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Protocol for a Mixed Methods Study of Hospital Readmissions: Sensemaking in Veterans Health Administration Health Care System

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Abstract

Introduction: Effective delivery of health care in complex systems requires managing interdependencies between professions and organizational units. Reducing 30-day hospital readmissions may be one of the most complex tasks that a health care system can undertake. We propose that these less than optimal outcomes are related to difficulties managing the complex interdependencies among organizational units and to a lack of effective sensemaking among individuals and organizational units regarding how best to coordinate patient needs.

Methods and analysis: This is a mixed method, multi-stepped study. We will conduct in-depth qualitative organizational case studies in 10 Veterans Health Administration facilities (6 with improving and 4 with worsening readmission rates), focusing on relationships, sensemaking and improvisation around care transition processes intended to reduce early readmissions. Data will be gathered through multiple methods (e.g., chart reviews, surveys, interviews, observations) and analyzed using analytic memos, qualitative coding, and statistical analyses. We will construct an agent based model based on those results to explore the influence of sensemaking and specific care transition processes on early readmissions.

Ethics and dissemination: Ethical approval has been obtained through the Institutional Review Board (IRB) of the University of Texas Health Science Center at San Antonio (approval number: 14-258H). We will disseminate our findings in manuscripts in peer-reviewed journals, professional conferences, and through short reports back to participating entities and stakeholders.

Strengths and limitations of this study

- Using Eisenhardt's recommendations for building theory from case studies(1), this study samples 10 sites with a minimum of 2000 discharges per year, all of which have attempted efforts to improve hospital-to-home care transition processes and have either worsening or improving hospital readmission rates over a 5 year period, allowing us to explore organizational characteristics leading to these performance patterns.
- For each site, we create an in-depth qualitative organizational case study of relationships, sensemaking and improvisation around care transition processes, from which we will build an agent based model to explore how system elements may impact hospital readmission rates and identify potential leverage points for new types of interventions.
- Limitations include the single point in time data collection, all facilities are drawn from a single health care system (the Veterans Health Administration), and the study is observational rather than interventional.

Introduction

Complex systems cannot be understood by breaking their processes down into component parts or into individuals' jobs, even though this is often our first response to solving complicated problems in healthcare (2,3). Effective healthcare delivery requires effective management of interdependencies between socially distinct professions and between organizational units with unique perceived purposes and purviews. Within well integrated systems, patients navigating unit boundaries should feel like system components form a continuum that communicate and cooperate for the explicit purpose of patient wellness.

As the United States' largest integrated health care system, the Veterans Health Administration (VHA) is theoretically positioned to deliver integrated care along such a continuum. Despite this, VHA's performance has been similar or worse than Medicare providers with regard to outcomes reflecting complex interdependencies, such as unplanned hospital readmissions (4). We propose that these less than optimal outcomes are related to difficulties managing the complex interdependencies among VHA organizational units and to a lack of effective sensemaking among individuals and organizational units regarding how best to coordinate Veteran needs.

Early Readmissions as a Persistent Problem

Hospital readmissions continue to receive significant attention as a source of potential waste and a marker of poor quality. A growing elderly population, rising healthcare costs, and an increasing US federal deficit form a broader context for focus on the prevention of early, unplanned readmissions. Reduction of Medicare payments to hospitals with higher than expected readmission rates for targeted conditions is now legislated as part of the Affordable Care Act (ACA), under the Hospital Readmission Reduction Program (5). Although the policy emphasis on readmissions is recent, early readmissions have been proposed as a quality indicator for at least 22 years (6). Numerous studies assessing the extent of preventability of early readmissions have had widely varying estimates: 5-79% (7–9).

Readmission rates have been declining but are still felt to be at an unacceptable level. Thirty-day hospital readmission rates for Medicare beneficiaries showed significant, then slowed declines after the implementation of penalties: going from 21.5% to 17.8% for targeted conditions and from 15% to 13% for nontargeted conditions between 2007 and 2015 (10). VHA hospital-wide risk adjusted 30-day readmission rates, which were not subject to the same penalties, gradually

dropped 3 percent from 1997 to 2010 (16.5% to 13.8%),(11) and have remained around 13 percent (IPEC readmission cube on VSSC, accessed 5/19/2017).

There have been gains in reducing hospital readmission rates, particularly among hospitals that were lower performing before the passage of the ACA but rates remain a concern (12). Why has reducing early hospital readmissions been such a persistent challenge? We believe the answer lies in the nature of the problem. Reducing readmissions within 30 days may be one of the most complex tasks that a health care system can undertake. First, success depends on the intersection, coordination and collaboration of many parts of the system that may not be well-aligned: hospitals and out-patient practices (primary care and specialty), nursing homes, rehabilitation facilities, pharmacies, and home health agencies. The VHA has an advantage over many other systems in that some of these pieces are part of its system. Second, patients and their caregivers are in control of many of the factors that will determine their ability to stay out of the hospital; healthcare delivery systems may not recognize the challenges patients and their caregivers face or the help and education they may need. Third, with such tremendous focus on shortening length of stay in the last 15 years, assumptions have been made on both inpatient and outpatient providers' parts about who is responsible for different aspects of care, with gaps occurring when expectations are not congruent. Fourth, a dearth of geriatricians, who might have more insight into frail patients' needs and be better equipped to deal with the large numbers of chronically ill elderly, exists. We found in our preliminary work that in 2006 only 6.1% of readmitted Veterans aged 65 years and older had any geriatric visits in the preceding year (13). Fifth, due to ongoing fragmentation of relationships with patients, there may be both a lack of recognition of the declining slope of health towards death and a lack of comfort in discussing when the switch should be made from full acute care treatment to supportive palliative care. Finally, we have

technologies and processes to prolong life, allowing us to care for sicker patients who in fact may require a greater number of appropriate hospital admissions over their life course.

Given the complexity of understanding all elements contributing to readmissions, deciding where it might be cost effective to try change efforts and for whom, what will be perceived as beneficial for quality of life by the patient, and how to bring so many different but interdependent parts of the system to work together, it is no surprise that preventing early readmissions remains a challenging health care issue.

Risk Prediction Models for Readmissions

One approach to reduce readmission rates has been to implement risk prediction models to identify and target interventions toward those most at risk for early readmission. Kansagara, in a systematic review commissioned by the VA, reviewed 30 published studies of 26 unique models. The article concluded "most current readmission risk prediction models that were designed for either comparative or clinical purposes perform poorly. Although in certain settings such models may prove useful, efforts to improve their performance are needed as use becomes more widespread " (14). This finding was largely corroborated by a more recent systematic review by Zhou and colleagues (15), which found that while risk prediction models are growing in number and condition specificity, they show only moderate discriminative ability. These models typically focused on characteristics of the patients that were risk factors for readmission and not characteristics of institutional behavior from the index admission that might have put them at risk.

Care Transitions Studies

Hansen et al (16) reviewed interventions to reduce 30-day rehospitalization. They characterized each intervention in relation to its timing with regard to the admission: predischarge, intervention

bridging the transition, and postdischarge intervention. Within predischarge interventions were patient education, discharge planning, medication reconciliation, and appointment scheduled before discharge. Bridging interventions included transition coaches, patient-centered discharge instructions and provider continuity. Postdischarge interventions included timely follow-up, timely PCP communication, follow-up telephone call, patient hotline, and home visit. Of 16 randomized, controlled trials only 5 documented statistically significant improvement in < 30 day rehospitalization outcomes. Four of the five tested multicomponent discharge bundles such as the Care Transition Intervention (17), Project RED (18), and the Care Transitions Model (19). But 11 other RCTs, some of which also used bundles with similar elements failed to show improvements. Leppin et al (20) reviewed 42 trials and while the majority of these trials (38 of 42) did not have a significant effect on readmissions, the metaanalysis did find a significant reduction of readmissions across the studies. They also found that studies with 5 or more unique activities in the intervention were more effective at reducing readmissions as were those with 2 or more individuals involved in the intervention. Given that trials are typically performed under the most ideal of circumstances and often in a single setting, such interventions may be even less effective when rolled out widely. One interpretation from the complexity science perspective of the lack of improvement from these interventions is that they focus on breaking down processes into component parts or on changing the behaviors of individuals (assigning specific individuals to specific tasks) but do not address the interdependencies and boundary crossings that make the transitions so difficult.

Despite the ambiguity of the evidence and because of the burden of readmission for both the patient and the system, many VHA facilities are trying some of the more promising of the above models. These efforts include implementing standardized models such as Project RED and

Project BOOST. There have also been VHA sponsored efforts, such as to address chronic heart failure readmissions (21) and to enact transition management initiatives. The VHA has also already adopted nationwide policies to implement specific elements of these recommended bundles such as 2 day call back by primary care teams after inpatient discharge and required medication reconciliation prior to discharge.

Healthcare Organizations as Complex Systems

The application of complexity science to healthcare systems provides new insights that are relevant to the issue of readmissions. A defining characteristic of complex systems is their non-linearity. In complex systems, inputs and outputs are not necessarily proportional nor is the former necessarily predictable from the latter (22). As is characteristic of nonlinear systems, we may expect to find that even though organizations might implement care transition programs, the amount of effort put into their programs is not proportional to readmission rate outcomes. Specifically, that despite implementing improvements, readmission rates continue to increase. The presence of unpredictability fundamentally changes how we think about clinical settings by introducing the key notion of uncertainty (2,23,24). A critical implication of uncertainty is that to improve the performance of clinical systems, we must improve providers' ability to perform effectively in the face of uncertainty. This may be particularly true during transitional periods for patients, when patients' recovery is not yet assured, the home environment is often not well known to the staff, and the possibility of developing a relapse is significant. In these situations, the uncertainty is compounded: it is inherent in the trajectory of the patient's illness, the limits of our scientific knowledge, and in the system itself (24,25). This is also true during the implementation of new initiatives in healthcare systems: changing the way that we do things introduces uncertainty. An implication of complexity science is that approaches for improving

clinical systems must focus on not only process of care, but also on the relationships between and interdependencies among health care providers (2,3,26). These interdependencies are the basis for the social activities that enable patient care. We focus on sensemaking as an important skill among health care managers, health care providers, and patients that enables resilience, or the ability to maintain health and avoid hospitalization.

Relationships, Sensemaking, and Improvising

Relationships among health care workers including physicians are the foundation for the social activities that occur during patient care, including transitions of care. Based on Lanham's framework of work relationships, seven characteristics define effective relationships in healthcare settings: trust, mindfulness, heedfulness, respectful interaction, diversity, social and task relatedness, and rich and lean conversation (27). These characteristics interact with how individuals and groups of providers reflect, make sense, and learn in ways that shape the quality of patient outcomes. It is through the relationship infrastructure that care transitions staff are able to bring together a collection of individuals to function as a coordinated, interdependent group that is able to act effectively to provide the most appropriate care for the individual veteran. Fostering relationships to improve care delivery is not something to which health care organizations have traditionally paid attention. However, emerging data speaks to its importance (27–29). For example, relationships among surgical teams are associated with their ability to successfully implement new techniques (30). Clinic staff member relationships are recognized as potentially important to clinic function (27) and improving how clinic members in primary care settings speak to each other leads to improved clinic performance (31,32). Finally, literature related to ICU team performance is rooted in characteristics of relationships among team members such as mindfulness (33).

We suspect that one reason care transitions interventions have had widely varying effectiveness despite implementing similar interventions may be a difference in the relationship infrastructures across services, teams and organizations. The relationship infrastructure can give way to activities, such as sensemaking and improvising, which help providers and other organizational staff manage uncertainties and stressors. In sensemaking, people assimilate information, reach conclusions, and take steps to act. According to Weick, "Sensemaking is a diagnostic process directed at constructing plausible interpretations of patterns based on ambiguous cues that are sufficient to sustain action" (34). In the inpatient setting, sensemaking can occur in relation to individual patient diagnosis and care, as well as understanding more broadly patient illness trajectories and how their condition changes over time (35). For example, surgical mortality has been found to be related not to the occurrence of complications, but to the ability of the provider team to recognize the complication and act effectively (36). The inability to do this has been called "failure to rescue," and we believe reflects a failure of the team to make sense of a complication as it unfolds. In settings from operating rooms (30) to intensive care units (37), and from nursing homes (38) to primary care offices (28,39), when health care providers are able to make sense of their patients' conditions, care improves.

Preventing early readmissions via sensemaking involves multiple sets of individuals interacting to make sense beyond the physician team. Our model below summarizes these interdependencies (Figure 1). Not only does the trajectory of the patient's illness need to be understood as it continues in the home or next institutional environment but also in relation to how the home environment now does or does not meet the patient's needs post-hospitalization (how much independence has the patient lost), what actual supports need to brought together (prosthetics, pharmacy, home delivery of equipment, etc.), the level of understanding of the patient and/or

caregiver of the self-management that will need to occur (for example, salt and water intake, self-weighing, and medication adherence for CHF), understanding of funding mechanisms, and more. While checklists help remind care transition managers of what needs to be done, they do not necessarily help them make sense of what needs to be done for whom, or when or how to engage individuals in other services to become part of their team.

Improvising is varying what one does based on the context and situation at hand (40,41). For example, Jazz ensemble members each build upon their own and the groups' talents and experiences as they improvise. In their interplay, they are a more effective whole (42). Physicians similarly describe the importance of improvisation amid new or uncertain situations in patient care (41). Thus, improving care transitions teams' ability to improvise may be a powerful strategy for decreasing readmissions. In the context of care transitions, a care manager might improvise by varying what they are doing based on the needs of the individual patient being discharged.

[INSERT FIGURE 1]

Project Aim:

We are studying care transition interventions aimed at reducing early readmissions as an exemplar of processes requiring a high level of interdependencies and sensemaking. By studying VHA facilities that have attempted interventions to improve care transitions and have had either improvement *or* worsening in their readmission rates, we will not only improve our understanding of the care transition processes themselves but also the sensemaking within the organization needed to implement change when there is no single part of the organization responsible for the outcome.

Objective 1: Conduct in-depth qualitative, organizational case studies of relationships, sensemaking, and improvisation in 6 facilities with improving and 4 facilities with worsening early readmissions rates between fiscal years 2006 and 2011, all of which engaged in care transition interventions to improve early readmissions.

Objective 2: Extend learning from and enhance generalizability of the case studies, using agent based modeling to simulate facilities implementing care transition innovations and to explore both specific care transition processes and elements of sensemaking as they prevent early readmissions, or not, as possible system outcomes.

Methods and Analysis

Study Design Overview

We are conducting a mixed method, multi-stepped study. It will be conducted in 2 parts: the first part will be an in-depth qualitative organizational case study of relationships, sensemaking and improvisation around care transition processes intended to reduce early readmissions in 10 facilities; the second part will be constructing an agent based model based on those results to explore both specific care transition processes and elements of sensemaking as they prevent early readmissions, or not, as possible system outcomes.

Case Sample and Individual Recruitment

Given that the intent of the study is to build or extend theory, not to test existing theory, we are using Eisenhardt's recommendations with regard to sampling for case studies in her methodological review, "Building theories from case study research" (1). In this context, cases are chosen on theoretical grounds and not for statistical reasons. Cases may be chosen to replicate previous cases or extend emergent theory or they may be chosen to fill theoretical categories and provide examples of polar types, in which the process of interest is "transparently

observable" (1,43). Random selection is neither necessary nor even preferable. The goal of the theoretical sampling is to choose cases which are likely to replicate or extend the emergent theory. In this spirit, our criteria for case selection are as follows:

Criteria 1: A minimum of 2000 admissions per year to the facility. After visually reviewing the all cause medical surgical readmission rates for 2006 to 2011 for all VHA hospitals and comparing facilities with varying admission totals, we identified that facilities with more than 2000 admissions/year had less dramatic variability in their year-to-year readmissions rates. We also felt that facilities with larger numbers of admissions were more likely to spend intellectual and human resources on care transitions.

Criteria 2: Significantly increasing or decreasing all cause medical surgical readmission rate between fiscal years 2006 and 2011**.** Using the unadjusted readmission rates obtained from the IPEC Readmission cube (44), we tested whether the change in rate over five years was significant or not. Eleven facilities were improvers (declining readmission rates), nine facilities had significantly worsening rates (increasing readmission rates) over that time. We chose facilities with significantly changing rates as we wanted to explore attempts at innovations and changes in the outcomes of interest to the facility.

Criteria 3: Two or more care transition innovations identified**.** Within the two different readmission performance groups (improving or worsening), we narrowed selection further using multiple sources of data regarding care transitions innovations within the VHA including a national survey of Utilization Management Nurses conducted in 2013, listings of all transitional care pilot projects funded by through a VHA initiative called the Geriatrics T21 funds, and listings of all VHA Flow Improvement collaboratives on care transitions in the same time frame. By comparing each of these sources for information, we identified 13 facilities, meeting the

above criteria, with evidence of two or more innovations taking place around care transitions and prevention of readmissions. We eliminated from the potential sample pool the 7 facilities for which we did not have evidence of two or more care transitions innovations.

Within each facility case, individuals will be recruited using purposive sampling.(45) Purposive sampling allows us to identify and recruit individuals with specific experiences and knowledge that will inform our case building. We will use information from facility websites (e.g., organizational charts, service rosters) and the VA's Microsoft Outlook contact list to identify individuals occupying specific roles. During site visits, snowball and convenience sampling will also be used to identify people with knowledge of site care transition innovations and experience with care transition practices.

Potential participants will be invited to participate through email and/or face-to-face. In introducing the study, investigators will explain they are studying the interdependencies between care providers and care units in early readmissions and care transitions, and that the potential participant's facility is one of 10 case study sites the team will visit. Specific forms of sampling and recruitment will vary based on data collection activity:

- Service leaders for interviews: A sample of approximately 10 individuals from medicine, nursing, social work, pharmacy, and primary care leadership (i.e., service chiefs and supervisors) will be identified through organizational charts available on facility websites or sharepoints, the VHA Outlook contact list, or by other staff at the facility. They will be contacted by phone or by email to participate in interviews.
- Patients for chart review: Project staff and investigators will review the charts of a random selection of 10 veterans admitted to the facility's hospital within the three to six months before the scheduled site visit. Five of the Veterans will have had 30 day

readmissions following their index admissions and five of them will have not. All 10 veterans must meet the following inclusion criteria at the time of the index admission: (a) inpatient or outpatient contact in the previous year with a VHA provider; (b) a Charlson Comorbidity index (46) of two or more; (c) discharge from a general medicine unit at the case study hospital within the sampling period; (d) discharge diagnosis of chronic obstructive pulmonary disease, chronic heart failure, and/or pneumonia; and (e) discharge to home. Patients are excluded if they are discharged to a long term care or skilled facility. For each site, a project analyst will provide the team with a random sample of 10 readmitted and 10 non-readmitted patients meeting these criteria. A waiver of consent was obtained for the sample of patients for whom we conduct chart reviews.

