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BRIEF COMMUNICATION

Polypharmacy in older patients presenting to a tertiary regional health service: identifying correlations between demographics, presentations and length of stay

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Abstract

This study aimed to describe hospital admissions in patients experiencing polypharmacy and evaluate the effects of demographic factors on length of stay (LOS) and polypharmacy. We found that increasing age is associated with increasing polypharmacy rates but decreasing LOS. Females were more likely to experience higher rates of polypharmacy, but males were more likely to have longer LOS. First Nations peoples had higher rates of polypharmacy and longer LOS. Future projects investigating deprescribing methods are critical.

Polypharmacy, commonly described as the use of ≥5 medications, is an increasing global public health challenge.[1] Although often clinically appropriate, polypharmacy presents risks such as adverse drug reactions, increased morbidity and mortality, hospital admission, functional impairment, geriatric syndromes (e.g. confusion, falls and frailty) and reduced adherence to treatment plans.[1–3] People aged ≥65 years are particularly susceptible to these risks because of the increased likelihood of polypharmacy and the physiological effects of ageing.[2]

In Australia, 20.9% of the population experience polypharmacy, with 3.3% experiencing hyperpolypharmacy (≥10 medications), increasing to 45% and 8.3% respectively in those aged ≥70 years.[4] Polypharmacy is associated with both suboptimal and potentially inappropriate prescribing,[5] with approximately half of older adults in Australia estimated to take a harmful or unnecessary medication.[6] In Australia, it is estimated that medication-related issues account for 2.5% of hospital admissions, reflecting 20.5% in the elderly, and a total of ~AU$1.4 billion.[7]

It is estimated that 50% of this is preventable.[7]

In light of the increasing prevalence of polypharmacy[8] but deficit of evidence in regional settings, we aimed to identify correlations between hospital admissions, rates of polypharmacy and length of stay (LOS), with a consideration of patient demographics, at Townsville University Hospital (TUH).

Retrospective data collection was used for all inpatient episodes of care across all services at TUH from 12 March 2019 to 8 March 2022 for patients ≥65 years of age (yoa) with documented prescriptions of ≥5 medications total. Data from the Integrated Electronic Medical Record programme were extracted, with the collection of data points including demographics, primary diagnosis, admission details and medications.

Data were analysed using SPSS 28 software (IBM Corp. Released 2021. IBM SPSS Statistics for Mac OSX, Version 28.0. Armonk, NY: IBM Corp). Cohort demographics were presented in number and percentages, or mean with standard deviation. The emergency department (ED) primary diagnosis was presented with numbers and percentages, and average LOS was presented

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by mean and standard deviation. Spearman's correlation analysis determined the relationship between LOS and polypharmacy. To determine the factors associated with polypharmacy and LOS, univariate analysis using binary logistic regression (unadjusted) was first carried out, followed by multivariate binary logistic regression (adjusted) with other variable factors that included age, sex, ethnicity and polypharmacy. To carry out a multinominal logistic regression, LOS was categorised into groups of 1 night, 2–3 nights and 4 nights, as suggested by Han *et al.*[9] A P value of <0.05 was considered statistically significant.

Approval was gained through Townsville Hospital and Health Service Audit, Quality and Innovation Review (panel reference number: THHSAQUIRE1446) in compliance with the Queensland Hospital and Health Boards Act and the National Health and Medical Research Council National Ethics Statement. This research project is congruent with the National Statement on Ethical Conduct in Human Research (2007, updated 2018) section 5.1.22, and approval was granted for the Human Research Ethics Committee exemption.

A total of 5663 participants with unique first encounters were included in the analysis (Table S1). The average age was 78 ± 8 years, with 51.3% male and 48.7% female and 5.2% identifying as First Nations. The number of medications taken ranged from 5 to 32, averaging 9.1 ± 3.8. The average length of hospitalisation was 5.3 ± 7.2 nights.

The ED primary diagnoses for unique encounters (Table S2) showed the most common primary diagnosis was 'cardiovascular and vascular', with the least common being 'psychosocial, psychological and psychiatric'.

The effects of age, sex, First Nations status and LOS on the likelihood of polypharmacy as a primary outcome were assessed (Table 1). It was found that patients aged ≥85 years, compared to patients aged 65–74 years, were more likely to have 7–9 medications than 5–6 (odds ratio (OR) = 1.361, $P = 0.001$). Patients 75–84 yoa and those ≥85 yoa, compared to patients 65–74 yoa, are both more likely to have ≥10 medications compared to five or six (OR = 1.388, $P \leq 0.001$ and 2.149, $P \leq 0.001$ respectively). Males, compared to females, are less likely to take seven to nine medications (OR = 0.847, $P = 0.014$) and ≥10 medications (OR = 0.828, $P = 0.005$) than to take five or six medications. First Nations patients, compared to non-First Nations patients, are more likely to take ≥10 medications than five or six medications (OR = 1.539, $P = 0.004$).

