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Conditions associated with the initiation of domiciliary care following a hospital admission: a cohort study in East London, England

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ABSTRACT

Objective Older people and people with complex needs often require both health and social care services, but there is limited insight into individual journeys across these services. To help inform joint health and social care planning, we aimed to assess the relationship between hospital admissions and domiciliary care receipt.

Design Retrospective cohort study, using linked data on primary care activity, hospital admissions and social care records.

Setting London Borough of Barking and Dagenham, England.

Participants Adults aged 19 and over who lived in the area on 1 April 2018 and who were registered at a general practice in East London between 1 April 2018 and 31 March 2020 (n=140 987).

Outcome measures The outcome was initiation of domiciliary care. We estimated the rate of hospital-associated care package initiation, and of care packages unrelated to hospital admission. We also described the characteristics of hospital admissions that preceded domiciliary care, including primary diagnosis codes.

Results 2041/140 987 (1.4%) participants had a domiciliary care package during a median follow-up of 1.87 years. 32.6% of packages were initiated during a hospital stay or within 7 days of discharge. The rate of new domiciliary care packages was 120 times greater (95% CI 110 to 130) during or after a hospital stay than at other times, and this association was present for all age groups. Primary admission reasons accounting for the largest number of domiciliary care packages were hip fracture, pneumonia, stroke, urinary tract infection, septicaemia and exacerbations of long-term conditions (chronic obstructive pulmonary disease and heart failure). Admission reasons with the greatest likelihood of a subsequent domiciliary care package were fractures and strokes.

Conclusion Hospitals are a major referral route into domiciliary care. While patients admitted due to new and acute illnesses account for many domiciliary care packages, exacerbations of long-term conditions and age-related and frailty-related conditions are also important drivers.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study describes publicly funded domiciliary care and its relationship with hospital admissions for the entire population of an area in England.
⇒ Individual-level linked hospital and social care data were used, allowing us to track patients' journeys across services.
⇒ This is an observational study, using administrative records that lack information on some factors that influence domiciliary care need, such as functional status, living arrangements and availability of informal carer support.
⇒ Factors that may limit the generalisability of the findings include high levels of socioeconomic deprivation, young age and ethnic diversity of the local population, as well as differences between local areas in approaches to social care commissioning and provision.

BACKGROUND

Domiciliary care, also known as home care, comprises a range of services that support people living in their own home. This includes help with personal care and routine household tasks, aiming to improve individuals' health and well-being, and to maintain their independence. Several factors contribute to the rising demand for domiciliary care services, including an ageing population, medical advances that enable people to live longer with chronic conditions, a decrease in the number of care home beds and rising care costs, as well as the national policy ambition to enable people to live independently for as long as possible.[1] In England, an estimated 714 000 adults received publicly or privately funded homecare services in 2019.[2 3] The majority of clients are older people, though domiciliary care services also support some younger clients who have difficulty with personal and household tasks.

Social care services in England, including domiciliary care, are funded from local government budgets, rather than through the National Health Service (NHS). Local authorities usually

do not provide these services directly, but commission them from independent third-party providers. In 2018/2019, local authorities in England spent £1411 million on directly commissioning homecare for older people with physical or sensory needs.[2] Unlike healthcare provided by the NHS, which is free at the point of service, access to publicly funded social care in England is needs-tested and means-tested. A referral for domiciliary care can come from family members or carers, social workers, hospital staff or primary care but in all instances a needs assessment by social services is carried out before a package can be initiated. If an individual's savings are above a fixed threshold, they are responsible for partially or fully funding their own care, but the proportion of so-called self-funders varies widely between local areas. Recent cuts to local government budgets and rising costs of care packages have led to increasing pressure on services.[4]

Older people and people with complex health needs often move between different kinds of care. Hospital stays can be detrimental to older people's health and well-being, and can lead to decreased physical function and increased dependence.[5–7] In England, one in five requests for social care support received by local authorities relate to people being discharged from hospital, though this figure does not differentiate domiciliary care and other types of social care, and this includes requests that are redirected or denied.[8] By supporting people to return home, domiciliary care also enables hospitals to operate efficiently. Waiting for domiciliary care packages is a frequent bottleneck in the hospital discharge process and was the reason for 21% of delayed transfers of care in the NHS in 2019/2020.[9]

We aimed to help health and local authority planners and commissioners anticipate and plan for future domiciliary care need by providing a more detailed understanding of the relationship between hospital admissions and domiciliary care provision, which has not been examined quantitatively before. We used a local, linked health and social care dataset to examine (a) what proportion of new, publicly funded domiciliary care packages were associated with discharge from hospital, (b) which groups of hospital patients have the greatest likelihood of receiving domiciliary care after discharge.