- Front line providers for interviews: We will recruit approximately 15-20 front line staff to participate in individual interviews. We will sample 1 to 4 providers from each of the following roles: hospitalists, inpatient medicine nurses, inpatient social workers, pharmacists who deal with discharge education and supply of medications to patients on discharge, primary care team providers, and, when present, dedicated care transition staff (e.g. patient care coordinators). Depending upon each site's processes and programs, interviews may also be held with representative staff from palliative care, subspecialty care (e.g., geriatrics, cardiology), telecare, utilization management, and others as appropriate.
- Front line providers for focus groups: One to two focus groups, comprised of four to 10 individuals, will be held at each site. For each focus group, the team will aim to recruit one to two staff to represent the following roles: hospitalists, nurses, social workers, pharmacists, and any roles important to care transitions at that site (e.g. patient care

coordinators, utilization management nurses). Investigators will recruit front line staff using snowball and quota sampling methods.

- Front line providers for observations: Staff participating in discharge planning, performing care transition tasks (e.g. discharge education), and doing day-to-day work on medicine units (e.g. rounds) will be eligible for observation. Investigators will purposively recruit participants for observations before the site visit (e.g. through email) and face-to-face during the site visit. The specific types of activities observed and number of times they are observed will vary depending on the facility, but the team will broadly aim to observe 3-6 medicine rounds, 3-6 discharge planning meetings, 4 med-surg unit observations, 3-6 job role shadowing, and 4-8 patient discharge educations. During observations, as necessary, researchers will identify themselves to obtain verbal consent from other patients, staff, and other individuals they meet during the observation. Data collection will cease if any person declines to be observed.
- Front line providers for surveys: Members of the inpatient care transition teams (e.g., hospitalists, social workers, nurses, pharmacists) and any front line staff members with a direct role in care transitions (e.g., primary care nurses and physicians) will be invited to participate in an anonymous survey. They will be identified during data collection activities (e.g., observing discharge planning meetings, individual interviews), and invited to participate either by email or in person. Everyone encountered who is eligible to participate will be recruited.
- Patients being discharged for interviews: Five patients being discharged from medicine units to home will be recruited for interviews. Patients will be sampled using convenience methods and identified by front line staff.

- Leaders for exit debriefing: During early email communications with site representatives, facility leadership will be asked to attend an hour long exit debrief on the last day of the team's site visit. Facility directors and chiefs of staff will be invited, along with anyone else they deem appropriate.

All providers and staff recruited to participate in interviews, focus groups, observations, and surveys will be consented using a verbal consent form distributed through email and/or in hard copy form. The verbal consent form outlines the purpose of the study and that participation is voluntary. Investigators trained in subject recruitment will ensure the potential participants read and understand the form, and agree to participation before engaging subjects in research. A waiver for the documentation of signed consent was obtained as a further level of protecting VHA staff participants' anonymity. Patients will be consented through a signed consent process and asked to sign a Health Insurance Portability Accountability Act (HIPAA) form to allow researchers to access their electronic health record. If at any point a potential or consented participant expresses a desire to not participate, investigators will discontinue recruitment or data collection efforts with them.

Data collection

We will gather and organize preliminary data before the site visit to delimit the organizational context and identify particularly promising areas for interviews and observations. We will visit each facility for a 5 day on-site visit. We will do follow-up data collection, when necessary by phone and protected correspondence. We will undertake to complete roughly one site visit per quarter with 2 to 2.5 months of qualitative data analysis between. Due to the planning for the Agent Based Modeling (see below) we anticipate that parameters and agent characteristics that we learn about in early interviews will suggest questions and observations for subsequent site

visits, checking for the presence or absence of these parameters or agent characteristics. Specific time frames and methods used will be responsive to local context and what we learn during previous site visits.

Team investigators hold advanced degrees in a diversity of fields, including medicine (JP, LL), anthropology (EF, LP), psychology (PN), and business (HL, LL). They each have at least 10 years of experience conducting qualitative research. If not already experienced with complexity theory and agent based modeling, each was provided orientation to these approaches before the study commenced.

Case Data Collection

Each site visit will follow the same general data collection approach, with site specific variations depending on local context (e.g., care transition processes, staffing and roles). Site visit preparation involves logistical activities and data gathering through leadership interviews and chart reviews. The 5-day site visit involves a continuation of activities started before the site visits, as well as additional interviews, observations of care transition work, focus groups, and staff surveys. Follow-up patient interviews occur about a month after the site visit.

Throughout the course of case study data collection, team members talk about what they are finding and fine-tune questions and approaches so that data collection is responsive to site processes and contexts. Decision-making during weekly meetings are documented in detailed meeting notes. Changes in data collection are recorded in site-specific data protocol.

Each site visit will be made by three investigators trained and experienced in qualitative methods (JP, PN, LP, and/or HL). Investigators have no relationship with participants prior to the start of the study. Data collection instruments will be tested at the investigator's home facility to ensure standardized use.

Table 1. General Schedule for Case Study Data Collection and Analysis

<----------3 Months---------->			
	Pre-Site Visit	**5 Day Site Visit**	**Post-Site Visit**
Data Collection	Facility Background Chart Reviews Leadership Interviews	Leadership Interviews (cont.) Front Line Provider Interviews Patient Interviews Focus Groups Observations Front Line Provider Surveys Care Transition Process Checklist	30 Day Post-Discharge Interviews with Patients
Data Analysis	Chart Review Memos	Observation Scoring Team Debrief Memos	Facility Reflection Qualitative Analysis in NVivo Quantitative Analysis

Facility Background: The project coordinator and investigators conducting the site visit will begin to compile background information on the facility as soon as a visit date is set. Sources of information will include VHA Support Service Center (VSSC) for performance metrics (e.g. 30-day risk standardized readmission rate) and the facility webpage and sharepoint (e.g., for unit structure, inpatient discharge policies, care transition-related pilots). Investigators will also add information about site specific roles, care transition processes (e.g. discharge planning), and readmission-reduction efforts gathered during pre-site visit interviews (see below). Facility background documents will inform site visit planning and data gathering activities, and serve as broader context for the case study.

Qualitative Data Collection

Chart reviews: Recently discharged patients' chart notes will be reviewed for two primary purposes: (1) to identify if, where, and how sites' systematically capture and communicate information about widely agreed upon readmission risk factors and (2) to synthesize information gleaned through specific patient case reviews to create individual case profiles. The latter will describe, for example, the documentation of index admission regarding what plans were in place,

how robust were the plans, how well did they consider issues likely to arise, what issues did arise, and for the readmissions, cause of readmission and preventability (7,8,47).

After verifying the 20 sampled patients meet inclusion criteria (described above), the project coordinator will assign the first five individuals of each group that meet inclusion criteria to staff and investigators responsible for site chart reviews. Each researcher will be given two to three patients, at least one that has a 30-day readmission. Researchers access the patient electronic health record through the VHA's Compensation and Pension Record Interchange (CAPRI).

The project coordinator or one of the investigators will identify the site-specific names for the following chart note types: medicine history and physical, nursing admission, social work screening/assessment, interdisciplinary treatment team plan, nursing discharge, social work discharge, pharmacy discharge, medicine discharge, discharge summary, and post-discharge primary care nurse follow-up call. We will also identify any additional site-specific care transition notes. The site-specific list of notes of interest will form the basis for the chart note reviews.

Chart reviews involve two steps and use structured forms in REDCap (48):

1. Chart note type review: for each index admission and readmission, reviewers identify and review two to three instances of the note types of interest (see above). Structured reviews occur through a REDCap form. Each note is assessed for whether they contain (a) documentation of widely agreed upon readmission risk factors and (b) co-signers.

2. Patient case study: for each patient, reviewers will read additional notes to type a brief, de-identified case study narrative of the patient's course during and after the admission(s). Reviewers will use an additional structured REDCap form to document patient specific

readmission risk factors and characteristics (e.g. non-VHA insurance coverage). The case study narrative will also be copied into this form.

Service leader interviews: Investigators conducting the site visit will purposively recruit by email or phone service leaders for semi-structured interviews. These interactions will serve to (a) inform service leadership of the project and ensure their support of the participation of their service staff and (b) identify the best ways to recruit staff for interviews and focus groups, and observe care transitions. Leaders involved in efforts to reduce hospital readmissions at the facility or who are knowledgeable about facility care transition practices, will be invited to answer interview questions about historical and current care transition processes at their facility (see Additional file 1).

Interviews generally will occur by phone or Microsoft Lync or Skype for Business. Interviews with leadership that do not take place before the site visit, will occur on site in a private setting of the participants' choosing. The interviews will last between 10 and 30 minutes. When possible, interviews will be audio recorded and transcribed; written notes will be taken and typed up when audio recordings are not available.

Front line provider interviews: Investigators will use snowball and purposive sampling to recruit by email or in person front line staff for participation in interviews during the site visit. Semi-structured interview guides will cover the history of care transitions at the facility, what motivated and who was involved in those changes, sensemaking around specific patient cases, and current care transitions processes and support at the facility (see Additional file 1). Interviews will last between 20 minutes to an hour. Interviews will take place in private spaces within the facility and be audio recorded. Audio recordings will be transcribed.

Focus groups: One to two, interdisciplinary focus groups will be held at each site. Staff will be purposively sampled so that focus groups have representatives from the services of interest. One investigator will facilitate the focus group, while at least one investigator assists. The investigators will follow a focus group script (see Additional file 1) that probes into care transition processes, sensemaking around readmissions, and staff relationships. The mixed role compositions of the focus groups will provide opportunities for the team to document group interactions, and for the identification of group norms, differences, attitudes, and priorities (49). Focus groups will be held in facility meeting rooms and last one hour. Focus groups will be audio recorded and transcribed.

Observations of care transitions work: Researchers will routinely observe medical and/or interdisciplinary rounds, discharge planning meetings, nursing discharge education to patients, and certain job roles during their daily work (e.g., social workers, nurse practitioners). Additional site-specific care transition activities, such as pharmacy discharge education with patients and readmissions workgroup meetings, will also be observed. Staff will be sampled by snowball or purposive sampling methods. They will be recruited by email or in person.

Observations may last between 10 minutes (e.g. patient education) and several hours (e.g. medical team rounds). Investigators record their observations in field notes (1). Objective field notes will focus on interactions between people, the qualities of those interactions (e.g., roles interacting, who says or does what), and how and what information is communicated. After observations are completed, investigators will fill in gaps in handwritten notes and add contextual information (e.g. description of setting). Analytic notes may also be written (e.g., questions for follow-up, comparing and contrasting with other data), but will be differentiated from objective data by italics or brackets. Written field notes will be taken during the observation

and later typed. Observation notes will also serve to inform the site's care transition process checklist.

Site checklist for care transition processes: The checklist (see Additional file 2) contains items that during proposal preparation work were gleaned processes from the published papers and manuals for care transitions starting with the systematic review by Hansen (16), matching across studies and arriving at a comprehensive list. Care transitions on the list will be scored as present, absent, or inconsistent. During the 5-day site visit, site investigators will independently fill out the checklist. At the completion of the site visit, investigators will meet to identify on a structured checklist the established care transition processes they observed and heard about during the site visit to create an agreed upon version. This version will be entered in REDCap by a staff member.

Debrief with facility leaders. Exit debriefs consist of 40 minute presentations by the project PI and 20 minutes of questions and discussion with invited facility leaders. Debriefs will follow a general format: (1) explanation of the study and its methods; (2) description of care transition resources, processes, and special programs or initiatives to reduce readmissions at the site; and (3) preliminary identified challenges to reducing readmissions. During these one hour meetings, leaders have an opportunity to fill in what they might see as gaps or errors in the investigators' understanding, to sensemake about the information presented, and to reflect on priorities and processes at their facility. When possible, they will be audio recorded and detailed summary notes recorded for analysis.

Staff surveys: Staff involved with patient care transitions and met by the investigators during the site visit will be invited to participate in surveys. Inv19-24itations will be made in person and/or by email. The survey items consist of: work relationship scale developed in our previous study of

learning and relationships(50), relational coordination adapted from Gittell's health care work (51) and an adapted version of the Safety Organizing Scale as a measure of sensemaking (35). (see Additional file 3) Results of this survey will be considered markers of the care transition team's ability to make sense.

Work Relationships Scale (WRS)*:* A 15 item scale developed to assess the perceived quality of working relationships in health care settings developed in a previous study by our group. We drew upon the organizational behavior literature to develop an original set of 19 items reflecting the 7 characteristics of work relationships identified among high-functioning PC clinics by Lanham et al (27). The 15 item scale is associated with patient satisfaction with care in the PC environment (50).

Relational Coordination (RC) Survey: The RC survey includes questions that examine 7 dimensions that were developed through inductive field research, and which have been validated in several studies. Items are rated by participants on a 5-point scale indicating the frequency to which each dimension exists in their care setting (e.g., frequency: 1=Never, 5=constantly). This instrument has been found to be reliable for use in airline and healthcare industries with Cronbach's alpha of .80 and .86 respectively (52).

Adapted Safety Organization Scale: This scale measures behaviors related to sensemaking and improvising around patient safety, for example, how the team reacts to a crisis situation (35). This scale was developed for nursing use in inpatient setting and modifications were made to change language to be appropriate to care transitions.

Participants will complete the survey on paper or through the online web application REDCap. Paper copies will be personally distributed and collected by investigators while conducting activities on site (e.g. during discharge planning meetings, at interviews and focus groups). Web

links to the survey will be provided through email. Completed surveys are anonymous and will not include any respondent's personally identifiable information.

Qualitative Data Analysis

For each case study, qualitative analysis will overlap with data collection processes. Early findings will inform site-specific adjustments to on-site data collection protocols. Qualitative data analysis will take two forms: memoing and coding.

Memoing: The team will keep a variety of memos during data collection and analysis. Memos record reflexive comments about methods, data, and theory (53). Memos will provide early opportunities for writing about and making connections within the case study data. Some memos will be written by individual researchers, while others will be created by several researchers through discussion. Memos will be periodically reviewed at team meetings to inform ongoing data collection, qualitative coding, and model building. They also serve to help document team sensemaking.

Meeting Memos: Detailed summary meeting notes will be kept during team meetings. As described by Eisenhardt (1), team meetings can be useful for overlapping data collection and analysis. These meeting notes will document, for example, how and why data collection protocols change, what researchers are learning about a specific site, and how what they are learning informs theory and agent-based model building. This information will be extracted as memos.

Chart Review Memos: While conducting chart reviews, researchers will write memos to record and reflect on (a) care transition processes evident in the notes (e.g., readmission risk assessment, discharge education, post-discharge follow-up), (b) provider communication (e.g., co-signing practices, discrepancies in what providers report), (c) sensemaking (e.g., providers documented

concerns, how patients' situations are described), and (d) questions or issues for team follow-up. These memos will serve to help the team document what they know so far about care transition processes at the site, identify questions for follow-up, and reflect on specific cases and provider relationships and sensemaking.

Facility Reflections: These 1 to 2 page documents will be written by investigators conducting the site visits during post-visit meetings. Reflections will be organized by headings derived from the agent based model. These headings will evolve as the agent based model develops (see below). Examples of possible headings include: institutional history and leadership, structures and routines, and information flow and exchange.

These analytic memos (53) document and summarize what the team thinks they know about the site, what patterns they observed during data collection, and what gaps might exist in their knowledge. Site reflections will inform the final site case study, data collection methods and approaches at future sites, and ongoing analysis and model building (see below).

Qualitative Coding: Transcripts will be analyzed using NVivo software (54). We will develop a code book using deductive and inductive approaches. An initial codebook will be created based on the original model (see Figure 1). It will be modified as additional elements and patterns are observed through memoing, code report reading, and model building.

Coding will proceed in a stepped fashion.26 For the first two sites, six team members (LP, JP, PN, HL, EF, and the project coordinator) will code all interview and focus group transcripts. For each site, a random sample of 20% of transcripts will be independently coded by two members of the team. Pairs will check for concordance and discrepancies will be discussed by the team, and the codebook updated as needed in bimonthly coding meetings. For the final seven sites, three team members (HL, the project coordinator, and a research assistant) will code the

remaining transcripts. They will check for concordance on at least 10% of a random sample of transcripts for each site. Areas of discrepancy will be discussed and resolved by the full research team during weekly team meetings.

Quantitative Data Analysis

Quantitative data analysis will be conducted on data collected through patient chart reviews, staff surveys, and observations. Statistical tests will be conducted in Stata IC 14 (55).

Chart notes: At each site, we will determine the likelihood each note type documents the different readmission risk factors and identify which, if any, providers are usually co-signed to the note. We will evaluate findings across and within note types, and across facilities. Findings will also be compared with qualitative data (e.g. interview data related to coordination practices and sensemaking related to readmission risk).

Staff surveys: The survey's three scales will be scored as described below, and the scores compared between sites. As response rates allow, some within site comparisons may also be made. Results will be triangulated with observation, interview, and focus group data.

Work relationship: Due to survey burden and partial overlap with other scales (see below), the original 15 item work relationship scale was reduced to 9 items based on the original Rasch item analyses and areas of overlap with items on the other scales. Items 1,2,4,5,8,9,11, 14 and 15 of the original items were retained and references to clinic were changed to team (50). A new Rasch item analysis and principal components analysis will be conducted to assure that unidimensionality has been retained. Total scores will be calculated per respondent (possible range 9-45), averaged across respondents for each facility, and facilities will be compared using SAS PROC Mixed.

Relational coordination: RC scores are first calculated for each individual by summing the scores of all roles (e.g. care transitions staff, inpatient attending, outpatient primary care nurse, etc.) for each dimension (e.g. frequent communication) and then dividing by the number of responses. The overall RC score for each participant is derived by calculating the mean of the seven individual scores (range 1-5) (52).

RC scores at the facility level are calculated for each functional group (e.g., care transitions manager, hospitalist, primary care nurse or physician) by calculating the mean of each dimension for all members of the functional group, and then a facility RC mean. The primary analyses will use the facility mean score, and secondary analyses will examine variation in RC scores among functional groups (care transitions staff, inpatient attendings, primary care teams).

Safety Organizing Scale: Originally described by Vogus and Sutcliffe (56) as a measure of self-reported behaviors enabling a safety culture in hospital nursing units. Original respondents were RNs only. Questions 1,3, and 4 were used unmodified. Questions 2,4, 7, 8 and 9 were modified to be focused on care transitions and preventing readmissions. For example, the original question 2 was "we talk about mistakes and ways to learn from them." The modified version is "we talk about readmissions and ways to learn from them." The original question 5 was dropped as it dealt only with inpatient nursing shift report giving. The responses were kept the same. As for the Work Relationship Scale above, a Rasch item analysis and principal components analysis will be conducted to assure that unidimensionality has been retained. Total scores will be calculated per respondent (possible range 8-56), averaged across respondents for each facility, and facilities will be compared using SAS PROC Mixed.

Observation note scoring: Within their field notes, site investigators will identify the following types of observations for structured scoring: (1) discharge planning meetings; (2) staff-to-staff

interactions; and (3) staff-to-patient discharge education. Notes from each observation will be entered into scoring logs and scored according to relationship and sensemaking features (see Table 2). The scoring systems are based on the Lanham (57) and Situation, Task, Intent, Concern, and Calibrate frameworks (58). Project staff will enter scoring into REDCap. Two investigators experienced with applying these frameworks to observations in medical settings (LL and HL) will train the team on how to recognize behaviors that match these characteristics. Consistency in scoring will be established through use of the codebook and during multiple rounds of team scoring. For the first two sites, during weekly meetings following data collection, a sample of roughly 5% of the observations will be independently scored by each team member. Scoring will be compared and discrepancies discussed until the group has reached consensus. Clarifying discussions about scoring will be documented in meeting notes and fed back to improve the scoring guide. Scores will be compared within and between sites.

