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

Margo Linn Barr [ID] [1,5] BSc, MPH, GCertTertTLP, PhD, Associate Professor and Director

Heidi Welberry [1] BSc, MBiostats, Project manager/data analyst

John Hall [2] MBBS, PhD, MPHTM, FACRRM, FAFPHM, Primary Care Professor

Elizabeth J. Comino [1] BVSc, MPH, PhD, Associate Professor

Elizabeth Harris [1] BA, DipSocWk, DipEdu, MPH, PhD, Associate Professor

Ben F. Harris-Roxas [1] BSW, MPASR, PhD, Associate Professor and Director

Tony Jackson [3] BSc Health (Nursing), MA, GradDipPA, Deputy Director, Population and Community Health

Debra Donnelly [4] RN, GradDipMgt, Clinical Manager

Mark Fort Harris [1] MBBS MDSyd, DRACOG, FRACGP, PhD, Professor and Executive Director

[1]Centre for Primary Health Care and Equity, Faculty of Medicine, Level 3, AGSM Building, UNSW, Sydney, NSW 2052, Australia. Email: h.welberry@unsw.edu.au; e.comino@unsw.edu.au; e.harris@unsw.edu.au; b.harris-roxas@unsw.edu.au; m.f.harris@unsw.edu.au
[2]Faculty of Medicine, Wallace Wurth Building, 18 High Street, UNSW, Sydney, NSW 2052, Australia. Email: john.hall@unsw.edu.au
[3]South Eastern Sydney Local Health District, NSW Health, District Executive Unit, Locked Mail Bag 21, Tarren Point, NSW 2229, Australia. Email: tony.jackson@health.nsw.gov.au
[4]Sydney Local Health District, NSW Health, Level 11, KGV Building, Missenden Road, Camperdown, NSW 2050, Australia. Email: debra.donnelly@health.nsw.gov.au
[5]Corresponding author. Email: margo.barr@unsw.edu.au

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.

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 Linkage[18] 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 data[19] or NSW Admitted Patient Data Collection data[18] 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 6.0[21] 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.
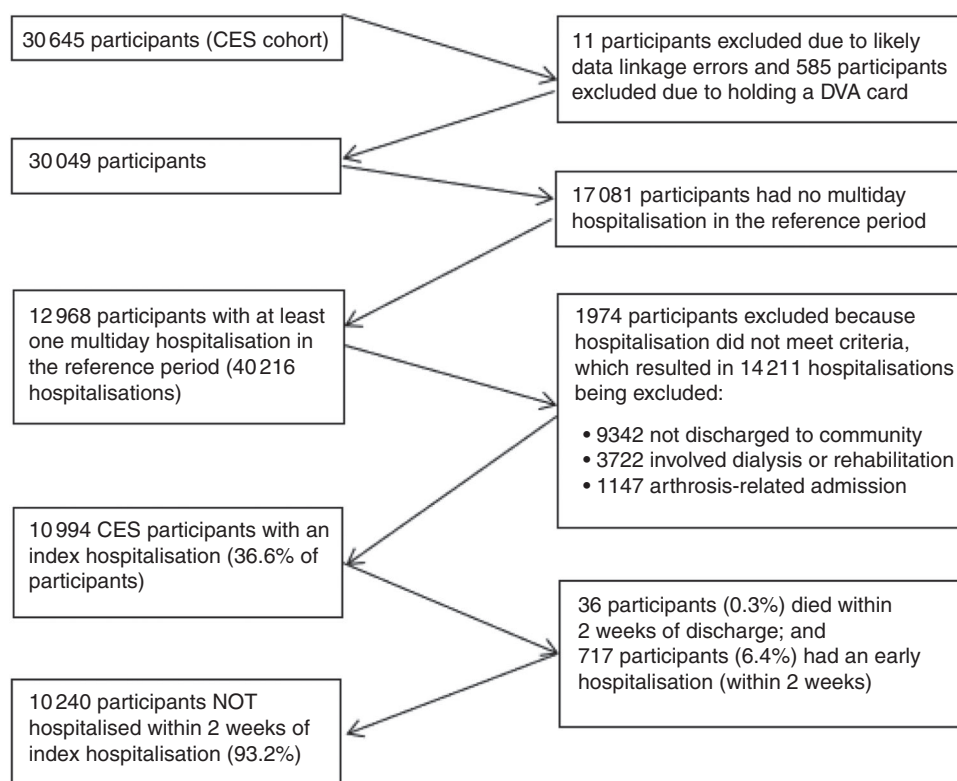
Results