METHODS

Study design

This is a cohort study of adults living in the London Borough of Barking and Dagenham (LBBD), England. We described the incidence of new domiciliary care packages and their association with hospital admissions.

Local context

The LBBD is an urban area in East London. Compared with England, the population is young, socioeconomically deprived and ethnically diverse. Just 9% of Barking and Dagenham's population is over the age of 65, compared with 19% nationally, making it one of the youngest boroughs in London.[10] Barking and Dagenham is ranked 20th most income-deprived local authority in England by the Office for National Statistics, with 19.4% of the overall population and 26.1% of people aged 60 or over experiencing income deprivation.[11] Around half of the population is White British, with large numbers of people describing their ethnicity as Black African, Indian, Pakistani, Bangladeshi and White Other.[12] Many of this last group have Eastern European heritage, and Lithuanian is the second-most spoken language in the borough.[13] Although data on people paying for their own care is generally poor, a disproportionately small proportion of domiciliary users in Barking and Dagenham are estimated to pay for their own care because of high levels of income deprivation. In 2014, LBBD estimated that 11% of domiciliary care users fund their own care, compared with 20–25% nationally.

Data source

The 'Care City cohort' is a resource of linked administrative health and care records in East London. It was set up by local authorities and NHS commissioners to allow individual-level analysis of service use across multiple settings of care. It includes two central lists: residents of the LBBD, and patients registered with primary care providers in the North East London Clinical Commissioning Group (an NHS commissioning organisation). The resource includes information from local authority services, including Adult Social Care provision such as domiciliary care, and information from local primary care providers (such as appointments, clinical diagnoses, number of comorbidities, number of prescriptions and date of death). The data are linked to national databases including Hospital Episode Statistics, a database of NHS-funded hospital activity in England.

Population

We included people aged 19 and over who lived in the LBBD on 1 April 2018 and were also registered at a general practice (GP) in East London between 1 April 2018 and 31 March 2020. The study entry date was the latest of 1 April 2018 and the first registration at a GP surgery. The study exit date was the earliest of 31 March 2020 or the date of death. We extracted participants' age and sex from the central local authority list, and comorbidities at study entry from primary care data.

Domiciliary care packages

The outcome was a new domiciliary care package recorded in the local authority Adult Social Care database. Some participants had overlapping care packages, and some had multiple packages in close proximity. We combined care packages by merging those that overlapped or had a gap of less than 30 days between the end date of one package and the start date of the next (figure 1). We then determined which packages started during a hospital admission or in the 7 days after discharge and classified these as 'hospital-associated' domiciliary care packages.

Figure 1 Processing of domiciliary care packages, and identification of hospital-associated domiciliary care packages.

Categorisation of hospital diagnoses

We categorised hospital discharges according to the primary International Classification of Diseases and Related Health Problems 10th Revision (ICD-10) discharge diagnosis code. We used the 3-digit version, for example, I21 ('acute myocardial infarction'), rather than the more detailed 4-digit version, for example, I21.4 ('acute subendocardial myocardial infarction'). Published code lists were used to identify hospital admissions where the primary diagnosis code was related to frailty.[14]

Statistical analysis

To estimate how frequently new domiciliary care packages were initiated, we expanded follow-up for individuals into days and calculated the duration of follow-up (in person-years), excluding times when participants had a 'live' domiciliary care package, by (a) age groups of 19–29, 30–39 and then 10-year age bands up to 80+; and (b) whether or not the participant was in the hospital or had been discharged in the previous 7 days. We then calculated the rate of new domiciliary care packages by age group and time period (during hospital admission or within 7 days of discharge, or other times).

To examine how frequently hospital admissions resulted in the initiation of domiciliary care packages and what the most common admission reasons were among patients who required domiciliary care, we calculated the number of hospital admissions and the number with an associated domiciliary care package for each primary hospital diagnosis code.

Finally, to understand which primary admission diagnoses were most strongly associated with receiving a domiciliary care package, we estimated a ratio of observed to expected domiciliary care packages for each diagnosis code with at least five associated packages. We estimated this ratio in four stages: (a) calculation of the proportion of admissions with an associated domiciliary care package, across the whole cohort; (b) applying this proportion to the number of admissions for each diagnosis code, giving an expected number; (c) dividing the observed number by the expected number to give a ratio; (d) estimation of a 95% CI for this ratio, assuming a Poisson distribution in the observed number of packages.