Table 2: Characteristics to Be Observed

Characteristic	Behaviors we will observe	Metric
Relationships		
Trust	Saying "I don't know" Asking for help Accepting others' clinical judgments if person is a peer or lower in hierarchy Mistrust	Interactions will be given a "-1," "0" or "1" based on the presence of negative behaviors, absence of behaviors or positive behaviors reflecting each relationship characteristic
Diversity	Number / level of team members who contribute to plan	
Respect	Extent to which team members listen to each other, allow each other to talk without interruption, and consider each other's suggestions	
Rich / Lean communication	Using verbal communication with others not in the room or with each other outside the meeting Type of communication with other staff members and with consultants	
Social / task relatedness	Whether staff talk about work and non-work topics / personal lives Jokes made Laughter	
Heedful inter-relating	Acknowledging the potential /actual impact of their behaviors on how others get their jobs done or on	

	patient care or disposition planning.	
Mindfulness	Responding to each other's ideas for the evolving plan. Helping each other with tasks. Suggesting new ideas or discussing how the team might do things differently.	
Sensemaking		
Situation	Assesses patient's situation	Teams will be given a "0" or "1" based on the use or non-use of each sensemaking element
Task	Develops a plan about what needs to get done (objectives) based on assessment of patient.	
Intent	Statement of rationale for the plan.	
Concern	Discusses concerns / things that could go wrong / things where plan might fall short with patient. Develops a contingency plan.	
Calibrate	Asks for feedback from each other about the plan based on concerns.	
Social vs. solitary	Shared decision-making between staff, patient, and /or family. May be between 2 staff members. Must come to a shared understanding.	
Degree of identity definition	Performs tasks outside of hierarchical role	
Backward-noticing	Discussion of prior patients with similar presentation or issues, or prior situation of the current patient	

Creating, Verifying and Validating an Agent Based Model (ABM) of Sensemaking Regarding Transitions of Care and Prevention of Readmissions

Complex, nonlinear systems are difficult to study with traditional analytic methods because of multiple interactions among variables, feedback loops, path dependency, and contingencies in any dynamic process; there is often no set of equations that can be solved to predict characteristics of the system (59). A more effective way to examine nonlinear behavior in complex systems is to simulate it by building a model and then running the simulation multiple times to explore the space of possible system trajectories (59). In our study of sensemaking and readmissions, the interdependencies among the patients, health care providers, resources (VHA and non-VHA) and leadership support are clearly nonlinear. Individuals who make sense of the ways in which readmissions occur illustrate this by mentioning different aspects they consider to be critical: patient context, patient understanding and motivation, resource availability, effective

communication between health care providers, stage of disease, failures in a system for which they (patient or provider) have little control. These aspects interact in variable ways in the context of different patients. Vest et al. identified the plethora of variables that contribute to readmissions before even addressing the interdependencies (60). Additionally, the literature demonstrates that classical prediction models of readmissions perform poorly (14). We suggest that these explanatory gaps in the literature are due at least in part to a mismatch of analytic strategy to type of system being studied. We see readmission as an emergent outcome of nonlinear interactions among these many aspects of clinical and organizational processes. Through modeling and simulation, we will be better able to understand and evaluate factors contributing to readmissions. While any single case may be difficult to predict, modeling will allow us to identify leverage points in the system that the data demonstrate are particularly sensitive to sensemaking effectiveness. These leverage points could then be considered potential targets for interventions. Through modeling and the subsequent ability to run it numerous times (simulation), we will be able to extend the case study sample to make it more generalizable to better understand how readmissions occur across the care transition interventions, patient circumstances, and facility environments. Through modeling and simulations we are able to create a laboratory that will allow us to understand better how readmissions occur, helping us to identify gaps in our knowledge as well.

ABM is a version of nonlinear dynamic modeling, a computer implementation of complexity concepts, in which autonomous agents interact in an environment to produce emergent--sometimes surprising--system properties over time (61–63). Since Epstein and Axtell's pioneering work in the late 1990s,(64) it has been applied to research on human groups under the rubric of "artificial societies" (59). ABM is an ideal approach to our research questions for

several reasons: first, as noted earlier, our data regarding health care provider interactions are non-linear, making it potentially more difficult to represent patterns and interdependencies using more traditional approaches. ABMs are grounded in non-linear mathematics, assuming interactions and contingencies in a manner that more accurately reflects clinical systems. Second, ABMs allow us to create a broader space of outcomes from rich observations that may be low in number but high in information, accounting not only for the facilities and teams within facilities that we sample, but other types of findings that result from experimenting with parameter changes. Formalizing the interactions leads to a generalization of the processes we observed. Thus, ABMs enable us to leverage small samples to create broader understandings. Third, we can model interactions across levels and over time to explore emergent outcomes. ABMs are laboratories for structure-agency interactions that allow us to understand these multiple levels.

Proposed Modeling Work

Conceptual Work: While data are being collected, our research team will meet regularly to identify the parameters, agent characteristics and interaction patterns. Our starting point will be the conceptual model of care transitions shown in Figure 1. As we develop the ABM, we will iteratively build on our conceptual model using the qualitative data being collected. We will begin developing the ABM after our first few site visits, and refine the model with each subsequent visit. Constructing the model in this way will complement our qualitative data collection and help us identify areas where more intensive inquiry might be necessary. Initial tasks for building the model will include identification of:

Types of agents to be included: In ABM agents can and, in our case, will have correspondence to real world actors, both individuals and organizational units. We will start with the general categories of patients, inpatient providers, outpatient providers, and care transitions personnel.

We will then refine the specific individuals contained in these categories, and add any additional categories or types of individuals as we collect and analyze our qualitative data.

Interactions and interdependencies among agents: We will create rules of interaction between the agents in the model based on our site visit data, starting with the initial site visits and refining these interactions with subsequent site visit data. Interactions will focus on the sensemaking activities and categories we observe in the site visits. Those sensemaking attributes were detailed in above in the sections on Observations of Care Transitions Work and Qualitative Data Analysis.

Boundaries and characteristics of the environment: Our model will be built to simulate a single organizational entity. We will create a model to allow ourselves the ability to adjust these characteristics and assess their impact through our simulations. We intend to simulate critical facility characteristics and will use the first year to consider the types of qualitative characteristics we will obtain during the site visits as well as the quantitative data already available for VHA facilities such as culture (annual employee survey), learning and improvement culture (Voice of VHA survey), number of care transition processes used routinely (from our prior UM survey and verification for study sites), demographics of Veterans served, and facility admission rates. We will also consider known parameters used in traditional readmission prediction models, although most of these parameters focus on the patient such as comorbidities, prior health care use, functional status, socioeconomic status (14,60).

Organizational characteristics relate back to the technical processes of care and system resources noted on our conceptual model.

Levels of model: One of the rationales in studying transitions of care as an exemplar is the multiple individuals and teams that interact with the patient and the system to make the care

transitions successful. A benefit of ABM is that it allows us to consider levels of interactions, and the system-level outcomes that emerge from these levels of interactions. In building the model, we will need to address how different parts interact with the next to produce the product of interest—successful or unsuccessful care transitions. Care transition teams and Veterans interact with inpatient teams as well as outpatient teams, resource providers (such as prosthetics and pharmacy), home care providers, institutional providers, and patient caregivers. Additionally, leadership determines extent of resources available at many of these levels. We will define the levels and how they will feed into each other. Again, we will use our conceptual model of care transitions as the starting point. Processes of care and the organizational characteristics will form this level. The formal interactions or organizational structure will also be reflected here. The agents will interact in this level, producing emergent outcomes of sensemaking that are grounded in their interactions and inter-relating. These sensemaking patterns will form the second level of the model. From them, care transition outcomes will emerge, forming the model outputs. In our model, the two outcomes will be a successful care transition or a readmission.

Feedback loops can be created within the levels of the model. For example, as either successful care transitions or readmissions occur, these outcomes can feed back into how the agents' sensemaking processes. We will specifically collect data on these types of feedback loops during our site visits. (See questions about feedback to care transitions staff above.) These feedback effects will be modeled using standard best practices from the System Dynamics modeling methodology, which concentrates on how to model systems with nonlinear feedback loops (65–67).

Modeling software: We will use NetLogo software to create our model. NetLogo is a freely available software that has been under development for two decades and is widely used for ABM (68). It is now in Version 5 and has become a sophisticated language for modeling intelligent autonomous agents interacting in "live" environments. With the most recent versions, NetLogo extensions have been incorporated that enable more sophisticated agents and with hybrid capabilities enabling combined agent-based and discrete-event simulation. These capabilities will allow us to create a robust model that best represents the relevant processes of care and agent interactions.

Model Verification and Refinement: As we develop the model, we will make our understanding of the interdependencies between different levels more explicit. Because we will begin to conceptualize and create the model in parallel with data collection, we will be able to use ongoing site visits to refine aspects of our model.

Additionally, we will perform verification to ensure that the associations and interdependencies between levels of the model are expressed in the way we intend. Verification "concerns whether the program is working as the researcher expects it to" (59). Our model will act as a thought-experiment laboratory that forces us to clarify and formalize the interactions in which we are interested. The verification will support this clarification.

Model simulation and sensitivity testing*:* We will use simulation to deepen our understanding of the ways that provider sensemaking influences care transition outcomes. We will be able to vary the following parameters: organizational factors, including patient population characteristics and other facility-level data; care transition practices; sensemaking practices. We will assess the impact of parameter variation on our outcome of interest—readmissions and successful care transitions. During this time simulations will be run for multiple "facilities" to expand the

generalizability of our qualitative sample, using different combinations of individual and facility characteristics to understand how sensemaking emerges, and how sensemaking then impacts care transition outcomes.

Model verification and boundary testing*:* During this period, we will present our model results to our local site PIs from 10 sites as well as our Systems Reengineering organizational partners for input as to the face validity of the findings of the simulations. These presentations will follow a formal, focus group process to ensure that we capture all concerns and feedback regarding the model. We will use this feedback to further refine the model.

Ethics and dissemination

The Institutional Review Board (IRB) of the University of Texas Health Science Center at San Antonio approved this study (approval number: 14-258H). Participation in this study is voluntary and participants are not compensated for their participation. Written consent and HIPPA forms are obtained for patients participating in interviews. As permitted by our IRB, VA staff participating in research activities (e.g., interviews, surveys, observations) are given an information form about the study, assured confidentiality, and asked to give verbal consent to participation.

Findings from our work will be disseminated through manuscripts in peer reviewed journals, at professional conferences, and in short reports distributed to stakeholders and study participants. Our data will not be made available in repositories.

Authors' contributions

JP, LL, HL, PN, and EF provided conceptual and methodological expertise to the design of the study protocol. JP and LP were major contributors to writing the manuscript. All authors read, edited, and approved the final manuscript.

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Competing interests statement

The authors declare that they have no competing interests.

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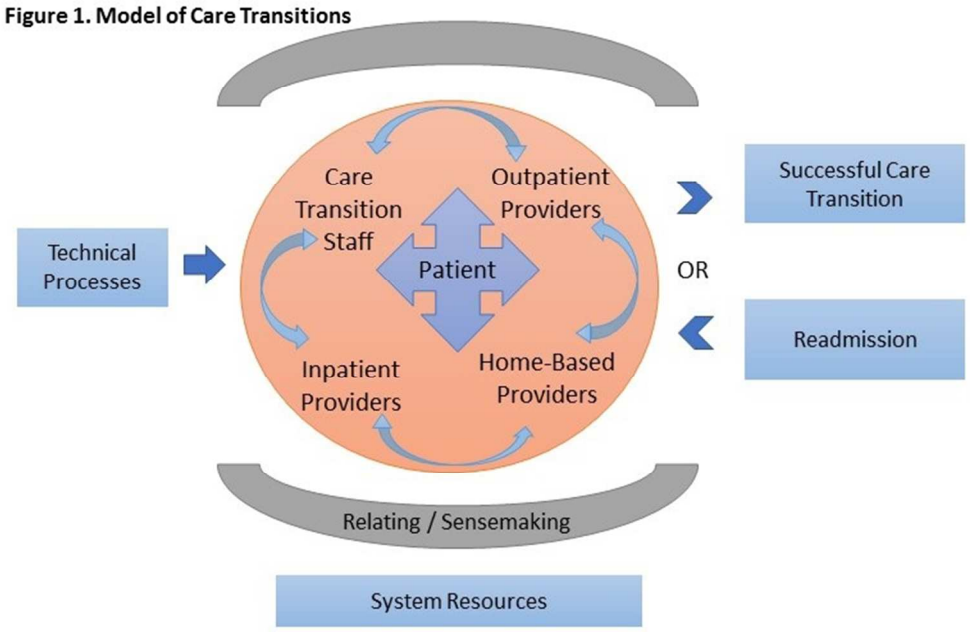

Figure 1. Model of the care transitions process

206x139mm (96 x 96 DPI)

Interview and Focus Group Guides

Thematic areas to be explored in leadership and supervisory interviews:

- *History of care transitions work at this facility*: Tell me the history of care transitions at your facility. What has been the biggest challenge regarding care transitions? The biggest success?

- *Motivation for change in care transitions structure or process*: When changes in the care transitions processes or staffing have been made, what prompted those changes to occur? (Probes: data regarding readmissions, local staff or patient concerns regarding failure of transitions, pressure to improve performance measurement)

- *Key players and description of planning processes*: Who was involved in planning these changes? How did the planning proceed and turn into actual processes?

- *Current organizational "ownership" of care transitions*: In your facility, where do care transitions workers sit organizationally?

- *Facility support for cross-unit cooperation for care transitions*: Care transitions involve cooperation among many different services or organizational units. How has this been addressed in your facility?

- *Organizational priorities*: What are your clinical performance priorities? Were there any initiatives taken last year to meet those priorities? If yes, what were those initiatives? Have you had any local initiatives to decrease unplanned hospital readmissions? If yes, what were those? How do you balance between care transition priorities and other competing priorities?

Thematic areas to be explored with front-line care transitions staff interviews:

- *Work history*: What are your responsibilities as a [job title]? How long have you been a [job title]?

- *Case studies:* Tell me about a patient whose care you were involved with who was readmitted. Tell me a story of a recent patient you thought would end up back in the hospital but has not. Tell me about a patient you thought would do well but ended up being readmitted. (Probes for case studies: Why did he/ she get readmitted? What do you think contributed to his readmission? What, if anything, do you think could have been done to prevent that readmission?)

- *Work processes*: Tell me all of the various tasks you might do for a patient prior to discharge. (Probe on the 16 processes. If this worker does not do them, does anyone else or are they just not done here?) Are patients at this facility assessed for their risk for readmission? If so, how is this done? Who does it? How do you use this information? If a patient you have taken care of has been readmitted, are you informed of this?

- *Work relationships*: When multiple but disagreeing opinions are voiced about a complicated patient's discharge plan, how does the group finalize the plan? When you need to transition

a patient to outpatient providers, home health agencies, or SNFs/ rehabs/ CLCs, how do you communicate the patient's needs? (Probe into rich vs lean communication) How much of your work coordinating patient care with other services gets done inside of meetings?

- *Sensemaking and Improvising*: Tell me about facilitators and barriers to carrying out your work. How do you work around barriers as needed? Tell me some stories about what you did on a particular case to overcome such barriers. Do your coworkers such as the doctors on the inpatient teams or staff in outpatient units work with you on overcoming barriers? Understanding the patient needs better?

- *Institutional history and leadership/information flow and exchange*: What clinical performance measures are you focusing on at this facility? If a new initiative were to come out, how would you hear about it? How do you decide what you need to do differently when these initiatives come out? What kind of feedback do you typically get about how you are doing on these initiatives?

- *Improvement*: Is there anything you think could be done to improve discharge planning/ care transition processes at your facility?

Thematic areas to be explored in patient interviews, before discharge:

- *Issues from the veteran perspective:* How do you feel about being discharged from the hospital today?

- *Relating:* Can you name up to six people who have been most involved in getting you ready to go back home? How did they learn about your needs after you get home? Did these individuals ask you about what kind of help you need at home? How often did they speak with you? Did they speak with your family? How are (these people) working together to meet your needs after you leave the hospital? How are these people working with the providers who take care of you outside of the hospital?

- *Sensemaking:* Did your providers ask you about any concerns you might have about going home? Did your providers talk to you about what you need to watch out for after going home? Did the people taking care of you in the hospital identify things that you need that you weren't aware of? Do you think you have everything you need to go home without any problems? Has anything surprised you about the discharge process? What didn't we ask about that we should have?

Thematic areas to be explored in patient interviews, after discharge:

- *Veteran experience post-discharge*: How have you been doing since you were discharged? Have things gone as expected since you arrived home? Have you had any problems with your [*insert medical diagnosis*]? How did you handle it?

- *Improvement*: Thinking back to the end of your hospitalization, is there anything that could have better prepared you for managing your health at home?

Thematic areas to be explored in care transition staff focus groups:

- *Work processes:* Tell us about inpatient to outpatient care transitions processes related to hospital discharge here. (Probe into who is typically involved) When you think a patient is at high risk for readmission, do you do anything differently? If so, please describe.

- *Sensemaking:* What do you do well here with regard to care transitions and prevention of readmissions? Are there particular types of patients or situations for whom you see readmissions here at <facility name>? Is there a process in place to discuss/debrief on readmissions (perceived preventable or otherwise) at this facility? If so, please describe.

- *Work Relationships:* Is there usually agreement among ward nursing, UM staff, care transition staff, and physicians about patients' readiness for discharge or post-discharge patient needs? When there is not agreement, how do you reach resolution? Do you feel comfortable speaking up if you disagree with the decisions on those issues? When there is a lack of agreement, what are some common types of reasons for the disagreement? (Probe)

- *Case Studies:* What is your most memorable readmission? Why? Please describe.

- *Improvement:* Do you think there is room for improvement here? If so, where/how? Tell us about a time/case when you were not sure about how well the patient might do in terms of staying out of the hospital. Tell us about those uncertainties. How did you, as a team, deal with those uncertainties? Did you do anything different? Tell us about any step/initiative that you took to prevent readmission for this individual.

***ORGANIZATION*: Checklist of care transition processes observed at facility**

Facility: _____

Date: _____ Observer:_____

Check boxes if occurrence of element of care processes were undertaken or routinely used at facility during the entire visit.

