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A time-motion study of residents and medical students performing patient discharges from general internal medicine wards: a disjointed, interrupted process

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Abstract Patients are at high risk for adverse events after discharge from a hospital admission. As a critical and often time-consuming aspect of care for hospitalized patients, the purpose of this study was to describe the physician time, events and workflow in performing a patient discharge. On General Internal Medicine (GIM) wards at two academic medical centers in Toronto, a time-motion study was performed on 11 residents and 2 medical students performing 32 patient discharges. Using a paper data collection tool, a research associate aimed to capture the distribution of activities and the nature and frequency of workflow interruptions during patient discharges from the perspective of resident and medical student housestaff. Thirty-two GIM patient discharges by the 13 housestaff were observed over a period of 116 h. Discharges required 69.2 ± 41.2 min of housestaff-dedicated time to complete, but spanned over a mean 3.7 h from start to finish. On average, 32.8 min (47.3%) of time spent on discharges was dedicated to documentation activities; 13.5 min (19.6%) to direct patient communication; 10.8 min (15.6%) to communication with other clinicians and providers; 6.5 min (9.4%) to arranging outpatient care; 5.7 min (8.2%) to time in transit and waiting. For each discharge, housestaff were interrupted a mean of 5.5 times and switched tasks 8.7 times. During the discharge process, housestaff mainly dedicated themselves to documentation activities and focused minimally on direct patient communication. Clinicians were also found to experience several workflow inefficiencies and interruptions. The present study can be used to identify opportunities to improve and further focus efforts in characterizing this dynamic process.

Keywords Discharge planning · Time-motion study · Workflow · Hospital care · Transitions

Introduction

In the transition from hospital to home, patients are known to experience a well-described "voltage drop" of care making them more vulnerable to adverse events or medical errors during the post-discharge period [1–3].

To promote a safe transition to a new care environment, many steps are undertaken by clinicians to ensure a high-quality discharge [4]. These include educating the patient or caregiver regarding the condition, the treatment, the expected outcomes and other potential medical issues. Inpatient physicians also coordinate follow-up care, communicate with the primary care provider, and create a discharge summary to disseminate information to healthcare professionals within the patient's circle of care.

Compromises in any of these areas may affect discharge quality and lead to adverse patient outcomes. Deficits in communication and discharge summaries can leave both patients and primary care providers with ambiguous instructions and care plans [5–8]. Also, frequent interruptions to clinical workflow—common to a hospital ward

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environment—are known to impair clinical task performance and may negatively affect the quality of patient discharges [9–11].

Academic medical centers, in particular, face further challenges in the care they provide for hospitalized patients as it is often residents and medical students who deliver it. The structure and requirements of their educational programs can result in: (1) a high number of handoffs; (2) competing priorities between clinical service needs and educational activities in the face of duty hour restrictions; (3) the creation of discharge documents by inexperienced clinicians [12–14]. Moreover, the lack of coordination between different members of the interprofessional team may further undermine high-quality discharge care [15].

Despite efforts to improve the efficiency and quality of the process through guidelines and checklists, the uptake of these measures is generally poor—possibly due to the competing priorities of physicians as well as a lack of understanding surrounding the workflow of the patient discharge [16]. To our knowledge, there are no studies examining the workflow of the hospital discharge process from a physician's working context. With that, we sought to describe the activities and workflow of this process from the perspective of residents and medical students.

Methods

Study design

We conducted a time-motion study to characterize the processes and workflow of discharging hospitalized patients.

Study setting

The study was conducted on General Internal Medicine (GIM) wards at Toronto Western and Toronto General Hospitals—two large academic medical centers in Toronto, Ontario with 261 and 417 inpatient beds, respectively. Both hospitals are similar in terms of staff organization, clinical workflow and patient volumes. In 2013, the GIM service at the Toronto General Hospital had 76 patient beds and 4080 discharges; the GIM service at Toronto Western Hospital had 78 patient beds and 3658 discharges. Each site has four clinical teaching teams and one hospitalist team. Each clinical teaching team has an attending physician, one senior resident, 2–3 first-year residents and typically 1–2 medical students. The hospitalist team has one attending physician and 2–3 internal medicine fellows who have completed their training in either Internal or Family Medicine.