Analysis was performed using R V.3.6.2.

Patient and public involvement

No patients were involved in setting the research question or the outcome measures, nor were they involved in the design or conduct of the study. No patients were asked to advise on the interpretation or writing up of results. There are no plans to disseminate the results of the research to study participants.

RESULTS

The study included 140 987 participants, with a median follow-up of 1.87 years (IQR 1.85–94). 2041/140 987 (1.4%) participants had a domiciliary care package at any time during the 2-year follow-up period, with greater proportions among older participants and those with comorbidities (table 1). Of those with a domiciliary care package, 1777/2041 (87.1%) had only one package during the study. 693/140 987 (0.5%) participants had a hospital-associated domiciliary care package, with similar associations with age, sex and comorbidities.

The study included 2362 domiciliary care packages. 771/2362 (32.6%) started during or shortly after a hospital admission (in the 7 days after discharge, table 2). The rate of new domiciliary care packages during or shortly after a hospital stay was 120 times greater than the rate at other times (table 2). We found this strong association between hospital admission and domiciliary care in all age groups.

Participants were admitted to the hospital 67 268 times. In 771/67 268 (1.1%) of admissions, the admission was followed by a new domiciliary care package (table 3). Domiciliary care packages were more common for patients who were older, had more comorbidities, stayed in the hospital for longer and who were admitted as an emergency.

Table 1 Baseline characteristics of participants, additionally split by receipt of domiciliary care (DC) during the study period

Variable	Level	All participants (n=140 987)	Participants with DC package	
			DC package initiated at any time (n=2041, 1.4%)	Hospital-associated DC package (n=693, 0.5%)
Sex	Female	71 445 (50.7)	1255 (61.5)	442 (63.8)
	Male	69 542 (49.3)	786 (38.5)	251 (36.2)
Age at entry	19–29	28 344 (20.1)	23 (1.1)	<10 (<1.4)
	30–39	34 161 (24.2)	40 (2.0)	<10 (<1.4)
	40–49	29 447 (20.9)	63 (3.1)	11 (1.6)
	50–59	22 876 (16.2)	179 (8.8)	45 (6.5)
	60–69	13 048 (9.3)	301 (14.7)	107 (15.4)
	70–79	7849 (5.6)	504 (24.7)	187 (27.0)
	80+	5262 (3.7)	931 (45.6)	336 (48.5)
	Median (IQR)	42.6 (32.1–55.5)	78.6 (67.6–85.6)	79.6 (70.2–85.9)
Comorbidities	Blindness	1466 (1.0)	114 (5.6)	32 (4.6)
	Cancer	2992 (2.1)	233 (11.4)	95 (13.7)
	CHD	4649 (3.3)	422 (20.7)	162 (23.4)
	Kidney	2555 (1.8)	320 (15.7)	118 (17.0)
	Liver	1694 (1.2)	33 (1.6)	11 (1.6)
	COPD	4319 (3.1)	370 (18.1)	142 (20.5)
	Dementia	1246 (0.9)	272 (13.3)	84 (12.1)
	Depression	13 189 (9.4)	481 (23.6)	148 (21.4)
	Diabetes	14 413 (10.2)	632 (31.0)	219 (31.6)
	Heart failure	1358 (1.0)	200 (9.8)	88 (12.7)
	Learning disabilities	754 (0.5)	24 (1.2)	<10 (<2)
	Parkinson's disease	258 (0.2)	48 (2.4)	14 (2.0)
	PVD	795 (0.6)	82 (4.0)	30 (4.3)
	Stroke	2503 (1.8)	274 (13.4)	102 (14.7)

Data are n (%) or median (IQR). Small groups were censored.
CHD, coronary heart disease; COPD, chronic obstructive pulmonary disease; DC, domiciliary care; PVD, peripheral vascular disease.

The diagnoses accounting for the largest numbers of hospital-associated domiciliary care packages were hip fracture, pneumonia, stroke, urinary tract infection, chronic obstructive pulmonary disease (COPD), sepsis and heart failure (table 4), but after adjustment for the effect of age, not all of these diagnoses were associated with a higher-than-expected rate of domiciliary care. Diagnoses most strongly associated with domiciliary care (ie, with the highest ratio between observed and expected number of hospital-associated packages) were fractures and strokes (table 4 and figure 2).

