JOURNAL OF Pharmacy Practice and Research
Official Journal of the Society of Hospital Pharmacists of Australia
shpa
shpacpd

RESEARCH ARTICLE

Design and development of the clinical pharmacy key performance indicators dashboard for equity of service provision at regional and rural hospitals in North Queensland, Australia

Sanja Mirkov, BPharm, PGDipPH[1,*], Rhondda Jones, BSc, BInfTech, PhD[2], Alexander Ison, BPharm[3], Allan Wilesmith, CertIVInfoTech[4], Jason Black, BScPharm (Hons), ClinDipPharm[1]

[1] Pharmacy Department, Cairns and Hinterland Hospital and Health Service, Cairns, Australia
[2] James Cook University, Townsville, Australia
[3] Strategic Projects, Digital Health Services, Children's Health Queensland Hospital and Health Service, Brisbane, Australia
[4] Casemix and Clinical Costing Department, Cairns and Hinterland Hospital and Health Service, Cairns, Australia

Abstract

Background: Provision of a Medication Action Plan (MAP) on admission and a Discharge Medication Record (DMR) are associated with reduced medication-related harm.
Aim: To report factors associated with the provision of MAPs and DMRs in rural and regional hospitals in Queensland, Australia.
Method: A literature search, environmental scan and department consultations were conducted to develop Clinical Pharmacy Key Performance Indicators (cpKPIs) and design a cpKPI dashboard. Two of the five KPIs included in the dashboard, relating to medication action plans on admission and medication records on discharge, were reported for all the hospitals and were included in the study. A retrospective, period-prevalence study was conducted to evaluate the coverage and equity of clinical pharmacy service provision for patients admitted for longer than 24 h. The proportions of patients who received MAPs and DMRs were stratified by age, gender, Indigeneity and hospital type. Statistical analysis used chi-squared tests and logistic regression in R. This project was exempt due to the local policy requirements that constitute research by the Far North Queensland Human Research Ethics Committee (Reference no: EX/2023/QCH/94383-1684QA). The justification for this exemption is as follows: the project was determined to be negligible risk research and involved the use of existing collection of data or records that contain only non-identifiable data about human beings.
Results: In total, 13 818 patients (37.9% of admissions) received a MAP and 11 631 patients (32.7% of discharges) received a DMR. The proportion of MAPs and DMRs was significantly higher in rural hospitals than in regional hospitals (MAP 50.6% vs 34.6%, DMR 33.1% vs 31.3%) and for male patients than female patients (MAP 42.2% vs 33.7%, DMR 36.4% vs 29.2%). When stratified by age, First Nations patients received a higher proportion of MAPs and DMRs in each age group, except for age 85 years and over. The proportion of First Nations patients aged 50 years and over who received MAP was lower compared to that for non-Indigenous patients aged 65 years and over (56.3% vs 59.8%), whilst the proportion for DMRs was similar (50.4% vs 49.3%).
Conclusion: The study defined the clinical pharmacy key performance indicators for measuring equity of clinical pharmacy service provision in Australia. When adjusted for a difference in life expectancy, the proportion of MAPs for First Nations patients was lower compared to the proportion of MAPs for non-Indigenous patients. Further improvements are required to achieve equity of service provision for First Nations patients and female patients.

Keywords: Aboriginal and Torres Strait Islander health, clinical pharmacy hospital, First Nations, medication safety, key performance indicators, equity.

INTRODUCTION

In Australia, the eight National Safety and Quality Health Service (NSQHS) Standards[1] provide nationally consistent statements about the level of care consumers can expect from health services. The Medication Safety Standard ensures that clinicians are competent to safely

*Address for correspondence: Sanja Mirkov, Pharmacy Department, Cairns and Hinterland Hospital and Health Service, Cairns, Queensland 4870, Australia.
E-mail: sanja.mirkov@health.qld.gov.au

prescribe, dispense, administer, and monitor medicines, and consumers are informed about medicines and understand the benefits and risks of their medicines.[1]

Provision of clinical pharmacy services such as medication reconciliation on admission and transition of care, and medication review during hospitalisation and at discharge, are the recommended strategies for improving medication safety and preventing medication-related harm.[2–5] Quantitative measures of clinical pharmacists' activities, such as Quality Use of Medicines (QUM) indicators,[6] provide evidence for health service organisations to adhere to the NSQHS Standards. More recently, the consensus Clinical Pharmacy Key Performance Indicators (cpKPIs) were developed in Canada and describe the patient journey and comprehensive care received by clinical pharmacists during the hospital stay.[7]

Delivering sustainable, culturally safe and responsive healthcare services is one of the key priority outcome areas of the *First Peoples Health Equity Strategy*,[8] along with creating the measures to monitor performance. In New Zealand, the key performance indicators for medicines reconciliation include measures of equitable provision of clinical pharmacy services by taking into consideration the difference in life expectancy for Māori and Pacific peoples populations.[9]

The aim of this project was to report factors associated with provision of medication action plans on admission and discharge medication records on discharge in Queensland rural and regional hospitals. The objectives were to enable efficient and cost-effective reporting of clinical pharmacy activities to demonstrate adherence to the NSQHS Standards and gain insight into the coverage and equity[10] of clinical pharmacy service provision for the purpose of improvement. The terminology Aboriginal and Torres Strait Islander people, the First Nations people of Australia, will be used throughout this paper except when referring to existing resources which use other terminology to refer to Aboriginal and Torres Strait Islander peoples.