A centralized electronic patient record is used for medication order entry, results review and access to an electronic discharge summary with medication reconciliation through an electronic prescription tool. There is also a paper chart for the documentation of medical treatment orders not available in the electronic patient record, and clinical assessments including admission notes, consultations and progress notes produced by physicians and other members of the clinical team. At the time of discharge, 97% of GIM patients are provided with a printed discharge summary from medical housestaff including medication reconciliation.

The Research Ethics Board of the University Health Network approved this study.

Pilot testing

An observational time-motion study was conducted in accordance with previously described methods [17–19]. We developed a paper data collection tool with an initial activity list drawn from prior published time-motion studies and input from a group of senior GIM attending physicians [17]. We tested the data collection tool and iteratively revised it to better capture observed discharge-related activities. Adjustments included recording events from a per-quarter-minute to a per-second basis to more accurately capture their sequence; creating an *Operating Overhead* category to incorporate the time in walking to and from patient's rooms and in experiencing delays due to system or personnel constraints; and further stratifying communication based on individual parties with whom discussions were carried out.

Participants and observation procedure

Study participants were medical residents and fourth year medical students rotating on GIM. Following their informed written consent, workshadowing observations took place on weekdays starting at 8 am with morning clinician team rounds and finished when the clinician participant deemed discharge work to be complete for that day. The observer was a research associate who received prior training and instruction from clinical staff in recognizing discharge-related activities. They had no direct relationship with the GIM team and followed one team for 1 week at a time. The observer followed a participant from the team who indicated their intention to discharge a patient at the start of the workday; and if there was more than one discharge planned for that day, the observer followed the discharge that was of greater complexity as perceived by the medical team. Certain participants were able to anticipate their patient's discharge and began discharge-related work the day prior to their discharge. In

these instances, the observer recorded discharge activities over the 2-day period leading up to the patient's discharge.

Throughout the week, the observer followed different members of the GIM team depending on the division of patient workload and likelihood of discharges. This process was repeated for three GIM teams at both the Toronto Western and Toronto General Hospital for a total of six teams over a period of 6 weeks between December 2013 and January 2014. Observations did not take place over dates between December 21 and January 5—taking into account the potential impact that holiday scheduling may have had on services and workflow.

A single observer was trained and responsible for recording the time spent on each activity during observations. Prior to the study, the observer was trained to minimize distractions and obtrusions for clarifying participant activities. At the end of each discharge, clinician participants were asked to self-report on the perceived complexity of completing the patient discharge on a three-point scale: simple, medium and complex; as well as to indicate the time and type of any discharge-related activities that occurred outside of the period of observation.

Patients and caregivers involved in the discharges were informed of the study, and their participation in the study was voluntary for which informed written consent was obtained.

Data collection

We defined *discharge-related activities* as any activity related to discharge occurring after participants identified such a patient as a likely discharge candidate. These included both direct and indirect patient activities. Communication with the patient was considered a *direct patient activity*. *Indirect patient activity* included communication with other physicians and the interprofessional team, documentation, arranging post-hospital care, moving around the ward between patients, and searching for individuals or objects necessary to the discharge. We reported our findings under various categories recognizing elements of a discharge framework described by Jack et al. [20], with a focus on all discharge activities that were most consistent with patients observed in our general internal medicine wards (Table 1).

Using the approach described by Walter et al. [21], we defined a *task* as any single participant event that contributed to the patient discharge (i.e. filling out the discharge summary, arranging follow-up care, communication with patient and staff, etc.). *Task-switching* was defined as moving away from a discharge task to other non-discharge-related work prior to task completion motivated by factors internal or external to the participant.

Interruptions were defined as breaks in a patient's care planning occurring exclusively as the result of external, unplanned or unscheduled factors based on a definition from Weigl et al. [9]. We distinguished interruptions occurring within the discharge process by characterizing *discharge interruptions* as any activity external to the participant that causes an immediate break from a discharge-related activity for the patient. Interruptions were categorized as resulting from colleagues (such as doctors or nurses), others (such as patients, their caregivers or personal) or impediments and delays (such as searching for objects or people).