DISCUSSION

Key findings

One-third of new domiciliary care packages were initiated during or immediately after a hospital stay in our East London cohort. Across all age groups, hospital admissions were strongly associated with new domiciliary care packages. Domiciliary care packages were more common among patients who were older, had more comorbidities, were admitted in an emergency and had longer hospital stays. There was also wide variation between primary admission reasons in the frequency of domiciliary care receipt after discharge. Heart failure diagnoses have previously been identified as a risk factor for longer-term social care need (within 5 years).[15] These findings are novel: while previous studies have examined the overlap between health and social care use,[16] no studies have yet looked at the role of healthcare services as the route into social care. They have important implications given the rising rates of emergency admissions in England and the pressures on social care services.

Strengths and limitations

A strength of our analysis is that it included individual-level linked data for all residents of a geographical area, including complete information on primary and secondary healthcare use and local authority-funded domiciliary care provision, thereby limiting the risk of selection bias. This type of data, covering both health and social care services, is not currently available in the UK at a national level. Despite being key to supporting adults to live independently in the community, there remains

Table 2 Association between hospital discharge and new domiciliary care (DC) packages, by age group and time period (95% confidence intervals)

Age group	During hospital admission or in the 7 days after discharge			Other times			Comparison	
	PYs	New DC package (A)	Rate/100 PYs (B)	PYs	New DC package (C)	Rate/100 PYs (D)	Rate ratio (B/D)	Proportion (%) (A/(A+C)×100)
19–29	<160*	<10*	0.65 (0.02 to 3.59)	75446	22	0.03 (0.02 to 0.04)	22.12 (1.24 to 105.25)	<29*
30–39	<210*	<10*	4.32 (1.97 to 8.20)	91298	36	0.04 (0.03 to 0.05)	109.53 (49.53 to 217.39)	<20*
40–49	221	12	5.42 (2.80 to 9.47)	80298	58	0.07 (0.05 to 0.09)	75.06 (38.40 to 134.67)	17.14 (9.55 to 28.42)
50–59	266	47	17.65 (12.97 to 23.47)	62656	145	0.23 (0.20 to 0.27)	76.27 (54.34 to 105.09)	24.48 (18.70 to 31.30)
60–69	238	122	51.17 (42.49 to 61.09)	35452	237	0.67 (0.59 to 0.76)	76.54 (61.35 to 95.00)	33.98 (29.14 to 39.17)
70–79	222	209	94.00 (81.69 to 107.64)	21120	395	1.87 (1.69 to 2.06)	50.26 (42.44 to 59.35)	34.60 (30.84 to 38.57)
80+	227	371	163.17 (146.99 to 180.65)	13376	698	5.22 (4.84 to 5.62)	31.27 (27.54 to 35.44)	34.71 (31.87 to 37.66)
All	1539	771	50.09 (46.62 to 53.76)	379646	1591	0.42 (0.40 to 0.44)	119.53 (109.63 to 130.21)	32.64 (30.76 to 34.58)

PY is calculated as the years elapsed between the cohort entry and exit dates, aggregated across participants.
*Small groups are censored and some values are rounded to prevent disclosure.
PYs, person-years.

little evidence on the nature of accessing and receiving home care.[17] Evidence on patterns of service use across and between health and social care settings is also scarce, largely due to limited access to linked datasets across the NHS and social care.

A limitation is that the dataset only captures domiciliary care provision funded by the local authority, not care that is paid for privately by individuals. Nationally, approximately 61% of home care is directly commissioned by local authorities (£2.4 billion, compared with £1.5 billion self-funding in 2018/2019).[2] As Barking and Dagenham is a relatively deprived area, in the bottom 10% with respect to household income and in the top 10% with respect to older age income deprivation, we expect there to be a lower proportion of people funding their own care.[11] This assumption is supported by our observation that 1.4% of the study cohort received domiciliary care at any point, which is comparable to the estimated 1.6% of the adult population in England who received publicly or privately funded homecare services in 2019.[2 3] Other factors that might limit the generalisability of the findings include the variation across geographies in approaches to commissioning and providing domiciliary care and the high socioeconomic deprivation, young age and ethnic diversity of the local population. Furthermore, there may be residual confounding due to limitations of the dataset, with several factors such as functional status, living arrangements, level and nature of informal carer support, and intensity or frequency of domiciliary care provided not available.

Due to the impact of the COVID-19 pandemic, and the likely differences in the relationship between hospitals and domiciliary care during that time, we purposefully limited follow-up to the period before COVID-19. The pandemic may have had several effects—with potential for more unmet need for domiciliary care at home and fewer people being identified in hospital as a result of changes in health seeking behaviour. In addition, patients being discharged after COVID-19 infection (which is associated with long hospital stays) may increase demand for domiciliary care, particularly given the multi-organ impact of the infection.