METHOD

Ethics Statement

This project was exempt due to the local policy requirements that constitute research by the Far North Queensland Human Research Ethics Committee (Reference no: EX/2023/QCH/94383-1684QA). The justification for this ethics exemption was as follows: The project was determined to be negligible risk research and involved the use of existing collection of data or records that contain only non-identifiable data about human beings.

Study design

A literature search, environmental scan, and consultations with the Pharmacy Department, Coding Department, and Casemix and Clinical Costing Department were conducted to define and develop the cpKPIs and design the cpKPIs dashboard. Two of the five key performance indicators (KPIs) included in the dashboard, relating to provision of medication action plans on admission and medication records on discharge, were reported for all hospitals and were included in this study.

The regional and rural health service, located in Queensland, Australia, consists of a 531-bed principal referral public acute group A hospital[11] in a regional centre (Modified Monash [MM] Model Suburb and Locality Classification[12] category MM2) with Level 5 medication services[13] and seven outer rural hospitals: five public acute hospitals in group C and two public acute hospitals in group D (three hospitals located in medium rural towns [MM4] and four hospitals located in small rural towns [MM5]), with a total of 145 inpatient beds. The regional centre hospital had electronic medical records (ieMRs) and paper-based medication charts. The rural hospitals had both paper-based medical records and medication charts.

The cpKPIs dashboard was developed using the Qlik Sense (Insight Software, Raleigh, NC, USA) data analytic platform and data from hospital decision support services (Casemix), ieMRs, and the Enterprise-wide Liaison Medication System (eLMS v1.15, web-based platform that manages medicine-related information used by Queensland Health). A retrospective, period-prevalence study was conducted to evaluate the coverage and equity of clinical pharmacy service provision. Included in the study were patients admitted to regional and rural hospitals who stayed longer than 24 h (overnight). Excluded from the study were patients who stayed less than 24 h (day stay). Descriptive statistics measures of frequency, such as count and percentage, using graphical and pictorial methods (histogram) were used to provide information about the cpKPIs in the dataset.

The primary outcome was the proportion of all patients who received a medication action plan (MAP) containing the best possible medication history on admission, and a discharge medication record (DMR), a medication list at discharge. The secondary outcomes were the proportion of patients who received MAPs and DMRs stratified by age, gender, Indigenous status, and type of hospital. Statistical analysis used logistic regressions with the proportion receiving MAPs and DMRs in R (version 4.2.1, R Foundation for Statistical

Table 1 Relationship between cpKPIs,[7] coding,[30] national QUM indicators,[6] and NSQHS Standards[1]

cpKPIs	Coding	National QUM indicator	NSQHS Standard
On admission			
MAP% = The proportion of patients who had an authorised MAP that included a medication list (using eLMs) within 24 h from admission to hospital	96027-00	3.1: Percentage of patients whose current medicines are documented and reconciled at admission	Standard 1 (items 1.4, 1.6, 1.8, 1.15) Standard 4 (items 4.3, 4.5, 4.6, 4.7, 4.10, 4.11, 4.12)
MAP% = The proportion of patients 65 years and over for non-Indigenous patients, or 50 years and over for Aboriginal and Torres Strait Islander patients in metropolitan areas or 45 years and over in regional and rural areas for whom a pharmacist has developed a MAP (using eLMS) to initiate medication reconciliation within 24 h of admission			Standard 6 (items 6.1 to 6.11)
PAN% = The proportion of patients who had a PAN documented in their ieMR within 24 h from admission		6.2: Percentage of patients that are reviewed by a clinical pharmacist within 24 h of admission	Standard 1 (items 1.4, 1.6, 1.8, 1.15) Standard 4 (items 4.3, 4.5, 4.6, 4.7, 4.8, 4.10, 4.11, 4.12)
During hospital stay			
PIN% = The proportion of patients who had a PIN documented in their ieMR during their hospital stay	95550-09	Multiple Outcomes QUM measures to be developed	Standard 4 (items 4.10, 4.11) Standard 6 (items 6.3, 6.4, 6.5, 6.9. 6.10, 6.11)
At discharge			
DMR% = The proportion of patients who had authorised a DMR created using eLMs within 72 h at discharge from hospital		5.3: Percentage of discharge summaries that include medication therapy changes and explanations for changes[a]	Standard 1 (items 1.4, 1.6, 1.8, 1.15) Standard 4 (items 4.3, 4.5, 4.6, 4.7, 4.8, 4.10, 4.11, 4.12)
DMR% = The proportion of patients 65 years and over for non-Indigenous patients, or 50 years and over for Aboriginal and Torres Strait Islander patients in metropolitan areas or 45 years and over in regional and rural areas who had an authorised DMR created using eLMs within 72 h at discharge from hospital			Standard 6 (items 6.1 to 6.11)
PDN% = The proportion of patients who had a PDN documented in their ieMR	96072-00	5.9: Percentage of patients who receive a current, accurate, and comprehensive medication list at the time of hospital discharge	Standard 1 (items 1.4, 1.6, 1.8, 1.15) Standard 4 (items 4.3, 4.5, 4.6, 4.7, 4.8, 4.10, 4.11, 4.12) Standard 6 (items 6.1 to 6.11)
% Bundle of care[a] The proportion of patients who received comprehensive direct patient care from a pharmacist working in collaboration with the healthcare team Measured by the percentage of patients who had a MAP on admission, a PIN during the hospital stay, and a DMR at discharge			Standard 1 Standard 4 Standard 6