Technical Process	**Observed?**	**Source**	**Staff Responsible**	**Notes (describe quality of process, contradictions or confirmations in data sources)**
Pre-discharge patient education	Y N Inconsistent			
Use of teach-back method with patients	Y N Inconsistent			
Increased emphasis on patient education about diagnoses, self-management and medications throughout hospitalization	Y N Inconsistent			
Communication of medical plans in front of patients (nurse to nurse hand-offs, nurse to physician, bedside rounds, etc.)	Y N Inconsistent			
Implementation of a discharge checklist	Y N Inconsistent			
Use of a checklist to assess readmission risk	Y N Inconsistent			
Implementation of discharge planning rounds	Y N Inconsistent			

Technical Process	Observed?	Source	Staff Responsible	Notes (describe quality of process, contradictions or confirmations in data sources)
Medication reconciliation prior to discharge	Y N Inconsistent			
Assignment of medication reconciliation to pharmacist	Y N Inconsistent			
Utilization of discharge/care transitions case manager	Y N Inconsistent			
Printed follow-up instructions which might include medication reconciliation, follow-up appointments, self-care tasks or action plan for management of symptoms	Y N Inconsistent			
Post discharge follow-up appointments to PCP and for diagnostic testing made prior to discharge	Y N Inconsistent			
Direct communication with PCP or other PACT team members	Y N Inconsistent			
Potential benefits of referral to telehealth assessed as part of discharge planning process	Y N Inconsistent			
Need for rehabilitation services routinely assessed during discharge planning	Y N Inconsistent			
Rehabilitation services scheduled prior to discharge	Y N Inconsistent			

Technical Process	Observed?	Source	Staff Responsible	Notes (describe quality of process, contradictions or confirmations in data sources)
Assessment for advance care planning (palliative / hospice)	Y N Inconsistent			
Enlisting social and community supports (home health services, Meals-on-Wheels, day care services, housing, etc.) for post-discharge care	Y N Inconsistent			
Post-discharge patient hotline available?	Y N Inconsistent			
Post-discharge home visit available?	Y N Inconsistent			
Post-discharge phone call from hospital (who, time frame)	Y N Inconsistent			
Post-discharge phone call from PACT team mentioned	Y N Inconsistent			

***STAFF*: Care Transitions Survey Guide**

*Your participation in the survey is **voluntary**. Your responses are **anonymous** and will be kept strictly **confidential**. The results will be reported in summary form and not as individual responses.*

Facility: _____

Ward/Service: _____

Date: _____

Please indicate your individual professional role below.

◯ Staff physician
◯ Resident / Intern
◯ NP/PA
◯ RN
◯ LVN
◯ Social worker
◯ Pharmacist
◯ Clerk
◯ Other (Specify:_____)

Please indicate any additional functional roles you may serve. Select all that apply.

◯ Case manager
◯ Utilization Management (UM)
◯ Palliative care
◯ Discharge planning
◯ PACT team
◯ Other (Specify:_____)

In what setting do you work?

◯ Inpatient care
◯ Primary care
◯ Other outpatient care (Specify:_____)

Safety Organizing Scale

Item	Not at all	To a very limited extent	To a limited extent	To a moderate extent	To a considerable extent	To a great extent	To a very great extent
1. We have a good "map" of each other's talents and skills	○	○	○	○	○	○	○
2. We talk about readmissions and ways to learn from them	○	○	○	○	○	○	○
3. We discuss our unique skills with each other so we know who on the team has relevant specialized skills and knowledge	○	○	○	○	○	○	○
4. When attempting to resolve a problem, we take advantage of the unique skills of our colleagues	○	○	○	○	○	○	○
5. We discuss alternatives as to how to best transition patients from the hospital to outpatient settings	○	○	○	○	○	○	○
6. We discuss ways to prevent high risk patients from being readmitted	○	○	○	○	○	○	○
7. When failures occur in transitioning patients from the hospital to outpatient settings, we discuss how we could have prevented them	○	○	○	○	○	○	○
8. When difficult disposition issues arise, we rapidly pool our collective expertise to attempt to resolve it	○	○	○	○	○	○	○

Relational Coordination Survey

1. How <u>frequently</u> do people in each of these groups communicate with you about patients transitioning from the hospital to outpatient settings?

	Never	Rarely	Occasionally	Often	Always	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT team members	1	2	3	4	5	N/A
Other individuals or services involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4	5	N/A

2. How frequently do the people in these groups communicate with you in a <u>timely</u> way about patients transitioning from the hospital to outpatient settings?

	Never	Rarely	Occasionally	Often	Always	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT team members	1	2	3	4	5	N/A
Other individuals or services involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4	5	N/A

3. When problems arise with transitioning patients from the hospital to outpatient settings, how often do the people in these groups work with you to help solve the problem?

	Never	Rarely	Occasionally	Often	Always	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT Team members	1	2	3	4	5	N/A
Other individuals or services involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4	5	N/A

4. How much do the people in these groups know about the work you do in transitioning patients from the hospital to outpatient settings?

	Nothing	A little	Some	A lot	Everything	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT Team members	1	2	3	4	5	N/A
Other individuals or services involved in transitioning patients from hospital to outpatient settings (please identify:_____)	1	2	3	4	5	N/A

5. To what extent do the people in these groups share your goals for transitioning patients from the hospital to outpatient settings?

	Not at all	A little	Somewhat	A lot	Completely	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT Team members	1	2	3	4	5	N/A
Other individuals or services involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4	5	N/A

6. Who is <u>ultimately responsible</u> for the care for a patient?

	Never	Rarely	Occasionally	Often	Always	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT Team members	1	2	3	4	5	N/A
Other individuals or services in involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4	5	N/A

8. How often do you use information from the following sources in making decisions about the discharge of a patient?

	Never	Rarely	Occasionally	Often	Always	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT Team members	1	2	3	4	5	N/A
Other individuals or services in involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4	5	N/A
Historical information in EMR	1	2	3	4	5	N/A
Evidence-based guidelines / systematic reviews	1	2	3	4	5	N/A
Summary resources (e.g. UpToDate)	1	2	3	4	5	N/A
Medline / pubmed	1	2	3	4	5	N/A
Web-based search tools	1	2	3	4	5	N/A

9. How do you communicate with the following groups of people?

	In person	On phone	Text pages / electronic orders	Through notes / documentation
Patients	1	2	3	4
Patient families	1	2	3	4
Physicians	1	2	3	4
NPs/PAs	1	2	3	4
Ward nurses	1	2	3	4
Social workers	1	2	3	4
Pharmacists	1	2	3	4
Case managers	1	2	3	4
Ward clerks	1	2	3	4
Palliative care team members	1	2	3	4
PACT Team members	1	2	3	4
Other individuals or services in involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4

Work Relationship Scale

Listed below are a number of statements that could describe **all of the providers and staff who are involved in transitioning patients from the hospital to outpatient settings, referred to as the "team" below**. Please select the response that best describes how much you agree or disagree with the following statements.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
1. This team encourages input from all providers and staff when making changes.	○	○	○	○	○
2. Most people on the team are willing to change how they do things in response to feedback from others.	○	○	○	○	○
3. Most people on the team are comfortable voicing their opinion even though it may be unpopular.	○	○	○	○	○
4. Most people on the team pay attention to how their actions affect others on the team.	○	○	○	○	○
5. This team values people who have different points of view.	○	○	○	○	○
6. Difficult problems are usually solved through face-to-face discussion.	○	○	○	○	○
7. When there is a conflict on the team, the people involved are encouraged to talk about it.	○	○	○	○	○
8. My opinion is valued by others on the team.	○	○	○	○	○
9. The leaders of this organization usually make sure that we have the time and space necessary to discuss changes to improve care transitions.	○	○	○	○	○

COREQ (COnsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
Personal characteristics			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	19
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	18
Occupation	3	What was their occupation at the time of the study?	18
Gender	4	Was the researcher male or female?	N/A
Experience and training	5	What experience or training did the researcher have?	18
Relationship with participants			
Relationship established	6	Was a relationship established prior to study commencement?	19
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	17
Interviewer characteristics	8	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	N/A
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	12
Participant selection			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	12-17
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	12-17
Sample size	12	How many participants were in the study?	N/A
Non-participation	13	How many people refused to participate or dropped out? Reasons?	N/A
Setting			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	17-23
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	17-23
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	14-17
Data collection			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	18, 19-24
Repeat interviews	18	Were repeat inter views carried out? If yes, how many?	N/A
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	21-23
Field notes	20	Were field notes made during and/or after the inter view or focus group?	21-23
Duration	21	What was the duration of the inter views or focus group?	21-23
Data saturation	22	Was data saturation discussed?	N/A
Transcripts returned	23	Were transcripts returned to participants for comment and/or	N/A

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
Data analysis			
Number of data coders	24	How many data coders coded the data?	26
Description of the coding tree	25	Did authors provide a description of the coding tree?	N/A
Derivation of themes	26	Were themes identified in advance or derived from the data?	26
Software	27	What software, if applicable, was used to manage the data?	26
Participant checking	28	Did participants provide feedback on the findings?	N/A
Reporting			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	N/A
Data and findings consistent	30	Was there consistency between the data presented and the findings?	N/A
Clarity of major themes	31	Were major themes clearly presented in the findings?	N/A
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Protocol for a Mixed Methods Study of Hospital Readmissions: Sensemaking in Veterans Health Administration Health Care System

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Protocol for a Mixed Methods Study of Hospital Readmissions: Sensemaking in Veterans Health Administration Health Care System

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Protocol for a Mixed Methods Study of Hospital Readmissions: Sensemaking in Veterans Health Administration Health Care System

Abstract

Introduction: Effective delivery of health care in complex systems requires managing interdependencies between professions and organizational units. Reducing 30-day hospital readmissions may be one of the most complex tasks that a health care system can undertake. We propose that these less than optimal outcomes are related to difficulties managing the complex interdependencies among organizational units and to a lack of effective sensemaking among individuals and organizational units regarding how best to coordinate patient needs.

Methods and analysis: This is a mixed method, multi-stepped study. We will conduct in-depth qualitative organizational case studies in 10 Veterans Health Administration facilities (6 with improving and 4 with worsening readmission rates), focusing on relationships, sensemaking and improvisation around care transition processes intended to reduce early readmissions. Data will be gathered through multiple methods (e.g., chart reviews, surveys, interviews, observations) and analyzed using analytic memos, qualitative coding, and statistical analyses. We will construct an agent based model based on those results to explore the influence of sensemaking and specific care transition processes on early readmissions.

Ethics and dissemination: Ethical approval has been obtained through the Institutional Review Board (IRB) of the University of Texas Health Science Center at San Antonio (approval number: 14-258H). We will disseminate our findings in manuscripts in peer-reviewed journals, professional conferences, and through short reports back to participating entities and stakeholders.

Key words: care transitions; hospital readmissions; sensemaking; complexity science; veterans

Strengths and limitations of this study

- Using Eisenhardt's recommendations for building theory from case studies, this study samples 10 sites with a minimum of 2000 discharges per year, all of which have attempted efforts to improve hospital-to-home care transition processes and have either worsening or improving hospital readmission rates over a 5 year period, allowing us to explore organizational characteristics leading to these performance patterns.
- For each site, we create an in-depth qualitative organizational case study of relationships, sensemaking and improvisation around care transition processes, from which we will build an agent based model to explore how system elements may impact hospital readmission rates and identify potential leverage points for new types of interventions.
- Limitations include the single point in time data collection, all facilities are drawn from a single health care system (the Veterans Health Administration), and the study is observational rather than interventional.

Introduction

Complex systems cannot be understood by breaking their processes down into component parts or into individuals' jobs, even though this is often our first response to solving complicated problems in healthcare (1,2). Effective healthcare delivery requires effective management of interdependencies between socially distinct professions and between organizational units with unique perceived purposes and purviews. Within well integrated systems, patients navigating

unit boundaries should feel like system components form a continuum that communicate and cooperate for the explicit purpose of patient wellness.

As the United States' largest integrated health care system, the Veterans Health Administration (VHA) is theoretically positioned to deliver integrated care along such a continuum. Despite this, VHA's performance has been similar or worse than Medicare providers with regard to outcomes reflecting complex interdependencies, such as unplanned hospital readmissions (3). We propose that these less than optimal outcomes are related to difficulties managing the complex interdependencies among VHA organizational units and to a lack of effective sensemaking among individuals and organizational units regarding how best to coordinate Veteran needs.

Early Readmissions as a Persistent Problem

Hospital readmissions continue to receive significant attention as a source of potential waste and a marker of poor quality. A growing elderly population, rising healthcare costs, and an increasing US federal deficit form a broader context for focus on the prevention of early, unplanned readmissions. Reduction of Medicare payments to hospitals with higher than expected readmission rates for targeted conditions is now legislated as part of the Affordable Care Act (ACA), under the Hospital Readmission Reduction Program (4). Although the policy emphasis on readmissions is recent, early readmissions have been proposed as a quality indicator for at least 22 years (5). Numerous studies assessing the extent of preventability of early readmissions have had widely varying estimates: 5-79% (6–8).

Readmission rates have been declining but are still felt to be at an unacceptable level. Thirty-day hospital readmission rates for Medicare beneficiaries showed significant, then slowed declines after the implementation of penalties: going from 21.5% to 17.8% for targeted conditions and from 15% to 13% for nontargeted conditions between 2007 and 2015 (9). VHA hospital-wide

risk adjusted 30-day readmission rates, which were not subject to the same penalties, gradually dropped 3 percent from 1997 to 2010 (16.5% to 13.8%),(10) and have remained around 13 percent (IPEC readmission cube on VSSC, accessed 5/19/2017).

Why has reducing early hospital readmissions been such a persistent challenge? We believe the answer lies in the nature of the problem. Reducing readmissions within 30 days may be one of the most complex tasks that a health care system can undertake. First, success depends on the intersection, coordination and collaboration of many parts of the system that may not be well-aligned. The VHA has an advantage over many other systems in that some of these pieces (e.g., hospital, specialty, and primary care, nursing homes, pharmacies) are part of its system. Second, patients and their caregivers are in control of many of the factors that will determine their ability to stay out of the hospital; healthcare delivery systems may not recognize the challenges patients and their caregivers face or the help and education they may need. Third, with such tremendous focus on shortening length of stay in the last 15 years, assumptions have been made on both inpatient and outpatient providers' parts about who is responsible for different aspects of care, with gaps occurring when expectations are not congruent. Fourth, a dearth of geriatricians, who might have more insight into frail patients' needs and be better equipped to deal with the large numbers of chronically ill elderly, exists (11). Fifth, due to ongoing fragmentation of relationships with patients, there may be both a lack of recognition of the declining slope of health towards death and a lack of comfort in discussing when the switch should be made from full acute care treatment to supportive palliative care. Finally, we have technologies and processes to prolong life, allowing us to care for sicker patients who in fact may require a greater number of appropriate hospital admissions over their life course.

Given the complexity of understanding all elements contributing to readmissions, it is no surprise that preventing early readmissions remains a challenging health care issue.

Risk Prediction Models for Readmissions

One approach to reduce readmission rates has been to implement risk prediction models to identify and target interventions toward those most at risk for early readmission. Kansagara, in a systematic review commissioned by the VA, reviewed 30 published studies of 26 unique models. The article concluded that most readmission risk prediction models performed poorly and as yet are not useful in clinical settings. . This finding was corroborated by a systematic review by Zhou and colleagues (12), which found that while risk prediction models are growing in number and condition specificity, they show only moderate discriminative ability. These models typically focused on characteristics of the patients that were risk factors for readmission and not characteristics of institutional behavior from the index admission that might have put them at risk.

Care Transitions Studies

Another approach to reducing readmission rates is through care transition interventions. In Hansen et al (13)'s reviewthey found that of 16 randomized, controlled trials of interventions to improve 30-day rehospitalization rates, only 5 documented statistically significant improvement in reducing rehospitalizations. Four of these five tested multicomponent discharge bundles such as the Care Transition Intervention (14), Project RED (15), and the Care Transitions Model (16). But 11 other RCTs, some of which also used bundles with similar elements, failed to show improvements. Leppin et al (17) reviewed 42 trials and while the majority of these trials (38 of 42) did not have a significant effect on readmissions, the metaanalysis did find a significant reduction of readmissions across the studies. They also found that studies with 5 or more unique

activities in the intervention were more effective at reducing readmissions as were those with 2 or more individuals involved in the intervention. One interpretation from the complexity science perspective of the lack of improvement from these interventions is that they focus on breaking down processes into component parts or on changing the behaviors of individuals (assigning specific individuals to specific tasks) but do not address the interdependencies and boundary crossings that make the transitions so difficult.

Despite the ambiguity of the evidence and because of the burden of readmission for both the patient and the system, many VHA facilities are trying some of the more promising of the above models. Individual facility efforts include implementing standardized models such as Project RED and Project BOOST. There have also been VHA sponsored efforts, such as to address chronic heart failure readmissions (18) and to enact transition management initiatives. The VHA has also adopted nationwide policies to implement specific elements of these recommended bundles such as 2-day call back by primary care teams after inpatient discharge and required medication reconciliation prior to discharge. However, other than these two policies, there are few care transition elements mandated to be implemented across VHA facilities.

Complexity Science as a Theoretical Lens for Understanding Why Reducing Readmissions is so Difficult

The application of complexity science to healthcare systems can provide new insights to the issue of readmissions. Defining characteristics of complex adaptive systems are diverse learning agents who interact non-linearly with both themselves and interventions and who self-organize. These complex systems co-evolve with their environment and have emergent properties that are not predictable. Due to the systems' non-linearity, inputs and outputs are not necessarily proportional nor is the former necessarily predictable from the latter (19). We may expect to find

that even though organizations might implement care transition programs, the amount of effort put into their programs is not proportional to readmission rate outcomes.

.. The inherent non-linearity of complex systems also leads to uncertainty in the system. This may be particularly true during transitional periods for patients, when patients' recovery is not yet assured, the home environment is often not well known to the staff, and the possibility of developing a relapse is significant. In these situations, the uncertainty is compounded: it is inherent in the trajectory of the patient's illness, the limits of our scientific knowledge, and in the system itself (20,21). This is also true during the implementation of new initiatives in healthcare systems: changing the way that we do things introduces uncertainty. An implication of complexity science is that approaches for improving clinical systems must focus on not only process of care, but also on the relationships between and interdependencies among health care providers (1,2,22). These interdependencies are the basis for the social activities that enable patient care. This study will focus on sensemaking as an important skill among health care managers, health care providers, and patients that enables resilience, or the ability to maintain health and avoid hospitalization.

Relationships, Sensemaking, and Improvising

Relationships among health care workers are the foundation for the social activities that occur during patient care, including transitions of care. Based on Lanham's framework of work relationships, seven characteristics define effective relationships in healthcare settings: trust, mindfulness, heedfulness, respectful interaction, diversity, social and task relatedness, and rich and lean conversation (23). These characteristics interact with how individuals and groups of providers reflect, make sense, and learn in ways that shape the quality of patient outcomes. It is through the relationship infrastructure that care transitions staff can bring together a collection of

individuals to function as a coordinated, interdependent group that is able to act effectively to provide the most appropriate care for the individual patient. Fostering relationships to improve care delivery is not something to which health care organizations have traditionally paid attention. However, emerging data speaks to its importance (23–25).

We propose that one reason care transitions interventions have had widely varying effectiveness despite implementing similar interventions may be a difference in the relationship infrastructures across services, teams and organizations. The relationship infrastructure can give way to activities, such as sensemaking and improvising, which help providers and other organizational staff manage uncertainties and stressors. In sensemaking, people assimilate information, reach conclusions, and take steps to act. According to Weick, "Sensemaking is a diagnostic process directed at constructing plausible interpretations of patterns based on ambiguous cues that are sufficient to sustain action" (26). In the inpatient setting, sensemaking can occur in relation to individual patient diagnosis and care, as well as understanding more broadly patient illness trajectories and how their condition changes over time (27).

