

General practitioner follow-up after hospitalisation in Central and Eastern Sydney, Australia: access and impact on health services

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Abstract.

Objectives. General practitioner (GP) follow-up after a hospital admission is an important indicator of integrated care. We examined the characteristics of patients who saw a GP within 2 weeks of hospital discharge in the Central and Eastern Sydney (CES) region, Australia, and the relationship between GP follow-up and subsequent hospitalisation.

Methods. This data linkage study used a cohort of 10 240 people from the 45 and Up Study who resided in CES and experienced an overnight hospitalisation in the 5 years following recruitment (2007–14). Characteristics of participants who saw a GP within 2 weeks of discharge were compared with those who did not using generalised linear models. Time to subsequent hospitalisation was compared for the two groups using Cox proportional hazards regression models stratified by prior frequency of GP use.

Results. Within 2 weeks of discharge, 64.3% participants saw a GP. Seeing a GP within 2 weeks of discharge was associated with lower rates of rehospitalisation for infrequent GP users (i.e. <8 visits in year before the index hospitalisation; hazard ratio (HR) 0.83; 95% confidence interval (CI) 0.70–0.97) but not frequent GP users (i.e. ≥8 plus visits; HR 1.02; 95% CI 0.90–1.17).

Conclusion. The effect of seeing a GP on subsequent hospitalisation was protective but differed depending on patient care needs.

What is known about the topic? There is general consensus among healthcare providers that primary care is a significant source of ongoing health care provision.

What does this paper add? This study explored the relationship between GP follow-up after an uncomplicated hospitalisation and its effect on rehospitalisation.

What are the implications for practitioners? Discharge planning and the transfer of care from hospital to GP through discharge arrangements have substantial benefits for both patients and the health system.

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Introduction

Integration and coordination of health care are key performance indicators for health services.¹ One measure of integration is the transfer of care to general practitioners (GPs) after a hospital admission for follow-up and ongoing management. The Australian Commission on Safety and Quality in Health Care, the Australian Medical Association and the NSW Ministry of Health all advocate for timely, relevant and structured clinical handover from hospital to primary care.^{2–4} Follow-up guidelines after hospitalisation vary by condition, but most guidelines suggest follow-up should be within 2–4 weeks.^{5–8}

The follow-up of patients in the GP setting after hospital admission is dependent on the patient, the GP and the hospital. The relationship between these three is complex.⁹ Patient factors determining when and whether they see a GP include the patient's understanding of the cause of their illness, their perception of the value of follow-up with a GP and how the hospital has communicated the need for follow-up. Patient factors also include very practical issues, such as needing a prescription or a patient's ability to get to the GP. GP factors can include the nature of the relationship between the GP and the patient, the accessibility of the GP and whether the GP has received notice of the patient's discharge from hospital. Hospital factors can include education of the patient about the need to see their GP and hospital communication with the GP.

The nature of the illness for which the patient has been admitted to hospital is also a determinant of time to follow-up by a GP. An illness such as cancer, where the patient will be returning regularly to the oncology unit for chemotherapy, will mean that follow-up will be with the specialist in the oncology unit. For an acute event, such as pneumonia, where there is no ongoing hospital treatment, follow-up with a GP will be required sooner, especially if there is a need for further antibiotics. The overall health of the person before the hospitalisation, often measured by frequency of service use,^{10,11} influences the need for ongoing GP care after hospitalisation and the likelihood of having subsequent hospitalisations. There is no universally adopted definition of 'high' levels of GP use. In their review, Vedsted and Christensen found that the threshold for high levels of GP use in their included studies ranged between five and 15 visits per year.¹⁰ Conversely, Byrne *et al.* focused on emergency department (ED) attenders in Ireland and found that frequent attenders had a median GP use of 12 visits per year, compared with three visits for non-frequent ED attenders.¹¹

From his meta-analysis, Scott found that discharge processes are effective in reducing readmissions if they include factors such as needs assessments, patient education regarding self-management and timely communication with a primary care team regarding patient management.¹² Based on their systematic review, Hansen *et al.* stated that no single intervention implemented alone was regularly associated with reduced risk

for 30-day readmission.¹³ When examining timeliness of follow-up after hospital discharge and its effect on subsequent hospitalisations, Jackson *et al.* concluded that most patients do not benefit from early primary care follow-up and that resources are best allocated to the highest-risk patients to maximise the chance they receive follow-up within 7 days.¹⁴ However, in their study of 71 231 patients in California, Shen *et al.* found that patients who completed any primary care visits within 7 days had a 12–24% lower risk for 30-day readmission.¹⁵

