


Effect of a formalised discharge process which includes electronic delivery of prescriptions to pharmacies on the incidence of delayed prescription retrieval

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ABSTRACT

Background Lack of prescription adherence after discharge from the inpatient hospital setting is a barrier to the delivery of optimal patient care. Non-adherence to medication for cardiac diseases can lead to substantial morbidity, mortality and healthcare costs. Electronic delivery of prescriptions by fax is a potential method of improving patient satisfaction and reducing pharmacy wait times.

Methods This study was completed in the cardiology inpatient wards at a hospital in London, Ontario, Canada. 'Delayed prescription retrieval' was defined as the retrieval of a prescribed medication by a patient from their local pharmacy after the documented calendar day of discharge. The current discharge process on the cardiology wards was assessed and an initial monitoring period of study participants was completed to determine the baseline delayed prescription retrieval rate (preintervention group). A formalised discharge process, which included electronic delivery of prescriptions to pharmacies by fax, was implemented for study participants (postintervention group). The rate of delayed prescription retrieval was assessed in both groups.

Results 15 of 42 patients (35.7%) in the preintervention group and 9 of 72 (14.3%) in the postintervention group had delayed prescription retrieval suggesting relative and absolute risk reductions of 65% and 23.2% ($p=0.0045$). Of the participants with delayed prescription retrieval, 100% in the preintervention group and 77.8% in the postintervention group were due a new prescribed medication on the day of discharge.

Conclusions Patients who experienced a formalised discharge process, which included electronic delivery of prescriptions by fax, at the time of discharge from cardiac inpatient care had a lower rate of delayed prescription retrieval. Future studies are required to examine the impact of formal discharge processes on patient morbidity and mortality.

BACKGROUND

Lack of prescription adherence after discharge from the inpatient hospital setting is a known barrier to the delivery of optimal patient care. Non-adherence to medications

for cardiac diseases can lead to substantial morbidity, mortality and healthcare costs.^{1–3} Particularly in patients with heart failure or recent percutaneous coronary intervention, delay in prescription retrieval after discharge and non-adherence to medical therapy can expose the patient to increased risk of worsening heart failure or stent thrombosis, which can result in myocardial infarction and death.^{4–6}

In the cardiac care setting, patients have reported several factors that affect medication adherence including medication costs, transportation to the pharmacy, pharmacist counselling before discharge and use of a pillbox.⁷ Among emergency department patients, electronic delivery of prescriptions by fax did not improve medication adherence but has been identified as a method of improving patient satisfaction and reducing pharmacy wait times.⁸ However, the impact of electronic delivery of prescriptions by fax on prescription retrieval in the inpatient cardiac care setting remains unclear.

The purpose of this study was to assess the impact of a formal discharge process, which included electronic delivery of prescriptions by fax at time of discharge, on the incidence of delayed prescription retrieval among cardiac inpatients.

METHODS

The study was completed in the cardiology inpatient care units (general ward and cardiology critical care unit) at an academic tertiary care centre in London, Ontario, Canada, and was classified as a quality improvement investigation based on the requirements listed in the Tri-Council Policy Statement (Article 1.1). The study process was also reviewed by the Privacy and Medical Affairs offices of the

London Health Sciences Centre. All study participants had their confidential information protected. Only the primary researcher and coinvestigators had access to the data and these were stored in a password-protected database on the hospital server.

The current discharge process on the cardiology wards was assessed and a process map was created based on input from the physician, nursing, pharmacy and unit clerk teams ([figure 1](#)). Patient input into the discharge process was also obtained through discussion with patients who had been discharged from the inpatient cardiac wards during their follow-up clinic visits.

‘Delayed prescription retrieval’ was defined as the retrieval of a prescribed medication by a patient from their local pharmacy after the documented calendar day of discharge. Verbal consent was obtained from patients to participate in the study at the time of discharge from the inpatient unit. The participants who provided consent had their prescriptions compared with their admission medication reconciliations, to ensure that no existing home medications were duplicated, and had the dates that their prescriptions were submitted to their local pharmacies tracked using the Drug Profile Viewer from the E-Health Ontario online system which was accessed through their electronic health records and the hospital server. The prescription medication retrieval date from the pharmacy was also confirmed by directly contacting the pharmacy. Participants were excluded from the study if they did not receive a new prescription at the time of discharge, if they were transferred to another inpatient care or long-term care institution, or if their prescription submission and retrieval at their respective pharmacies could not be tracked, for example, due to limitations of the electronic system of their local pharmacy being able to connect to E-Health Ontario.