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
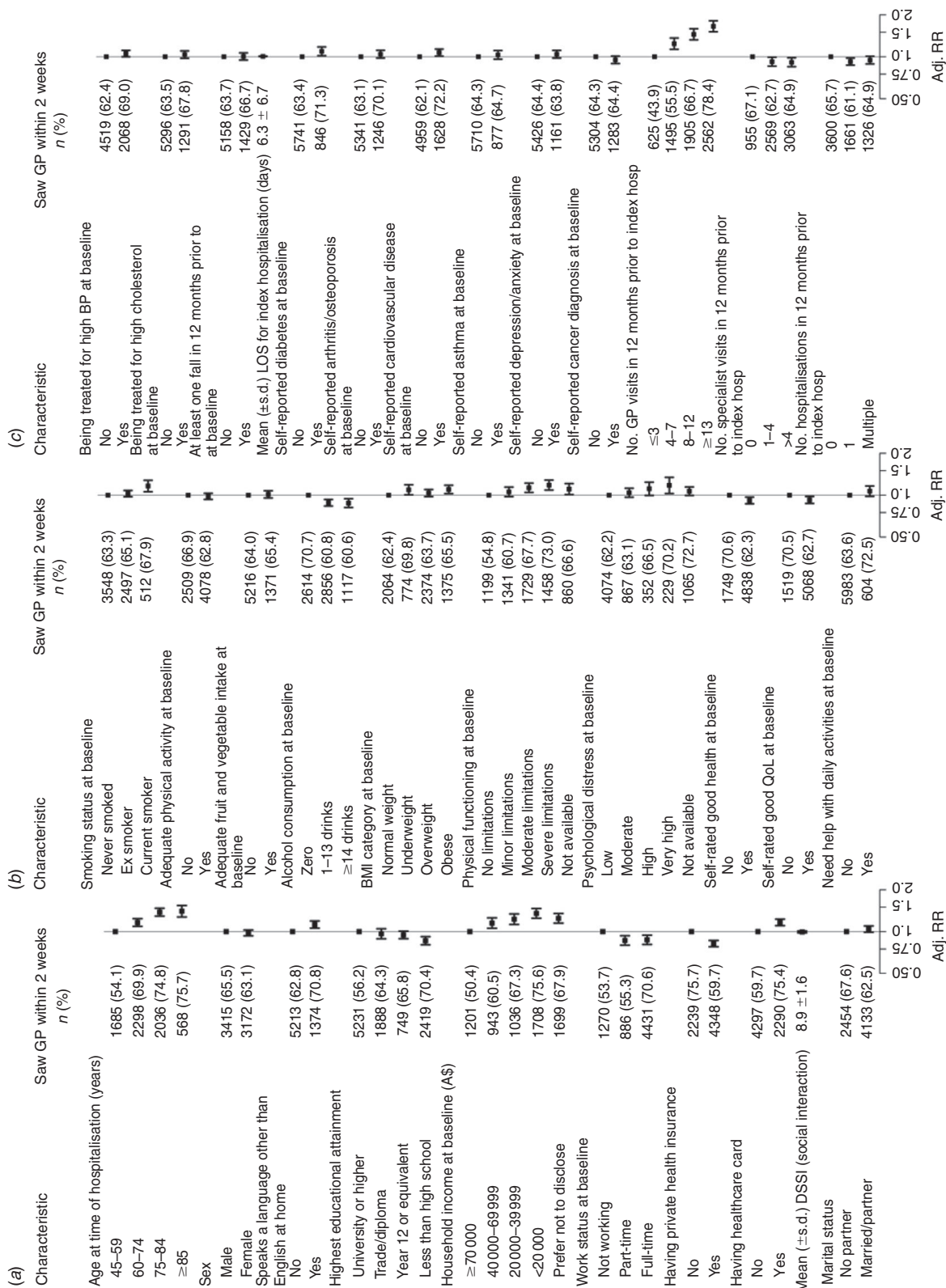
1997 rehospitalisations). However, as indicated by the hazard ratios (HRs) in Table 1, after adjusting for age and sex and the propensity to see a GP, the rate of rehospitalisation was significantly lower for those who saw a GP in the 2 weeks following discharge from the index hospitalisation (adjusted 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 codes[23] 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,

(a)