Preventing early readmissions via sensemaking involves multiple sets of individuals interacting to make sense beyond the physician team. Our model below summarizes these interdependencies (Figure 1). Not only does the trajectory of the patient's illness need to be understood as it continues in the home or next institutional environment but also in relation to how the home environment now does or does not meet the patient's needs post-hospitalization (how much independence has the patient lost), what actual supports need to brought together (prosthetics, pharmacy, home delivery of equipment, etc.), the level of understanding of the patient and/or caregiver of the self-management that will need to occur (for example, salt and water intake, self-weighing, and medication adherence for chronic heart failure disease management),

understanding of funding mechanisms, and more. While checklists help remind care transition managers of what needs to be done, they do not necessarily help them make sense of what needs to be done for whom, or when or how to engage individuals in other services to become part of their team.

Improvising is varying what one does based on the context and situation at hand (28,29). For example, Jazz ensemble members each build upon their own and the groups' talents and experiences as they improvise. In their interplay, they are a more effective whole (30). Physicians similarly describe the importance of improvisation amid new or uncertain situations in patient care (29). Thus, improving care transitions teams' ability to improvise may be a powerful strategy for decreasing readmissions. In the context of care transitions, a care manager might improvise by varying what they are doing based on the needs of the individual patient being discharged.

[INSERT FIGURE 1]

Project Aim:

We are studying care transition interventions aimed at reducing early readmissions as an exemplar of processes requiring a high level of interdependencies and sensemaking. By investigating VHA facility cases that have attempted interventions to improve care transitions and have had either improvement *or* worsening in their readmission rates, we will not only improve our understanding of the care transition processes themselves but also the sensemaking within the organization needed to implement change when there is no single part of the organization responsible for the outcome.

- Objective 1: Conduct in-depth qualitative, organizational case studies to explore relationships, sensemaking, and improvisation in 6 facilities with improving and 4

facilities with worsening early readmissions rates between fiscal years 2006 and 2011, all of which engaged in care transition interventions to improve early readmissions.

- Objective 2: Extend learning from and enhance generalizability of the case studies, using agent based modeling to simulate facilities implementing care transition innovations and to explore both specific care transition processes and elements of sensemaking as they prevent early readmissions, or not, as possible system outcomes.

Methods and Analysis

Study Design Overview

We are conducting a mixed method, multi-stepped study using concurrent triangulation. It will be conducted in 2 parts: the first part will be an in-depth qualitative organizational case study; the second part will be constructing an agent based model based on those results.

Objective 1. Organizational Case Studies

Case Sample and Individual Recruitment within Cases

Given that the intent of the study is to build or extend theory, not to test existing theory, we are using Eisenhardt's recommendations with regard to sampling for case studies in her methodological review, "Building theories from case study research" (31). In this context, cases are chosen on theoretical grounds and not for statistical reasons. Cases may be chosen to replicate previous cases or extend emergent theory or they may be chosen to fill theoretical categories and provide examples of polar types, in which the process of interest is "transparently observable" (31,32). Random selection is neither necessary nor even preferable. The goal of the theoretical sampling is to choose cases which are likely to replicate or extend the emergent theory. In this spirit, our criteria for case selection concerned facility size, trending 5-year readmission rates, and documented care transition improvement efforts (see Table 1).

Table 1. Case study eligibility criteria

Eligibility criteria	Process for establishing eligibility
Criteria 1. A minimum of 2000 admissions per year to the facility	After visually reviewing the all cause medical surgical readmission rates for 2006 to 2011 for all VHA hospitals and comparing facilities with varying admission totals, we identified that facilities with more than 2000 admissions/year had less dramatic variability in their year-to-year readmissions rates. We also felt that facilities with larger numbers of admissions were more likely to spend intellectual and human resources on care transitions.
Criteria 2. Significantly increasing or decreasing all cause medical surgical readmission rate between fiscal years 2006 and 2011	Using the unadjusted readmission rates obtained from the IPEC Readmission cube (33), we tested whether the change in rate over five years was significant or not. Eleven facilities were improvers (declining readmission rates), nine facilities had significantly worsening rates (increasing readmission rates) over that time. We chose facilities with significantly changing rates as we wanted to explore attempts at innovations and changes in the outcomes of interest to the facility.
Criteria 3. Two or more care transition innovations identified	Within the two different readmission performance groups (improving or worsening), we narrowed selection further using multiple sources of data regarding care transitions innovations within the VHA including a national survey of Utilization Management Nurses conducted in 2013, listings of all transitional care pilot projects funded by through a VHA initiative called the Geriatrics T21 funds, and listings of all VHA Flow Improvement collaboratives on care transitions in the same time frame. We felt documented efforts to improve care transition processes provided evidence of some attempts at bettering readmission rates but did not expect that these would be the only care transition or rate improvement efforts undertaken by the sites. By comparing each of these sources for information, we identified 13 facilities, meeting the above criteria, with evidence of two or more innovations taking place around care transitions and prevention of readmissions. We eliminated from the potential sample pool the 7 facilities for which we did not have evidence of two or more care transitions innovations.

Within each facility case, individuals will be recruited to participate in interviews, focus groups, observations, and/or surveys using purposive sampling.(34) Purposive sampling allows us to identify and recruit individuals with specific experiences and knowledge that will inform our case building. We will use information from facility websites (e.g., organizational charts, service rosters) and the VA's Microsoft Outlook contact list to identify individuals occupying specific roles. During site visits, snowball and convenience sampling will also be used to identify people with knowledge of site care transition innovations and experience with care transition practices.

Potential participants will be invited to participate through email and/or face-to-face. Specific forms of sampling and recruitment will vary based on data collection activity (see Table 2). Note, recruitment for one activity does not preclude recruitment for other activities. For example, a hospitalist might be engaged in an interview as well as an observation of her medicine rounds. At each site, investigators will aim to balance recruiting to obtain diverse, representative perspectives and to generate deeper knowledge about specific experiences.

Table 2. Participant recruitment for each case study site

Activity	Population	Description of recruitment
Interviews	Service leaders (n=~10)	Individuals from medicine, nursing, social work, pharmacy, and primary care leadership (i.e., service chiefs and supervisors) will be identified through organizational charts available on facility websites or sharepoints, the VHA Outlook contact list, or by other staff at the facility. They will be contacted by phone or by email to participate in interviews.
Chart Reviews	Patients (n=10)	Project staff and investigators will review the charts of a random selection of 10 veterans admitted to the facility's hospital within the 3-6 months before the scheduled site visit. Five of the Veterans will have had 30 day readmissions following their index admissions and five of them will have not. All 10 veterans must meet the following inclusion criteria at the time of the index admission: (a) inpatient or outpatient contact in the previous year with a VHA provider; (b) a Charlson Comorbidity index (35) of two or more; (c) discharge from a general medicine unit at the case study hospital within the sampling period; (d) discharge diagnosis of chronic obstructive pulmonary disease, chronic heart failure, and/or pneumonia; and (e) discharge to home. Patients are excluded if they are discharged to a long term care or skilled facility. For each site, a VA data analyst will provide the team with a sample of the first 10 readmitted and 10 non-readmitted patients meeting these criteria. The project coordinator will verify that these patients meet eligibility criteria and assign the first 5 in each group which meet eligibility criteria to be reviewed. A waiver of consent was obtained for the sample of patients for whom we conduct chart reviews.
Interviews	Front line providers (n=15-20)	We will sample 1 to 4 providers from each of the following roles: hospitalists, inpatient medicine nurses, inpatient social workers, pharmacists who deal with discharge education and supply of medications to patients on discharge, primary care team providers, and, when present, dedicated care transition staff (e.g. patient care

		coordinators). Depending upon each site's processes and programs, interviews may also be held with representative staff from palliative care, subspecialty care (e.g., geriatrics, cardiology), telecare, utilization management, and others as appropriate.
Focus groups	Front line providers (n=1-2)	One to two focus groups, comprised of four to 10 individuals, will be held at each site. For each focus group, the team will aim to recruit one to two staff to represent the following roles: hospitalists, nurses, social workers, pharmacists, and any roles important to care transitions at that site (e.g. patient care coordinators, utilization management nurses). Investigators will recruit front line staff using snowball and quota sampling methods.
Observations	Front line providers (n=17-30)	Staff participating in discharge planning, performing care transition tasks (e.g. discharge education), and doing day-to-day work on medicine units (e.g. rounds) will be eligible for observation. Investigators will purposively recruit participants for observations before the site visit (e.g. through email) and face-to-face during the site visit prior to the start of observations. The specific types of activities observed and number of times they are observed will vary depending on the facility, but the team will broadly aim to observe 3-6 medicine rounds, 3-6 discharge planning meetings, 4 med-surg unit observations, 3-6 job role shadowing, and 4-8 patient discharge educations. Observation lengths will also vary, from 10 minutes (e.g. patient discharge education) to 3 hours (e.g. medicine rounds). During observations, as necessary, researchers will identify themselves to obtain verbal consent from other patients, staff, and other individuals that enter the field of observation once it has commenced. Investigators will use discretion to cease observations if they determine an individual may not be in a position to provide informed consent (e.g. a critically ill patient). Data collection will cease if any person declines to be observed.
Surveys	Front line providers (n=15)	Members of the inpatient care transition teams (e.g., hospitalists, social workers, nurses, pharmacists) and any front line staff members with a direct role in care transitions (e.g., primary care nurses and physicians) will be invited to participate in an anonymous survey. They will be identified during data collection activities (e.g., observing discharge planning meetings, individual interviews), and invited to participate either by email or in person. Everyone encountered who is eligible to participate will be recruited. Surveys can be filled out online (through REDCap) or by handing in a paper copy, neither form collects identifying information and investigators will not make any notes about who turns in paper forms of the survey.
Interviews	Patients (n=5)	Five patients being discharged from medicine units to home will be recruited for interviews. Patients will be sampled using convenience methods and identified by front line staff.
Exit debrief	Facility leaders (n=2-8)	During early email communications with site representatives, facility leadership will be asked to attend an hour long exit debrief on the last day of the team's site visit. Facility directors and chiefs of staff will be

		invited, along with anyone else they deem appropriate.

Ethical. All providers and staff recruited to participate in interviews, focus groups, observations, and surveys will be consented using a verbal consent form distributed through email and/or in hard copy form. The verbal consent form outlines the purpose of the study and that participation is voluntary. Investigators trained in subject recruitment will ensure the potential participants read and understand the form, and agree to participation before engaging subjects in research. A waiver for the documentation of signed consent was obtained as a further level of protecting VHA staff participants' anonymity. Patients will be consented through a signed consent process and asked to sign a Health Insurance Portability Accountability Act form (a form required by U.S. law to protect personal health information and medical records) to allow researchers to access their electronic health record. If at any point a potential or consented participant expresses a desire to not participate, investigators will discontinue recruitment or data collection efforts with them.

Data collection

We will gather and organize preliminary data before the site visit to delimit the organizational context and identify particularly promising areas for interviews and observations. We will visit each facility for a 5-day on-site visit. We will do follow-up data collection, when necessary by phone and protected correspondence. We will undertake to complete roughly one site visit per quarter with 2 to 2.5 months of qualitative data analysis between. Due to the planning for the Agent Based Modeling (see below) we anticipate that parameters and agent characteristics that we learn about in early interviews will suggest questions and observations for subsequent site visits, checking for the presence or absence of these parameters or agent characteristics. Specific

time frames and methods used will be responsive to local context and what we learn during previous site visits.

Team investigators hold advanced degrees in a diversity of fields, including medicine (JP, LL), anthropology (EF, LP), psychology (PN), and business (HL, LL). They each have at least 10 years of experience conducting qualitative research. If not already experienced with complexity theory and agent based modeling, each was provided orientation to these approaches before the study commenced.

Case Data Collection

Each site visit will follow the same general data collection approach, with site specific variations depending on local context (e.g., care transition processes, staffing and roles) (see Table 3). Preparation will involve logistical activities and data gathering through leadership interviews and chart reviews. The 5-day site visit will include a continuation of activities started before the site visits, as well as additional interviews, observations of care transition work, focus groups, and staff surveys. Follow-up patient interviews will occur about a month after the site visit.

Table 3. General Schedule for Case Study Data Collection and Analysis for each Site

	<----------3 Months----------→		
	Pre-Site Visit	**5 Day Site Visit**	**Post-Site Visit**
Data Collection	Facility Background Chart Reviews Leadership Interviews	Leadership Interviews (cont.) Front Line Provider Interviews Patient Interviews Focus Groups Observations Front Line Provider Surveys Care Transition Process Checklist	30 Day Post-Discharge Interviews with Patients
Data Analysis	Chart Review Memos	Observation Scoring Team Debrief Memos	Facility Reflection Qualitative Analysis in NVivo Quantitative Analysis

Throughout the course of case study data collection, team members will talk about what they are finding and fine-tune questions and approaches so that data collection is responsive to site processes and contexts. Decision-making during weekly meetings will be documented in detailed meeting notes. Changes in data collection will be recorded in site-specific data protocol.

Each site visit will be made by three investigators trained and experienced in qualitative methods (JP, PN, LP, and/or HL). Investigators have no relationship with participants prior to the start of the study. Data collection instruments will be tested at the investigators' home facility to ensure interrater reliability.

For each case study, qualitative and quantitative data will be collected in the form of background documents, patient chart reviews, semi-structured interviews, focus groups, observations, check lists, debriefments, and surveys (see Table 4).

Table 4. Case Study Data Collection

Type	Description	Purpose and link to aims
Facility Background	The project coordinator and investigators conducting the site visit will begin to compile background information on the facility as soon as a visit date is set. Sources of information will include VHA Support Service Center (VSSC) for performance metrics (e.g. 30-day risk standardized readmission rate) and the facility webpage and sharepoint (e.g., for unit structure, inpatient discharge policies, care transition-related pilots). Investigators will also add information about site specific roles, care transition processes (e.g. discharge planning), and readmission-reduction efforts gathered during pre-site visit interviews (see below).	Facility background documents will inform site visit planning and data gathering activities, and serve as broader context for the case study.
Patient Chart Reviews	Project staff and investigators performing chart reviews will be assigned two to three patients to perform chart reviews through the electronic health record on the VHA's Compensation and Pension Record Interchange (CAPRI). The following chart note types will be reviewed for each hospitalization: medicine history and physical, nursing admission, social work screening/assessment, interdisciplinary treatment team plan, nursing discharge, social work discharge, pharmacy discharge, medicine discharge, discharge summary, post-discharge primary care	Recently discharged patients' chart notes will be reviewed for two primary purposes: (1) to identify if, where, and how sites' systematically capture and communicate information about widely agreed upon readmission

	nurse follow-up call, and any site-specific care transition notes. Chart reviews involve two steps and use structured forms in REDCap (36): 1. Chart note type review: for each index admission and readmission, reviewers identify and review two to three instances of the note types of interest (see above). Structured reviews occur through a REDCap form. Each note is assessed for whether they contain (a) documentation of widely agreed upon readmission risk factors and (b) co-signers. 2. Patient case study: for each patient, reviewers will read additional notes to type a brief, de-identified case study narrative of the patient's course during and after the admission(s). Reviewers will use an additional structured REDCap form to document patient specific readmission risk factors and characteristics (e.g. non-VHA insurance coverage). The case study narrative will also be copied into this form.	risk factors and (2) to synthesize information gleaned through specific patient case reviews to create individual case profiles. The latter will describe, for example, the documentation of index admission regarding what plans were in place, how robust were the plans, how well did they consider issues likely to arise, what issues did arise, and for the readmissions, cause of readmission and preventability (6,7,37). This information will inform our understanding of organizational relationships (e.g. who is communicating) and sensemaking (e.g. what information is available for sensemaking about risk for readmissions).
Service Leader Interviews	Service leaders will participate in interviews using a guide that collects basic information about service composition and processes, as well as middle level supervisors to contact about front line recruitment. Leaders involved in efforts to reduce hospital readmissions at the facility or who are knowledgeable about facility care transition practices, will be invited to answer additional questions about historical and current care transition processes at their facility (see Additional file 1). Interviews generally will occur by phone or Microsoft Lync or Skype for Business. Interviews with leadership that do not take place before the site visit, will occur on site in a private setting of the participants' choosing. The interviews will last between 10 and 30 minutes. When possible, interviews will be audio recorded and transcribed; written notes will be taken and typed up when audio recordings are not available.	These interactions will serve to (a) inform service leadership of the project and ensure their support of the participation of their service staff and (b) identify the best ways to recruit staff for interviews and focus groups, and observe care transitions. These interviews will also inform our understanding of organizational relationships and processes.
Front Line Provider Interviews	Semi-structured interview guides will cover the history of care transitions at the facility, what motivated and who was involved in those changes, sensemaking around specific patient cases, and current care transitions processes and	Front line provider interviews will provide information about organizational processes,

	support at the facility (see Additional file 1). Interviews will last between 20 minutes to an hour. Interviews will take place in private spaces within the facility and be audio recorded. Audio recordings will be transcribed.	relationships, and sensemaking.
Focus Groups	One to two, interdisciplinary focus groups will be held at each site. Staff will be purposively sampled so that focus groups have representatives from the services of interest. One investigator will facilitate the focus group, while at least one investigator assists. The investigators will follow a focus group script (see Additional file 1) that probes into care transition processes, sensemaking around readmissions, and staff relationships. Focus groups will be held in facility meeting rooms and last one hour. Focus groups will be audio recorded and transcribed.	The mixed role compositions of the focus groups will provide opportunities for the team to document group interactions, and for the identification of group norms, differences, attitudes, and priorities (38). They will provide specific information about organizational relationships and sensemaking.
Observations of Care Transitions Work	Observations may last between 10 minutes (e.g. patient education) and several hours (e.g. medical team rounds). Investigators record their observations in field notes (31). Objective field notes will focus on interactions between people, the qualities of those interactions (e.g., roles interacting, who says or does what), and how and what information is communicated. After observations are completed, investigators will fill in gaps in handwritten notes and add contextual information (e.g. description of setting). Analytic notes may also be written (e.g., questions for follow-up, comparing and contrasting with other data), but will be differentiated from objective data by italics or brackets. Written field notes will be taken during the observation and later typed.	Observation notes will also serve to inform the site's care transition process checklist, as well as assessment of relationships and sensemaking.
Checklist for Care Transition Processes	The checklist (see Additional file 2) contains items that during proposal preparation work were gleaned processes from the published papers and manuals for care transitions starting with the systematic review by Hansen (13), matching across studies and arriving at a comprehensive list. Care transitions on the list will be scored as present, absent, or inconsistent. During the 5-day site visit, site investigators will independently fill out the checklist. At the completion of the site visit, investigators will meet to identify on a structured checklist the established care transition processes they observed and heard about during the site visit to create an agreed upon version. This version will be entered in REDCap by the project coordinator.	This checklist will help us to quickly quantify how many and which care transition processes are used at each facility.
Debrief with Facility Leaders	Exit debriefs will consist of 40-minute presentations by the project PI and 20 minutes of questions and discussion with invited facility leaders. Debriefs will follow a general format:	Leadership debriefments provide leaders an opportunity to fill in what

	(1) explanation of the study and its methods; (2) description of care transition resources, processes, and special programs or initiatives to reduce readmissions at the site; (3) preliminary identified challenges to reducing readmissions; and (4) feedback. When possible, they will be audio recorded and detailed summary notes recorded for analysis.	they might see as gaps or errors in the investigators' understanding, to sensemake about the information presented, and to reflect on priorities and processes at their facility.
Frontline Provider Surveys	The survey items consist of: work relationship scale developed in our previous study of learning and relationships(39), relational coordination adapted from Gittell's health care work (40) and an adapted version of the Safety Organizing Scale as a measure of sensemaking (27). (see Additional file 3) Work Relationships Scale (WRS)*:* A 15 item scale developed to assess the perceived quality of working relationships in health care settings developed in a previous study by our group. We drew upon the organizational behavior literature to develop an original set of 19 items reflecting the 7 characteristics of work relationships identified among high-functioning PC clinics by Lanham et al (23). The 15 item scale is associated with patient satisfaction with care in the PC environment (39). In our survey, to avoid redundancy with items from the other instruments (see below), we have reduced this to a 9 items to which participants respond on a five point scale (from strongly disagree to strongly agree). Relational Coordination (RC) Survey: The RC survey includes questions that examine 7 dimensions that were developed through inductive field research, and which have been validated in several studies. Items are rated by participants on a 5-point scale indicating the frequency to which each dimension exists in their care setting (e.g., frequency: 1=Never, 5=constantly). This instrument has been found to be reliable for use in airline and healthcare industries with Cronbach's alpha of .80 and .86 respectively (41). Adapted Safety Organization Scale: This scale measures behaviors related to sensemaking and improvising around patient safety, for example, how the team reacts to a crisis situation (27). Participants respond to 8 statements, such as "We talk about readmissions and ways to learn from them," using a 7-point scale (from not at all to a very great extent). This scale was developed for nursing use in inpatient setting and modifications were made to change language to be appropriate to care transitions. Participants will complete the survey on paper or through the online web application REDCap. Paper copies will be personally distributed and collected by investigators while	Results of this survey will be considered markers of relationships among staff participating in patient care transitions and the care transition team's ability to make sense.

	conducting activities on site (e.g. during discharge planning meetings, at interviews and focus groups). Web links to the survey will be provided through email. Completed surveys are anonymous and will not include any respondent's personally identifiable information.	