cpKPIs = clinical pharmacy Key Performance Indictors; DMR = Discharge Medication Record (medication list); eLMS = Enterprise-wide Liaison Management System; h = hour; ieMR = electronic medical record; MAP = Medication Action Plan; NSQHS = National Safety and Quality Health Service; PAN = Pharmacist's Admission Note; PIN = Pharmacist's Intervention Note; PDN = Pharmacist's Discharge Note; QUM = Quality Use of Medicines.
Coding procedure codes and description:
95550-09 Allied health intervention, pharmacy
96027-00 Prescribed/self-selected medication assessment
96072-00 Prescribed/self-selected medication counsel/education.
[a] Not currently implemented.

Computing, Vienna, Austria) as response variables, and with age, gender, Indigenous status, type of hospital, and interactions between them as explanatory variables.[14] Statistical analysis used chi-squared tests (χ^2) and logistic regression in R. Analyses of deviance of the logistic regressions were used to evaluate the statistical significance of each explanatory variable. The null hypotheses were that the explanatory variables were not associated with differences in the proportion of patients receiving clinical pharmacy services.

RESULTS

Design and development of the cpKPIs dashboard

From April–October 2022, five cpKPIs were developed in consultation with the stakeholders for inclusion in the cpKPIs dashboard (Table 1). The cpKPIs were quantitative process measures measured on admission, during hospital stay, and at discharge. The relationship between cpKPIs, coding data, national QUM indicators, and NSQHS Standards is presented in Table 1.

The dashboard provided visualisation of the cpKPIs data, customisable by month (22 months), stay type (overnight or same day), age range (five categories: 0–18, 19–49, 50–64, 65–84, and 85 years and over), sex (male, female), Indigenous status (five categories: Aboriginal not Torres Strait islander, Torres Strait Islander not Aboriginal, both Aboriginal and Torres Strait Islander, not Aboriginal or Torres Strait Islander, not stated/unknown-follow up required), site (eight hospitals), and ward (59 wards).

Proportion of MAPs and DMRs

From 1 January–31 December 2022, a total of 36 460 patients were admitted to the regional and rural hospitals for longer than 24 h. Out of 13 818 patients (37.9% of total admissions) who received a MAP on admission, 11 014 (40%) were non-Indigenous patients and 2781 (32.1%) were First Nations patients The proportion of patients who received a MAP on admission at the rural hospitals was higher than that at the regional hospital (50.6% vs 34.6%, χ^2 650.4, $p < 0.001$). The proportion of male patients who received a MAP on admission was higher than proportion of female patients (42.2% vs 33.7%, χ^2 279.6, $p < 0.001$).

Out of 11 631 patients (32.7% of discharges) who received a DMR, 9052 (33.7%) were non-Indigenous patients and 2579 (30.5%) were First Nations patients.

Table 2 Number and proportion of patients who received a MAP on admission and a DMR at discharge by age, Indigeneity, type of hospital, and gender

	All patients[a] (*n*, %)	First Nations (*n*, %)	non-Indigenous (*n*, %)	p (χ^2)
MAP				
All patients (age group, years)	13 818 (37.9)	2781 (32.1)	11 014 (40.0)	<0.001 (174.2)
0–18	147 (2.8)	64 (3.5)	97 (2.5)	
19–49	1515 (17.2)	606 (19.6)	904 (16.0)	0.001 (17.9)
50–64	3335 (44.4)	1180 (52.8)	2149 (41.2)	<0.001 (85.5)
65–84	6048 (57.5)	730 (62.6)	5312 (57.2)	0.001 (85.5)
85 and over	2118 (67.5)	73 (62.4)	2044 (67.9)	
Regional hospital	10 005 (34.6)	2176 (29.8)	7809 (36.5)	<0.001 (107.5)
Rural hospitals	3817 (50.6%)	603 (44.3)	3206 (52.2)	<0.001 (28.1)
Male	7590 (42.2)	1329 (35.8)	6252 (44.2)	<0.001 (85.1)
Female	6226 (33.7)	1450 (29.3)	4754 (35.5)	<0.001 (62.2)
DMR				
All patients (age group, years)	11 631 (32.7)	2579 (30.5)	9052 (33.7)	<0.001 (29.8)
0–18	203 (3.9)	79 (4.4)	121 (3.6)	<0.01 (105.7)
19–49	1542 (17.9)	658 (21.8)	879 (15.9)	<0.001 (46.1)
50–64	2742 (37.9)	1010 (46.7)	1747 (34.4)	<0.001 (97.2)
65–84	4888 (47.8)	646 (56.8)	4241 (47.0)	<0.001 (38.9)
85 and over	1720 (56.6)	64 (57.1)	1651 (56.6)	
Regional hospital	9354 (33.1)	2218 (31.1)	7111 (34.0)	<0.001 (20.1)
Rural hospitals	2287 (31.3)	361 (27.3)	1926 (32.4)	0.003 (13.2)
Male	6374 (36.4)	1202 (33.3)	5153 (37.4)	<0.001 (20.7)
Female	5273 (29.2)	1381 (28.5)	3885 (29.7)	

DMR = Discharge Medication Record (medication list); MAP = Medication Action Plan.
[a]Includes patients of unknown/not stated Indigenous status.

