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Processing of discharge summaries in general practice:

a retrospective record review

Abstract

Background
There is a need for greater understanding of the epidemiology of primary care patient safety in order to generate solutions to prevent future harm.

Aim
To estimate the rate of failures in processing actions requested in hospital discharge summaries, and to determine factors associated with these failures.

Design and setting
The authors undertook a retrospective records review. The study population was emergency admissions for patients aged ≥75 years, drawn from 10 practices in three areas of England.

Method
One GP researcher reviewed the records for 300 patients after hospital discharge to determine the rate of compliance with actions requested in the discharge summary, and to estimate the rate of associated harm from non-compliance. In cases where GPs documented decision-making contrary to what was requested, these instances did not constitute failures. Data were also collected on time taken to process discharge communications.

Results
There were failures in processing actions requested in 46% (112/246) of discharge summaries (95% confidence interval [CI] = 39 to 52%). Medications changes were not made in 17% (124/750) of requests (95% CI = 14 to 19%). Tests were not completed for 26% of requests (95% CI = 16 to 35%), and 27% of requested follow-ups were not arranged (95% CI = 20 to 33%). The harm rate associated with these failures was 8%. Increased risk of failure to process test requests was significantly associated with the type of clinical IT system, and male patients.

Conclusion
Failures occurred in the processing of requested actions in almost half of all discharge summaries, and with all types of action requested. Associated harms were uncommon and most were of moderate severity.

Keywords
care transition; general practice; patient discharge; patient safety.

INTRODUCTION

Following the publication of the Berwick[1] and Francis reports,[2] it is clear that placing patient safety 'above all other aims' is a national goal within the NHS as a whole. The incidence of adverse events in secondary care has been established,[3] but in primary care the epidemiological situation is more uncertain.[4] Understanding the epidemiology of hospital errors is crucial to the development of hospital-based safety and public support for efforts to improve safety.[5] This effort needs to be replicated across all parts of the primary care system.[6] To date, most research has focused on medications safety, whereas information flow (the movement of paper and electronic information relating to patients) has been relatively neglected. One of the most influential taxonomies of GP patient safety, which was compiled from 433 event reports from the TAPS (Threats to Australian Patient Safety) study, included information flow as an important issue,[7] and it is vital to patient safety, particularly during care transitions. The authors' previous literature review[8] did not identify any tools in relation to information flow in general practices, although the taxonomies and defence organisation literature recognise it as a crucial and underexplored field.[9,10] An analysis of error reports about discharge processes submitted by GPs to the National Reporting and Learning Service (NRLS) showed that more than three-quarters of patients involved in these reports had been harmed.[11]

The authors studied patients aged ≥75 years, because 24% of all admissions occur in those aged >75 years[12] and they are associated with increased frailty and/or multimorbidity.[13] Discharge summaries for older patients often contain a relatively high number of drugs and are therefore more complex to process.[14] This study uses the discharge summary to identify patients who might be at higher risk of avoidable harm. The authors' main aim was to estimate the rate of failure in the processing of actions requested in discharge summaries in patients aged >75 in the 90 days following receipt at the general practice.

METHOD

General practice surgeries were recruited purposively via the clinical research network in three areas (Nottinghamshire, Coventry, and Manchester), with the aim of sampling a range of practice demographics, including one 'super-surgery' of >20 000 registered patients. At each surgery site, 30 discharge summaries from emergency admissions

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How this fits in

Little is known about failures made in processing discharge summaries in general practice, but we do know that older people are particularly vulnerable at care transition due to polypharmacy, frailty, and multimorbidity. This research shows that these failures are frequent for this vulnerable population, and a small proportion of patients are being harmed by this. More work is needed to establish what might help GPs improve their practice, but these results are an indicator of the importance of careful processing of discharge summary information.

between 3 and 15 months before the data extraction date were chosen at random. The data were collected entirely by retrospective electronic record review, including manual reading of the free text of consultations and documents by one researcher who is also a GP. When a request specified a particular time limit, a leeway of twice the duration was given (for example, a blood test requested in 1 week would be allowed 2 weeks). Patients with <3 months of electronic health records after discharge were excluded.

