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# Evaluating pharmacy high-needs criteria: a tool for identifying inpatients at risk of medication-related problems

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## Abstract

Due to the high cost of clinical pharmacy services, vulnerable patients should be given priority in healthcare systems with limited resources. For our healthcare system, this meant formulating high-needs pharmacy criteria to identify those patients who would benefit most from clinical pharmacy care. To assess the efficacy of the high-needs pharmacy criteria in identifying patients at elevated risk of medication-related poor clinical outcomes, a retrospective research was conducted on 761 patients admitted to four hospitals in metropolitan Melbourne. The medical histories of potential high-needs patients were examined. The computerized data were mined for information on patient stays, 30-day readmission rates, medication issues, and medication-related occurrences. Patients who met at least one high-needs criterion were in the hospital longer (mean 6.7 days vs 3.1 days, p 0.01), were more likely to be readmitted within 30 days (27% vs 16%, p 0.01), and had a greater incidence of medication-related issues (15% vs 7.6%, p 0.01). Patients with medication issues, medication events, or readmission within 30 days were detected with a sensitivity of over 80% using the high-needs criterion. Overall, the high-needs pharmacy criteria successfully identified older patients with longer lengths of stay who are at increased risk for 30-day readmission and medication-related issues.

## Introduction

Clinical pharmacy services aim to minimise medication risks, improve patient safety, and optimise health out- comes.[1] Inpatient clinical pharmacist activities in Australia include medication reconciliation, medication clinical review, therapeutic drug monitoring, adverse drug event (ADE) management, providing medicine-related informa- tion to patients, and ensuring continuity of medication management at transitions between care settings.[1]

Medication-related problems (MRPs) refer to circum- stances which involve a patient's drug treatment that actually or potentially interferes with the achievement of an optimal outcome.[2] MRPs include medication errors, ADEs, and adverse drug reactions (ADRs). An ADE is defined as harm caused by appropriate or inappropriate use of a drug whereas an ADR is a subset of these events, where harm is directly caused by a drug under appropriate use.[3]

Clinical pharmacy services can be costly and in resource-constrained healthcare services should be priori- tised towards patients with the greatest potential risks.[2,4] Among healthcare organisations, prioritisation is com- monly achieved via organisational policies or individual clinical judgement.[5,6] Tools which have been developed to date frequently target specific patient groups and are often not validated against clinical outcomes.[2]

### Pharmacology

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The few tools which have been validated against clini-cal outcomes have been validated against the patients' risks of developing an ADE or MRP.[7–9] Less commonly, outcomes used to validate risk assessment tools include the 30-day readmission rate.[10] Previous studies have often been limited to specific clinical populations, including obstetrics,[11] geriatrics,[9–12] paediatrics,[13] or cardiology,[7] thus limiting the generalisability of these tools.

In order to make it easier for clinical pharmacists to use these criteria, they were revised to focus on the first assessment of hospitalized patients. Departmental and senior clinical pharmacists as well as the pharmacy

At our health network, prioritisation of clinical phar-macy services occurs through the use of high-needs (HN) criteria (Table 1), a modification of the Society of Hospital Pharmacists of Australia (SHPA) *Fact Sheet: Risk factors for medication-related problems*.[14] The risk fac-tors identified by SHPA were considered too extensive for efficient use in daily practice, therefore the HN.

management committee all gave their stamp of approval to the finalized HN criteria. The effectiveness of these HN criteria remains to be

| Table 1 High-needs clinical pharmacy criteria |
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| Diagnosis or patient comorbidities |
|   Cardiovascular and cerebrovascular events |
|   Cognitive impairment (delirium, dementia, Alzheimer's disease) |
|   Epilepsy |
|   Liver disease – acute or chronic |
|   Medication misadventure (including misuse and overdose) |
|   Renal impairment (eGFR ≤ 30 mL/min or SCr > 200 1mol/L) – acute or chronic |
|   Type I and II diabetes (excluding gestational and diet-controlled diabetes) |
|   Transplant |
| Patient factors |
|   Breastfeeding (excluding maternity patients unless fulfils another criteria) |
|   Extreme BMI (cachexia or morbidly obese) |
|   Pregnancy (excluding maternity patients unless fulfils another criteria) |
|   Age < 12 years old |
| Medications |
|   Antineoplastic drugs (cytotoxic and noncytotoxic, including "nibs" and "mabs") |
|   Clozapine and depot antipsychotics |
|   Continuous subcutaneous syringe drivers |
|   Drugs requiring specialised monitoring (e.g. theophylline, lithium, phenytoin, digoxin, carbamazepine, valproate) |
|   Epidural or blocks |
|   Immunosuppressants |
|   Insulin (excluding use in gestational diabetes) |
|   Intravenous orders requiring manufacturing by pharmacy |
|   Parkinson's medication |
|   Pharmacotherapy (methadone or buprenorphine) |
|   Restricted antimicrobials |
|   Therapeutic anticoagulation |
|   Non formulary medications |
| Inpatient circumstances |
|   Intensive care unit transfer |
|   Feeding tube, parenteral nutrition or medication modification as per speech pathologist |
|   Pathology |
|   • Patient with potassium <3 or >6 mmol/L |
|   • Patient with sodium <125 or >155 mmol/L |
|   • Patient with INR >2.5 and other abnormal coagulation pathology |
|   • Patient with drug levels reported |
| BMI = body mass index; eGFR = estimated glomerular filtration rate; INR = international normalised ratio; SCr = serum creatinine. |

Patients at risk of MRPs, readmission, or extended hospital stays are identified.