Sample size

Based on previous time-motion studies [19], we estimated that we were required to observe between 20–30 discharges for 80–120 h to provide useful insight into the discharge process.

Data analysis

Tasks were categorized and the time spent on each activity was summarized in minutes and as a proportion of total discharge-related time according to trainee level. The number of interruptions and task switches were tabulated for each discharge and the total time spent on all discharge activities per patient was calculated for those deemed simple, medium and complex from participating clinicians. In addition, the absolute time from the start of the discharge to its completion was calculated. Discharges were distinguished between those that occurred on the same day that patients were deemed suitable for discharge and those where discharge activities occurred over two consecutive days. Completion of discharge activities was taken as the time when the participant declared the discharge to be complete. *t* tests were performed to compare the results between sites. All analyses were performed using Microsoft Excel version 2010.

Results

Over a period of 20 days and approximately 116 h of observation, 32 patient discharges were observed (Supplementary Table 1). Of the thirteen participants (7 females and 6 males), two were medical students, ten were first-year residents, and one was a senior resident. Participants were on their GIM rotation for a mean of 19.7 days and were principally responsible for the care of 5.6 (SD 1.6) patients per day. The average GIM patient at both sites was 66.7 years of age and had a length of stay of 8.1 days. Each GIM team had an average of 19.7 (SD 4.2) patients

Table 1 Components of observed discharge process

Component	Description
Documentation	
Discharge summary	Completing a written summary of patient's inpatient stay, and further instructions for care, with information pertaining to:
	Reason for hospitalization and diagnosis
	Results from conducted procedures and investigations
	Description of services provided to patient while in hospital
	Reconciled medication list including noted allergies
	Patient's condition at the point of discharge and outstanding tests for which results are pending
	Contact information and instructions for follow-up appointments and services
Chart	Reviewing and/or updating patient's electronic and paper medical record with information relating to the status of their health, results of investigations and care plan moving forward from the point of discharge
Prescription	Completing an electronic and handwritten medication prescription form
Communication	
Patient	Educating patient on relevant diagnoses, investigations (pending and completed), follow-up appointments and overall care instructions following their discharge. Reconciling new or altered medication list with patient. May also include communication with third parties including family members and/or residences/institutions who share direct caregiving responsibilities
Medical team	Discussions with participant's clinical teaching team regarding care for the patient at the point of discharge
Interprofessional team	Discussions with non-physician members of the patient's healthcare team to collect information and coordinate care for patient at the point of discharge
Consultants	Discussions with other in-hospital physician services to collect information related to specific diagnoses, results of investigations and to solicit input for patient care management post-discharge
Primary care provider	Discussions of inpatient stay and post-discharge care, including transmission of documents (discharge summary) to primary care provider
Arranging outpatient care	
Follow-up care	Communication and organization of follow-up appointments and tests with outpatient clinics and services
Arranging home care	Coordinating community care through a local electronic information and referral system for appropriate patients
Operating overhead	
In transit	Walking to and from patients' rooms and ward units
Impediments/ delays	Searching for the patient, providers and materials (charts, forms, computer workstations, medical equipment, etc.) necessary to coordinate patient discharge

and discharged 2.9 (SD 1.7) patients per day during this time period.

Discharge processes for one patient resulted in a mean 69.2 min of observed activity. When including additional unobserved activity, discharge processes took 76.3 min (Table 2). Observed discharges ranged from 26 to 174 min (Fig. 1). Over all patient discharges, participants spent a mean of 80.4% of their time engaging in indirect patient activities (47.3% on documentation; 15.6% on total non-patient communication; 9.4% on arranging outpatient care; 8.2% on other discharge-related activities) and 19.6% in direct patient activity (Table 2). The top three most time-consuming activities were completion of discharge summary (20.1 ± 10.0 min), communication with patients and caregivers (13.5 ± 11.9 min) and chart-related work (11.2 ± 10.4 min). Time spent on discharge activities showed no significant difference between sites.

When comparing the time spent on discharge activities between different levels of trainee, the senior resident spent considerably less time with documentation activities (26.5 ± 4.7 min) and operational overhead (1.7 ± 0.9 min) than their junior level colleagues (Table 3).