The overall failure rate was calculated as follows: the denominator was the total number of discharge summaries with directions requiring at least one action and the numerator was the number of discharge summaries where one or more requested actions had not been completed in accordance with directions contained within the discharge summary (unless there was documentary evidence in the GP record to explain why requested actions had not been completed). Data were collected on patient and admission demographics, the speed of processing, details of the medicines reconciliation process, tests and/or follow-up, and harms detected during data collection.

All data were collected on paper forms and entered into the study database in Microsoft Excel by one researcher. Analyses were conducted using the statistical programming language R. After generating simple descriptive statistics, multivariate logistic regression models were constructed including all variables found to have a *P*-value of ≤0.15 in a univariate logistic regression model. Otherwise, the significance level was set at $P<0.05$. Five outcome variables were considered in separate models: overall failure to complete actions, failure to change medications, failure to complete tests, failure to complete follow-up, and harm. When modelling failures involving medicines changes, tests, and follow-up, the modelling was based on individual actions rather than the patients affected.

RESULTS

Demographics and workflow

Table 1 shows the demographics of the 10 general practices in the study. The median practice list size was 8092 (range 4600–21 700). Two practices were

Table 1. Study practice characteristics

Practice study code	Geographical location	Practice list size[a]	Patient population aged ≥75, %[b]	Is the practice a training practice?	Index of multiple deprivation[b]	Ratio WTE GPs to head of population	Clinical system	QOF score[b]	CQC rating[c]
10	Nottingham	8800	5	Yes	39.5	1760	SystmOne	90.3	Outstanding
11	Nottingham	12 900	6	Yes	33.6	1355	SystmOne	94.3	Good
12	Nottingham	13 300	10	Yes	7	2484	SystmOne	99.9	Outstanding
13	Nottingham	7300	3	Yes	43.7	2440	EMIS Web	96	Good
14	Nottingham	7400	6	No	50.2	1476	SystmOne	93.2	Good
15	Coventry	4600	7	Yes	44.7	1314	EMIS Web	91.2	Requires improvement
16	Coventry	6400	6	Yes	38.2	1600	SystmOne	97.3	Good
17	Nottingham	9500	9	No	23.4	1727	SystmOne	93.9	Good
18	Manchester	5600	5	Yes	33.4	1251	EMIS Web	99.7	Good
19	Manchester	21 700	1	Yes	40.5	2281	EMIS Web	98.9	Good

[a]Practice list sizes rounded to nearest 100 to preserve anonymity. [b]Based on 2015–2016 practice profiles: https://fingertips.phe.org.uk/profile/general-practice. [c]From CQC interactive map: http://www.cqc.org.uk/content/doctorsgps. CQC = Care Quality Commission. EMIS = Egton Medical Information Systems. QOF = Quality and Outcomes Framework. WTE = whole-time equivalent.

Table 2. Modelling of overall failure to complete actions

	Univariate models			Multivariate model		
	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Practice (10 is reference)				0.444[a]		
Practice 11	1.10	0.34 to 3.60	0.875			
Practice 12	1.1	0.34 to3.60	0.875			
Practice 13	1.03	0.32 to 3.35	0.959			
Practice 14	1.36	0.40 to 4.70	0.624			
Practice 15	3.64	1.04 to 12.78	0.044			
Practice 16	1.50	0.46 to 4.88	0.501			
Practice 17	1.18	0.36 to 3.89	0.787			
Practice 18	1.27	0.38 to 4.22	0.698			
Practice 19	0.75	0.23 to 2.49	0.639			
Admission length	1.00	0.99 to 1.01	0.939			
Days to GP workflow	0.03	0.03 to 1.14	0.253			
Receipt time estimate	1.01	0.99 to 1.02	0.503			
Speciality surgical	1.23	0.58 to 2.59	0.587			
Ratio of GPs to patient population	1.00	1.00 to 1.00	0.098	1.00	1.00 to 1.00	0.693
Practice size (small is reference)				0.022[a]		0.417[a]
Medium practice size	0.33	0.13 to 0.85	0.022	0.40	0.10 to 1.61	0.195
Large practice size	0.27	0.10 to 0.72	0.009	0.35	0.07 to 1.76	0.203
EMIS Web IT system	1.11	0.67 to 1.85	0.685			
Training practice status	0.99	0.52 to 1.89	0.985			
IMD of practice	1.01	0.99 to 1.03	0.490			
Urban practice	1.16	0.51 to 2.63	0.728			
QOF score of practice	0.95	0.88 to 1.03	0.192			
CQC rating[b]	1.62	0.99 to 2.65	0.053	0.98	0.45 to 2.12	0.962
Patient age	1.03	0.98 to 1.07	0.257			
Patient sex, male	1.40	0.84 to 2.33	0.191			
Number of medicines changes	1.12	1.01 to 1.25	0.028	1.14	1.02 to 1.27	0.0216
Hospital (Nottingham QMC is reference)				0.100[a]		0.631[a]
Central Manchester Hospital	0.67	0.33 to 1.40	0.288	0.68	0.31 to 1.51	0.345
University of Coventry Hospital	1.89	0.97 to 3.65	0.060	1.22	0.49 to 3.05	0.664
Other hospitals	1.30	0.49 to 3.48	0.601	1.30	0.47 to 3.58	0.616
Follow-up on phone	0.95	0.57 to 1.60	0.854			