An initial monitoring period of approximately 2 months was completed and the incidence of delayed prescription retrieval was assessed among patients who experienced the current discharge process in order to establish the baseline rate of delayed prescription retrieval among cardiac patients who receive usual care. This group of patients was designated the ‘preintervention group’. After the initial monitoring period, a new formalised discharge process was implemented on the cardiology inpatient wards for an additional 2 months ([figure 2](#)). This discharge process specified clear roles for medical, nursing, and administrative staff and also included having patients’ prescriptions sent electronically by fax to their preferred pharmacies at the time of discharge for study participants. The original hard copy of each prescription was also provided to the patients. Participants’ online hospital charts and the E-Health Ontario system were used to ensure that the prescription was received by the pharmacies and the prescription retrieval date was also confirmed by contacting the pharmacies directly. The group of participants who experienced the new discharge process was designated the ‘postintervention group’. The same exclusion criteria applied to the preintervention

group were also applied to participants in the postintervention group with the additional requirement that patients had to consent to have their prescriptions faxed.

The rate of delayed prescription retrieval in both the preintervention and postintervention groups was analysed. Comparison of both groups was completed using the Fisher’s exact test with Prism V.8 statistical analysis software (GraphPad software).

PATIENT AND PUBLIC INVOLVEMENT

Patients were involved in the initial phases of the study design. During clinic visits, patients who had been discharged from cardiac inpatient care would often voluntarily share what they experienced during their hospital admissions and after discharge, including some of the obstacles they faced when retrieving new prescriptions. These patients were not formally part of the study population, however it was their shared experiences that inspired the development of the study and helped the study team better understand the discharge process that was in place from a patient’s perspective. The patients’ experiences also helped identify potential opportunities for improvement in the discharge process and led to the conception of the study.

RESULTS

A total of 95 patients were initially enrolled in the preintervention group. Of these, 53 were excluded due to not receiving a new prescription, being transferred to a long-term care institution at discharge, or not having online tracking information available at their pharmacy ([figure 3](#)). A total of 42 patients from the preintervention group were included in the data analysis ([table 1](#)). A total of 15 patients (35.7%) had delayed prescription retrieval after discharge. All of these patients were due a new prescribed medication on the day of discharge ([table 2](#)). In addition, six (40%) of the patients with delayed prescription retrieval submitted their prescriptions to the pharmacy on the day of discharge but did not return the same day to retrieve them.

There were 146 patients initially enrolled in the postintervention group. Of these, 74 were excluded using the same exclusion criteria as the preintervention group or because they did not consent to have their prescription faxed ([figure 3](#)). There were 72 patients in the postintervention group included in the data analysis. A total of nine patients (14.3%) had delayed prescription retrieval after discharge suggesting relative and absolute risk reductions of 65.0% and 23.2%, respectively ($p=0.0045$) ([figure 4](#)). There were seven patients (77.8%) due a new prescribed medication on the day of discharge ([table 2](#)).

DISCUSSION

In this study we examined the effect of a formal discharge process, which included electronic delivery of prescriptions by fax, on the incidence of delayed prescription