Qualitative Data Analysis

For each case study, qualitative analysis will overlap with data collection processes. Early findings will inform site-specific adjustments to on-site data collection protocols. Qualitative data analysis will take two forms: memoing and coding.

Memoing: The team will keep a variety of memos during data collection and analysis (see Table 5). Memos record reflexive comments about methods, data, and theory (42). Memos will provide early opportunities for writing about and making connections within the case study data. Some memos will be written by individual researchers (e.g. chart review memos), while others will be created by several researchers through discussion (e.g., meeting memos, facility reflections). Memos will be periodically reviewed at team meetings to inform ongoing data collection, qualitative coding, and model building. They also serve to help document team sensemaking.

Table 5. Memo types

Memo Type	Description
Meeting memos	Detailed summary meeting notes will be kept during team meetings. As described by Eisenhardt (31), team meetings can be useful for overlapping data collection and analysis. These meeting notes will document, for example, how and why data collection protocols change, what researchers are learning about a specific site, and how what they are learning informs theory and agent-based model building. This information will be extracted as memos.
Chart review memos	While conducting chart reviews, researchers will write memos to record and reflect on (a) care transition processes evident in the notes (e.g., readmission risk assessment, discharge education, post-discharge follow-up), (b) provider communication (e.g., co-signing practices, discrepancies in what providers report), (c) sensemaking (e.g., providers documented concerns, how patients' situations are described), and (d) questions or issues for team follow-up. These memos will serve to help the team document what they know so far about care transition processes at the site, identify questions for follow-up, and reflect on specific cases and provider relationships and sensemaking.
Facility reflections	These 1 to 2 page documents will be written by investigators conducting the site visits during post-visit meetings. Reflections will be organized by headings derived

	from the agent based model. These headings will evolve as the agent based model develops (see below). Examples of possible headings include: institutional history and leadership, structures and routines, and information flow and exchange. These analytic memos (42) document and summarize what the team thinks they know about the site, what patterns they observed during data collection, and what gaps might exist in their knowledge. Site reflections will inform the final site case study, data collection methods and approaches at future sites, and ongoing analysis and model building (see below).

Qualitative Coding: Transcripts will be analyzed using NVivo software (43). We will develop a code book using deductive and inductive approaches. An initial codebook will be created based on the original model (see Figure 1). It will be modified as additional elements and patterns are observed through memoing, code report reading, and model building.

Coding will proceed in a stepped fashion. For the first two sites, six team members (LP, JP, PN, HL, EF, and the project coordinator) will code all interview and focus group transcripts. For each site, a random sample of 20% of transcripts will be independently coded by two members of the team. Pairs will check for concordance and discrepancies will be discussed by the team, and the codebook updated as needed in bimonthly coding meetings. For the final seven sites, three team members (HL, the project coordinator, and a research assistant) will code the remaining transcripts. They will check for concordance on at least 10% of a random sample of transcripts for each site. Areas of discrepancy will be discussed and resolved by the full research team during weekly team meetings.

Quantitative Data Analysis

Quantitative data analysis will be conducted on data collected through patient chart reviews, staff surveys, and observations. Knowing readmission rates can change rapidly, at the end of data collection we will also acquire from the VA data warehouse each site's current 5-year readmission rate trend to ensure each site is correctly categorized (as improving or worsening). We will adjust categorization as necessary. Statistical tests will be conducted in Stata IC 14 (44).

Chart notes: At each site, we will determine the likelihood each note type documents the different readmission risk factors and identify which, if any, providers are usually co-signed to the note. We will evaluate findings across and within note types, and across facilities. Findings will also be compared with qualitative data (e.g. interview data related to coordination practices and sensemaking related to readmission risk).

Staff surveys: The survey's three scales will be scored as described in Table 6, and the scores compared between sites. As response rates allow, some within site comparisons may also be made. Results will be triangulated with observation, interview, and focus group data.

Table 6. Scoring frontline provider surveys

Survey Instrument	Scoring
Work Relationship Scale (WRS)	Due to survey burden and partial overlap with other scales (see below), the original 15 item work relationship scale was reduced to 9 items based on the original Rasch item analyses and areas of overlap with items on the other scales. Items 1,2,4,5,8,9,11, 14 and 15 of the original items were retained and references to clinic were changed to team (39). A new Rasch item analysis and principal components analysis will be conducted to assure that unidimensionality has been retained. Total scores will be calculated per respondent (possible range 9-45), averaged across respondents for each facility, and facilities will be compared using SAS PROC Mixed.
Relational Coordination (RC) Survey	RC scores are first calculated for each individual by summing the scores of all roles (e.g. care transitions staff, inpatient attending, outpatient primary care nurse, etc.) for each dimension (e.g. frequent communication) and then dividing by the number of responses. The overall RC score for each participant is derived by calculating the mean of the seven individual scores (range 1-5) (41). RC scores at the facility level are calculated for each functional group (e.g., care transitions manager, hospitalist, primary care nurse or physician) by calculating the mean of each dimension for all members of the functional group, and then a facility RC mean. The primary analyses will use the facility mean score, and secondary analyses will examine variation in RC scores among functional groups (care transitions staff, inpatient attendings, primary care teams).
Adapted Safety Organization Scale	Originally described by Vogus and Sutcliffe (45) as a measure of self-reported behaviors enabling a safety culture in hospital nursing units. Original respondents were RNs only. Questions 1,3, and 4 were used unmodified. Questions 2,4, 7, 8 and 9 were modified to be focused on care transitions and preventing readmissions. For example, the original question 2 was "we talk about mistakes and ways to learn from them." The modified version is "we talk about readmissions and ways to learn from them." The original question 5 was dropped as it dealt only with inpatient nursing shift report giving. The responses

	were kept the same. As for the Work Relationship Scale above, a Rasch item analysis and principal components analysis will be conducted to assure that unidimensionality has been retained. Total scores will be calculated per respondent (possible range 8-56), averaged across respondents for each facility, and facilities will be compared using SAS PROC Mixed.

Observation note scoring: Within their field notes, site investigators will identify the following types of observations for structured scoring: (1) discharge planning meetings; (2) staff-to-staff interactions; and (3) staff-to-patient discharge education. Notes from each observation will be entered into scoring logs and scored according to relationship and sensemaking features (see Table 7). The scoring systems are based on the Lanham (46) and Situation, Task, Intent, Concern, and Calibrate frameworks (47). Project staff will enter scoring into REDCap. Two investigators experienced with applying these frameworks to observations in medical settings (LL and HL) will train the team on how to recognize behaviors that match these characteristics. Consistency in scoring will be established through use of the codebook and during multiple rounds of team scoring. For the first two sites, during weekly meetings following data collection, a sample of roughly 5% of the observations will be independently scored by each team member. Scoring will be compared and discrepancies discussed until the group has reached consensus. Clarifying discussions about scoring will be documented in meeting notes and fed back to improve the scoring guide. Visual inspection of the distribution of all variables will be performed. Where appropriate, power transformations will be applied to variables outside of assumptions of parametric statistics. Group differences will be determined using ordinary or generalized least squares (OLS or GLS) regression with the relevant covariates.

Table 7. Relationship and sensemaking characteristics to be scored during observations

Characteristic	Behaviors we will observe	Metric
RELATIONSHIPS		
Trust	Saying "I don't know" Asking for help Accepting others' clinical judgments if person is a peer or lower in hierarchy	Interactions will be given a "-1," "0" or "1" based on the presence of negative

	Mistrust	behaviors, absence of behaviors or positive behaviors reflecting each relationship characteristic
Diversity	Number / level of team members who contribute to plan	
Respect	Extent to which team members listen to each other, allow each other to talk without interruption, and consider each other's suggestions	
Rich / Lean communication	Using verbal communication with others not in the room or with each other outside the meeting Type of communication with other staff members and with consultants	
Social / task relatedness	Whether staff talk about work and non-work topics / personal lives Jokes made Laughter	
Heedful inter-relating	Acknowledging the potential /actual impact of their behaviors on how others get their jobs done or on patient care or disposition planning.	
Mindfulness	Responding to each other's ideas for the evolving plan. Helping each other with tasks. Suggesting new ideas or discussing how the team might do things differently.	
SENSEMAKING		
Situation	Assesses patient's situation	Teams will be given a "0" or "1" based on the use or non-use of each sensemaking element
Task	Develops a plan about what needs to get done (objectives) based on assessment of patient.	
Intent	Statement of rationale for the plan.	
Concern	Discusses concerns / things that could go wrong / things where plan might fall short with patient. Develops a contingency plan.	
Calibrate	Asks for feedback from each other about the plan based on concerns.	
Social vs. solitary	Shared decision-making between staff, patient, and /or family. May be between 2 staff members. Must come to a shared understanding.	
Degree of identity definition	Performs tasks outside of hierarchical role	
Backward-noticing	Discussion of prior patients with similar presentation or issues, or prior situation of the current patient	

Objective 2. Creating, Verifying and Validating an Agent Based Model (ABM) of Sensemaking Regarding Transitions of Care and Prevention of Readmissions

Complex, nonlinear systems are difficult to study with traditional analytic methods because of multiple interactions among variables, feedback loops, path dependency, and contingencies in any dynamic process; there is often no set of equations that can be solved to predict characteristics of the system (48). A more effective way to examine nonlinear behavior in complex systems is to simulate it by building a model and then running the simulation multiple times to explore the space of possible system trajectories (48). In our study of sensemaking and readmissions, the interdependencies among the patients, health care providers, resources (VHA and non-VHA) and leadership support are clearly nonlinear. Individuals who make sense of the ways in which readmissions occur illustrate this by mentioning different aspects they consider to be critical: patient context, patient understanding and motivation, resource availability, effective communication between health care providers, stage of disease, failures in a system for which they (patient or provider) have little control. These aspects interact in variable ways in the context of different patients. Vest et al. identified the plethora of variables that contribute to readmissions before even addressing the interdependencies (49). Additionally, the literature demonstrates that classical prediction models of readmissions perform poorly (50). We suggest that these explanatory gaps in the literature are due at least in part to a mismatch of analytic strategy to type of system being studied. We see readmission as an emergent outcome of nonlinear interactions among these many aspects of clinical and organizational processes. Through modeling and simulation, we will be better able to understand and evaluate factors contributing to readmissions. While any single case may be difficult to predict, modeling will allow us to identify leverage points in the system that the data demonstrate are particularly sensitive to sensemaking effectiveness. These leverage points could then be considered potential targets for interventions. Through modeling and the subsequent ability to run it numerous times

(simulation), we will be able to extend the case study sample to make it more generalizable to better understand how readmissions occur across the care transition interventions, patient circumstances, and facility environments. Through modeling and simulations we are able to create a laboratory that will allow us to understand better how readmissions occur, helping us to identify gaps in our knowledge as well.

ABM is a version of nonlinear dynamic modeling, a computer implementation of complexity concepts, in which autonomous agents interact in an environment to produce emergent--sometimes surprising--system properties over time (51–53). Since Epstein and Axtell's pioneering work in the late 1990s,(54) it has been applied to research on human groups under the rubric of "artificial societies" (48). ABM is an ideal approach to our research questions for several reasons: first, as noted earlier, our data regarding health care provider interactions are non-linear, making it potentially more difficult to represent patterns and interdependencies using more traditional approaches. ABMs are grounded in non-linear mathematics, assuming interactions and contingencies in a manner that more accurately reflects clinical systems. Second, ABMs allow us to create a broader space of outcomes from rich observations that may be low in number but high in information, accounting not only for the facilities and teams within facilities that we sample, but other types of findings that result from experimenting with parameter changes. Formalizing the interactions leads to a generalization of the processes we observed. Thus, ABMs enable us to leverage small samples to create broader understandings. Third, we can model interactions across levels and over time to explore emergent outcomes. ABMs are laboratories for structure-agency interactions that allow us to understand these multiple levels.

Proposed Modeling Work

Conceptual Work: While data are being collected, our research team will meet regularly to identify the parameters, agent characteristics and interaction patterns. Our starting point will be the conceptual model of care transitions shown in Figure 1. As we develop the ABM, we will iteratively build on our conceptual model using the qualitative data being collected. We will begin developing the ABM after our first few site visits, and refine the model with each subsequent visit. Constructing the model in this way will complement our qualitative data collection and help us identify areas where more intensive inquiry might be necessary. Initial tasks for building the model will include identification of:

Types of agents to be included: In ABM agents can and, in our case, will have correspondence to real world actors, both individuals and organizational units. We will start with the general categories of patients, inpatient providers, outpatient providers, and care transitions personnel. We will then refine the specific individuals contained in these categories, and add any additional categories or types of individuals as we collect and analyze our qualitative data.

Interactions and interdependencies among agents: We will create rules of interaction between the agents in the model based on our site visit data, starting with the initial site visits and refining these interactions with subsequent site visit data. Interactions will focus on the sensemaking activities and categories we observe in the site visits. Those sensemaking attributes were detailed in above in the sections on Observations of Care Transitions Work and Qualitative Data Analysis.

Boundaries and characteristics of the environment: Our model will be built to simulate a single organizational entity. We will create a model to allow ourselves the ability to adjust these characteristics and assess their impact through our simulations. We intend to simulate critical facility characteristics and will use the first year to consider the types of qualitative

characteristics we will obtain during the site visits as well as the quantitative data already available for VHA facilities such as culture (annual employee survey), learning and improvement culture (Voice of VHA survey), number of care transition processes used routinely (from our prior UM survey and verification for study sites), demographics of Veterans served, and facility admission rates. We will also consider known parameters used in traditional readmission prediction models, although most of these parameters focus on the patient such as comorbidities, prior health care use, functional status, socioeconomic status (49,50). Organizational characteristics relate back to the technical processes of care and system resources noted on our conceptual model.

Levels of model*:* One of the rationales in studying transitions of care as an exemplar is the multiple individuals and teams that interact with the patient and the system to make the care transitions successful. A benefit of ABM is that it allows us to consider levels of interactions, and the system-level outcomes that emerge from these levels of interactions. In building the model, we will need to address how different parts interact with the next to produce the product of interest—successful or unsuccessful care transitions. Care transition teams and Veterans interact with inpatient teams as well as outpatient teams, resource providers (such as prosthetics and pharmacy), home care providers, institutional providers, and patient caregivers. Additionally, leadership determines extent of resources available at many of these levels. We will define the levels and how they will feed into each other. Again, we will use our conceptual model of care transitions as the starting point. Processes of care and the organizational characteristics will form this level. The formal interactions or organizational structure will also be reflected here. The agents will interact in this level, producing emergent outcomes of sensemaking that are grounded in their interactions and inter-relating. These sensemaking

patterns will form the second level of the model. From them, care transition outcomes will emerge, forming the model outputs. In our model, the two outcomes will be a successful care transition or a readmission.

Feedback loops can be created within the levels of the model. For example, as either successful care transitions or readmissions occur, these outcomes can feed back into how the agents' sensemaking processes. We will specifically collect data on these types of feedback loops during our site visits. (See questions about feedback to care transitions staff above.) These feedback effects will be modeled using standard best practices from the System Dynamics modeling methodology, which concentrates on how to model systems with nonlinear feedback loops (55–57).

Modeling software: We will use NetLogo software to create our model. NetLogo is a freely available software that has been under development for two decades and is widely used for ABM (58). It is now in Version 5 and has become a sophisticated language for modeling intelligent autonomous agents interacting in "live" environments. With the most recent versions, NetLogo extensions have been incorporated that enable more sophisticated agents and with hybrid capabilities enabling combined agent-based and discrete-event simulation. These capabilities will allow us to create a robust model that best represents the relevant processes of care and agent interactions.

Model Verification and Refinement: As we develop the model, we will make our understanding of the interdependencies between different levels more explicit. Because we will begin to conceptualize and create the model in parallel with data collection, we will be able to use ongoing site visits to refine aspects of our model.

Additionally, we will perform verification to ensure that the associations and interdependencies between levels of the model are expressed in the way we intend. Verification "concerns whether the program is working as the researcher expects it to" (48). Our model will act as a thought-experiment laboratory that forces us to clarify and formalize the interactions in which we are interested. The verification will support this clarification.

Model simulation and sensitivity testing*:* We will use simulation to deepen our understanding of the ways that provider sensemaking influences care transition outcomes. We will be able to vary the following parameters: organizational factors, including patient population characteristics and other facility-level data; care transition practices; sensemaking practices. We will assess the impact of parameter variation on our outcome of interest—readmissions and successful care transitions. During this time simulations will be run for multiple "facilities" to expand the generalizability of our qualitative sample, using different combinations of individual and facility characteristics to understand how sensemaking emerges, and how sensemaking then impacts care transition outcomes.

Model verification and boundary testing*:* During this period, we will present our model results to our local site PIs from 10 sites as well as our Systems Reengineering organizational partners for input as to the face validity of the findings of the simulations. These presentations will follow a formal, focus group process to ensure that we capture all concerns and feedback regarding the model. We will use this feedback to further refine the model.

Study Status

Data collection at the first case study site began in July 2015 and continued through December 2017. Qualitative and quantitative data analysis, and Agent based modeling work began during this period and were ongoing at the time of writing.

Ethics and Dissemination

The Institutional Review Board (IRB) of the University of Texas Health Science Center at San Antonio, the administrative body responsible for protecting the rights and welfare of people participating in human subjects research at our institution, approved this study (approval number: 14-258H). Participation in this study is voluntary and participants are not compensated for their participation. Written consent and HIPPA forms are obtained for patients participating in interviews. As permitted by our IRB, VA staff participating in research activities (e.g., interviews, surveys, observations) are given an information form about the study, assured confidentiality, and asked to give verbal consent to participation.