Correlation analysis between LOS and polypharmacy revealed a weak association, with a correlation coefficient of −0.049, $P < 0.001$. In a comparison average LOS as a secondary outcome of polypharmacy (Table S3), there was a statistically significant difference ($P \leq 0.001$) in mean LOS between all three age groups, 65–74 yoa (6.26 ± 8.999 nights), 75–84 yoa (5.15 ± 6.175) and ≥85 yoa (5.27 ± 7.204), with a small effect size of 0.016. There was a statistically significant difference ($P \leq 0.001$) in mean LOS for males (5.86 ± 8.013) and females (4.65 ± 6.181). There was a significant difference ($P = 0.025$) in mean LOS between First Nations (6.26 ± 7.684) and non-Indigenous patients (5.22 ± 7.174); however, the effect size was again small (0.0009). There was no statistically significant impact of polypharmacy groups on average LOS.

In a further exploration of LOS in association with polypharmacy, LOS was grouped (1 night, 2–3 nights and ≥4 nights) and adjusted for other predictor variables such as age, sex, First Nations status and rates of polypharmacy (Table 2). Patients aged 75–84 yoa, when compared to patients aged 65–74 yoa, are less likely to

Table 1 Polypharmacy (odds ratio (OR))

	5–6 Medications	7–9 Medications unadjusted (OR, 95% CI)	7–9 Medications adjusted (OR, 95% CI)	≥10 Medications unadjusted (OR, 95% CI)	≥10 Medications adjusted (OR, 95% CI)
Age (years)					
65–74	Ref	Ref	Ref	Ref	Ref
75–84	Ref	1.071 (0.926–1.240)	1.069 (0.922–1.239)	1.352 (1.169–1.563)***	1.388 (1.198–1.609)***
≥85	Ref	1.389 (1.157–1.668)***	1.361 (1.130–1.640)**	2.126 (1.781–2.537)***	2.149 (1.793–2.574)***
Sex					
Male	Ref	0.828 (0.726–0.945)**	0.847 (0.742–0.967)*	0.777 (0.684–0.884)***	0.828 (0.727–0.943)**
Female	Ref	Ref	Ref	Ref	Ref
First Nations status					
First Nations	Ref	0.961 (0.703–1.314)	1.002 (0.731–1.375)	1.310 (0.983–1.746)	1.539 (1.148–2.062)**
Non-Indigenous	Ref	Ref	Ref	Ref	Ref
Length of stay (nights)	Ref	0.999 (0.990–1.008)	1.002 (0.993–1.011)	996 (0.987–1.005)	1.001 (0.992–1.011)

*$P < 0.05$.

**$P < 0.01$.

***$P < 0.001$.

CI, confidence interval; Ref, reference group.

Table 2 Length of stay (LOS) (odds ratio)

	LOS 1 night	LOS 2–3 nights unadjusted	LOS 2–3 nights adjusted	LOS ≥4 nights unadjusted	LOS ≥4 nights adjusted
Age					
65–74 yoa	Ref	Ref	Ref	Ref	Ref
75–84 yoa	Ref	0.712 (0.602–0.842)***	0.715 (0.603–0.847)***	0.666 (0.578–0.768)***	0.678 (0.588–0.783)***
≥85 yoa	Ref	0.461 (0.380–0.559)***	0.475 (0.390–0.578)***	0.354 (0.301–0.417)***	0.377 (0.319–0.446)***
Sex					
Male	Ref	1.192 (1.032–1.377)*	1.111 (0.960–1.286)	1.422 (1.259–1.605)***	1.307 (1.155–1.479)***
Female	Ref	Ref	Ref	Ref	Ref
First Nations status					
Non-Indigenous	Ref	Ref	Ref	Ref	Ref
First Nations	Ref	0.994 (0.706–1.400)	0.848 (0.598–1.202)	1.261 (0.957–1.662)	1.043 (0.786–1.384)
Polypharmacy					
5–6 medications	Ref	Ref	Ref	Ref	Ref
7–9 medications	Ref	0.863 (0.719–1.035)	0.893 (0.743–1.073)	0.820 (0.703–0.957)*	0.862 (0.737–1.009)
≥10 medications	Ref	0.729 (0.610–0.871)***	0.793 (0.662–0.950)*	0.726 (0.625–0.843)***	0.811 (0.696–0.944)**