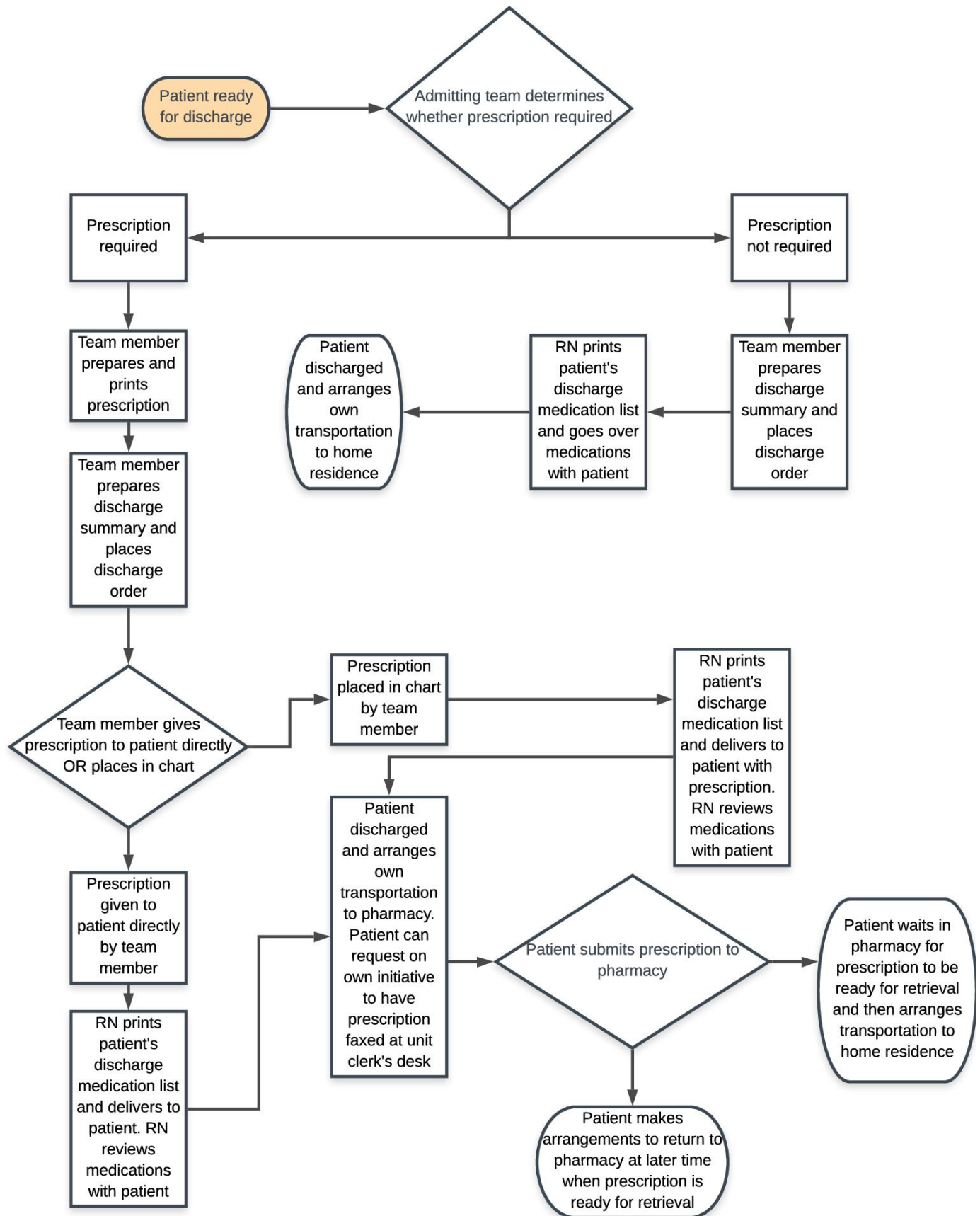


Figure 1 Preintervention discharge process (RN = Registered Nurse)

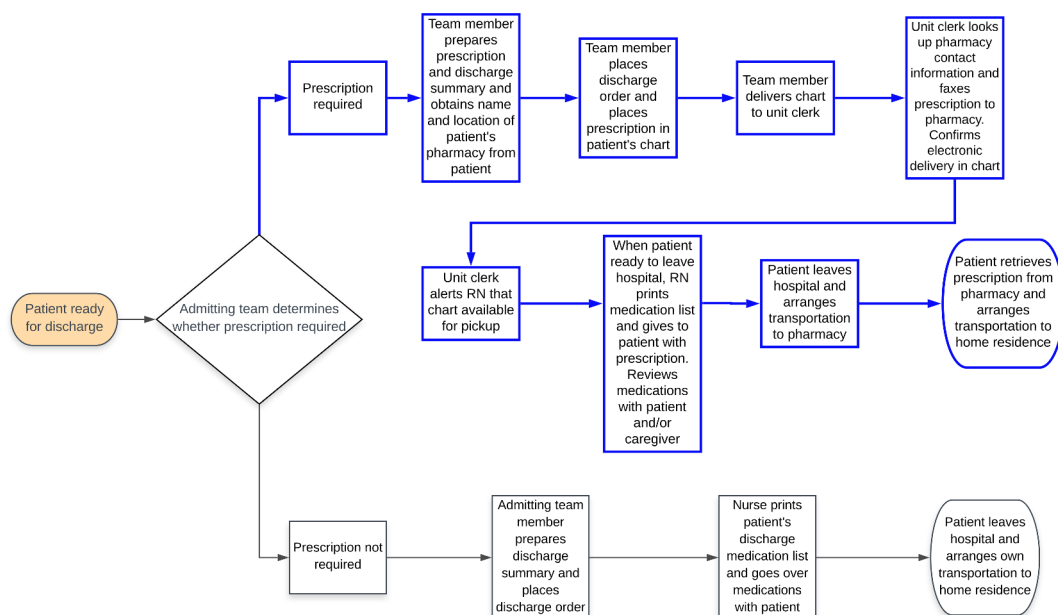


Figure 2 Formal discharge process with incorporation of electronic prescription delivery by fax (RN = Registered Nurse)

retrieval by patients discharged from a cardiology inpatient unit. The results of this study suggest that the implementation of the formal discharge process led to a significant reduction in the incidence of delayed prescription retrieval.