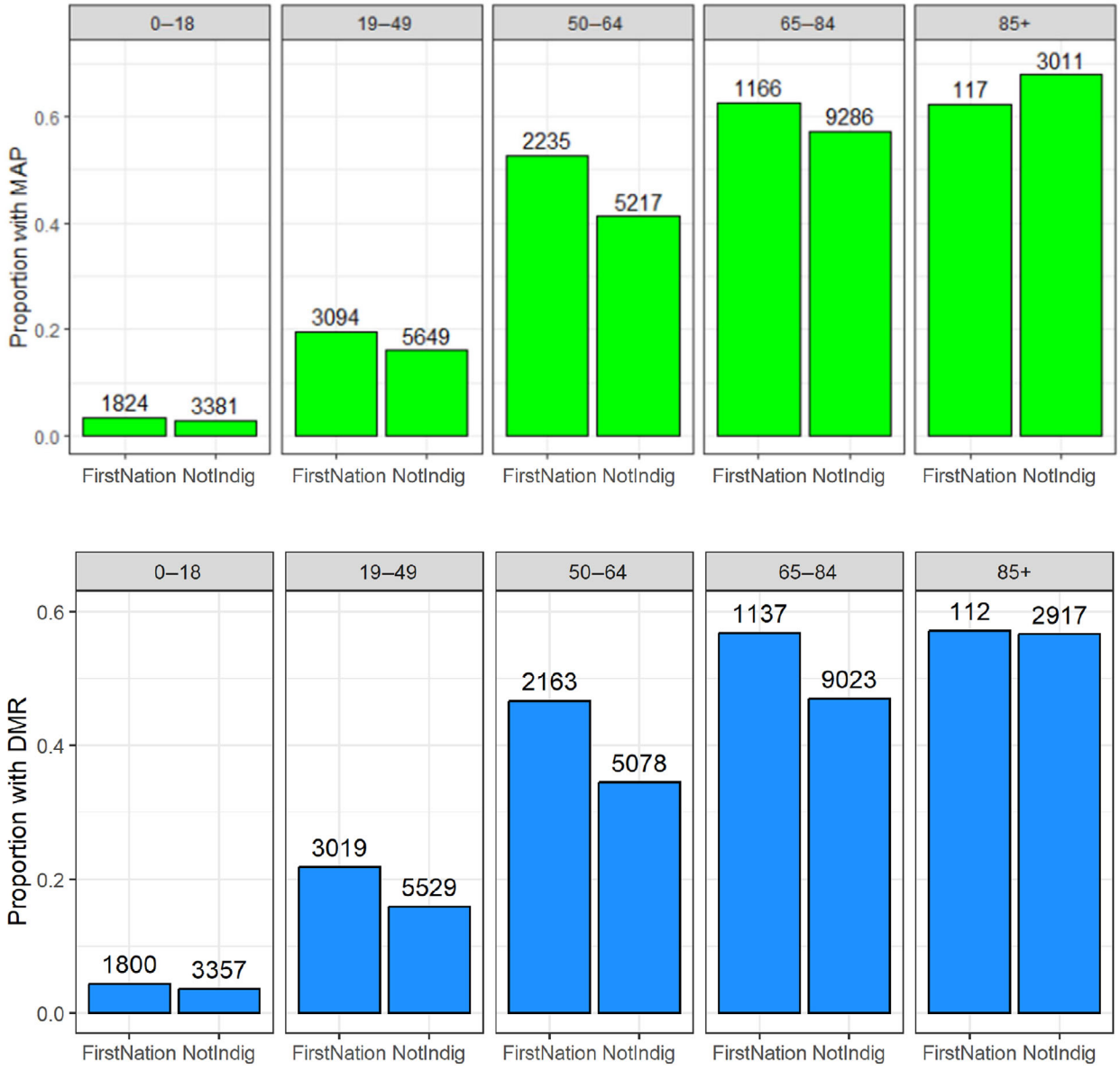

Figure 1 Proportion of patients who received a MAP on admission and a DMR at discharge stratified by age (years) and Indigenous status. The sample size for each individual population is presented as a number at the top of each bar.
DMR = discharge medication record; FirstNation = First Nations patients; MAP = medication action plan; NotIndig = non-Indigenous patients.

The proportion of patients who received a DMR at the regional hospital was higher than at the rural hospitals (33.1% vs 31.3%, χ^2 8.6, $p < 0.004$). The proportion of male patients who received a DMR was higher than the proportion of female patients (36.4% vs 29.2%, χ^2 209.2, $p < 0.001$).