Characteristic	Saw GP within 2 weeks n (%)
Age at time of hospitalisation (years)	
45–59	1685 (54.1)
60–74	2298 (69.9)
75–84	2036 (74.8)
≥85	568 (75.7)
Sex	
Male	3415 (65.5)
Female	3172 (63.1)
Speaks a language other than English at home	
No	5213 (62.8)
Yes	1374 (70.8)
Highest educational attainment	
University or higher	5231 (56.2)
Trade/diploma	1888 (64.3)
Year 12 or equivalent	749 (65.8)
Less than high school	2419 (70.4)
Household income at baseline (A$)	
≥70 000	1201 (50.4)
40 000–69 999	943 (60.5)
20 000–39 999	1036 (67.3)
<20 000	1708 (75.6)
Prefer not to disclose	1699 (67.9)
Work status at baseline	
Not working	1270 (53.7)
Part-time	886 (55.3)
Full-time	4431 (70.6)
Having private health insurance	
No	2239 (75.7)
Yes	4348 (59.7)
Having healthcare card	
No	4297 (59.7)
Yes	2290 (75.4)
Mean (±s.d.) DSSI (social interaction)	8.9 ± 1.6
Marital status	
No partner	2454 (67.6)
Married/partner	4133 (62.5)

Adj. RR: 0.50 0.75 1.0 1.5 2.0

(b)

Characteristic	Saw GP within 2 weeks n (%)
Smoking status at baseline	
Never smoked	3548 (63.3)
Ex smoker	2497 (65.1)
Current smoker	512 (67.9)
Adequate physical activity at baseline	
No	2509 (66.9)
Yes	4078 (62.8)
Adequate fruit and vegetable intake at baseline	
No	5216 (64.0)
Yes	1371 (65.4)
Alcohol consumption at baseline	
Zero	2614 (70.7)
1–13 drinks	2856 (60.8)
≥14 drinks	1117 (60.6)
BMI category at baseline	
Normal weight	2064 (62.4)
Underweight	774 (69.8)
Overweight	2374 (63.7)
Obese	1375 (65.5)
Physical functioning at baseline	
No limitations	1199 (54.8)
Minor limitations	1341 (60.7)
Moderate limitations	1729 (67.7)
Severe limitations	1458 (73.0)
Not available	860 (66.6)
Psychological distress at baseline	
Low	4074 (62.2)
Moderate	867 (63.1)
High	352 (66.5)
Very high	229 (70.2)
Not available	1065 (72.7)
Self-rated good health at baseline	
No	1749 (70.6)
Yes	4838 (62.3)
Self-rated good QoL at baseline	
No	1519 (70.5)
Yes	5068 (62.7)
Need help with daily activities at baseline	
No	5983 (63.6)
Yes	604 (72.5)

Adj. RR: 0.50 0.75 1.0 1.5 2.0

(c)

Characteristic	Saw GP within 2 weeks n (%)
Being treated for high BP at baseline	
No	4519 (62.4)
Yes	2068 (69.0)
Being treated for high cholesterol at baseline	
No	5296 (63.5)
Yes	1291 (67.8)
At least one fall in 12 months prior to at baseline	
No	5158 (63.7)
Yes	1429 (66.7)
Mean (±s.d.) LOS for index hospitalisation (days)	6.3 ± 6.7
Self-reported diabetes at baseline	
No	5741 (63.4)
Yes	846 (71.3)
Self-reported arthritis/osteoporosis at baseline	
No	5341 (63.1)
Yes	1246 (70.1)
Self-reported cardiovascular disease at baseline	
No	4959 (62.1)
Yes	1628 (72.2)
Self-reported asthma at baseline	
No	5710 (64.3)
Yes	877 (64.7)
Self-reported depression/anxiety at baseline	
No	5426 (64.4)
Yes	1161 (63.8)
Self-reported cancer diagnosis at baseline	
No	5304 (64.3)
Yes	1283 (64.4)
No. GP visits in 12 months prior to index hosp	
≤3	625 (43.9)
4–7	1495 (55.5)
8–12	1905 (66.7)
≥13	2562 (78.4)
No. specialist visits in 12 months prior to index hosp	
0	955 (67.1)
1–4	2569 (62.7)
>4	3063 (64.9)
No. hospitalisations in 12 months prior to index hosp	
0	3600 (65.7)
1	1661 (61.1)
Multiple	1326 (64.9)

Adj. RR: 0.50 0.75 1.0 1.5 2.0

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 sex only, and sex, 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

References

1   Braithwaite J, Hibbert P, Blakely B, Plumb J, Hannaford N, Long JC, Marks D. Health system frameworks and performance indicators in eight countries: a comparative international analysis. *SAGE Open Med* 2017; 5: 2050312116686516. doi:10.1177/2050312116686516

2   Australian Commission on Safety and Quality in Health Care (ACSQHC). National safety and quality health service standards. 2nd edn. Sydney: ACSQHC; 2017.

