide the foundational clinical logic for AI algorithms, MALPIP offers the necessary contextual data to tailor these digital tools to Malaysian prescribing realities [7].

AI has the potential to enhance risk stratification, streamline criteria application, support deprescribing interventions, and inform system-level quality improvement when embedded within pharmacist-led workflows. Careful implementation, local validation, and rigorous outcome evaluation will determine whether AI could meaningfully advance medication safety for Malaysia's ageing population.

CONFLICT OF INTEREST

The authors declare no conflict of interests.

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