[a]ANOVA P-values are from a likelihood ratio test, the remainder are Wald P-values. [b]CQC rating was converted to a numeric scale for all analyses (1 = outstanding, 2 = good, 3 = requires improvement) in order to model this variable. ANOVA = analysis of variance. CQC = Care Quality Commission. EMIS = Egton Medical Information Systems. IMD = index of multiple deprivation. OR = odds ratio. QMC = Queen's Medical Centre. QOF = Quality and Outcomes Framework.

rated 'outstanding' by the Care Quality Commission (CQC), one was rated 'requires improvement', and the remainder 'good'. Study practices were more deprived than the national average.

The mean age of the 300 sample patients was 84 years. Of these, 254 (85%) had a medical admission, and 46 (15%) a surgical admission. The mean duration of admission was 12 days (range 0–201 days, interquartile range [IQR] 2–12 days). In the 90 days after discharge, 176/300 (59%) of patients had face-to-face follow-up, and 115 (38%) patients consulted on the phone. Only nine patients did not have contact with a primary care clinician in this time period. GPs reviewed 276/300 patients (92%).

All discharge summaries were uploaded to electronic document management systems (EDMS) in the practices, regardless of the route of arrival, and the median time from discharge to EDMS upload was 2 days (IQR 1–4 days). The median time from receipt of the discharge summary into a GP's electronic inbox to filing in the patient record was 1 working day (IQR 0–2 days).