3   Australian Medical Association. General practice/hospitals transfer of care arrangements. 2013; Available at: https://ama.com.au/system/tdf/documents/AMA_position_statement_general_practice_and_hospitals_transfer_of_care_arrangements_final.pdf?file=1&type=node&id=40603 [verified 1 September 2018].

4   NSW Ministry of Health. Policy directive. Care coordination: planning from admission to transfer of care in NSW public hospitals. PD2011_015; 2011. Available at: https://www1.health.nsw.gov.au/pds/ActivePDSDocuments/PD2011_015.pdf [verified 22 September 2020].

5   Howlett JG, McKelvie RS, Costigan J, Ducharme A, Estrella-Holder E, Ezekowitz JA, Giannetti N, Haddad H, Heckman GA, Herd AM, Isaac D, Kouz S, Leblanc K, Liu P, Mann E, Moe GW, O'Meara E, Rajda M, Siu S, Stolee P, Swiggum E, Zeiroth S. The 2010 Canadian Cardiovascular Society guidelines for the diagnosis and management of heart failure update: heart failure in ethnic minority populations, heart failure and pregnancy, disease management, and quality improvement/assurance programs. *Can J Cardiol* 2010; 26: 185–202. doi:10.1016/S0828-282X(10)70367-6

6   Yancy CW, Jessup M, Bozkurt B, Butler J, Casey DE, Jr, Drazner MH, Fonarow GC, Geraci SA, Horwich T, Januzzi JL, Johnson MR, Kasper EK, Levy WC, Masoudi FA, McBride PE, McMurray JJ, Mitchell JE, Peterson PN, Riegel B, Sam F, Stevenson LW, Tang WH, Tsai EJ, Wilkoff BL. ACCF/AHA guideline for the management of heart failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on practice guidelines. American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *Circulation* 2013; 128: e240–327. doi:10.1161/CIR.0b013e31829e8776

7   Tran CTT, Lee DS, Flintoft VF, Higginson L, Grant FC, Tu JV, Cox J, Holder D, Jackevicius C, Pilote L, Tanser P, Thompson C, Tsoi E, Warnica W, Wielgosz A, Canadian Cardiovascular Outcomes Research Team/Canadian Cardiovascular SocietyAcute Myocardial Infarction Quality Indicator Panel. CCORT/CCS quality indicators for acute myocardial infarction care. *Can J Cardiol* 2003; 19: 38–45.

8   National Heart Foundation of Australia, Cardiac Society of Australia and New Zealand. Guidelines for the prevention, detection and management of chronic heart failure in Australia. 2011; Available at: https://www.csanz.edu.au/documents/guidelines/clinical_practice/2011_HF_CSANZ_Chronic_Heart_Failure.pdf [verified 25 September 2018].

9   Cohen MD, Hilligoss PB. The published literature on handoffs in hospitals: deficiencies identified in an extensive review. *Qual Saf Health Care* 2010; 19: 493–7. doi:10.1136/qshc.2009.033480

10 Vedsted P, Christensen MB. Frequent attenders in general practice care: a literature review with special reference to methodological considerations. *Public Health* 2005; 119: 118–37. doi:10.1016/j.puhe.2004.03.007

11 Byrne M, Murphy AW, Plunkett PK, McGee HM, Murray A, Bury G. Frequent attenders to an emergency department: a study of primary health care use, medical profile, and psychosocial characteristics. *Ann Emerg Med* 2003; 41: 309–18. doi:10.1067/mem.2003.68

12 Scott IA. Preventing the rebound: improving care transition in hospital discharge processes. *Aust Health Rev* 2010; 34: 445–51. doi:10.1071/AH09777

13 Hansen LO, Young RS, Hinami K, Leung A, Williams MV. Interventions to reduce 30-day rehospitalization: a systematic review. *Ann Intern Med* 2011; 155: 520–8. doi:10.7326/0003-4819-155-8-201110180-00008

14 Jackson C, Shahsahebi M, Wedlake T, DuBard CA. Timeliness of outpatient follow-up: an evidence-based approach for planning after hospital discharge. *Ann Fam Med* 2015; 13: 115–22. doi:10.1370/afm.1753

15 Shen E, Koyama SY, Huynh DN, Watson HL, Mittman B, Kanter MH, Nguyen HQ. Association of a dedicated post-hospital discharge follow-up visit and 30-day re-admission risk in a Medicare Advantage population. *JAMA Intern Med.* 2017; 177: 132–5. doi:10.1001/jamainternmed.2016.7061

16 Comino EJ, Harris E, Page J, McDonald J, Harris MF. The 45 and Up Study: a tool for local population health and health service planning to improve integration of healthcare. *Public Health Res Pract* 2016; 26: e2631629. doi:10.17061/phrp2631629

17 45 and Up Study Collaborators. Cohort profile: the 45 and Up Study. *Int J Epidemiol* 2008; 37: 941–7. doi:10.1093/ije/dym184

18 NSW Ministry of Health. Centre for Health Record Linkage. Data Dictionaries: NSW Admitted Patient Data Collection 2018; Available at: https://www.cherel.org.au/data-dictionaries#section1 / [verified 1 September 2018].