Across all 24 discharges performed over a single day, discharge activities spanned a period of 3.7 h (SD 2.2, range 0.5–7.6). For the eight patients whose discharge planning was observed over two consecutive days, discharges spanned an average of 24 h (SD 4.1, range 19.7–33).

Over the course of a single patient's discharge planning, irrespective of level of trainee, a mean of 5.5 interruptions occurred (Table 4). These consisted of 3.2 (SD 3.1) interruptions from colleagues, 1.6 (SD 1.9) impediments and delays and 0.8 (SD 1.2) interruptions from other individuals. Impediments and delays included searching for

Table 2 Time spent in minutes on discharge activities per discharge

Discharge activity	Observed time spent per discharge in minutes (%, SD)	Combined observed and unobserved time spent per discharge in minutes (%, SD)	Number of discharges in which the activity was observed ($n = 32$)
Documentation	32.8 (47.3%, 16.7)	39.4 (51.6%, 18.8)	–
Discharge summary	20.1 (29%, 10.0)	26.5 (34.7%, 12.9)	32
Chart	11.2 (16.2%, 10.4)	11.4 (14.9%, 10.4)	32
Prescription	1.5 (2.2%, 1.2)	1.5 (2.0%, 1.2)	24
Communication	24.3 (35.1%, 22.1)	24.5 (32.1%, 22.4)	–
Patient	13.5 (19.6%, 11.9)	13.5 (17.7%, 11.9)	32
Medical team	4.5 (6.5%, 4.4)	4.5 (5.9%, 4.5)	25
Interprofessional team	3.3 (4.8%, 2.8)	3.3 (4.4%, 2.8)	31
Consultants	2.4 (3.5%, 7.8)	2.4 (3.2%, 7.8)	8
Primary care provider	0.5 (0.8%, 2.0)	0.7 (0.9%, 2.1)	3
Arranging outpatient care	6.5 (9.4%, 8.9)	6.8 (8.9%, 9.4)	–
Follow-up care	6.3 (9.2%, 9.0)	6.7 (8.7%, 9.5)	15
Arranging home care	0.1 (0.2%, 0.6)	0.1 (0.2%, 0.6)	2
Operating overhead	5.7 (8.2%, 5.7)	5.7 (7.4%, 5.7)	–
In transit	3.8 (5.5%, 3.4)	3.8 (5.0%, 3.4)	32
Impediments/delays	1.9 (2.7%, 3.2)	1.9 (2.4%, 3.2)	21

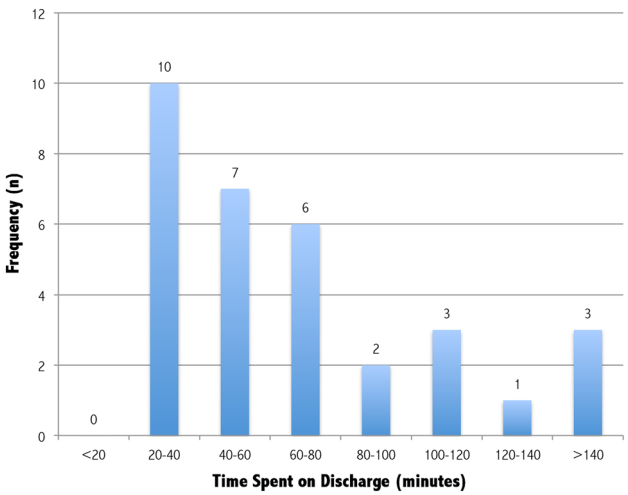

Fig. 1 Distribution of time required to discharge patients

objects such as the patient's chart, searching for people, technology issues and waiting for faxes (Table 4). Task-switching occurred a mean of 8.7 (SD 6.4) times per discharge as outlined in the Fig. 2 schematic of a discharge of simple complexity being performed by a medical student.

Discharges deemed by the participating clinician to be simple (17, 53%), medium (9, 28%) and complex (6, 19%) required 53.3 (SD 25.7), 63.9 (SD 36.5) and 122.1 (SD 44.6) minutes of activity, respectively. For the six discharges deemed as complex, clinicians viewed arranging follow-up care and contacting outpatient providers as their most challenging tasks. Accounting for all discharges, direct communication was *observed* to occur with the primary care provider for 3 (9.4%) patients.