Table 3. Modelling of failure to complete medications changes

	Univariate models			Multivariate model		
	OR	95% CI	*P*-value	OR	95% CI	*P*-value
BNF chapter (2 is reference)			<0.001[a]			<0.001
BNF chapter 1 (Gastrointestinal)	9.77	5.26 to 18.15	<0.001	8.55	4.30 to 16.99	<0.001
BNF chapter 3 (Respiratory)	4.93	1.47 to 16.58	0.010	4.16	1.15 to 15.06	0.030
BNF chapter 4 (CNS)	6.66	3.38 to 13.12	<0.001	7.41	3.56 to 15.44	<0.001
BNF chapter 6 (Endocrine)	1.93	0.61 to 6.08	0.264	1.39	0.42 to 4.62	0.590
BNF chapter 7 (Genitourinary)	5.92	1.47 to 23.78	0.012	3.40	0.68 to 17.01	0.136
BNF chapter 9 (Nutrition and blood)	3.29	1.32 to 8.18	0.010	2.06	0.77 to 5.52	0.150
BNF chapter 10 (Musculoskeletal and Joint)	6.58	1.22 to 35.37	0.028	5.58	0.98 to 31.76	0.053
BNF chapter 16 (Dietary supplements[b])	8.13	2.93 to 22.57	<0.001	7.41	2.31 to 23.78	0.001
BNF chapter other	7.18	2.04 to 25.21	0.002	8.88	2.32 to 34.01	0.001
Medication (newly started is reference)			<0.001[a]			0.025[a]
Medication stopped	0.25	0.14 to 0.46	<0.001	0.40	0.20 to 0.81	0.011
Dose changed	0.70	0.40 to 1.21	0.201	0.81	0.41 to 1.61	0.553
No reason for medicines change	1.71	1.08 to 2.68	0.021	1.64	0.92 to 2.91	0.094
Practice (10 is reference)			0.043[a]			[c]
Practice 11	0.77	0.31 to 1.88	0.563			
Practice 12	1.18	0.47 to 2.93	0.722			
Practice 13	0.83	0.33 to 2.07	0.686			
Practice 14	1.32	0.54 to 3.25	0.547			
Practice 15	2.04	0.87 to 4.81	0.103			
Practice 16	1.29	0.53 to 3.18	0.574			
Practice 17	0.87	0.35 to 2.15	0.767			
Practice 18	0.63	0.24 to 1.66	0.351			
Practice 19	0.40	0.14 to 1.18	0.097			
Admission length	0.99	0.98 to 1.00	0.011	0.99	0.98 to 1.00	0.150
Days to GP workflow	1.11	0.84 to 1.47	0.473			
Receipt time estimate	1.01	1.00 to 1.01	0.023	1.01	1.00 to 1.02	0.003
Specialty surgical	2.28	1.33 to 3.92	0.003	1.70	0.88 to 3.29	0.117
GP ratio to population	1.00	1.00 to 1.00	0.235			
Practice size (small is reference)			0.011[a]			0.240[a]
Medium practice size	0.47	0.26 to 0.84	0.011	0.52	0.16 to 1.68	0.274
Large practice size	0.37	0.19 to 0.69	0.002	0.32	0.08 to 1.39	0.130
EMIS Web IT system	0.85	0.57 to 1.26	0.415			
Training practice status	0.90	0.56 to 1.43	0.648			
IMD of practice	1.00	0.99 to 1.02	0.608			
Urban practice	0.81	0.43 to 1.53	0.508			
QOF score of practice	0.93	0.88 to 0.99	0.033	1.00	0.90 to 1.12	0.962
CQC rating	1.29	0.88 to 1.90	0.198			
Patient age	1.01	0.98 to 1.05	0.411			
Patient sex, male	0.93	0.63 to 1.37	0.715			
Number of medicines changes	0.85	0.78 to 0.92	<0.001	0.86	0.77 to 0.95	0.004
Hospital (Nottingham QMC is reference)			0.001[a]			0.339[a]
Central Manchester Hospital	0.56	0.30 to 1.06	0.073	0.68	0.29 to 1.61	0.381
University of Coventry Hospital	1.69	1.06 to 2.69	0.029	1.07	0.46 to 2.51	0.868
Other hospitals	0.36	0.13 to 1.03	0.058	0.38	0.11 to 1.32	0.129
Follow-up on phone	1.21	0.81 to 1.80	0.361			

[a]ANOVA P-values are from a likelihood ratio test, the remainder are Wald P-values. [b]For example, Fortisip. [c]Practice variable not included in multivariate model due to confounding with practice size and QOF score. ANOVA = analysis of variance. BNF = British National Formulary. *CQC = Care Quality Commission. EMIS = Egton Medical Information Systems. IMD = index of multiple deprivation. OR = odds ratio. QMC = Queen's Medical Centre. QOF = Quality and Outcomes Framework.*

Table 4. Modelling of failure to complete tests

	Univariate modelling			Multivariate modelling		
	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Test type (blood test is reference)			0.262[a]			
Imaging	2.62	0.73 to 9.44	0.141			
Other tests	2.20	0.47 to 10.27	0.316			
Time frame given	0.77	0.30 to 2.02	0.601			
Admission length	1.01	0.99 to 1.04	0.363			
Receipt time estimate	0.99	0.91 to 1.07	0.720			
Specialty surgical	1.18	0.21 to 6.55	0.849			
GP ratio to population	1.00	1.00 to 1.00	0.952			
EMIS Web IT system	2.98	1.12 to 7.91	0.029	3.67	1.30 to 10.35	0.014
Training practice status	2.64	0.70 to 9.92	0.151			
Practice size (small is reference)			0.210[a]			
Medium practice size	0.41	0.11 to 1.55	0.190			
Large practice size	0.24	0.05 to 1.19	0.081			
IMD of practice	1.03	0.99 to 1.08	0.193			
Urban practice	2.98	0.35 to 25.25	0.316			
QOF score of practice	0.97	0.84 to 1.11	0.640			
CQC rating (1 = outstanding)	1.69	0.71 to 4.02	0.235			
Patient sex, male	2.30	0.87 to 6.07	0.091	2.95	1.04 to 8.36	0.042
Number of medicines changes	0.89	0.74 to 1.08	0.240			
Hospital (Nottingham QMC is reference)			0.189[a]			
Central Manchester Hospital	3.33	0.84 to 13.17	0.086			
University of Coventry Hospital	2.40	0.70 to 8.18	0.162			
Other hospitals	0.73	0.14 to 3.82	0.707			
Follow-up on phone	2.06	0.76 to 5.57	0.154			

[a]ANOVA P-values are from a likelihood ratio test, the remainder are Wald P-values. ANOVA = analysis of variance. CQC = Care Quality Commission. EMIS = EMIS = Egton Medical Information Systems. IMD = index of multiple deprivation. OR = odds ratio. QMC = Queen's Medical Centre. QOF = Quality and Outcomes Framework.