Implications for policy and practice

The results of the present study show that hospital admissions often precede domiciliary care packages. While we were not able to describe the type of domiciliary care provided, the diagnoses made in hospital provide some insight into the mechanisms behind this relationship. We argue that there are three overlapping mechanisms, the first one being accidents or illnesses that cause both the hospital admission and a new need for domiciliary care. Examples for this are strokes and fractures, which were strongly associated with domiciliary care need at the individual patient level and account for a substantial proportion of patients who require care after discharge. The second mechanism likely involves hospital-associated deconditioning, or loss of fitness due to bed rest and

Table 3 Characteristics of hospital admissions during the study period, by whether a new domiciliary care package was initiated during the hospital stay or within 7 days of hospital discharge

		Admissions	
Variable	**Level**	**with DC package n=771**	**without DC package n=66 497**
Age group	19–29	<10 (<1.3)	7461 (11.2)
	30–39	<10 (<1.3)	9837 (14.8)
	40–49	12 (1.6)	10 509 (15.8)
	50–59	47 (6.1)	12 342 (18.6)
	60–69	122 (15.8)	10 424 (15.7)
	70–79	209 (27.1)	8512 (12.8)
	80+	370 (48.0)	7412 (11.1)
	Median (IQR)	79.5 (70.0–85.7)	54.3 (39.3–69.4)
Sex	Female	489 (63.4)	39 607 (59.6)
	Male	282 (36.6)	26 890 (40.4)
Number of comorbidities at study entry	0	180 (23.3)	32 657 (49.2)
	1	243 (31.5)	18 807 (28.3)
	2	174 (22.6)	8656 (13.0)
	3+	174 (22.6)	6239 (9.4)
	Median (IQR)	1 (1–2)	1 (0–1)
Length of stay (days)	0	29 (3.8)	44 038 (66.2)
	1–4	107 (13.9)	14 419 (21.7)
	5–9	187 (24.3)	4401 (6.6)
	10–19	222 (28.8)	2184 (3.3)
	20+	226 (29.3)	1455 (2.2)
	Median (IQR)	11(6–22)	0 (0–1)
Admission type	Planned	90 (11.7)	41 618 (62.6)
	Emergency	681 (88.3)	24 879 (37.4)
Frail admission type (primary diagnosis)	No	650 (84.3)	65 488 (98.5)
	Yes	121 (15.7)	1009 (1.5)

Data are n (%) or median (IQR). Small groups were censored.
DC, domiciliary care.

inactivity. Our findings show that hospital stays followed by new domiciliary care packages were longer (median 11 days vs median 0 days for other admissions). Longer hospital stays for patients who subsequently receive domiciliary care may be due to more severe clinical need or delayed hospital discharges while patients wait for domiciliary care to be arranged. The third mechanism is hospital admissions uncovering an existing need for support or inability to cope at home, or minor illnesses that tip people who are 'just about managing' into a greater need for care. We found that many new domiciliary care packages follow age and frailty-related diagnoses such as pneumonia, acute exacerbations of COPD and urinary tract infections. These hospital admissions were not strongly predictive of domiciliary care for individual patients, but they are common and therefore precede a large absolute number of domiciliary care packages.

These three mechanisms have different implications for policy. Prevention of accidents and acute illnesses such as strokes are wider, long-term public health issues that are unlikely to be directly impacted by domiciliary care planners. Hospital associated deconditioning can be minimised by reducing delayed transfers of care which will require greater capacity and funding for social care services. Uncovering of existing need for domiciliary care in hospitals suggests that other referral routes may need to be strengthened. These include health services and community organisations that support older people, including primary care, other council services such as housing, voluntary organisations, ambulance services, and community care teams.

In the UK, these services currently have a challenging funding environment, driven by cuts to local authority budgets, an increasing focus of NHS funding on secondary (hospital) services rather than primary and community care, and increasing population needs and expectations. These factors may mean that community services have less capacity to identify unmet domiciliary

Table 4 Primary hospital diagnoses with at least five hospital-associated domiciliary care packages, and the observed-to-expected ratio for the frequency of domiciliary care after hospital discharge