Discussion

In this time-motion study describing the events involved in discharging patients from hospital, clinicians were found to focus almost half of their time on documentation activities related to their patients' care. While discharge activities occupied a mean 69.2 min of activity, frequent interruptions from colleagues, subsequent task-switching during discharge activities, barriers and other complexities to discharge may be responsible for lengthening the average time to completing the discharge for a patient to the observed 3.7 h.

According to our findings, indirect patient care and administrative activities occupied the majority of clinicians' time; in contrast to direct patient care, to which they devoted less than a fifth of their time at the point of discharge. The minimal amount of time clinicians spent on direct in-person communication with patients and their caregivers is consistent with other time-motion studies reporting that hospital-based clinicians spent only 12–18% of their overall time on direct patient care [17, 19, 22]. However, direct communication with patients is key to the delivery of care instructions and may improve the patient experience at the time of discharge [23]. It is also an

Table 3 Time spent in minutes on discharge activities per discharge (*n*) per trainee level

Discharge activity	Medical student discharges ($n = 4$, % total, SD)	First-year resident discharges ($n = 24$, % total, SD)	Senior resident discharges ($n = 4$, % total, SD)
Documentation	32.9 (46.9%, 28.0)	33.8 (46.7%, 16.2)	26.5 (53.1%, 4.7)
Discharge summary	18.6 (26.5%, 15.1)	20.3 (28.1%, 10.1)	20.2 (40.5%, 4.9)
Chart	13.6 (19.4%, 14.1)	12.0 (16.6%, 10.4)	4.0 (8.0%, 2.3)
Prescription	0.7 (1.0%, 0.9)	1.5 (2.1%, 1.3)	2.3 (4.6%, 0.6)
Communication	21.0 (30.0%, 10.7)	26.2 (36.3%, 24.5)	16.0 (32.1%, 14.8)
Patient	8.7 (12.5%, 4.1)	15.0 (20.7%, 13.1)	9.7 (19.4%, 8.2)
Medical team	6.9 (9.8%, 4.7)	4.7 (6.5%, 4.5)	0.6 (1.1%, 0.7)
Interprofessional team	2.9 (4.1%, 2.7)	3.7 (5.1%, 2.9)	1.7 (3.5%, 1.0)
Consultants	2.5 (3.6%, 5.0)	2.5 (3.4%, 8.8)	2.0 (4.0%, 2.8)
Primary care provider	0.0 (0.0%, 0.0)	0.4 (0.5%, 1.7)	2.0 (4.0%, 4.0)
Arranging outpatient care	5.1 (7.3%, 10.2)	6.9 (9.5%, 9.4)	5.7 (11.4%, 6.0)
Follow-up care	5.1 (7.3%, 10.2)	6.8 (9.4%, 9.5)	4.9 (9.9%, 6.6)
Arranging home care	0.0 (0.0%, 0.0)	0.1 (0.1%, 0.3)	0.7 (1.5%, 1.5)
Operating overhead	11.1 (15.8%, 7.7)	5.4 (7.5%, 5.5)	1.7 (3.5%, 0.9)
In transit	7.0 (10.0%, 3.4)	3.6 (5.0%, 3.3)	1.4 (2.8%, 1.1)
Impediments/delays	4.0 (5.8%, 5.0)	1.8 (2.4%, 3.0)	0.3 (0.6%, 0.5)

Table 4 Interruptions experienced during patient discharge

Interruption type	Mean interruptions per discharge (*n*, %)	Category Subcategory[a]	Mean interruptions (*n*, % of category)
Colleagues	3.2 (103, 58.2%)	Medical team	1.4 (44, 42.7%)
		Medical specialties	0.6 (18, 17.5%)
		Nurses	0.5 (15, 14.6%)
		Interprofessional team	0.4 (14, 13.6%)
		Phone call/text messages	0.4 (12, 11.7%)
Impediments and delays	1.6 (50, 28.2%)	Searching for object	0.8 (26, 52%)
		Chart	23
		Clinical referral form	2
		Technology issues	0.3 (9, 18%)
		Electronic chart	5
		Printer	3
		Searching or waiting for person	0.3 (9, 18%)
		Physician	6
		Waiting for fax	0.2 (6, 12%)
Others	0.8 (23, 13.6%)	Personal	0.6 (19, 82.6%)
		Patients	0.1 (3, 13%)