Despite care standards and guidelines on the need for follow-up and ongoing management after a hospitalisation,^{2–4} no previous Australian research has been undertaken on the relationship between seeing a GP in the period after hospital discharge and rehospitalisation. The aim of this study, using data from a large longitudinal study, was to address this gap. Specifically, the aims of the study were to: (1) describe the characteristics of those people who saw a GP after hospital discharge (within 2 weeks) compared with those who did not; and (2) examine the relationship between seeing a GP after hospital discharge and rehospitalisation.

Methods

Study sample and design

This study used the Central and Eastern Sydney (CES) residents ($n = 30\,645$) within the Central and Eastern Sydney Primary and Community Health Data Linkage Resource,¹⁶ a linked data collection based on the Sax Institute's 45 and Up Study.¹⁷ Specifically, the 45 and Up Study baseline questionnaire data were linked to the Medicare Benefits Schedule (MBS) data supplied by the Services Australia, and the NSW Admitted Patient Data Collection and Deaths Registry supplied by the NSW Centre for Health Record Linkage¹⁸ for the period 2006–14.

Participants joined the 45 and Up Study between 2006 and 2009 by completing a baseline questionnaire and consented to ongoing follow-up and linkage of their information to administrative databases. Approximately 18% of those invited participated in the study.¹⁷

Defining the study cohort

Participants were eligible for inclusion in this study if they had an overnight hospital stay in the period 1 January 2007–31 December 2014 and their hospital stay met the inclusion criteria for stays that were deemed likely to warrant post-discharge GP care. Accordingly, admissions where the patient was not discharged into the community (i.e. discharge to a nursing home or transfer to another hospital), admissions for rehabilitation or dialysis and admissions related to joint replacement were excluded. Rehabilitation or dialysis admissions were excluded because these would be expected to be part of an on-going treatment plan and admissions related to joint replacement were

excluded because postoperative care would be expected to include rehabilitation that would be part of an on-going treatment plan and may not include the GP.

Only the first eligible hospitalisation per person within this period was included.

Outcome variables

GP follow-up within 2 weeks of discharge was defined as ‘yes’ if a participant had claimed any one or more MBS item within Groups A1, A2, A5, A11, A14, A15, A17, A20, A22 and A23, excluding case conferences (Items 735–880), and ‘no’ if they had not. All rehospitalisations with a length of stay >1 day that occurred between 2 weeks and 12 months after discharge from an index hospitalisation to public and private facilities were included. Hospitalisations were excluded if they were for rehabilitation, because this would be expected to be part of an on-going treatment plan. Participant characteristics using 45 and Up Study baseline questionnaire data,¹⁷ MBS data¹⁹ or NSW Admitted Patient Data Collection data¹⁸ were grouped into four main categories: sociodemographic, health risk factors, health status and health care utilisation. These variables are defined in Table S1, available as Supplementary Material to this paper.

Statistical analyses

The statistical analysis included three components: (1) a descriptive analysis to calculate the proportion of participants with an index hospitalisation by whether or not they saw a GP within 2 weeks of discharge; (2) a multivariable generalised linear model with Poisson family and log link function to examine which factors (sociodemographic, health risk factors, health status and health service utilisation characteristic of interest) were significantly related to a GP follow-up within 2 weeks, controlling for age and sex; and (3) a time to event analysis, first calculating propensity weights to account for differences in characteristics between those who saw a GP and those who did not and then using weighted Cox proportional hazards regression modelling to examine the relationship between seeing a GP within 2 weeks of discharge from the index hospitalisation and reduced rehospitalisation in the subsequent 12 months. Outcomes were censored at first rehospitalisation, death or 12 months after the index hospitalisation, whichever occurred first.

The propensity of seeing a GP within 2 weeks was calculated using the Toolkit for Weighting and Analysis of Non-equivalent Groups (TWANG)²⁰ within R version 6.0²¹ using the variables outlined in Table S1. Two models were investigated: Model 1, an inverse probability of treatment (IPT) model that used propensity weights to control for the differences in those who saw a GP; and Model 2, a doubly robust IPT model that also used propensity weights but further directly controlled for the influence of covariates on hospitalisation outcomes. A doubly robust approach to estimation has been shown to have advantages in estimating causal effects using observational data.²² Where differences in characteristics between those who saw a GP and those who did not were not able to be adequately adjusted for using the propensity weights and the direct controlling, separate models were run.