ICD-10 code (3-digit) and description		Admissions	Admissions with DC package		
			Observed (O)	Expected (E)	Ratio O/E (95% CI)
Musculoskeletal, injuries					
S72	Fracture of femur	265	**69**	3.03	**22.8 (17.7 to 28.8)**
R29	Other symptoms and signs involving the nervous and musculoskeletal systems	425	**36**	4.86	7.4 (5.2 to 10.3)
M16	Coxarthrosis (arthrosis of hip)	303	20	3.46	5.8 (3.5 to 8.9)
S32	Fracture of lumbar spine and pelvis	101	19	1.15	**16.5 (9.9 to 25.7)**
M17	Gonarthrosis (arthrosis of knee)	604	16	6.91	2.3 (1.3 to 3.8)
S42	Fracture of shoulder and upper arm	88	13	1.01	**12.9 (6.9 to 22.1)**
S82	Fracture of lower leg; including ankle	201	11	2.30	4.8 (2.4 to 8.6)
T84	Complications of internal orthopaedic prosthetic devices; implants and grafts	143	10	1.63	6.1 (2.9 to 11.3)
M25	Other joint disorders; not elsewhere classified	675	8	7.72	1.0 (0.5 to 2.0)
S22	Fracture of rib(s); sternum and thoracic spine	50	6	0.57	**10.5 (3.9 to 22.9)**
S52	Fracture of forearm	112	5	1.28	3.9 (1.3 to 9.1)
M96	Postprocedural MSK, not elsewhere classified	33	5	0.38	13.3 (4.3 to 30.9)
Respiratory system					
J18	Pneumonia; organism unspecified	1178	**46**	13.47	3.4 (2.5 to 4.6)
J44	Other COPD	790	27	9.03	3.0 (2.0 to 4.4)
J22	Unspecified acute lower respiratory infection	451	13	5.16	2.5 (1.3 to 4.3)
J96	Respiratory failure; not elsewhere classified	68	6	0.78	7.7 (2.8 to 16.8)
J69	Pneumonitis due to solids and liquids	138	5	1.58	3.2 (1.0 to 7.4)
Circulatory system					
I63	Cerebral infarction	277	**31**	3.17	**9.8 (6.7 to 13.9)**
I50	Heart failure	494	20	5.65	3.5 (2.2 to 5.5)
I44	Atrioventricular and left bundle-branch block	107	8	1.22	6.5 (2.8 to 12.9)
I48	Atrial fibrillation and flutter	367	7	4.20	1.7 (0.7 to 3.4)
I61	Intracerebral haemorrhage	61	5	0.70	7.2 (2.3 to 16.7)
Genitourinary system					
N17	Acute renal failure	367	16	4.20	3.8 (2.2 to 6.2)
N39	Other disorders of urinary system	802	**29**	9.17	3.2 (2.1 to 4.5)
Digestive system					
K56	Paralytic ileus and intestinal obstruction without hernia	157	7	1.79	3.9 (1.6 to 8.0)
K57	Diverticular disease of intestine	606	5	6.93	0.7 (0.2 to 1.7)
K59	Other functional intestinal disorders	283	5	3.24	1.6 (0.5 to 3.6)
Endocrine					
E11	Non-insulin-dependent diabetes mellitus	220	7	2.52	2.8 (1.1 to 5.7)
E87	Other disorders of fluid; electrolyte and acid–base balance	266	13	3.04	4.3 (2.3 to 7.3)
Other					
D50	Iron deficiency anaemia	1038	5	11.87	0.4 (0.1 to 1.0)
L03	Cellulitis	397	14	4.54	3.1 (1.7 to 5.2)
A41	Other sepsis	646	25	7.39	3.4 (2.2 to 5.0)
C18	Malignant neoplasm of colon	499	8	5.70	1.4 (0.6 to 2.8)

Rows are ordered by the number of observed admissions with a domiciliary care package. The five highest values in the columns 'Observed' and 'Ratio O/E' are shown in bold.
COPD, chronic obstructive pulmonary disease; DC, domiciliary care; ICD-10, International Classification of Diseases and Related Health Problems 10th Revision; MSK, musculoskeletal disorders.