[a] Interruptions that were only observed once per category or subcategory are not displayed

opportunity for patient teach-back to consolidate understanding of care plans moving forward [23, 24]. With such limited contact from medical providers, patients may be at risk of having a reduced understanding of their condition, medications, and follow-up plans which, in turn, could increase their vulnerability to adverse events following discharge [6, 25].

Observed in only three discharges (9.4%), communication was also limited with the patient's primary care provider (PCP). Our findings are supported by other studies showing a deficit in communication with PCPs at the point of discharge in which only 3–20% of PCPs received direct communication from clinicians at this time [5, 8, 26]. In addition to comprehensive documentation of patient care in

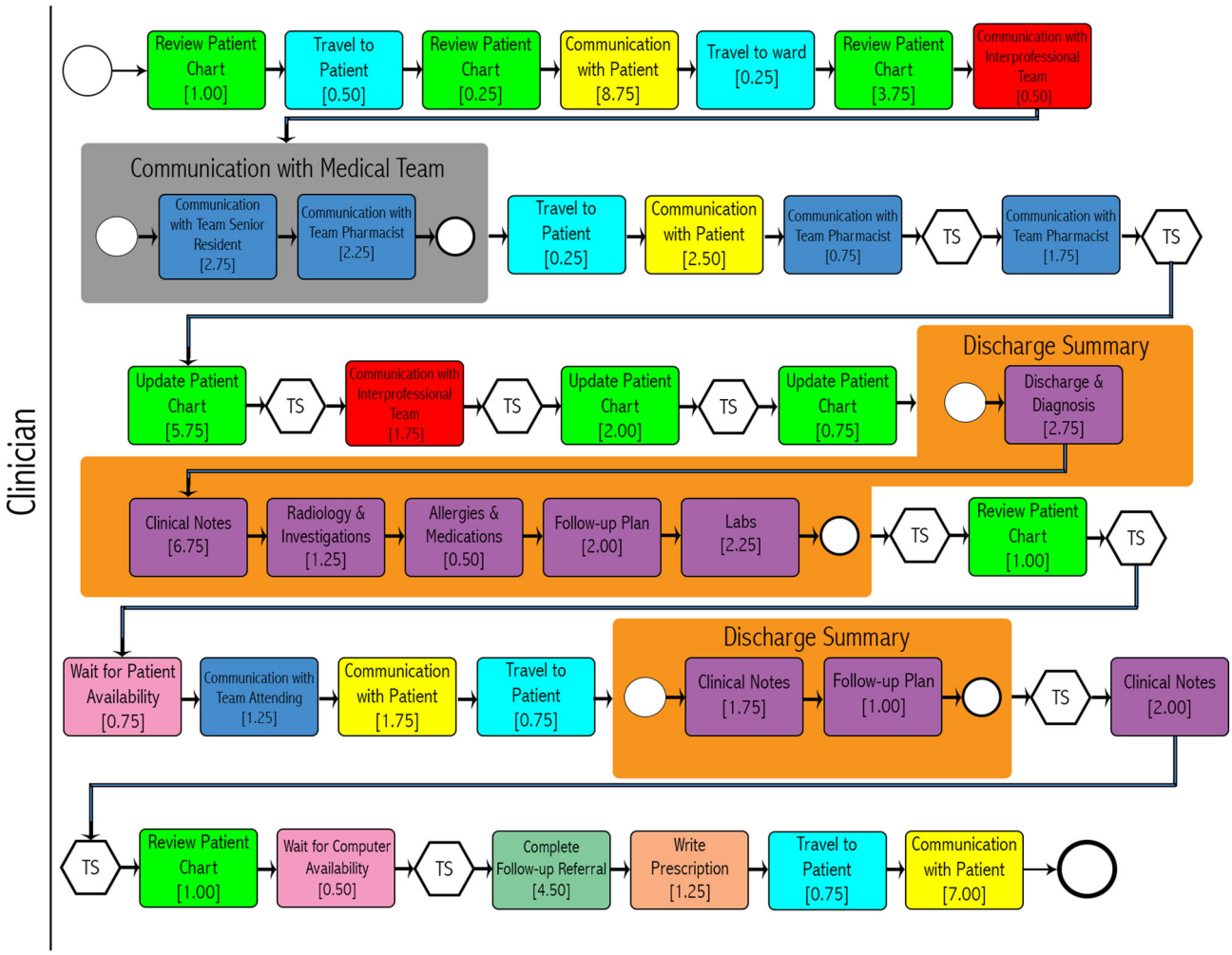

Fig. 2 Flow diagram of discharge activities performed by a medical student for a patient of simple complexity (time in minutes rounded in *brackets*). *TS* task-switching

the discharge summary, communication with PCPs is important to ensuring the continuity of care at a time when adverse events are common and when patients may still be recovering from their illness [3, 5, 8, 25, 26]. However, gaps in direct communication are common, and are often compounded by a lack of timely discharge summaries; further compromising patients' care [5] and, therefore, supporting the combined value of both these aspects to the patient's discharge.

Furthermore, the discharge process observed during our study was often disjointed and non-linear. While there were standard components to each discharge, the time spent on each activity and the sequence in which they were completed varied significantly between them. Standardized discharge protocols have both been produced [20] and shown to be effective [27]; however, the combination of institutional-specific frameworks of care and the patient-specific nature of discharge planning contribute to some degree of variability in this process. Related to this, and albeit with a small sample size, we also noted differences based on level of training. Compared to medical students and first-year residents, the senior level trainee spent less time in activities including documentation, communication with their medical team and operational overhead. This efficiency may reflect their familiarity with existing institutional systems, in addition to being a more experienced clinician than their junior level counterparts.