Overall failure to complete actions

Overall, 246 summaries requested one or more action. Of these summaries, 112 had one or more failure to complete requested actions, giving an overall failure rate of 46% (95% CI = 39 to 52%). The overall failure rate included: ordering, completing, and acting on test results ('failure to complete tests'), in-house actions and external referrals requested by secondary care ('failure to complete follow-up'), and discrepancies in the medications reconciliation process ('failure to change medication'). Multiple types of failure in processing actions requested in summaries occurred in 25 of the patient cases: 53 had medicine change failures only, 22 had follow-up failures only, and 12 had test failures only. In the multivariate model (Table 2), only the number of medicines changes requested was significantly associated with overall failure (odds ratio [OR] 1.14 for each additional drug, $P = 0.02$).

Failure to change medications

Of the 214 patients requiring medicines reconciliation, a mean of 3.5 drugs were changed per patient (total of 750 changes in the sample). Discontinued medicines accounted for 27% (202/750) of requested changes, newly started medications for 58% (435/750), and dose changes for 15% (113/750). For 81% (611/750) of these changes, the discharge summary specified a reason for the change. The most commonly changed drugs were cardiovascular 41%, gastroenterological 20%, and central nervous system (CNS) 14%.

Of the 750 changes requested, there were 124 instances where this was not completed without documented reason (17%, 95% CI = 14 to 19%) (Appendix 1). In the multivariate logistic regression model (Table 3), the type of medicine change request was significantly associated with failure (analysis of variance [ANOVA], $P = 0.025$). The risk of failure to make

changes was highest with newly-started medicines. Failures were least likely with cardiovascular drugs (Table 3, *British National Formulary* [*BNF*] chapter 2), but there were still 15 failures (12% of the medicines failures), and six of those failures were associated with subsequent harm (46% of the total medicines-related harm). In the multivariate model, gastroenterological drugs (OR 8.6, *P*<0.001, *BNF* chapter 1), CNS drugs (OR 7.4, *P*<0.001, *BNF* chapter 4), and dietary supplements (OR 7.4, *P* = 0.001) remained significantly less likely to be prescribed as requested. Each day delay to discharge summary processing by a GP increased the risk of failure to change medications (OR 1.01, *P* = 0.003). Each additional medication change requested reduced the risk of medicines change failure (OR 0.86, *P* = 0.004).

Failure to complete tests and follow-up

Tests were divided into laboratory, imaging, and 'other', and the majority of test requests came with a timeframe (61%, 55/90). In total, 26% (23/90) tests were not correctly completed (95% CI = 16 to 35%) (Appendix 2). Of these incomplete tests, 20% (18/90) were never actioned by the GP. Of 177 follow-up requests in the sample, 27% (47/177, 95% CI = 20 to 33%) were not actioned. Of 47 failures to follow-up, 24 were free text requests to review specific medications, but they are too diverse in nature to tabulate. In multivariate modelling of test failures (Table 4), EMIS Web was associated with an OR of risk of test failure of 3.67 (*P* = 0.014); this seems to be independent of geographical area, as the hospital from which patients were discharged was not significant even in a univariate model. Male patients had an OR of 2.95 in the multivariate model for test failure (*P* = 0.042). Modelling of follow-up failures did not yield any significant results.

Harm

Two of the authors, who are GPs, independently rated each instance of harm against three rating scales: — the NHS Education Scotland (NES) trigger tool[15] and the World Health Organization (WHO)[16] (severity), and a preventability scale for hospital deaths[17] adapted for use in the Avoidable Harms Project.[18] The two raters discussed their scores and a consensus score was given for each harm. The mean severity was 3 (moderate) on both scales used. The mean preventability was 3.27 (around 50:50) (Table 5). There were 23 harms and 20 patients affected by them (three patients had two harms). Therefore the harm rate per patient was 8% (20/246, 95% CI = 5 to 12%). Since the total number of harms was small, this presented challenges for modelling, and there were no significant factors. Examples of harm vignettes are given in Appendix 3.