Findings from our work will be disseminated through manuscripts in peer reviewed journals, at professional conferences, and in short reports distributed to stakeholders and study participants. Our data will not be made available in repositories.

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Authors' contributions

JP, LL, HL, PN, and EF provided conceptual and methodological expertise to the design of the study protocol. JP and LP were major contributors to writing the manuscript. All authors read, edited, and approved the final manuscript.

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Competing interests statement

The authors declare that they have no competing interests.

Figure 1. Model of Care Transitions

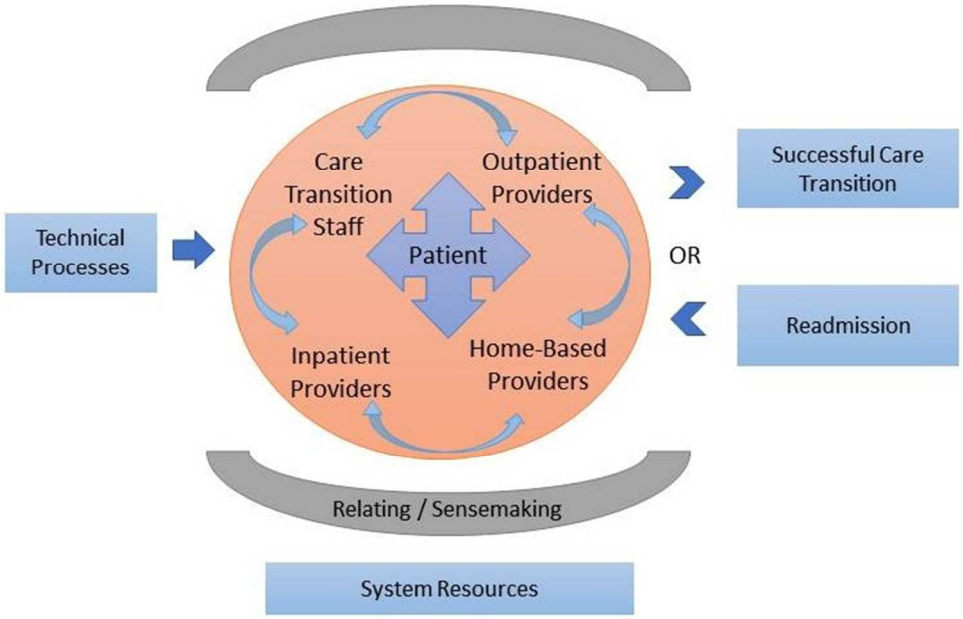

Figure 1. Model of the care transitions process

65x43mm (300 x 300 DPI)

Interview and Focus Group Guides

Thematic areas to be explored in leadership and supervisory interviews:

- *History of care transitions work at this facility*: Tell me the history of care transitions at your facility. What has been the biggest challenge regarding care transitions? The biggest success?

- *Motivation for change in care transitions structure or process*: When changes in the care transitions processes or staffing have been made, what prompted those changes to occur? (Probes: data regarding readmissions, local staff or patient concerns regarding failure of transitions, pressure to improve performance measurement)

- *Key players and description of planning processes*: Who was involved in planning these changes? How did the planning proceed and turn into actual processes?

- *Current organizational "ownership" of care transitions*: In your facility, where do care transitions workers sit organizationally?

- *Facility support for cross-unit cooperation for care transitions*: Care transitions involve cooperation among many different services or organizational units. How has this been addressed in your facility?

- *Organizational priorities*: What are your clinical performance priorities? Were there any initiatives taken last year to meet those priorities? If yes, what were those initiatives? Have you had any local initiatives to decrease unplanned hospital readmissions? If yes, what were those? How do you balance between care transition priorities and other competing priorities?

Thematic areas to be explored with front-line care transitions staff interviews:

- *Work history*: What are your responsibilities as a [job title]? How long have you been a [job title]?

- *Case studies:* Tell me about a patient whose care you were involved with who was readmitted. Tell me a story of a recent patient you thought would end up back in the hospital but has not. Tell me about a patient you thought would do well but ended up being readmitted. (Probes for case studies: Why did he/ she get readmitted? What do you think contributed to his readmission? What, if anything, do you think could have been done to prevent that readmission?)

- *Work processes*: Tell me all of the various tasks you might do for a patient prior to discharge. (Probe on the 16 processes. If this worker does not do them, does anyone else or are they just not done here?) Are patients at this facility assessed for their risk for readmission? If so, how is this done? Who does it? How do you use this information? If a patient you have taken care of has been readmitted, are you informed of this?

- *Work relationships*: When multiple but disagreeing opinions are voiced about a complicated patient's discharge plan, how does the group finalize the plan? When you need to transition a patient to outpatient providers, home health agencies, or SNFs/ rehabs/ CLCs, how do

you communicate the patient's needs? (Probe into rich vs lean communication) How much of your work coordinating patient care with other services gets done inside of meetings?

- *Sensemaking and Improvising*: Tell me about facilitators and barriers to carrying out your work. How do you work around barriers as needed? Tell me some stories about what you did on a particular case to overcome such barriers. Do your coworkers such as the doctors on the inpatient teams or staff in outpatient units work with you on overcoming barriers? Understanding the patient needs better?

- *Institutional history and leadership/information flow and exchange*: What clinical performance measures are you focusing on at this facility? If a new initiative were to come out, how would you hear about it? How do you decide what you need to do differently when these initiatives come out? What kind of feedback do you typically get about how you are doing on these initiatives?

- *Improvement*: Is there anything you think could be done to improve discharge planning/ care transition processes at your facility?

Thematic areas to be explored in patient interviews, before discharge:

- *Issues from the veteran perspective:* How do you feel about being discharged from the hospital today?

- *Relating:* Can you name up to six people who have been most involved in getting you ready to go back home? How did they learn about your needs after you get home? Did these individuals ask you about what kind of help you need at home? How often did they speak with you? Did they speak with your family? How are (these people) working together to meet your needs after you leave the hospital? How are these people working with the providers who take care of you outside of the hospital?

- *Sensemaking:* Did your providers ask you about any concerns you might have about going home? Did your providers talk to you about what you need to watch out for after going home? Did the people taking care of you in the hospital identify things that you need that you weren't aware of? Do you think you have everything you need to go home without any problems? Has anything surprised you about the discharge process? What didn't we ask about that we should have?

Thematic areas to be explored in patient interviews, after discharge:

- *Veteran experience post-discharge*: How have you been doing since you were discharged? Have things gone as expected since you arrived home? Have you had any problems with your [*insert medical diagnosis*]? How did you handle it?

- *Improvement*: Thinking back to the end of your hospitalization, is there anything that could have better prepared you for managing your health at home?

Thematic areas to be explored in care transition staff focus groups:

- *Work processes:* Tell us about inpatient to outpatient care transitions processes related to hospital discharge here. (Probe into who is typically involved) When you think a patient is at high risk for readmission, do you do anything differently? If so, please describe.

- *Sensemaking:* What do you do well here with regard to care transitions and prevention of readmissions? Are there particular types of patients or situations for whom you see readmissions here at <facility name>? Is there a process in place to discuss/debrief on readmissions (perceived preventable or otherwise) at this facility? If so, please describe.

- *Work Relationships:* Is there usually agreement among ward nursing, UM staff, care transition staff, and physicians about patients' readiness for discharge or post-discharge patient needs? When there is not agreement, how do you reach resolution? Do you feel comfortable speaking up if you disagree with the decisions on those issues? When there is a lack of agreement, what are some common types of reasons for the disagreement? (Probe)

- *Case Studies:* What is your most memorable readmission? Why? Please describe.

- *Improvement:* Do you think there is room for improvement here? If so, where/how? Tell us about a time/case when you were not sure about how well the patient might do in terms of staying out of the hospital. Tell us about those uncertainties. How did you, as a team, deal with those uncertainties? Did you do anything different? Tell us about any step/initiative that you took to prevent readmission for this individual.

***ORGANIZATION*: Checklist of care transition processes observed at facility**

Facility: _____

Date: _____ Observer:_____

Check boxes if occurrence of element of care processes were undertaken or routinely used at facility during the entire visit.

Technical Process	Observed?	Source	Staff Responsible	Notes (describe quality of process, contradictions or confirmations in data sources)
Pre-discharge patient education	Y N Inconsistent			
Use of teach-back method with patients	Y N Inconsistent			
Increased emphasis on patient education about diagnoses, self-management and medications throughout hospitalization	Y N Inconsistent			
Communication of medical plans in front of patients (nurse to nurse hand-offs, nurse to physician, bedside rounds, etc.)	Y N Inconsistent			
Implementation of a discharge checklist	Y N Inconsistent			
Use of a checklist to assess readmission risk	Y N Inconsistent			
Implementation of discharge planning rounds	Y N Inconsistent			

Technical Process	Observed?	Source	Staff Responsible	Notes (describe quality of process, contradictions or confirmations in data sources)
Medication reconciliation prior to discharge	Y N Inconsistent			
Assignment of medication reconciliation to pharmacist	Y N Inconsistent			
Utilization of discharge/care transitions case manager	Y N Inconsistent			
Printed follow-up instructions which might include medication reconciliation, follow-up appointments, self-care tasks or action plan for management of symptoms	Y N Inconsistent			
Post discharge follow-up appointments to PCP and for diagnostic testing made prior to discharge	Y N Inconsistent			
Direct communication with PCP or other PACT team members	Y N Inconsistent			
Potential benefits of referral to telehealth assessed as part of discharge planning process	Y N Inconsistent			
Need for rehabilitation services routinely assessed during discharge planning	Y N Inconsistent			
Rehabilitation services scheduled prior to discharge	Y N Inconsistent			

Technical Process	Observed?	Source	Staff Responsible	Notes (describe quality of process, contradictions or confirmations in data sources)
Assessment for advance care planning (palliative / hospice)	Y N Inconsistent			
Enlisting social and community supports (home health services, Meals-on-Wheels, day care services, housing, etc.) for post-discharge care	Y N Inconsistent			
Post-discharge patient hotline available?	Y N Inconsistent			
Post-discharge home visit available?	Y N Inconsistent			
Post-discharge phone call from hospital (who, time frame)	Y N Inconsistent			
Post-discharge phone call from PACT team mentioned	Y N Inconsistent			

***STAFF*: Care Transitions Survey Guide**

*Your participation in the survey is **voluntary**. Your responses are **anonymous** and will be kept strictly **confidential**. The results will be reported in summary form and not as individual responses.*

Facility: _____

Ward/Service: _____

Date: _____

Please indicate your individual professional role below.

◯ Staff physician
◯ Resident / Intern
◯ NP/PA
◯ RN
◯ LVN
◯ Social worker
◯ Pharmacist
◯ Clerk
◯ Other (Specify:_____)

Please indicate any additional functional roles you may serve. Select all that apply.

◯ Case manager
◯ Utilization Management (UM)
◯ Palliative care
◯ Discharge planning
◯ PACT team
◯ Other (Specify:_____)

In what setting do you work?

◯ Inpatient care
◯ Primary care
◯ Other outpatient care (Specify:_____)

Safety Organizing Scale

Item	Not at all	To a very limited extent	To a limited extent	To a moderate extent	To a considerable extent	To a great extent	To a very great extent
1. We have a good "map" of each other's talents and skills	○	○	○	○	○	○	○
2. We talk about readmissions and ways to learn from them	○	○	○	○	○	○	○
3. We discuss our unique skills with each other so we know who on the team has relevant specialized skills and knowledge	○	○	○	○	○	○	○
4. When attempting to resolve a problem, we take advantage of the unique skills of our colleagues	○	○	○	○	○	○	○
5. We discuss alternatives as to how to best transition patients from the hospital to outpatient settings	○	○	○	○	○	○	○
6. We discuss ways to prevent high risk patients from being readmitted	○	○	○	○	○	○	○
7. When failures occur in transitioning patients from the hospital to outpatient settings, we discuss how we could have prevented them	○	○	○	○	○	○	○
8. When difficult disposition issues arise, we rapidly pool our collective expertise to attempt to resolve it	○	○	○	○	○	○	○

Relational Coordination Survey

1. How <u>frequently</u> do people in each of these groups communicate with you about patients transitioning from the hospital to outpatient settings?

	Never	Rarely	Occasionally	Often	Always	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT team members	1	2	3	4	5	N/A
Other individuals or services involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4	5	N/A

2. How frequently do the people in these groups communicate with you in a timely way about patients transitioning from the hospital to outpatient settings?

	Never	Rarely	Occasionally	Often	Always	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT team members	1	2	3	4	5	N/A
Other individuals or services involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4	5	N/A

3. When problems arise with transitioning patients from the hospital to outpatient settings, how often do the people in these groups work with you to help solve the problem?

	Never	Rarely	Occasionally	Often	Always	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT Team members	1	2	3	4	5	N/A
Other individuals or services involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4	5	N/A

4. How much do the people in these groups know about the work you do in transitioning patients from the hospital to outpatient settings?

	Nothing	A little	Some	A lot	Everything	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT Team members	1	2	3	4	5	N/A
Other individuals or services involved in transitioning patients from hospital to outpatient settings (please identify:_____)	1	2	3	4	5	N/A

5. To what extent do the people in these groups share your goals for transitioning patients from the hospital to outpatient settings?

	Not at all	A little	Somewhat	A lot	Completely	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT Team members	1	2	3	4	5	N/A
Other individuals or services involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4	5	N/A

6. Who is <u>ultimately responsible</u> for the care for a patient?

	Never	Rarely	Occasionally	Often	Always	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT Team members	1	2	3	4	5	N/A
Other individuals or services in involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4	5	N/A

8. How often do you use information from the following sources in making decisions about the discharge of a patient?

	Never	Rarely	Occasionally	Often	Always	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT Team members	1	2	3	4	5	N/A
Other individuals or services in involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4	5	N/A
Historical information in EMR	1	2	3	4	5	N/A
Evidence-based guidelines / systematic reviews	1	2	3	4	5	N/A
Summary resources (e.g. UpToDate)	1	2	3	4	5	N/A
Medline / pubmed	1	2	3	4	5	N/A
Web-based search tools	1	2	3	4	5	N/A

9. How do you communicate with the following groups of people?

	In person	On phone	Text pages / electronic orders	Through notes / documentation
Patients	1	2	3	4
Patient families	1	2	3	4
Physicians	1	2	3	4
NPs/PAs	1	2	3	4
Ward nurses	1	2	3	4
Social workers	1	2	3	4
Pharmacists	1	2	3	4
Case managers	1	2	3	4
Ward clerks	1	2	3	4
Palliative care team members	1	2	3	4
PACT Team members	1	2	3	4
Other individuals or services in involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4

Work Relationship Scale

Listed below are a number of statements that could describe **all of the providers and staff who are involved in transitioning patients from the hospital to outpatient settings, referred to as the "team" below**. Please select the response that best describes how much you agree or disagree with the following statements.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
1. This team encourages input from all providers and staff when making changes.	○	○	○	○	○
2. Most people on the team are willing to change how they do things in response to feedback from others.	○	○	○	○	○
3. Most people on the team are comfortable voicing their opinion even though it may be unpopular.	○	○	○	○	○
4. Most people on the team pay attention to how their actions affect others on the team.	○	○	○	○	○
5. This team values people who have different points of view.	○	○	○	○	○
6. Difficult problems are usually solved through face-to-face discussion.	○	○	○	○	○
7. When there is a conflict on the team, the people involved are encouraged to talk about it.	○	○	○	○	○
8. My opinion is valued by others on the team.	○	○	○	○	○
9. The leaders of this organization usually make sure that we have the time and space necessary to discuss changes to improve care transitions.	○	○	○	○	○

COREQ (COnsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
Personal characteristics			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	16
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	18
Occupation	3	What was their occupation at the time of the study?	16
Gender	4	Was the researcher male or female?	N/A
Experience and training	5	What experience or training did the researcher have?	16
Relationship with participants			
Relationship established	6	Was a relationship established prior to study commencement?	18
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	16
Interviewer characteristics	8	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	N/A
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	11
Participant selection			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	12+ (Table 2)
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	12+ (Table 2)
Sample size	12	How many participants were in the study?	N/A
Non-participation	13	How many people refused to participate or dropped out? Reasons?	N/A
Setting			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	15+ (Table 4)
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	15+ (Table 4)
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	12+ (Table 2)
Data collection			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	17 (Table 4)
Repeat interviews	18	Were repeat inter views carried out? If yes, how many?	N/A
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	Table 4
Field notes	20	Were field notes made during and/or after the inter view or focus group?	Table 4
Duration	21	What was the duration of the inter views or focus group?	Table 4
Data saturation	22	Was data saturation discussed?	N/A
Transcripts returned	23	Were transcripts returned to participants for comment and/or	N/A

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
Data analysis			
Number of data coders	24	How many data coders coded the data?	26
Description of the coding tree	25	Did authors provide a description of the coding tree?	N/A
Derivation of themes	26	Were themes identified in advance or derived from the data?	23
Software	27	What software, if applicable, was used to manage the data?	23
Participant checking	28	Did participants provide feedback on the findings?	N/A
Reporting			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	N/A
Data and findings consistent	30	Was there consistency between the data presented and the findings?	N/A
Clarity of major themes	31	Were major themes clearly presented in the findings?	N/A
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	N/A

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.

BMJ Open

Protocol for a Mixed Methods Study of Hospital Readmissions: Sensemaking in Veterans Health Administration Health Care System in the United States

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Abstract

Introduction: Effective delivery of health care in complex systems requires managing interdependencies between professions and organizational units. Reducing 30-day hospital readmissions may be one of the most complex tasks that a health care system can undertake. We propose that these less than optimal outcomes are related to difficulties managing the complex interdependencies among organizational units and to a lack of effective sensemaking among individuals and organizational units regarding how best to coordinate patient needs.

Methods and analysis: This is a mixed method, multi-stepped study. We will conduct in-depth qualitative organizational case studies in 10 Veterans Health Administration facilities (6 with improving and 4 with worsening readmission rates), focusing on relationships, sensemaking and improvisation around care transition processes intended to reduce early readmissions. Data will be gathered through multiple methods (e.g., chart reviews, surveys, interviews, observations) and analyzed using analytic memos, qualitative coding, and statistical analyses. We will construct an agent based model based on those results to explore the influence of sensemaking and specific care transition processes on early readmissions.

Ethics and dissemination: Ethical approval has been obtained through the Institutional Review Board (IRB) of the University of Texas Health Science Center at San Antonio (approval number: 14-258H). We will disseminate our findings in manuscripts in peer-reviewed journals, professional conferences, and through short reports back to participating entities and stakeholders.

Key words: care transitions; hospital readmissions; sensemaking; complexity science; veterans

Strengths and limitations of this study

- Using Eisenhardt's recommendations for building theory from case studies, this study samples 10 sites with a minimum of 2000 discharges per year, all of which have attempted efforts to improve hospital-to-home care transition processes and have either worsening or improving hospital readmission rates over a 5 year period, allowing us to explore organizational characteristics leading to these performance patterns.
- For each site, we create an in-depth qualitative organizational case study of relationships, sensemaking and improvisation around care transition processes, from which we will build an agent based model to explore how system elements may impact hospital readmission rates and identify potential leverage points for new types of interventions.
- Limitations include the single point in time data collection, all facilities are drawn from a single health care system (the Veterans Health Administration), and the study is observational rather than interventional.