Clinician-perceived complexity and barriers to discharge increased the time required to discharge a patient. Complexity resulted from coordinating outpatient services and follow-up appointments; whereas barriers to patient discharge included outstanding test results, difficulties communicating with other staff and managing patients' social issues—factors most often outside the direct control of the clinician. Consequentially, though requiring a mean 69.2 min of active work, clinicians performed discharge activities over an average period of 3.7 h. As well, interruptions and task-switching were common and

attributable to colleagues on approximately 60% of occasions. In addition to delaying patient discharges and compromising clinical workflow and efficiency, frequent interruptions have been associated with medical errors that may further undermine the quality of care provided to patients [9, 10].

The ultimate impact of busy clinicians performing a lengthy discharge process with multiple components, interruptions, and delays can result in infrequent contact with the primary care provider, minimal time spent with the patient and a likely lower quality transition of care. While additional care transition processes such as discharge checklists or teach-back may be difficult to integrate, opportunities to improve the discharge process may include educational interventions such as provider-based seminars or exercises to address discharge workflows and practices; or regular group discussions between hospital and primary care providers to build consensus around the coordination of care at the point of a patient's discharge [28]. Furthermore, increased support through added roles such as dedicated discharge coordinators may help in streamlining the organization of outpatient services and follow-up appointments that consumed nearly 10% of the clinician's time. The development and use of shared electronic communication platforms between different members of the healthcare team may also provide the clinician who is directing the discharge the opportunity to access evolving patient information at their discretion; thus minimizing inefficiencies and interruptions that could further compromise workflow and patients' care. With our findings, future studies would benefit from examining the discharge process with more patients and providers. In addition, the associations between frequent interruptions, the quality of patient discharges, and how the patient experience with their discharge is impacted by clinician workload and workflow would merit consideration.