Ethics approval for this research project was granted by the New South Wales Population and Health Services Research Ethics Committee (Reference no. 2016/06/642) and the UNSW

Human Research Ethics Committee for the 45 and Up Study overall. All participants provided written consent before participating in the 45 and Up Study, which included consent to follow them over time using their health and other records, contact them in the future about changes in health and lifestyle and use their data for health research and in reports and publications based on deidentified information.

Availability of data and materials

The data that support the findings of this study are available from the Sax Institute, but restrictions apply to the availability of these data, which were used under licence for the present study, and so are not publicly available. However, the data are available from the authors upon reasonable request and with permission of the Sax Institute.

Results

Of the 30 645 CES participants, there were 10 240 eligible participants with an index hospitalisation within 5 years of recruitment to the 45 and Up Study. Fig. 1 shows a summary of the inclusion and exclusion criteria and the resultant eligible participants. Participants were excluded if they reported holding a Department of Veterans Affairs card due to incomplete MBS data ($n = 585$), if possible data linkage errors were detected ($n = 11$), if the participant died ($n = 36$) or their hospitalisation was not likely to warrant post-discharge GP care ($n = 1974$) in that the patient was discharged to a nursing home or transferred to another hospital or the hospitalisation involved dialysis or rehabilitation or was an arthrosis-related admission.

Participants were also excluded if they were readmitted to hospital within 2 weeks of hospital discharge ($n = 717$). Of the eligible participants, 6587 (64.3%) saw a GP within 2 weeks of discharge from the index hospitalisation and 75% had seen a GP within 1 month.

Factors associated with seeing a GP within 2 weeks of discharge

Fig. 2 shows the number of patients who saw a GP within 2 weeks for each of the sociodemographic, health risk and health status factors, as well as the adjusted risk ratios (RR) and 95% confidence intervals (CIs) controlling for age and sex. As shown in Fig. 2 the factors more likely to be significantly associated with seeing a GP within 2 weeks of discharge included increasing age, speaking a language other than English, having a lower income, having a health care card, being a current smoker, being underweight or obese (cf. being within the healthy weight range), having moderate or severe limitations, having very high psychological distress at baseline, self-reported diabetes at baseline, self-reported cardiovascular disease, having a longer length of stay for the index admission and having seen a GP frequently in the year before the index hospitalisation.

Factors less likely to be associated with seeing a GP within 2 weeks of discharge included being female, having less than high school qualifications (cf. university education), working part-time or full-time, having private health insurance, drinking alcohol, self-rated good health, having seen a specialist in the year before the index hospitalisation and having been hospitalised in the year before the index hospitalisation.