The analysis of deviance for the fitted logistic regression model revealed the strongest effect of age group (χ^2 7186.7, $p < 0.0001$), then Indigeneity (χ^2 104.1, $p < 0.0001$). The interaction term (Indigeneity: AgeGroup) was somewhat weaker (χ^2 12.7, $p = 0.005$), but also significant, indicating that the non-Indigenous--First Nations difference is not the same for every age group.

Clinical pharmacy services provision for MAP and DMR by age, Indigeneity, type of hospital, and gender is presented in Table 2. Figure 1 outlines the proportion of MAPs and DMRs by age and Indigeneity stratified

Table 3 Number and proportion of patients who received a MAP on admission and DMR at discharge for First Nations patients aged 50 years and over and non-Indigenous patients aged 65 years and over

	First Nations, 50 years and over (*n*, %)	non-Indigenous, 65 years and over (*n*, %)	p (χ^2)
MAP			
All	1981 (56.3)	7354 (59.8)	0.002 (14.1)
Male	899 (56.6)	4122 (58.7)	
Female	1082 (56.1)	3228 (61.2)	0.001 (15.3)
DMR			
All patients	1720 (50.4)	5886 (49.3)	
Male	759 (49.9)	3313 (48.5)	
Female	962 (51.3)	2579 (50.5)	

DMR = Discharge Medication Record (medication list); MAP = Medication Action Plan.
To account for the difference in life expectancy, the number and proportion of MAPs and DMRs for the First Nations patients aged 50 years and over were compared to non-Indigenous patients aged 65 years and over.

by age group. First Nations patients received a statistically higher proportion of MAPs and DMRs in each age group except for the aged 85 years and over group.

Older age and gender

In total, 8166 patients (59.8%) aged 65 years and over received a MAP on admission compared to 5006 patients (23.2%) aged 64 years and below (χ^2 4785.4, $p < 0.001$). There was a significant effect of Indigeneity and a marginal effect for gender for provision of MAP on admission.

In the age group 65 years and over, a higher proportion of First Nations patients received a MAP on admission and a DMR at discharge compared to non-Indigenous patients (MAP 62.8% vs 59.8%, χ^2 3.6, $p = 0.052$; DMR 56.8 vs 49.3%, χ^2 25.2, $p < 0.001$). In this age group, the proportions of female and male patients who received a MAP on admission were similar among First Nations and non-Indigenous patients (female 62.8% vs 61.2%, χ^2 0.70, $p = 0.402$; male 62.3% vs 58.7%, χ^2 2.6, $p = 0.104$). A higher proportion of First Nations female and male patients received a DMR at discharge compared to non-Indigenous patients (female: DMR 57.7% vs 50.5%, χ^2 13.5, $p = 0.002$; male: DMR 55.6% vs 48.5%, χ^2 9.5, $p = 0.002$).

The proportion of First Nations patients aged 50 years and over who received a MAP on admission was lower compared to the proportion of non-Indigenous patients aged 65 years and over (56.3% vs 59.8% χ^2 14.1, $p = 0.002$), and the provision of a DMR was similar (DMR 50.4% vs 49.3%) (Table 3). The proportion of First Nations male patients aged 50 years and over who received a MAP and a DMR was similar to the proportion of non-Indigenous patients aged 65 years and over who received both. The proportion of First Nations female patients aged 50 years and over who received a MAP was lower than the proportion of non-Indigenous female patients aged 65 years and over (female MAP: 56.1% vs 61.2%, χ^2 15.3, $p < 0.001$) who received a MAP and the proportion who received a DMR at discharge was similar.

DISCUSSION

The cpKPIs dashboard provided actionable insights about the coverage and equity of clinical pharmacy service provision, identifying areas of excellence and the need for improvement.

The results of this study demonstrate the ability to monitor equity of clinical pharmacy service provision and medication safety at several levels, for example between First Nations people and non-Indigenous people, genders, regional and rural hospitals, and clinical pharmacy service provision to different clinical areas within hospitals. This is the first report to our knowledge of the cpKPIs designed to monitor the equity of clinical pharmacy service provision and medication safety in Australia. In addition, the cpKPIs dashboard for regional and rural hospitals was developed as a tool for monitoring performance in a resource-limited setting,[15] i.e. regional and rural health services without fully integrated ieMRs. All five cpKPIs were reported for the regional hospital only due to the availability of the ieMRs.

Overall, at the regional and rural hospitals, non-Indigenous patients and male patients received a higher proportion of the MAPs on admission compared to First Nations patients and female patients, respectively. This overall proportion is a weighted summary

measure of the age-specific proportions, and it is confounded by the age composition of the two populations.[16] When the proportions are presented by age group, First Nations patients received higher proportion of MAPs and DMRs in each age group except for the 85 years and over group. The sample size for First Nations people aged 85 years and over who received a MAP or a DMR, shown in Table 2 and Figure 1, is small compared to the other age groups and non-Indigenous groups. This is due to the lower life expectancy in this population. This reduces the confidence in effect estimates for this group.