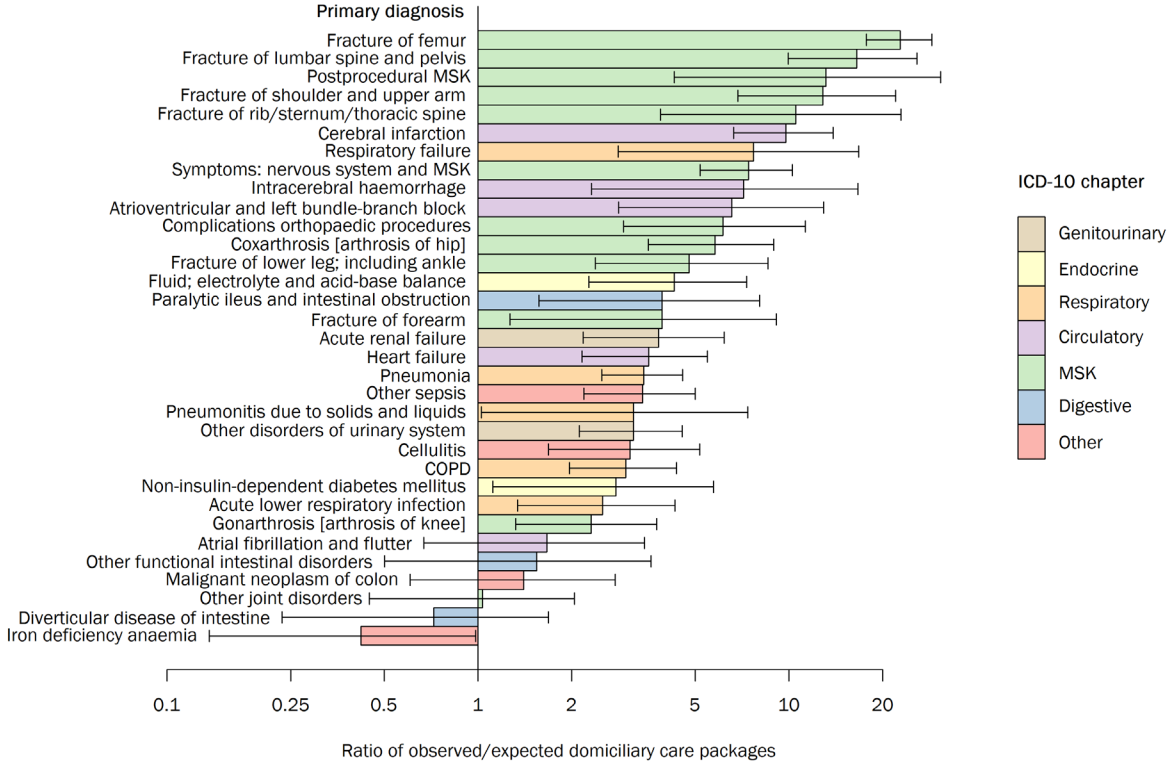

Figure 2 Observed-to-expected ratio and 95% confidence intervals for the frequency of domiciliary care packages after hospital discharge, by primary hospital diagnosis. Showing diagnoses with at least five hospital-associated care packages, also see table 4. COPD, chronic obstructive pulmonary disease; MSK, musculoskeletal disorders; ICD-10, International Classification of Diseases and Related Health Problems 10th Revision.

care needs, and these needs are more likely to be identified by acute hospital services.[18] Due to the relatively short follow-up in our study (2 years), we were not able to test changes in the association between hospital admission and domiciliary care over time. We anticipate that the challenging funding environment may have strengthened this relationship. The ongoing reductions to social care funding for local authorities in England offer further risks that this relationship may continue, especially with projections of 87% increase by 2040 in the number of older users of local authority funded home care services or direct payments due to demographic changes.[19]

The NHS and social care services in England are currently implementing partnerships called Integrated Care Systems.[1] These partnerships are designed to allow joined-up commissioning and delivery of health and social care services within geographical regions. Our results show that Integrated Care Systems should consider the need to rebalance resources towards community services, so that social care needs are less frequently identified in acute settings such as hospitals. While his type of reinvestment may not necessarily achieve a reduction in emergency hospital use, it may still reduce the burden on acute hospital services by facilitating earlier discharge and may improve service quality and outcomes for those in receipt of care.[20]

Conclusion

Our findings suggest that hospital discharge is an important route into domiciliary care. This appears to relate to identification of existing need in hospital as well as new illnesses or health events triggering new need. Identifying care need before an individual has required a hospital admission may lead to more proactive support for individuals, improvements in their quality of life and potential to delay deterioration, but further work is needed to determine whether earlier access to domiciliary care support would be able to prevent the hospital admission or reduce the intensity of care required thereafter.

The analysis highlights the value of using linked datasets to gather more in-depth understanding of the relationship between care receipt across settings of care. Understanding the pathway between hospital and domiciliary care can offer important insights for service planners and policy makers at a time of increasing financial and workforce pressures.