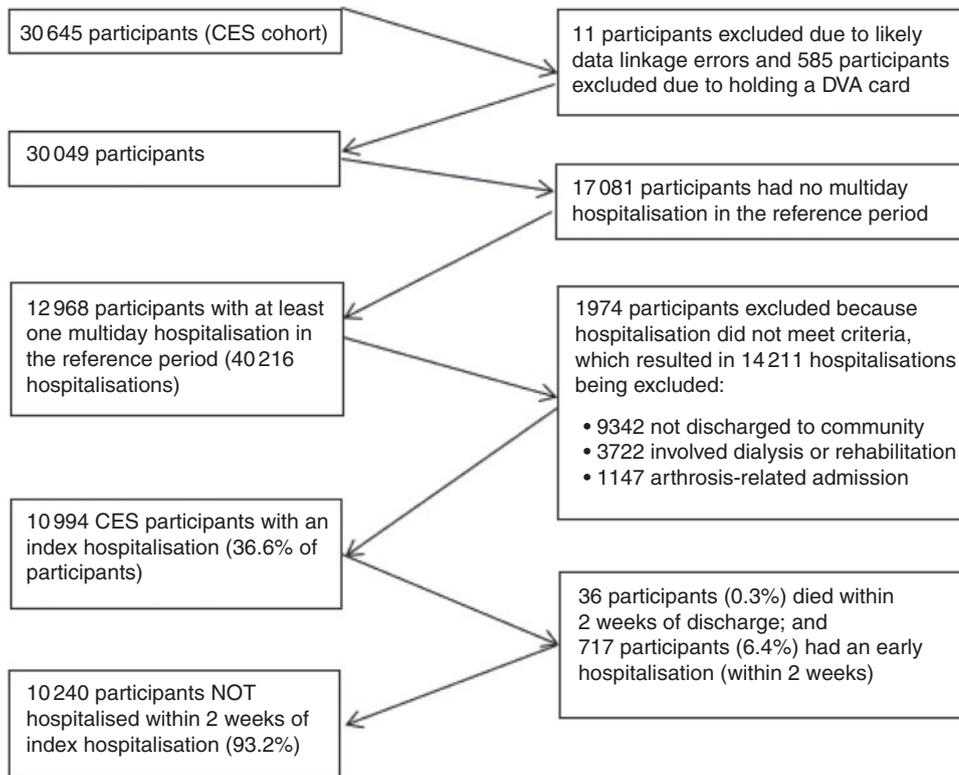


Fig. 1. Participant inclusion and exclusion criteria and resultant sample for the Central and Eastern Sydney (CES) cohort. DVA, Department of Veteran's Affairs.

Readmissions within 12 months of the index hospitalisation

Of the 10 240 eligible participants with an index hospitalisation, 2883 (28.2%) were rehospitalised (13.0% within the first month) and 88 died within 12 months following the index hospitalisation. As shown in Tables S2 and S3, after applying propensity weights to correct for the differences in characteristics between those who saw a GP within 2 weeks of discharge from the index hospitalisation and those who did not, there were still three variables that were marginally unbalanced: prior GP use, private health insurance status and whether someone held a health care card. Given these differences and the strong relationship between prior GP use and likelihood to see a GP after discharge, separate models were run for high and low GP use in the year before the index hospitalisation. Age and sex were additionally controlled for in the final doubly robust model. Sensitivity analysis was conducted to identify the most appropriate dichotomisation of the prior GP use categories, which resulted in infrequent GP users being classified as those with <8 visits in the year before the index hospitalisation and frequent users as those with ≥ 8 visits in the year before the index hospitalisation.

Effect of seeing a GP within 2 weeks of discharge on subsequent hospitalisations

Among the 4117 infrequent GP users, 894 (22%) were rehospitalised within the 12 months after discharge from the index hospitalisation. This proportion was slightly higher among those who saw a GP within 2 weeks of discharge (22.5% of the 2120 rehospitalisations) than among those who did not (20.9% of the

1997 rehospitalisations). However, as indicated by the hazard ratios (HRs) in Table 1, after adjusting for age and sex and the propensity to see a GP, the rate of rehospitalisation was significantly lower for those who saw a GP in the 2 weeks following discharge from the index hospitalisation (adjusted HR 0.83; 95% CI 0.70–0.97).

Among the 6123 frequent GP users, 1989 (33%) were rehospitalised within 12 months of discharge from the index hospitalisation. This proportion was higher among those who saw a GP within 2 weeks of discharge (34.5% of the 4467 rehospitalisations) than among those who did not (27.1% of the 1656 rehospitalisations). However, as also indicated in Table 1, after adjusting for age and sex and the propensity to see a GP, the rate of rehospitalisation was similar between the two groups (adjusted HR 1.02; 95% CI 0.90–1.17).

Effect of seeing a GP within 2 weeks of discharge on subsequent hospitalisations by condition

Table 2 shows index hospitalisations and rehospitalisations according to the International Classification of Diseases – Australian Modification principal chapter codes²³ for the top 10 chapters. The top chapters, accounting for 89.2% of the 10 240 index hospital admissions, were diseases of the circulatory system (16.9%), neoplasms (14.1%), diseases of the digestive system (11.4%), injury, poisoning and certain other consequences of external causes (10.6%), diseases of the genitourinary system (10.4%) and diseases of the musculoskeletal system and connective tissue (8.5%). As also shown in Table 2,