Older patients (aged 65 years and over) received a higher proportion of MAPs on admission compared to younger patients (aged 64 years and below), which demonstrates adherence to the patient prioritisation criteria for clinical pharmacy service provision, targeting patients with advanced age. Consequently, equitable provision of MAPs on admission was evident among patients 65 years and over. However, when adjusted for a difference in life expectancy between First Nations patients and non-Indigenous patients, the proportion of First Nations patients aged 50 years and over who received a MAP on admission was lower compared to that for non-Indigenous patients aged 65 years and over, and the proportion of DMRs at discharge was similar, indicating equitable service provision at discharge. In particular, a lower proportion of First Nations female patients aged 50 years and over received a MAP and a DMR compared to non-Indigenous female patients aged 65 and over, whilst the proportions of MAPs and DMRs for the respective male age group populations were similar.

In 2016, about 800 000 people in Australia (3%) identified as Aboriginal and Torres Strait Islander people and the majority lived in remote (18%) and very remote (47%) areas.[17] A total of 221 300 people (28%) that identified as Aboriginal and Torres Strait Islander people lived in Queensland. The proportion of Aboriginal and Torres Islander peoples in North Queensland is 11.6%, higher than the Queensland proportion of 4.6%.[18] In addition, the region has a higher proportion of the population in the lowest Socio-Economic Index for Area,[19] quintile (23%), compared to Queensland (18%).

Under the United Nations Declaration on the Rights of Indigenous Peoples, Indigenous people in Australia "have an equal right to the enjoyment of the highest attainable standard of physical and mental health" (Article 24.2).[20] Between 2015 and 2017, the age-adjusted life expectancy at birth in Australia was 71.6 years for Indigenous men and 75.6 years for Indigenous women, compared with 80.2 years for non-Indigenous men and 83.4 years for non-Indigenous women.[21] The difference in life expectancy at birth has improved slightly from 2005–2007 to 2015–2017, decreasing from 11.5 to 8.6 years between non-Indigenous and Indigenous males and 9.7 to 7.8 years between non-Indigenous and Indigenous females.[22] In addition, life expectancy at birth decreases as remoteness increases for Indigenous people, but not for non-Indigenous people in Australia.[17] For example, Far North regional Queensland has a median life expectancy for First Nations peoples of 61.3 years.[18] In 2021, the gap in life expectancy between First Nations and non-Indigenous peoples was 17 years.[18]

Furthermore, the rate and disease burden among Aboriginal and Torres Strait Islander people is 2.3 times that of non-Indigenous people in Australia.[17] During the period 2014–2018, the age-standardised rate of potentially preventable hospitalisations among Indigenous people was 312 per 100 000 people compared with 103 per 100 000 people for non-Indigenous people. The age-standardised rates of avoidable deaths (coronary heart disease, diabetes, chronic obstructive pulmonary disease, cancer, and suicide/self-inflicted injuries) increased for Indigenous people (per 100 000) compared to non-Indigenous people.[17] However, the total pharmaceutical expenditure per person in 2015–16 was lower for First Nations ($537) people compared to non-Indigenous ($891) people.[23] Although a systematic review found no evidence that medication adherence is lower among Indigenous people,[24] the most common reasons for not having a prescription filled in the 2018–19 National Aboriginal and Torres Strait Islander Health Survey[23,25] were cost (36%), patients decided that they didn't need the medication (30%), patients decided they didn't want the medication (15%), or patients were too busy (11%). In addition, language and the cultural competency of services were recognised as barriers to access. In 2019, there were 70 Indigenous pharmacists practicing in Australia, representing 0.5% of the total pharmacist workforce.[26]

The lack of a robust patient prioritisation tool that captures ethnicity-related inequalities and the reduced life expectancy of First Nations people may have contributed to the inequity of MAP provision to First Nations patients aged 50 years and over on admission. Provision of MAPs is based on manual patient prioritisation according to defined selection criteria,[27,28] which includes age, specifically older people. In clinical practice this information is sourced from a handover sheet from the patient flow manager application. The higher proportion of MAP for patients older than 65 years is consistent with the prioritisation of clinical pharmacy services based on the risks associated with advanced age and comorbidities, which demonstrates adherence

to the Medication Safety Standard. Historically, older age has been defined as aged 65 years and over. In recent years, to account for the reduced life expectancy of First Nations people, aged 50 years and over for First Nations people has been used as the equivalent to aged 65 years and over for non-Indigenous peoples. Aged 45 and over for First Nations peoples[28] should be used in regional and rural healthcare settings and the cpKPIs have been updated accordingly (Table 1). In consultation with the local Aboriginal and Torres Strait Islanders Health Unit, Indigenous status information was added to the handover sheet to improve prioritisation of First Nations patients for clinical pharmacy service provision. In addition, age categories 19–49 and 50–64 years in the dashboard were changed to 19–45 and 45–64 years.

A lower proportion of female patients received MAPs and DMRs compared to male patients. Historically, clinical pharmacy services to women's health and obstetrics wards were given lower priority for implementation[29] and the service was not available in these clinical areas at the hospitals included in this study. During the study period, 19–49 years was the largest age category for First Nations patients and approximately one-third of patients were admitted to the maternity ward, therefore future service development should address this unmet need.

A higher proportion of patients received a MAP and a DMR at the rural hospitals compared to the regional hospital due to clinical pharmacy services not being provided to all clinical areas at the regional hospital because of resource constraints.