19 Australian Government Department of Human Services. Medicare Benefits Schedule book, Publications number: 11720. 2017; Available at: http://www.mbsonline.gov.au/internet/mbsonline/publishing.nsf/Content/CF1350417910EAE6CA25817D0015AF5B/$File/201709-MBS.pdf [verified 1 September 2018].

20 Griffin BA, Ridgeway G, Morral AR, Burgette LF, Martin C, Almirall D, Ramchand R, Jaycox LH, McCaffrey DF. Toolkit for Weighting and Analysis of Nonequivalent Groups (TWANG) Website. Santa Monica, CA: RAND Corporation, 2014. Available at: http://www.rand.org/statistics/twang

21 R Core Team. (2019). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL Available at: https://www.R-project.org/.

22 Funk MJ, Westreich D, Wiesen C, Stürmer T, Brookhart MA, Davidian M. Doubly robust estimation of causal effects. *Am J Epidemiol* 2011; 173: 761–7. doi:10.1093/aje/kwq439

23 National Centre for Classification in Health (NCCH). The international statistical classification of diseases and related health problems, 10th Revision, Australian modification (ICD-10-AM). Australian Coding Standards. Sydney: NCCH; 2006.

24 Roughead EE, Kalisch LM, Ramsay EN, Ryan P, Gilbert AL. Continuity of care: when do patients visit community healthcare providers after leaving hospital? *Intern Med J* 2011; 41: 662–7. doi:10.1111/j.1445-5994.2009.02105.x

25 Watson B, Tam CW, Pellizzon B, Ban L, Doan H. General practitioner follow-up in older patients after an emergency department admission. *Aust Fam Physician* 2017; 46: 521–6.

26 Qureshi R, Asha SE, Zahra M, Howell S. Factors associated with failure to follow up with a general practitioner after discharge from the emergency department. *Emerg Med Australas* 2012; 24: 604–9. doi:10.1111/j.1742-6723.2012.01610.x

27 Silverstein MD, Qin H, Mercer SQ, Fong J, Haydar Z. Risk factors for 30-day hospital re-admission in patients ≥65 years of age. *Proc Bayl Univ Med Cent* 2008; 21: 363–72. doi:10.1080/08998280.2008.11928429

28 Considine J, Fox K, Plunkett D, Mecner M, O'Reilly M, Darzins P. Factors associated with unplanned re-admissions in a major Australian health service. *Aust Health Rev* 2019; 43: 1–9. doi:10.1071/AH16287

29 Field TS, Ogarek J, Garber L, Reed G, Gurwitz JH. Association of early post-discharge follow-up by a primary care physician and 30-day rehospitalization among older adults. *J Gen Intern Med* 2015; 30: 565–71. doi:10.1007/s11606-014-3106-4

30 Tooth L, Hockey R, Byles J, Dobson A. Weighted multimorbidity indexes predicted mortality, health service use, and health-related quality of life in older women. *J Clin Epidemiol* 2008; 61: 151–9. doi:10.1016/j.jclinepi.2007.05.015

31 Cresswell A, Hart M, Suchanek O, Young T, Leaver L, Hibbs H.. Mind the gap: improving discharge communication between secondary and primary care. *BMJ Quality Improvement Reports* 2015; 4: u207936.w3197. doi:10.1136/bmjquality.u207936.w3197

32 Schwarz CM, Hoffmann M, Schwarz P, Kamolz L-P, Brunner G, Sendlhofer G. A systematic literature review and narrative synthesis on the risks of medical discharge letters for patients' safety. *BMC Health Serv Res* 2019; 19: 158. doi:10.1186/s12913-019-3989-1

33 Mealing NM, Banks E, Jorm LR, Steel DG, Clements MS, Rogers KD. Investigation of relative risk estimates from studies of the same population with contrasting response rates and designs. *BMC Med Res Methodol* 2010; 10: 26. doi:10.1186/1471-2288-10-26

34 Wellson L (au.), Sweet M (ed.) An important overview of the pros, cons and questions about My Health Record. *Croakey* 6 June, 2018. Available at https://croakey.org/an-important-overview-of-the-pros-cons-and-questions-about-my-health-record/ [verified 18 February 2019].