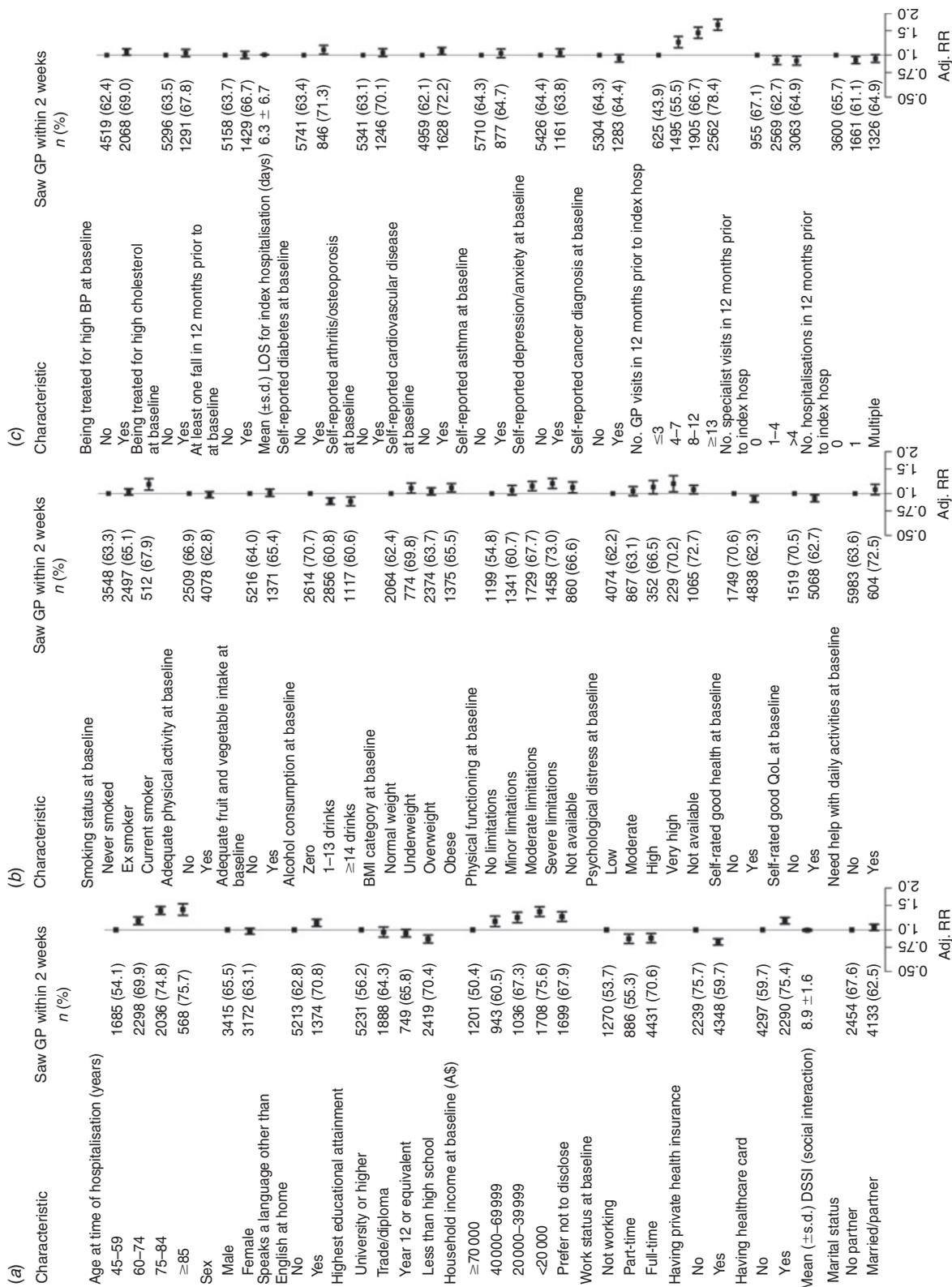


Fig. 2. Relationship between seeing a general practitioner (GP) within 2 weeks of discharge and (a) sociodemographic factors, (b) risk and protective factors and (c) health status and healthcare utilisation factors. Note, all risk ratios are adjusted (Adj. RR) for age and sex, except for age, which is adjusted for age only. BMI, body mass index; BP, blood pressure; DSSI, Duke Social Support Index; LOS, length of stay; QoL, quality of life.

Table 1. Cox proportional hazards modelling the association between seeing a general practitioner (GP) within 2 weeks of discharge and rehospitalisation, stratified by infrequent and frequent GP use in the year before the index hospitalisation

Data are given as hazard ratio with 95% confidence intervals in parentheses. Weighted model, inverse propensity weighted to account for characteristics that influence the propensity of seeing a GP; doubly robust model, inverse propensity weighted as per the weighted model plus further controlled for age and sex.