The potential benefits of the cpKPIs dashboard are multifaceted and include improvements of coverage and equity of service delivery, evidence for accreditation, and leadership for equity and cultural competency. The dashboard provides real-time, cost-effective data analytics visualisation for planning, monitoring, and improving clinical pharmacy service provision and eliminates the need for manual auditing of service performance. It also provides evidence of adherence to the NSQHS Standards, enabling performance improvement by providing peer comparisons and benchmarking. By promoting individual and team performance, and focusing on positive contributions and celebrating success, the dashboard may help to build an action-oriented culture in the pandemic/post-pandemic context of staff shortages. It has the potential to be used for quality improvement and research, and to contribute to workforce development and retention.[26]

The limitations of the dashboard include a lack of data from a fully integrated ieMR, such as medication data from electronic prescribing and pathology data pertinent to medication safety and quality use of medicines. At regional and rural hospitals, a lack of fully integrated ieMRs with a computerised physician order entry[3] was a major obstacle to providing safe and efficient clinical pharmacy services and conducting practice-based research for improvements in medication safety. Inconsistencies in the coding of clinical pharmacy activities were also identified from historical reports from clinical decision support services. The accuracy of coding of clinical pharmacists' documentation into electronic health records was improved by adding the relevant codes for healthcare professional intervention[30] to the pharmacists' electronic forms to aid detection of clinical pharmacist interventions by the coding department.

Future research should investigate and address the gaps in equitable provision of clinical pharmacy service, and barriers and enablers of pharmacy service provision and patient outcomes.

The overall proportions of MAPs and DMRs demonstrated inequity of clinical pharmacy service provision on admission and at discharge for female patients and First Nations patients compared to male and non-Indigenous patients, respectively. In contrast, age-specific proportions of MAPs and DMRs demonstrated equitable service provision, accounting for the differences in age distribution between the First Nations and non-Indigenous groups. However, when adjusted for a difference in life expectancy between First Nations patients and non-Indigenous patients, the proportion of First Nations patients aged 50 years and over who received a MAP on admission was lower compared to that for non-Indigenous patients aged 65 years and over, and the proportion of DMRs at discharge was similar. Future research should investigate the gaps, barriers, enablers, and outcomes of clinical pharmacy service provision at rural and regional hospitals.

ACKNOWLEDGEMENT

None.

CONFLICT OF INTEREST STATEMENT

SM received financial support from Cairns and Hinterland Hospital and Health Services to attend the 81st International Pharmacy Federation (FIP) World Congress of Pharmacy and Pharmaceutical Sciences in 2023, held in Brisbane, Australia and held positions on the Society of Hospital Pharmacy of Australia Specialty Practice Nephrology and Research Leadership Committees (2019–2022). The remaining authors declare that they have no conflicts of interest.

AUTHORSHIP STATEMENT

Conceptualisation and project administration: SM, AI, AW, and JB. Data curation: SM and AW. Formal analysis: SM and RJ. Investigation, methodology, visualisation and Writing review and editing: SM. Validation: SM, RJ, AI, AW, and JB. Resources and supervision: JB. Writing original: SM, RJ, and JB.

ETHICS STATEMENT

This project was exempt due to the local policy requirements that constitute research by the Far North Queensland Human Research Ethics Committee (Reference no: EX/2023/QCH/94383-1684QA). The justification for this ethics exemption was as follows: The project was determined to be negligible risk research and involved the use of existing collection of data or records that contain only non-identifiable data about human beings.

FUNDING STATEMENT

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

OPEN ACCESS STATEMENT

None.

DATA AVAILABILITY STATEMENT

Data available on request from the authors.