Our study has several limitations. First, we may have underestimated the time spent on, and frequency of, discharge activities in three ways. Because data collection began the day prior to or day of a planned discharge, we may have missed capturing discharge activities that began prior to this period. Also, regular clinical rounds with the entirety of a patient's healthcare team may involve very brief discussions about their discharge. The time spent in these rounds by clinicians was captured globally and not specific to the patient being discharged. Residents and the attending physician also occasionally shared patient responsibilities, leading to the possibility of missing aspects of the discharge process being performed concurrently by other members of the clinical team. In addition, discharges were observed on weekdays and largely during working hours so that any discharge work occurring overnight and on weekends was not captured. Together, these may have accounted for an underreporting of actual discharge-related activities performed by the clinician in the form of communication events with members of their healthcare team, PCPs or patients; and time spent on discharge-related documentation work.

Second, due to our study design, observations were conducted during the months of December and January when wards may experience atypical pre- and post-holiday workflow pressures. They precluded the holiday period, however, and followed GIM teams who continued to operate under their normal yearly working structure. Also,

Table 5 GIM interprofessional healthcare team contributions to patient discharges

Type	Role
Nurse	Responsible for many aspects related to the direct and indirect care of patients in coordination with members of both the medical and interprofessional teams. At the point of discharge, they are responsible for medically preparing the patient to leave the hospital and answering any questions that they or their caregivers may have
Pharmacist	Assists medical team with drug monitoring, medication histories and optimizing drug therapy. During patient discharges, they assist the medical team with medication reconciliation and answering drug information questions with patients
Social worker	Provides counseling, assesses patient capacity and ability to consent, coordinates family meetings that focus on patient disposition and/or relevant social issues and identifies systems for patient resources and support in the community
Occupational therapy	Assesses patient's physical and cognitive abilities against their baseline level of function and in the context of their social and community environments. They help determine a patient's discharge destination and the levels of supports they will receive when returning to the community. This could include equipment to support activities of daily living
Physiotherapy	Evaluates patient for mobility, falls, stroke or chest secretion clearance issues. In conjunction with Occupational Therapy, they determine patient rehabilitation potential and provide other recommendations for patient at discharge
Patient flow coordinator	Responsible for managing overall ward workflow and the processing of patient's inpatient stay from admission to the point of discharge. This includes bed management but also expediting tests that are discharge limiting
Community care coordinator	Conducts a standardized assessment to determine patient's needs and, with the medical team, determines if they are appropriate for Long-Term Care, Convalescent Care, Community Services and Case Management Services. In turn, they are responsible for coordinating and managing the application process for these services

we deliberately selected more complex discharges that may have biased the results. While we were unable to obtain ethical approval to characterize the patients who were being discharged (e.g. age, admission diagnoses, number of chronic conditions, number of medications, number of follow-up appointments, etc.), these results should be interpreted in the context of complex discharges of GIM patients.

Third, by observing only medical residents and medical students, we did not capture data on either the time spent or activities performed by other health professionals who, in contributing to the patient discharge, may impact the discharge activities undertaken by housestaff (Table 5). However, our study was designed to follow the medical team who, at our institutions, is responsible for key components of the discharge process such as documentation, arranging follow-up care and patient communication; all of which were captured in our data collection.

Fourth, we did not account for destination of discharge—an aspect of a patient's care that may impact the observed clinical workflow. Data was collected on clinician-led discharge activities of GIM patients—the majority of whom are discharged home.

Finally, the design and setting of our study may limit our findings to the environments of GIM services at academic medical centers that have similar resources. Extending observations to include a greater number of trainees and patient discharges would further generalizability.

Conclusion

The discharge process is complex and very time consuming. The majority of time spent at this point in care from the perspective of resident and medical student clinicians can be attributed to documentation rather than direct patient communication. The number of tasks, time required in completing them and the sequence in which they are completed is highly variable. Improvement opportunities could focus on building provider consensus around care at the point of discharge, increasing support and systems to efficiently arrange appropriate post-discharge care and restructuring communication frameworks and practices among housestaff.

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Author contribution RW conceived and designed the study. AS, VL, LLS, PW, CS, and RW refined the discharge activity list and study strategies. AS performed observations and initial analyses and prepared the initial draft. All authors discussed the findings, commented on and revised the manuscript.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Statement of human and animal rights This study was approved by the Research Ethics Board of the University Health Network.

Informed consent Written informed consent was obtained from all clinician and patient participants.

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Data sharing statement The dataset—while not made available to any clinical data repository—can be requested through contact with the corresponding author.

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