DISCUSSION

Summary

This study has determined a rate of general practice adherence to instructions given in hospital discharge summaries. The authors found that 46% of emergency admission discharge summaries requiring an action had one or more failures to complete those actions. Requested medications changes were not made 17% of the time, and 26–27% of requested tests and follow-up were not completed. Harm occurred in relation to 8% of these failures.

Failures occur with all aspects of discharge summary processing in general practice, and they are common. Requests for follow-up and tests were less likely to be completed than medicines reconciliation. Harm ensues from these failures infrequently but, when it does so, it can have a meaningful effect on patients.

Strengths and limitations

This study targeted an area of general practice not extensively investigated, in a moderately large population in three geographical areas. Sampling of practices

Table 5. Summary of harm measures and their weighted Cohen's kappas[19]

	What measured?	Scale	Modified kappa	95% CI
NES trigger tool	Severity	1–4	0.8 (good)	0.65 to 0.95
WHO	Severity	1–5	0.58 (moderate)	0.28 to 0.88
Hogan Healey	Preventability	1–6	0.50 (moderate)	0.1 to 0.89

NES = NHS Education Scotland. WHO = World Health Organization.

was purposive and not random. Practices expressing an interest in taking part in the study may have been particularly motivated to work on patient safety.

The record reviewing in this study was completed by one qualified GP working to the same standard across all practices and records, and not relying on coded information. The authors graded harms detected according to internationally accepted scales, using two GPs working independently. A limitation was the lack of a second record reviewer, and the initial detection of harms was limited to the record reviewer's ability to recognise instances within the record. As with any rates found from retrospective record review, the data are affected by which elements of the clinical decision-making process are actually documented (and this is particularly relevant to the more minor medication changes). It is also important to acknowledge the freedom of GPs to independently decide on the management of their patients, and that the term 'failures' is used here purely to describe an uncompleted action and is not used pejoratively to describe poor care. There may be clinical instances where the GP feels a course of action suggested in a discharge summary is inappropriate, and in an ideal world they would document their thinking. A limitation of logistic regression modelling is the assumption that individual patients are drawn at random and, while this is true within a single surgery site, it is not true across the pooled sample. The authors did not collect quantitative data on continuity of care.

Comparison with existing literature

As this study is one of the first attempts to estimate failure rates in paperwork processing in general practice, it is difficult to compare the findings directly with other primary care error estimates. Failure rates in this study are certainly higher than the estimated 0.8% error rate in general practice consultations.[4] This is likely due to the high-risk care transition episode in an older population deliberately chosen for study, and the method by which data were collected. The estimated rate of harm ensuing from failures (8%) is similar to the harm rate of 7% found in a previous trigger tool retrospective review of primary care records, perhaps because in this study hospital admission was one of the triggers used.[20]

Failures to make changes to medications were found less frequently (17%) than in the discharge subset of the PRACtICe study (28%).[21] Although the bulk of these failures related to drugs with 'weaker indications', such as laxatives and analgesics, there were a small number of drugs with likely 'strong indications', such as cardiovascular medications, and these were associated with harm. The authors present new evidence that tests and follow-up appear to be less likely to be completed than medications reconciliation. This finding is in line with claims data from the defence organisations, where test error and failure to follow-up results often figure in successful claims.[9,10]

It is possible that GPs are more likely to disagree with tests and follow-up requested, but if this is the case then GPs are not routinely recording their disagreement or their conversations with patients about it.

The processes required for tests and follow-up are different from those required for medications reconciliation. The actions are more complex (forms to be filled, appointments to be arranged, and so on) and involve a range of staff in the primary care system, not just the GP who is reviewing the discharge summary.

Implications for research and practice

The results indicate that GP surgeries are processing paperwork in a timely manner (ahead of targets set in Scotland).[22] Further work is needed to see if time pressures or other factors are the reason for the relatively high failure rates the authors have observed, and why delay to GP processing might increase the rate of failures. There is scope for building on US investigation of IT interventions[23,24] that might reduce test and follow-up error, and for more specific exploration of why certain IT systems might be performing better than others.