REFERENCES

1 Australian Commission on Safety and Quality in Health Care (ACSQHC). *National safety and quality health service standards*. 2nd edition. Sydney: ACSQHC; 2021.
2 Anderson LJ, Schnipper JL, Nuckols TK, Shane R, Le MM, Robbins K, et al. Effect of medication reconciliation interventions on outcomes: a systematic overview of systematic reviews. *Am J Health Syst Pharm* 2019; **76**: 2028–40.
3 Ciapponi A, Fernandez Nievas SE, Seijo M, Rodríguez MB, Vietto V, García-Perdomo HA, et al. Reducing medication errors for adults in hospital settings. *Cochrane Database Syst Rev* 2021; (11): CD009985.
4 Redmond P, Grimes TC, McDonnell R, Boland F, Hughes C, Fahey T. Impact of medication reconciliation for improving transitions of care. *Cochrane Database Syst Rev* 2018; (8): CD010791.
5 Billstein-Leber M, Carrillo CJD, Cassano AT, Moline K, Robertson JJ. ASHP guidelines on preventing medication errors in hospitals. *Am J Health Syst Pharm* 2018; **75**: 1493–1517.
6 Australian Commission on Safety and Quality in Health Care (ACSQHC). *National quality use of medicines indicators for Australian hospitals*. Sydney: ACSQHC; 2014.
7 Fernandes OTK, Pereira T, Lyder C, Bjelajac Mejia A, Shalansky S, Al-Sukhni M, et al. *Canadian consensus on clinical pharmacy key performance indicators: quick reference guide*. Ottawa: Canadian Society of Hospital Pharmacists; 2015.
8 Cairns and Hinterland Hospital and Health Service. *First Peoples health equity strategy 2022–2025*. Cairns: State of Queensland (Queensland Health); 2022.
9 Te Tāhū Hauora Health Quality & Safety Commission. *Medicine reconciliation*. Wellington: Te Tāhū Hauora Health Quality & Safety Commission; 2022. Available from <https://www.hqsc.govt.nz/our-work/system-safety/reducing-harm/medicines/projects/medicine-reconciliation/>. Accessed 16 December 2022.
10 Levesque J-F, Sutherland K. Combining patient, clinical and system perspectives in assessing performance in healthcare: an integrated measurement framework. *BMC Health Serv Res* 2020; **20**: 23.
11 Australian Institute of Health and Welfare (AIHW). *Australian hospital peer groups. Health services series no. 66. Cat. no. HSE 170*. Canberra: AIHW; 2015.
12 Department of Health. *Modified Monash model*. Canberra: Commonwealth of Australia; 2019. Available from <https://www.health.gov.au/sites/default/files/documents/2020/07/modified-monash-model-fact-sheet.pdf>.
13 Queensland Health. *Medication Services: CSCF v3.2*. Brisbane: Queensland Government; 2014. Available from <https://www.health.qld.gov.au/__data/assets/pdf_file/0023/444326/cscf-medication.pdf>. Accessed 13 March 2023.
14 R Code Team. *R: A language and environment for statistical computing*. Viena, Austria: R Foundation for Statistical Computing; 2021.
15 World Health Organization (WHO). *Medication safety in high-risk situations: technical report*. Geneva: WHO; 2019.
16 Australian Institute of Health and Welfare. *Principles on the use of direct age-standardisation in administrative data collections: for measuring the gap between Indigenous and non-Indigenous Australians. Cat no CSI 12*. Canberra: AIHW; 2011.
17 Australian Institute of Health and Welfare. *Aboriginal and Torres Strait Islander Health Performance Framework 2020 summary report. Cat. no. IHPF 2*. Canberra: AIHW; 2022.
18 Armstrong A, Layton K. *Our local health needs: local area needs assessment 2022*. Cairns: Cairns and Hinterland Health Service; 2022.
19 Australian Bureau of Statistics. *Technical paper: socio-economic indexes for areas (SEIFA) 2016*. Balconnen, ACT: Commonwealth of Australia; 2018.
20 United Nations. *United Nations declaration on the rights of indigenous peoples (A/RES/61/295)*. New York: United Nations; 2007.
21 Department of the Prime Minister and Cabinet. *Closing the Gap Report: 2020*. Canberra: Commonwealth of Australia; 2020. Available from <https://ctgreport.niaa.gov.au/sites/default/files/pdf/closing-the-gap-report-2020.pdf>. Accessed 16 December 2022.
22 Australian Institute of Health and Welfare. *Deaths in Australia* [updated 11 July 2023]. Canberra: AIHW; 2022. Available from

<https://www.aihw.gov.au/reports/life-expectancy-death/deaths-in-australia/contents/life-expectancy>. Accessed 15 December 2022.

23 Australian Institute of Health and Welfare. *3.15 Access to prescription medicines* [updated 2 April 2024]. Canberra: AIWH; 2020. Available from <https://www.indigenoushpf.gov.au/measures/3-15-access-prescription-medicines>. Accessed 13 March 2023.

24 de Dassel JL, Ralph AP, Cass A. A systematic review of adherence in indigenous Australians: an opportunity to improve chronic condition management. *BMC Health Serv Res* 2017; **17**: 845.

25 Australian Bureau of Statistics. *Results from the 2018–19 National Aboriginal and Torres Strait Islander Health Survey (NATSIHS)*. Canberra: Commonwealth of Australia; 2020. Available from <https://apo.org.au/node/306475>. Accessed 13 March 2023.

26 Obamiro K, Barnett T, Inyang I. The Australian pharmacist workforce: distribution and predictors of practising outside of metropolitan and regional areas in 2019. *Int J Pharm Pract* 2022; **30**: 354–59.

27 Bunte M. Standards of practice for clinical pharmacy services – Chapter 16: My health record. *J Pharm Pract Res* 2021; **51**: 536–551.

28 Tong E, Collins J, Firman P, Jovanovic M, Edwards A, Olding S, et al. Standard of practice in general medicine for pharmacy services. *J Pharm Pract Res* 2020; **50**: 356–365.

29 Gnadt S. Clinical pharmacy and obstetrics. *Am J Health Syst Pharm* 2020; **77**: 1941–44.

30 Australian Consortium for Classification Development. *Australian Classification of health interventions: ACHI tabular list*. 11th ed. Darlinghurst, NSW: Independent Hospital Pricing Authority; 2019.

Received: 10 April 2023
Revised version received: 20 December 2023
Accepted: 15 February 2024

apc | ACCREDITED CPD

This activity has been accredited for 1 hour of Group 1 CPD activity (or 1 CPD credit) suitable for inclusion in an individual pharmacist's CPD plan, which can be converted to 1 hour of Group 2 CPD (or 2 CPD credits) upon successful completion of the relevant assessment activity. No: S2024/53.