There are several potential reasons why the formal discharge process may have reduced the delayed prescription retrieval rate. In the preintervention group, after submitting their prescriptions to the pharmacy directly, patients would have had an additional wait time as the medications are being prepared before they are ready for retrieval. Some studies have suggested total wait times

for patients of between 40 and 120 min between the time of arrival to the pharmacy and the time the medications are ready for retrieval.^{9,10} This delay in medication preparation after the prescription has been submitted has previously been cited as a factor leading to patient dissatisfaction and can be a barrier to optimal patient care.^{8–10} Furthermore, cardiac patients are often limited in their transportation options for a period after discharge due to disease-related driving restrictions.¹¹ Patients discharged from the cardiac inpatient unit need to arrange their own transportation, often through family members or friends, to get to their respective pharmacies. Patients

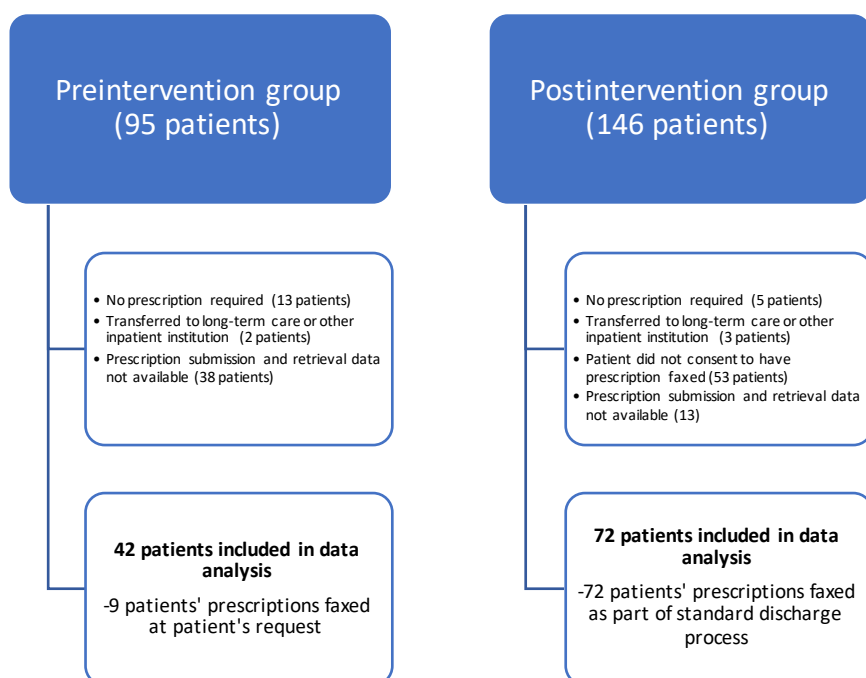


Figure 3 Enrolment and inclusion of participants in study and data analysis.

Table 1 Baseline characteristics of the participants

	Preintervention group (n=42)	Postintervention group (n=72)
Age (years)	72±12.6	70.9±14.4
Sex		
Male, n (%)	28 (66.6)	44 (61.1)
Female, n (%)	14 (33.3)	28 (38.9)
Reason for admission		
Acute coronary syndrome, n (%)	25 (59.5)	29 (40.3)
Heart failure, n (%)	8 (19.0)	18 (25.0)
Arrhythmia, n (%)	7 (16.6)	14 (19.4)
Miscellaneous, n (%)	2 (4.8)	11 (15.3)
Duration of admission (calendar days)	4.4±3.54	6.0±4.8
Social disposition		
Home alone, n (%)	9 (21.4)	16 (22.2)
Home with family, n (%)	31 (73.8)	53 (73.6)
Retirement home, n (%)	2 (4.8)	3 (4.2)
Distance of patient residence from hospital (km)	36.9±49.0	52.1±183.4
Time of discharge	14:12	14:31