Patient factors need to be explored in relation to test completion to understand why male patients might be at greater risk and what can be done to alleviate this. Directing sparse resources to relieve pressure on over-worked GPs[25] could help to lessen oversight errors which could harm patients, but more work needs to be done to determine where interventions should best be deployed.

It is possible that system changes that allow staff other than GPs to focus on care transitions might be warranted, but this needs further study.

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Ethical approval

The study received ethical approval from West Midlands, Coventry, and Warwickshire Research Ethics Committee. CAG reference: 16/CAG/0007. IRAS project ID: 140043. REC reference: 15/WM/0442.

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Competing interests

The authors have declared no competing interests.

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Appendix 1. Requested changes to medications which were not made, by therapeutic group

Drug Category	Drug Name	Frequency count
Laxatives	Senna	17
	Macrogols	14
	Docusate	5
	Lactulose	2
	Fybogel (ispaghula husk)	2
	Total	**40**
CNS drugs	Paracetamol	15
	Oral morphine	4
	Ibuprofen	2
	Oxycodone preparations	2
	Zopiclone	2
	Total	**25**
Other drugs	**Total**	**20**
Cardiac drugs	Bisoprolol	3
	Angiotensin converting enzyme inhibitors	3
	Amlodipine	2
	Furosemide	2
	Total	**10**
Antacid Drugs	Ulcer healing drugs	5
	Alginates	4
	Total	**9**
Bone protection	Calcium supplements	3
	Alendronate	2
	Cholecalciferol	2
	Total	**7**
Nutritional supplements	**Total**	**7**
Respiratory drugs	Carbocisteine	2
	Inhaled corticosteroids	2
	Total	**4**
Haematological drugs	Ferrous fumarate	2
	Total	**2**

CNS = central nervous system.

Appendix 2. Requested tests which were not completed

Group	Test	Frequency count
Blood tests	Multiple common tests or non-specific request for bloods	6
	Urea and electrolytes	5
	Other, full blood count, digoxin levels, prostate specific antigen, folate	4
	Total	**15**
Imagining	Chest X-Ray for resolution of pneumonia	3
	Dual-energy X-ray absorptiometry scan	1
	Cardiac echo	1
	Total	**5**
Other	Pulmonary function testing	1
	24-hour electrocardiogram	1
	Electroencephalogram	1
	Total	**3**

Appendix 3. A sample of high severity harm vignettes

84-year-old male initially admitted with acute kidney injury

The discharge summary requested the GP to monitor urea and electrolytes (U+E) after discharge, and continue with a reduced dose of furosemide only if the U+E was 'OK'. Although the initial dose reduction was made, the patient's furosemide was continued for 5 months, despite worsening chronic kidney disease (CKD). Despite a doubling of the creatinine level to >900 µmol/L, the advice regarding furosemide was not heeded. This worsening of CKD 5 (glomerular filtration rate <15ml/min) led to the patient needing dialysis.

94-year-old female initially admitted with fast atrial fibrillation due to sepsis

There were eight medications changes requested on the discharge summary (including three new cardiac drugs — digoxin, rivaroxaban, and bisoprolol — and two dose changes, furosemide and gliclazide. This patient was medically very complex, with multiple morbidities, including heart failure. The discharge summary requested the GP to increase furosemide from 20 mg to 40 mg twice daily, but this change was not made. The patient had a subsequent hospital admission with cardiac failure within a few months of the initial discharge.

86-year-old male initially admitted with aspiration pneumonia

This immobile patient had multiple morbidities and recurrent episodes of aspiration pneumonia following a stroke. The GP did not order the follow-up chest X-ray requested by the hospital for 6 weeks following discharge. The patient subsequently died from aspiration pneumonia 4 months later. The death could have been connected to a missed opportunity to diagnose aspiration pneumonia on an earlier chest X-ray.

76-year-old female initially admitted with exacerbation of chronic obstructive pulmonary disease

During the admission, Seretide was replaced with Fostair as the patient was 'unable to use (Seretide) effectively'. The discharge summary also requested the GP to prescribe carbocisteine to 'bring up phlegm'(these were the only requests made on the discharge summary). No change was made to the inhaled therapy following discharge, and carbocisteine was not initiated. The patient was admitted with a further exacerbation of COPD subsequently in the 9 months between discharge and the date of data collection.