* $P < 0.05$

	Saw a GP within 2 weeks of discharge from index hospitalisation	
	Weighted model	Doubly robust model
All	1.00 (0.90–1.11)	0.97 (0.88–1.08)
Infrequent GP users	0.86 (0.74–1.01)	0.83 (0.70–0.97)*
Frequent GP users	1.04 (0.91–1.18)	1.02 (0.90–1.17)

Table 2. Index hospitalisations by first rehospitalisations showing top 10 principal diagnosis chapters (International Classification of Diseases – Australian Modification) for those who did and did not see a general practitioner (GP) within 2 weeks of discharge from the index hospitalisation

Unless indicated otherwise, data are given as n (%). Bolded entries indicate lower rates in those who saw a GP compared to those who did not

Index admission chapter	Total no.	Saw a GP	Rehospitalised			
			Total no.	Same chapter as index	Those who saw a GP	Those who did not see a GP
Chapter 2. Neoplasms	1438	713 (49.6)	464 (32.3)	185 (39.9)	271 (38.0)	193 (26.6)
Chapter 3. Endocrine system	242	142 (58.7)	50 (20.7)	10 (20.0)	31 (21.8)	19 (19.0)
Chapter 4. Mental, behavioural and neurological disorders	234	147 (62.8)	82 (35.0)	48 (58.5)	46 (31.3)	36 (41.4)
Chapter 5. Circulatory system	1729	1426 (82.5)	555 (32.1)	236 (42.5)	450 (31.6)	105 (34.7)
Chapter 6. Respiratory system	635	512 (80.6)	229 (36.1)	85 (37.1)	183 (35.7)	46 (37.4)
Chapter 7. Digestive system	1170	769 (65.7)	307 (26.2)	103 (33.6)	226 (29.4)	81 (20.2)
Chapter 8. Musculoskeletal system and connective tissue	866	474 (54.7)	179 (20.7)	59 (33.0)	118 (24.9)	61 (15.6)
Chapter 9. Genitourinary system	1064	515 (48.4)	223 (21.0)	69 (30.9)	139 (27.0)	84 (15.3)
Chapter 10. Symptoms, signs	660	502 (76.1)	215 (32.9)	29 (13.5)	169 (33.7)	46 (29.1)
Chapter 11. Injury, poisoning and other external causes	1086	660 (60.8)	253 (23.3)	71 (28.1)	164 (24.9)	89 (20.9)

the rehospitalisations by top 10 chapters, accounting for 88.0% of the 2883 rehospitalisations, were similar to those for the index hospitalisations.

For approximately one-third of participants, the disease chapter for the index hospitalisation and rehospitalisation were the same, with the highest being for mental, behavioural and neurological disorders (58.5%), followed by diseases of the circulatory system (42.5%) and diseases of the respiratory system (37.1%). These were also the chapters where rehospitalisations were lower in those who had seen a GP within 2 weeks of discharge from the index hospitalisation (Table 2).

Discussion

Of the 10 240 eligible participants in CES with an overnight hospitalisation, two-thirds saw a GP within 2 weeks of discharge and three-quarters saw a GP within the first month. These proportions are similar to those reported by Roughead *et al.* (71% within the first month and a median time of 12 days), who used the Department of Veterans' Affairs claims database to examine the length of time from hospital discharge until a GP, pharmacy, specialist or care planning service visit.²⁴ Similar findings were also reported by Watson *et al.*, who examined GP follow-up after ED discharge from Fairfield Hospital in south-western Sydney (76% by Day 7).²⁵

We found that the groups more likely to see a GP within 2 weeks of discharge were older, current smokers, more socially

disadvantaged, with more chronic health conditions, saw their GP regularly and had a longer length of stay in hospital for the index hospitalisation. Those less likely to see a GP within 2 weeks of discharge were female, more advantaged, working, had good self-rated health, saw a specialist and had been hospitalised in the 12 months before the index hospitalisation. Other Australian research, conducted at St George Hospital (Sydney, NSW, Australia), examined 247 participants and found that GP follow-up after an ED visit that may have resulted in hospitalisation was more likely for people who were aware of the reason for follow-up, who were admitted to hospital through the ED, who had health insurance or who had a regular GP.²⁶ In the present study, the groups less likely to see a GP within 2 weeks of discharge were not in the at-risk 30-day readmission groups identified by other researchers (i.e. older, male, low income, no insurance), suggesting that follow-up is occurring for those with the highest need.^{27,28}