or the persons providing their transportation would not necessarily be able to wait the additional amount of time needed for the medications to be prepared and would need to make further arrangements to return at a later time to retrieve the medications. This additional waiting period likely contributes to delayed prescription retrieval, as suggested by the 40% of patients with delayed retrieval in the preintervention group who submitted their prescriptions to their pharmacies on the day of discharge but who did not return the same day to retrieve the new medications. It is this delay at the pharmacy level that was likely the most impacted by the new discharge process, particularly with the component of electronic delivery of the patients' prescriptions by fax prior to their departure from the inpatient ward. As pharmacies would have the opportunity to begin preparing the patients' medications in advance, patients' wait times on arrival at the pharmacies were potentially reduced.

Furthermore, medical team members noted that the new formalised discharge process allowed pharmacists to identify errors on prescriptions and then contact medical staff to arrange corrections in advance of the patients' arrivals for medication retrieval. In the preintervention group, pharmacists would also reach out to correct prescription errors but the delay in prescription submission until the physical prescription arrived at the pharmacy would sometimes mean that errors could not be corrected on the same calendar day of discharge. Therefore, the new discharge process likely allowed prescription corrections to be made in a timely fashion with minimal delay to the patients. In addition, electronic delivery of prescriptions possibly improved the likelihood that the prescriptions were received by the pharmacy and processed, as physical prescriptions would have been at risk of loss in transit with the patient.

Table 2 Incidence of delayed prescription retrieval, missed medications and hospital readmission

	Preintervention group (n=42)	Postintervention group (n=72)	P value
Prescription retrieved on day of discharge, n (%)	27 (64.3)	63 (87.5)	0.0045
Delayed prescription retrieval, n (%)	15 (35.7)	9 (12.5)	0.0045
Delayed retrieval by 1 day, n (%)	6 (14.3)	3 (4.2)	
Delayed retrieval by 2 days, n (%)	3 (7.1)	1 (1.3)	
Delayed retrieval by 3+ days, n (%)	6 (14.3)	5 (7.0)	
Patients with delayed prescription retrieval due a new prescription medication on day of discharge, n (%)	15 (100)	7 (77.8)	NS
Patients with delayed prescription retrieval readmitted within 30 days of discharge, n (%)	2 (13.3)	1 (11.1)	NS

NS, not significant.

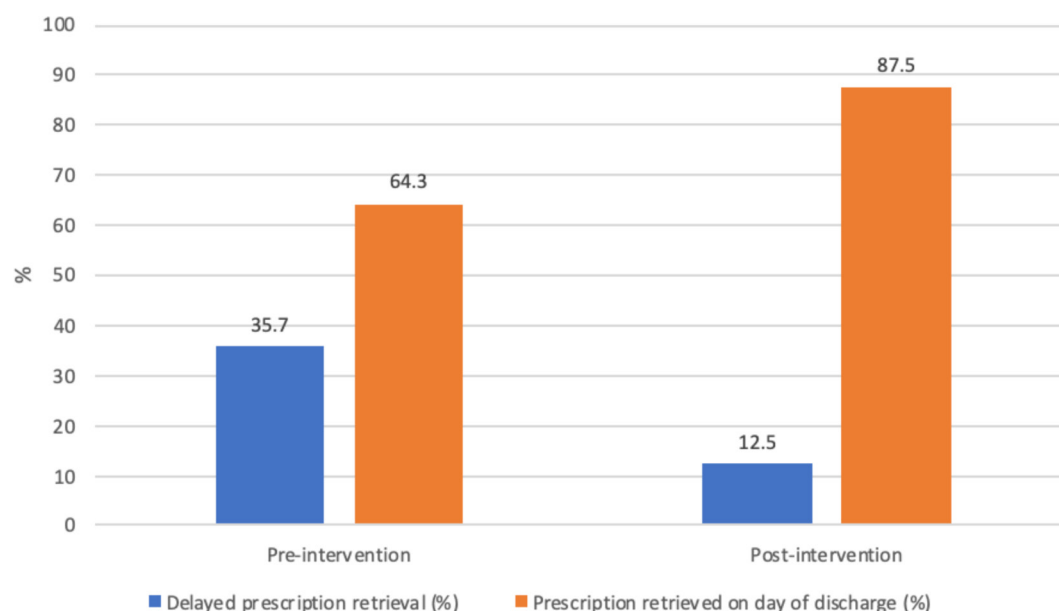


Figure 4 Incidence of delayed prescription retrieval in preintervention and postintervention groups.