*$P < 0.05$.
**$P < 0.01$.
***$P < 0.001$.
LOS, length of stay; Ref, reference group; yoa, years of age.

have a LOS of 2–3 nights (OR = 0.715, $P \leq 0.001$) or ≥4 nights (OR = 0.678, $P \leq 0.001$), than 1 night. Patients aged ≥85 yoa, when compared to patients aged 65–74 yoa, are less likely to have a LOS of 2–3 nights (OR = 0.475, $P \leq 0.001$) or ≥4 (OR = 0.377, $P \leq 0.001$) than 1 night. Males, compared to females, are more likely to have a LOS ≥4 nights (OR = 1.307, $P \leq 0.001$) than 1 night. Patients who take ≥10 medications, compared to those who take five or six medications, are less likely to have a LOS of 2–3 nights (OR = 0.793, $P = 0.012$) or ≥4 nights (OR = 0.811, $P = 0.007$) than 1 night.

Discussion

Overall, we found that the number of medications used increased with age; however, rising polypharmacy rates did not have a statistically significant impact on average LOS. Interestingly, increasing age was also associated with a decreasing average LOS.

Males were found to be less likely to experience polypharmacy but have higher average LOS compared to females. The Australian Institute of Health and Welfare (AIHW) reported that older men were more likely to be hospitalised than older women,[10,11] which is congruent with our findings. The AIHW has also found that, overall, females were more likely to have multiple chronic conditions and have a longer life expectancy of 84.6 years (vs 80.5 years for males).[10,12] This would help explain the higher rates of polypharmacy we found in women. Males spending longer periods of time in hospital could be partially, but not robustly, explained by higher rates of negative health behaviours such as alcohol and tobacco use.[10,12]

We found as people got older, they were more likely to experience higher rates of polypharmacy, which is congruent with national data.[4] The AIHW also reports that the rate of hospitalisation increases with age.[11] However, interestingly, our study found that the average LOS decreased with increasing age. This is contrary to national data indicating that the average LOS increases sequentially alongside age in people ≥65 years old.[13]

In older Australians, one study found the likelihood of being hospitalised and average LOS increased with age; however, this does depend upon the reason for admission (i.e. rehabilitative, maintenance, palliative or acute).[14] This study also reported that as people age, they are more likely to be discharged into residential aged care.[14] This might help explain why increasing age is associated with decreasing LOS, as it may be easier to discharge patients back to their pre-existing bed in an RACF with nursing care as opposed to those who live independently and may require more extensive safe discharge planning.

We found that First Nations peoples were more likely to experience hyperpolypharmacy and have longer hospital admissions. This could be explained by many factors, such as being more likely to develop chronic health conditions, as well as barriers to accessing healthcare, including logistical and financial, and availability of culturally safe services.[11,15]

Our study is congruent with evidence that First Nations peoples were hospitalised at 2.3 times the rate of non-Indigenous people,[16] given our sample population

approximately represents 40% of the local First Nations population and 20% of the non-Indigenous population.[17,18] Broadly speaking, this continues to underscore the need for multifaceted, substantial and ongoing efforts to close this health gap for First Nations consumers.

While degrees of polypharmacy did not have a statistically significant impact on average LOS, there was such an impact when LOS was grouped into 1 night, 2–3 nights and ≥4 nights. Interestingly, increasing rates of polypharmacy were associated with a decrease in LOS when grouped into 1 night, 2–3 nights and ≥4 nights. Although the current literature suggests that polypharmacy is associated with an increased risk of hospitalisation,[1,2] there is little literature on the impact of the degree of polypharmacy on LOS. This may suggest that the magnitude of polypharmacy is less important than the fact of experiencing polypharmacy with respect to hospitalisations.

Our study included a large sample population over a 3-year period at a regional health service providing comprehensive universal healthcare, thus lending credence to the findings. The limitations of this study include the inability to assess the appropriateness of polypharmacy rates and its inability to account for comorbidities or the medical complexity or frailty of patients. ED primary diagnosis is acknowledged to have limitations in describing a hospital admission because of the likely multi-morbid nature of individuals aged ≥65 years, and therefore, the admission reason was not accounted for as a variable. Another limitation is the use of 'best fit' or 'null' when no ED diagnosis was available.

Raising awareness of the impact of polypharmacy is a vital first step in addressing it.[1] Future projects investigating effective and culturally safe methods of deprescribing are critical in addressing this growing public health issue.

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