## AIM

The purpose of this research was to examine whether locally designed HN pharmacy admission criteria can reliably identify patients at high risk for MRPs, medication-related events, and readmission across all hospital inpatients.

## METHOD

Patients who were hospitalized to one of four public hospitals in the same healthcare network in metropolitan Melbourne, Australia, were the subjects of a retrospective cross-sectional observational research. For this reason, we limited our study to the four institutions with the most readily accessible computerized medical data. All patients aged 18 and above hospitalized between 10 and 16 February 2020 were considered for inclusion. Patients in the emergency room, those treated in an outpatient clinic, and those with LOSs of less than 24 hours were not included. In order to ascertain whether or not clinical pharmacy services were delivered and whether or not the patient satisfied the HN criteria, the researchers analyzed all relevant sections of each patient's medical record. The patients were classified as follows:
Patients with low needs (LN) did not fulfill any of the high-needs (HN) criteria.

(1) High Needs: Patient Meets HN Criteria but Receives No Clinical Pharmacy Services
Patient satisfied HN requirements and was provided clinical pharmacy services, therefore their needs were classified as "high."
The administrative database of the healthcare network was queried to calculate readmission rates after 30 days. The healthcare plan covered readmission to any of the seven affiliated hospitals. The Australian Commission on Safety and Quality in Health Care used the CHADx definition of a medication-related problem to establish MRPs. 15 When it comes to flagging adverse occurrences in hospitals, the Australian healthcare system often uses CHADx, a derivative of ICD-10 coding. 15 The Victoria Health Incident Management System provided data on medication-related occurrences.
In order to determine whether there was a statistically significant relationship between the various categories, we employed the chi-square test or Fisher's exact test. For continuous variables, we employed the Mann-Whitney U test (Wilcoxon rank-sum test). Every Statistical Formula are results of R (version 3.6.3, R Foundation for Statistical Computing, Vienna, Austria). The study was approved by the health network's ethics and research council after being classified as a quality assurance project.

## RESULTS

There were 761 participants from 4 hospitals who participated in this research (Table 2). Among those who satisfied HN requirements, 71% were treated by a clinical pharmacist, and 39% were given one or more clinical pharmacy services. Patients with longer LOS (mean days: 8.3 vs 3.6, p 0.01) and those who were hospitalized during the week were more likely to get clinical pharmacy services than those hospitalized on the weekend (42% vs 27%, p 0.01).

Patients with HN had a significantly higher mean age (67 vs 42, p 0.01) and a significantly longer LOS (6.7 vs 3.1 days, p 0.01). Compared to patients hospitalized to the mental health (65%), surgical (59%) and women's and children's (28%) units, those admitted to the geriatric (97%), general (92%), and speciality (86%) medical units were more likely to fulfill one or more HN criteria. For 17 individuals (HN 9, LN 8), we were unable to retrieve their ICD-10-coded data, hence they were not included in our MRP calculations. Patients who met the HN pharmacy criteria for MRP, medication-related event reporting, or readmission within 30 days had a sensitivity of over 80%. (Table 2). Patients who met one or more HN criteria were more likely to have an MRP during their hospitalization (15 percent vs. 7.6 percent, p 0.01) and to be readmitted within 30 days (27 percent vs. 16 percent, p 0.01). Those patients who met one or more of the HN pharmacy criteria had a higher incidence of reported medication-related events (3.9% vs. 1.4%, p = 0.07), although this difference did not achieve statistical significance.

There was a trend toward higher rates of readmission within 30 days (30% vs 24%, p > 0.05), MRPs (2.7% vs 0%, p > 0.05), and medication incidents (4.2% vs 2.7%, p > 0.05) in patients meeting one or more HN pharmacy criteria when excluding those who received clinical pharmacology services, but none of these differences were statistically significant..

## DISCUSSION

Our research shows that older patients who are at higher risk for a prolonged LOS, an MRP, or readmission within 30 days after discharge may be reliably identified using the HN pharmacy criteria already in use at the health network. A large sample size and patients from a variety of therapeutic settings are two of the study's strengths. Moreover, other validated clinical pharmacy triage techniques have been research based but too difficult for application in everyday practice,7 need sophisticated electronic systems that may not be accessible at all institutions,7 or have been assessed in very particular patient groups. ¯ insignificant results from statistical analysis. A typical flaw in readmission-based assessment studies is their inability to identify readmission beyond the study hospital network. 10 Due to the size and scope of our healthcare network, we expect this possible constraint to have had a modest influence on the outcomes of our research. Most unexpected readmissions are likely to have presented to one of our three emergency departments.

## Conclusion

Although we were able to apply the HN pharmacy criterion based on a comprehensive review of the patient's admission medical records, clinicians may not have access to all of this information during actual patient care. Further research is needed to determine how well our findings correlate with clinical evaluations in practice.

While the results of this research show that the HN pharmacy criteria may be used to identify individuals at risk for the outcomes of interest, the specificity of the criteria remains poor, and inter-rater reliability was not studied. If the HN tool can be simplified further to ensure consistent simplicity of use and/or increase its specificity, then further study into the individual criteria is warranted. Our health network is also exploring the possibility of developing more advanced and automated clinical pharmacy HN criteria and referral-based work-flows as a result of the implementation of electronic healthcare systems.

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