In addition to the benefits of electronic prescription delivery, the new formalised discharge process had other components that may have improved prescription retrieval. Patient education is known to be a key factor in improving medication adherence and can reduce morbidity and mortality.^{6 12–14} Education of patients' family members or caregivers can also improve medication adherence.¹⁵ Several members of the nursing team did note that the new discharge process allowed them a consistent opportunity to formally review the new prescriptions and medications with the patients and their families/caregivers prior to discharge. In the preintervention group, nursing team members were sometimes unsure whether medication education had already taken place when the medical team members delivered prescriptions to the patients directly at the bedside. Furthermore, the prescription may have been delivered to the patient in advance of the actual discharge time, without their family members or caregivers present. In the postintervention group, the opportunity for the nursing staff to consistently provide education, answer questions and emphasise the importance of medication adherence to patients and their families/caregivers immediately before discharge from the wards may have further contributed to the reduction in delayed prescription retrieval.

While patients in the postintervention group had a significantly lower incidence of delayed prescription retrieval, it is not known whether this translated to improved medical adherence, as patients may have retrieved their prescription but not actually taken their new medications. It is also unknown whether the discharge process reduced the occurrence of adverse clinical events or morbidity. In the preintervention group, all patients were due a new prescription medication on the day of discharge that they did not receive in hospital. Therefore, those with delayed retrieval likely missed a

dose of the new medication. These patients may have higher risk of morbidity and mortality particularly if, for example, they missed a dose of antiplatelet medication after receiving percutaneous coronary intervention for acute coronary syndrome or a new medication for heart failure.^{5 6} However, a patient who misses a single dose of a lipid-lowering medication immediately after discharge is unlikely to be at the same risk of adverse clinical events. Future studies which include a larger number of patients and more extensive postdischarge monitoring may be able to detect differences in clinical outcomes between the patient groups, particularly if these patients can continue to be followed when they return to their home cities or towns of residence.

There were additional limitations to this study. This was a single-centre study and due to the unavailability of electronic monitoring of prescriptions by some pharmacies, many of the initially enrolled patients had to be excluded due to the inability to track their prescription submissions and retrievals resulting in a smaller sample size. In addition, as the preintervention group and postintervention groups were created based on enrolment periods, rather than in a randomised fashion, it is possible that differences in patient demographics or comorbidities that were not accounted for may have contributed to each group's relative incidence of delayed prescription retrieval. A proportion of the enrolled patients in the postintervention group were also excluded as they did not consent to have their prescription faxed. Several patients commented that they could not participate as they or their caregivers had not yet chosen the pharmacy they were going to fill their prescriptions at. This factor suggests an opportunity for further improvement in future discharge planning as medical teams may be able to encourage patients and their caregivers to begin preparing for their eventual discharge in advance, including deciding on a pharmacy

to use so that more patients can take advantage of the new discharge process.

With newer internet-based technology facilitating transfer of data confidentially via the web, it is possible that fax technology may eventually become redundant. While the electronic delivery of prescriptions to pharmacies by fax was an essential part of the new discharge process used in this study, communication of patients' prescriptions to pharmacies directly from hospitals' electronic health record systems would be a suitable alternative. This technology is already available with some hospital platforms.

In conclusion, in this study, patients who experienced a formalised discharge process, which included electronic delivery of prescriptions by fax, had a lower rate of delayed prescription retrieval. Future studies are required to further examine the incidence of adverse clinical events among patients with delayed prescription retrieval and the impact of formal discharge processes on patient morbidity and mortality.

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Contributors AKS designed and planned the study, assisted with data collection, data analysis, and manuscript preparation, and submitted the study. SM, MA and ML assisted with study design, planning and data collection. JL assisted with study design, planning and data analysis. AG assisted with study design, planning, data analysis and manuscript preparation. RM assisted with study design, planning, data analysis, manuscript preparation and submission.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not required.

Ethics approval This study was classified as a quality improvement investigation based on the requirements listed in the Tri-Council Policy Statement (Article 1.1). The research team confirmed with the Research Ethics Board that articles classified as quality improvement investigations did not require ethics committee approval. The study process was also reviewed by the Privacy and Medical Affairs offices of the London Health Sciences Centre, where the study took place.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information. Deidentified individual participant

data are stored in a password-protected database on our institution's hospital server.

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