Of the 6587 participants who saw a GP within 2 weeks of discharge from their index hospitalisation, over one-third had another hospital admission within the next 12 months. Time to rehospitalisation followed a different pattern for infrequent and frequent GP users. After controlling for confounding factors, infrequent GP users who saw a GP within 2 weeks had a lower rate of rehospitalisation (17% less) than those who did not. This is in contrast to the 'no protective effects' of GP visits within 2 weeks of hospital discharge found by Jackson *et al.*¹⁴ and Field *et al.*²⁹

Understanding the differences we found in rehospitalisation rates between frequent and infrequent GP users is complex. As Tooth *et al.* found, different types of morbidities are associated with different use of services.³⁰ Specifically, Tooth *et al.* found that more serious conditions, such as cancer and stroke, predicted frequent GP use compared with non-life-threatening conditions such as arthritis and urinary incontinence.³⁰ The lack of a protective effect for the frequent GP user group that we found may be due, in part, to GP visits being less effective in avoiding hospitalisation in these patients (i.e. the patients were sicker). In contrast, the GP may have had a greater ability to intervene and prevent readmission in those patients who were less seriously ill and who required support that the GP could offer. Roughead *et al.* found that although patients may see the GP early, GPs often lack information from the hospital in the form of early discharge communication.²⁴

Interestingly, when we examined GP follow-up and rehospitalisation by principal diagnosis chapters, we found that for approximately one-third of participants the chapter for the index hospitalisation and rehospitalisation were the same, with the highest being for mental, behavioural and neurological disorders, diseases of the circulatory system and diseases of the respiratory system. These were also the chapters where rehospitalisations were lower in those who had seen a GP within 2 weeks of discharge from the index hospitalisation, highlighting the potential role of the GP in minimising hospitalisations for long-term chronic conditions, except for cancer, for which management patterns differ.

The findings of the present study support the need to maximise information flow and shared care between the patient, hospital and GP for timely, effective and safe transfer of care from hospital to community after a hospitalisation, as described by Cresswell *et al.*³¹ and Schwarz *et al.*³² Although this will differ by condition and situation, having easy-to-understand information that is consistent between each of the providers, within providers and across different modes, including online, is critical before and after discharge.

Although we did not have access to the discharge summary data for this study, we did have information on usual practice regarding the provision of discharge summaries in the study area. Electronic discharge summaries can be provided by hospitals in the study area. However, they can only be provided to the relevant GP if the GP's details are available and up to date on a patient's electronic medical record. So, having both hard and electronic discharge summaries is still important in bridging the communication gap between GPs and hospitals, as is having a discharge summary that is completed in a timely manner and contains quality information.

A major strength of this study was the use of an extremely large community-dwelling cohort of older people that was not limited to only those who have contact with health services, thus providing a more realistic denominator. However, there were some limitations with the cohort and the study. Although the 45 and Up Study cohort is reasonably representative of the population from which it was drawn, non-response at baseline may mean that the cohort varies slightly from the population.³³ Nevertheless, comparison of these rates over time and between subgroups is still valid. Another limitation of the MBS data is the lack of any information regarding the reason for the primary care consultation.

Further research to examine the effect of GP follow-up within 2 weeks of hospital discharge by specific conditions in more detail, as well as how it may differ across health service regions in NSW and over different time periods, particularly following the introduction of My Health Record, would be informative. This would allow us to understand whether the introduction of My Health Record can, as Wellson and Sweet stated,³⁴ improve information sharing, integration of care and ultimately patient outcomes.

Conclusion

The groups more likely to see a GP within 2 weeks of discharge were those who were older, more socially disadvantaged and had more chronic health conditions, suggesting that follow-up is being targeted to those with the highest need. Seeing a GP within 2 weeks of hospital discharge was associated with reduced rates of hospital readmission in the next 12 months for infrequent GP users but not for frequent GP users. Discharge planning and the transfer of care from the hospital to the GP through discharge arrangements have substantial benefits for both patients and the health system.

Competing interests

The authors declare that they have no competing interests.

Acknowledgments

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