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Contributors FG, JS, DL and JC conceived and designed the analysis. DL and JS verified the underlying data and DL performed the analysis. FG, DL, JS, JC and RR-W interpreted the results, drafted the original manuscript, reviewed and edited the paper. All authors had full access to the data and accept responsibility to submit for publication. JS is the guarantor.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants but the Care City cohort dataset is hosted in the Barking and Dagenham, Havering and Redbridge NHS Accredited Data Safe Haven and contains routinely collected, retrospective, pseudonymised data. It was created for research purposes with ongoing governance and oversight provided by the Barking and Dagenham, Havering and Redbridge Information Governance Steering Committee. This study meets national guidelines set out by the Research Ethics Service for the NHS in the UK. No further ethics approval was required exempted this study.

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Data availability statement Data may be obtained from a third party and are not publicly available. De-identified, linked data was available from local government services, health providers and health commissioners in Barking & Dagenham. Information about accessing the data can be found here: https://www.carecity.london/your-blog/180-linking-datasets-for-better-population-health-management.

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REFERENCES

1 NHS. The NHS long term plan, 2019. Available: https://www.longtermplan.nhs.uk/publication/nhs-long-term-plan/
2 LaingBuisson. *Homecare and supported living. UK market report. Third edition*, 2020.
3 Office of National Statistics. Population estimates for the UK, England and Wales, Scotland and Northern Ireland: mid-2019, 2020. Available: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/annualmidyearpopulationestimates/mid2019estimates
4 Bottery S, Ward D. Social care 360. King's fund [online], 2021. Available: https://www.kingsfund.org.uk/sites/default/files/2021-05/social-care-360-2021_0.pdf
5 Care Quality Commission. Beyond barriers: how older people move between health and social care in England, 2018. Available: https://www.cqc.org.uk/sites/default/files/20180702_beyond_barriers.pdf
6 Krumholz HM. Post-hospital syndrome - a condition of generalized risk. *N Engl J Med* 2013;368:100–2 https://www.nejm.org/doi/10.1056/NEJMp1212324
7 Volpato S, Onder G, Cavalieri M, *et al*. Characteristics of nondisabled older patients developing new disability associated with medical illnesses and hospitalization. *J Gen Intern Med* 2007;22:668–74.
8 NHS Digital. Adult social care activity and finance report, England - 2019-20, 2020. Available: https://digital.nhs.uk/data-and-information/publications/statistical/adult-social-care-activity-and-finance-report/2019-20
9 NHS England. Delayed transfers of care data 2019-20, 2020. Available: england.nhs.uk/statistics/statistical-work-areas/delayed-transfers-of-care/delayed-transfers-of-care-data-2019-20/
10 Office for National Statistics. Population estimates for the UK, England and Wales, Scotland and Northern Ireland: mid-2019, 2020. Available: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/annualmidyearpopulationestimates/mid2019estimates
11 GOV.UK. English indices of deprivation 2019, 2019. Available: https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019
12 GOV.UK. Regional ethnic diversity in England and Wales (2011 census), 2019. Available: https://data.gov.uk/dataset/ff9cec02-c9d0-49ad-a491-fb734932524b/regional-ethnic-diversity-in-england-and-wales
13 Office for National Statistics. Main language spoken at home (2011 census), borough. Available: https://data.london.gov.uk/dataset/main-language-spoken-at-home-borough
14 Soong J, Poots AJ, Scott S, *et al*. Quantifying the prevalence of frailty in English hospitals. *BMJ Open* 2015;5:e008456.
15 Rørth R, Fosbøl EL, Kragholm K, *et al*. Initiation of domiciliary care and nursing home admission following first hospitalization of heart failure patients: a nationwide cohort study. *Clin Epidemiol* 2018;10:917–30.
16 Bardsley M, Georghiou T, Chassin L, *et al*. Overlap of hospital use and social care in older people in England. *J Health Serv Res Policy* 2012;17:133–9.
17 Spiers G, Matthews FE, Moffatt S, *et al*. Impact of social care supply on healthcare utilisation by older adults: a systematic review and meta-analysis. *Age Ageing* 2019;48:57–66.
18 Crawford R, Stoye G, Zaranko B. Long-term care spending and hospital use among the older population in England. IFS working paper, 2020. Available: https://ifs.org.uk/publications/15212
19 Wittenberg R, Hu B, Hancock R. Projections of demand and expenditure on adult social care 2015 to 2040. PSSRU discussion paper 2944, 2018. Available: https://www.pssru.ac.uk/publications/pub-5421/
20 Lloyd T, Conti S, Alderwick H. Have integrated care programmes reduced emergency admissions? - Lessons for Integrated Care Systems (ICSs), 2021. Available: https://www.health.org.uk/publications/long-reads/have-integrated-care-programmes-reduced-emergency-admissions