Introduction

Complex systems cannot be understood by breaking their processes down into component parts or into individuals' jobs, even though this is often our first response to solving complicated problems in healthcare (1,2). Effective healthcare delivery requires effective management of interdependencies between socially distinct professions and between organizational units with unique perceived purposes and purviews. Within well integrated systems, patients navigating

unit boundaries should feel like system components form a continuum that communicate and cooperate for the explicit purpose of patient wellness.

As the United States' largest integrated health care system, the Veterans Health Administration (VHA) is theoretically positioned to deliver integrated care along such a continuum. Despite this, VHA's performance has been similar or worse than Medicare providers with regard to outcomes reflecting complex interdependencies, such as unplanned hospital readmissions (3). We propose that these less than optimal outcomes are related to difficulties managing the complex interdependencies among VHA organizational units and to a lack of effective sensemaking among individuals and organizational units regarding how best to coordinate Veteran needs.

Early Readmissions as a Persistent Problem

Hospital readmissions continue to receive significant attention as a source of potential waste and a marker of poor quality. Although the policy emphasis on readmissions is recent (4), early readmissions have been proposed as a quality indicator for at least 22 years (5). Numerous studies assessing the extent of preventability of early readmissions have had widely varying estimates: 5-79% (6–8).

Readmission rates have been declining but are still felt to be unacceptable (9). VHA hospital-wide risk adjusted 30-day readmission rates gradually dropped 3 percent from 1997 to 2010 (16.5% to 13.8%),(10) and have remained around 13 percent (IPEC readmission cube on VSSC, accessed 5/19/2017).

Why has reducing early hospital readmissions been such a persistent challenge? Reducing readmissions within 30 days may be one of the most complex tasks in a health care system. First, success depends on the intersection, coordination and collaboration of many parts of the system Second, patients and their caregivers are in control of many of the factors that will determine

their ability to stay out of the hospital, and healthcare delivery systems may not recognize the challenges faced post-discharge. Third, with a focus on shortening hospital length of stay, assumptions have been made about who is responsible for different aspects of care, with gaps occurring when expectations are not congruent. Fourth, there is a dearth of geriatricians who might have more insight into frail patients' needs and be better equipped to deal with the large numbers of chronically ill elderly (11). Fifth, due to ongoing fragmentation of provider-patient relationships, there may be both a lack of recognition of and communication regarding the need for palliative care. Finally, technologies and processes that prolong life may require a greater number of appropriate hospital admissions over an individual's life course.

Given the complexity of understanding all elements contributing to readmissions, it is no surprise that preventing early readmissions remains a challenging health care issue.

Risk Prediction Models for Readmissions

One approach to reduce readmission rates has been to implement risk prediction models to identify and target interventions toward those most at risk for early readmission. Kansagara and colleagues reviewed 26 unique models. They concluded that most readmission risk prediction models performed poorly and as yet are not useful in clinical settings. This finding was corroborated by a systematic review by Zhou and colleagues (12), which found that while risk prediction models are growing in number and condition specificity, they show only moderate discriminative ability. These models typically focused on risk characteristics of the patients and not characteristics of institutional behavior that might put patients at risk.

Care Transitions Studies

Another approach to reducing readmission rates is through care transition interventions. Hansen et al (13) found that of 16 randomized, controlled trials of interventions to improve 30-day

rehospitalization rates, only 5 documented statistically significant improvement in reducing rehospitalizations. Four of these 5 tested multicomponent discharge bundles however 11 other RCTs, some of which also used bundles with similar elements, failed to show improvements. Leppin et al (14) found the majority of reviewed trials (38 of 42) did not have a significant effect on readmissions, however studies with 5 or more unique activities in the intervention were more effective at reducing readmissions than those with 2 or more activities. One interpretation of these mixed findings from the perspective of complexity science is that interventions focus on breaking down processes into component parts or on changing the behaviors of individuals (assigning specific individuals to specific tasks) but do not address the interdependencies and boundary crossings that make the transitions so difficult.

Despite the ambiguity of the evidence and because of the burden of readmission for both the patient and the system, many individual VHA facilities are trying some of the more promising of the above models (e.g., Project RED, Project BOOST). There have also been VHA sponsored efforts, such as to address chronic heart failure readmissions (15) and to enact transition management initiatives, and nationwide policies to conduct discharge medication reconciliation and to conduct post-discharge follow-up calls. However, there are few care transition elements mandated to be implemented across VHA facilities.

Complexity Science as a Theoretical Lens for Understanding Why Reducing Readmissions is so Difficult

The application of complexity science to healthcare systems can provide new insights to the issue of readmissions. Defining characteristics of complex adaptive systems are diverse learning agents who interact non-linearly and who self-organize. These complex systems co-evolve with their environment and have emergent properties that are not predictable. Due to the systems'

non-linearity, inputs and outputs are not necessarily proportional (16). Even though organizations might implement care transition programs, the amount of effort put into their programs is not necessarily proportional to readmission rate outcomes.

The inherent non-linearity of complex systems also leads to uncertainty. This may be particularly true during transitional periods for patients, when patients' recovery is not yet assured, the home environment is often not well known to the staff, and the possibility of developing a relapse is significant. In these situations, uncertainty is compounded (17,18). Implementing new initiatives and changing processes also introduce uncertainty. An implication of this is that improvement efforts need to focus on not only process of care, but also on the relationships between and interdependencies among health care providers (1,2,19)

Relationships, Sensemaking, and Improvising

Relationships among health care workers are the foundation for the social activities that occur during patient care, like transitions of care. Lanham's framework of work relationships proposes that 7 characteristics define effective relationships in healthcare: trust, mindfulness, heedfulness, respectful interaction, diversity, social and task relatedness, and rich and lean conversation (20). These characteristics interact with how individuals and groups of providers reflect, make sense, and learn in ways that shape the quality of patient outcomes. Through relationship infrastructure, care transitions staff can coordinate as an effective, interdependent group in patient care. However, fostering relationships to improve care delivery is not something to which health care organizations have traditionally paid attention, even though data speaks to its importance (20–22).

Differences in relationship infrastructures across services, teams and organizations may help explain the varying impacts of care transition interventions. The relationship infrastructure can

give way to activities, such as sensemaking and improvising, which help providers and other organizational staff manage uncertainties and stressors. In sensemaking, people assimilate information, reach conclusions, and take steps to act (23). In the inpatient setting, sensemaking can occur in relation to individual patient diagnosis and care, as well as understanding more broadly patient illness trajectories and how their condition changes over time (24).

Preventing early readmissions via sensemaking involves multiple sets of individuals interacting to make sense beyond the physician team. Our model below summarizes these interdependencies (Figure 1). Not only does the trajectory of the patient's illness need to be understood as it continues in the home or next institutional environment but also in relation to how well the home environment meets patient post-hospitalization needs, what actual supports need to brought together, the level of understanding of the patient and/or caregiver of the self-management that will need to occur, understanding of funding mechanisms, and more. While checklists provide reminders of what needs to be done, they do not necessarily help providers make sense of what needs to be done for whom, or when or how to engage others to help.

Improvising is varying what one does based on the context and situation at hand (25,26). Physicians describe the importance of improvisation amid new or uncertain situations in patient care (26). Thus, improving care transitions teams' ability to improvise may be a powerful strategy for targeting activities to the needs of individual patients and decreasing readmissions.

[INSERT FIGURE 1]

Project Aim:

We are studying care transition interventions aimed at reducing early readmissions as an exemplar of processes requiring a high level of interdependencies and sensemaking. By investigating VHA facility cases that have attempted interventions to improve care transitions

and have had either improvement *or* worsening in their readmission rates, we will not only improve our understanding of the care transition processes themselves but also the sensemaking within the organization needed to implement change when there is no single part of the organization responsible for the outcome.

- Objective 1: Conduct in-depth qualitative, organizational case studies to explore relationships, sensemaking, and improvisation in 6 facilities with improving and 4 facilities with worsening early readmissions rates between fiscal years 2006 and 2011, all of which engaged in care transition interventions to improve early readmissions.
- Objective 2: Extend learning from and enhance generalizability of the case studies, using agent based modeling to simulate facilities implementing care transition innovations and to explore both specific care transition processes and elements of sensemaking as they prevent early readmissions, or not, as possible system outcomes.

Methods and Analysis

Study Design Overview

We are conducting a mixed method, multi-stepped study using concurrent triangulation. It will be conducted in 2 parts: the first part will be an in-depth qualitative organizational case study; the second part will be constructing an agent based model based on those results.

Objective 1. Organizational Case Studies

Case Sample and Individual Recruitment within Cases

Given that the intent of the study is to build or extend theory, not to test existing theory, we are using Eisenhardt's recommendations with regard to sampling for case studies in her methodological review, "Building theories from case study research" (27). In this context, cases are chosen on theoretical grounds and not for statistical reasons. Cases may be chosen to

replicate previous cases or extend emergent theory or they may be chosen to fill theoretical categories and provide examples of polar types, in which the process of interest is "transparently observable" (27,28). Random selection is neither necessary nor even preferable. The goal of the theoretical sampling is to choose cases which are likely to replicate or extend the emergent theory. In this spirit, our criteria for case selection concerned facility size, trending 5-year readmission rates, and documented care transition improvement efforts (see Table 1).

Table 1. Case study eligibility criteria

Eligibility criteria	Process for establishing eligibility
Criteria 1. A minimum of 2000 admissions per year to the facility	After visually reviewing the all cause medical surgical readmission rates for 2006 to 2011 for all VHA hospitals and comparing facilities with varying admission totals, we identified that facilities with more than 2000 admissions/year had less dramatic variability in their year-to-year readmissions rates. We also felt that facilities with larger numbers of admissions were more likely to spend intellectual and human resources on care transitions.
Criteria 2. Significantly increasing or decreasing all cause medical surgical readmission rate between fiscal years 2006 and 2011	Using the unadjusted readmission rates obtained from the IPEC Readmission cube (29), we tested whether the change in rate over five years was significant or not. Eleven facilities were improvers (declining readmission rates), nine facilities had significantly worsening rates (increasing readmission rates) over that time. We chose facilities with significantly changing rates as we wanted to explore attempts at innovations and changes in the outcomes of interest to the facility.
Criteria 3. Two or more care transition innovations identified	Within the two different readmission performance groups (improving or worsening), we narrowed selection further using multiple sources of data regarding care transitions innovations within the VHA including a national survey of Utilization Management Nurses conducted in 2013, listings of all transitional care pilot projects funded by through a VHA initiative called the Geriatrics T21 funds, and listings of all VHA Flow Improvement collaboratives on care transitions in the same time frame. We felt documented efforts to improve care transition processes provided evidence of some attempts at bettering readmission rates but did not expect that these would be the only care transition or rate improvement efforts undertaken by the sites. By comparing each of these sources for information, we identified 13 facilities, meeting the above criteria, with evidence of two or more innovations taking place around care transitions and prevention of readmissions. We eliminated from the potential sample pool the 7 facilities for which we did not have evidence of two or more care transitions innovations.

Within each facility case, individuals will be recruited to participate in interviews, focus groups, observations, and/or surveys using purposive sampling.(30) Purposive sampling allows us to identify and recruit individuals with specific experiences and knowledge that will inform our case building. We will use information from facility websites (e.g., organizational charts, service rosters) and the VA's Microsoft Outlook contact list to identify individuals occupying specific roles. During site visits, snowball and convenience sampling will also be used to identify people with knowledge of site care transition innovations and experience with care transition practices. Potential participants will be invited to participate through email and/or face-to-face. Specific forms of sampling and recruitment will vary based on data collection activity (see Table 2). Note, recruitment for one activity does not preclude recruitment for other activities. For example, a hospitalist might be engaged in an interview as well as an observation of her medicine rounds. At each site, investigators will aim to balance recruiting to obtain diverse, representative perspectives and to generate deeper knowledge about specific experiences.

Table 2. Participant recruitment for each case study site

Activity	Population	Description of recruitment
Interviews	Service leaders (n=~10)	Individuals from medicine, nursing, social work, pharmacy, and primary care leadership (i.e., service chiefs and supervisors) will be identified through organizational charts available on facility websites or sharepoints, the VHA Outlook contact list, or by other staff at the facility. They will be contacted by phone or by email to participate in interviews.
Chart Reviews	Patients (n=10)	Project staff and investigators will review the charts of a random selection of 10 veterans admitted to the facility's hospital within the 3-6 months before the scheduled site visit. Five of the Veterans will have had 30 day readmissions following their index admissions and five of them will have not. All 10 veterans must meet the following inclusion criteria at the time of the index admission: (a) inpatient or outpatient contact in the previous year with a VHA provider; (b) a Charlson Comorbidity index (31) of two or more; (c) discharge from a general

		medicine unit at the case study hospital within the sampling period; (d) discharge diagnosis of chronic obstructive pulmonary disease, chronic heart failure, and/or pneumonia; and (e) discharge to home. Patients are excluded if they are discharged to a long term care or skilled facility. For each site, a VA data analyst will provide the team with a sample of the first 10 readmitted and 10 non-readmitted patients meeting these criteria. The project coordinator will verify that these patients meet eligibility criteria and assign the first 5 in each group which meet eligibility criteria to be reviewed. A waiver of consent was obtained for the sample of patients for whom we conduct chart reviews.
Interviews	Front line providers (n=15-20)	We will sample 1 to 4 providers from each of the following roles: hospitalists, inpatient medicine nurses, inpatient social workers, pharmacists who deal with discharge education and supply of medications to patients on discharge, primary care team providers, and, when present, dedicated care transition staff (e.g. patient care coordinators). Depending upon each site's processes and programs, interviews may also be held with representative staff from palliative care, subspecialty care (e.g., geriatrics, cardiology), telecare, utilization management, and others as appropriate.
Focus groups	Front line providers (n=1-2)	One to two focus groups, comprised of four to 10 individuals, will be held at each site. For each focus group, the team will aim to recruit one to two staff to represent the following roles: hospitalists, nurses, social workers, pharmacists, and any roles important to care transitions at that site (e.g. patient care coordinators, utilization management nurses). Investigators will recruit front line staff using snowball and quota sampling methods.
Observations	Front line providers (n=17-30)	Staff participating in discharge planning, performing care transition tasks (e.g. discharge education), and doing day-to-day work on medicine units (e.g. rounds) will be eligible for observation. Investigators will purposively recruit participants for observations before the site visit (e.g. through email) and face-to-face during the site visit prior to the start of observations. The specific types of activities observed and number of times they are observed will vary depending on the facility, but the team will broadly aim to observe 3-6 medicine rounds, 3-6 discharge planning meetings, 4 med-surg unit observations, 3-6 job role shadowing, and 4-8 patient discharge educations. Observation lengths will also vary, from 10 minutes (e.g. patient discharge education) to 3 hours (e.g. medicine rounds). During observations, as necessary, researchers will identify themselves to obtain verbal consent from other patients, staff, and other individuals that enter the field of observation once it has commenced. Investigators will use discretion to cease observations if they determine an individual may not be in a position to provide informed consent (e.g. a critically ill patient). Data collection will cease if any person declines to be observed.
Surveys	Front line providers	Members of the inpatient care transition teams (e.g., hospitalists, social workers, nurses, pharmacists) and any front line staff members

	(n=15)	with a direct role in care transitions (e.g., primary care nurses and physicians) will be invited to participate in an anonymous survey. They will be identified during data collection activities (e.g., observing discharge planning meetings, individual interviews), and invited to participate either by email or in person. Everyone encountered who is eligible to participate will be recruited. Surveys can be filled out online (through REDCap) or by handing in a paper copy, neither form collects identifying information and investigators will not make any notes about who turns in paper forms of the survey.
Interviews	Patients (n=5)	Five patients being discharged from medicine units to home will be recruited for interviews. Patients will be sampled using convenience methods and identified by front line staff.
Exit debrief	Facility leaders (n=2-8)	During early email communications with site representatives, facility leadership will be asked to attend an hour long exit debrief on the last day of the team's site visit. Facility directors and chiefs of staff will be invited, along with anyone else they deem appropriate.

Ethical. All providers and staff recruited to participate in interviews, focus groups, observations, and surveys will be consented using a verbal consent form distributed through email and/or in hard copy form. The verbal consent form outlines the purpose of the study and that participation is voluntary. Investigators trained in subject recruitment will ensure the potential participants read and understand the form, and agree to participation before engaging subjects in research. A waiver for the documentation of signed consent was obtained as a further level of protecting VHA staff participants' anonymity. Patients will be consented through a signed consent process and asked to sign a Health Insurance Portability Accountability Act form (a form required by U.S. law to protect personal health information and medical records) to allow researchers to access their electronic health record. If at any point a potential or consented participant expresses a desire to not participate, investigators will discontinue recruitment or data collection efforts with them.

Data collection

We will gather and organize preliminary data before the site visit to delimit the organizational context and identify particularly promising areas for interviews and observations. We will visit

each facility for a 5-day on-site visit. We will do follow-up data collection, when necessary by phone and protected correspondence. We will undertake to complete roughly one site visit per quarter with 2 to 2.5 months of qualitative data analysis between. Due to the planning for the Agent Based Modeling (see below) we anticipate that parameters and agent characteristics that we learn about in early interviews will suggest questions and observations for subsequent site visits, checking for the presence or absence of these parameters or agent characteristics. Specific time frames and methods used will be responsive to local context and what we learn during previous site visits.

Team investigators hold advanced degrees in a diversity of fields, including medicine (JP, LL), anthropology (EF, LP), psychology (PN), and business (HL, LL). They each have at least 10 years of experience conducting qualitative research. If not already experienced with complexity theory and agent based modeling, each was provided orientation to these approaches before the study commenced.

Case Data Collection

Each site visit will follow the same general data collection approach, with site specific variations depending on local context (e.g., care transition processes, staffing and roles) (see Table 3). Preparation will involve logistical activities and data gathering through leadership interviews and chart reviews. The 5-day site visit will include a continuation of activities started before the site visits, as well as additional interviews, observations of care transition work, focus groups, and staff surveys. Follow-up patient interviews will occur about a month after the site visit.

Table 3. General Schedule for Case Study Data Collection and Analysis for each Site

<----------3 Months----------→		
Pre-Site Visit	**5 Day Site Visit**	**Post-Site Visit**

Data Collection	Facility Background Chart Reviews Leadership Interviews	Leadership Interviews (cont.) Front Line Provider Interviews Patient Interviews Focus Groups Observations Front Line Provider Surveys Care Transition Process Checklist	30 Day Post-Discharge Interviews with Patients
Data Analysis	Chart Review Memos	Observation Scoring Team Debrief Memos	Facility Reflection Qualitative Analysis in NVivo Quantitative Analysis

Throughout the course of case study data collection, team members will talk about what they are finding and fine-tune questions and approaches so that data collection is responsive to site processes and contexts. Decision-making during weekly meetings will be documented in detailed meeting notes. Changes in data collection will be recorded in site-specific data protocol.

Each site visit will be made by three investigators trained and experienced in qualitative methods (JP, PN, LP, and/or HL). Investigators have no relationship with participants prior to the start of the study. Data collection instruments will be tested at the investigators' home facility to ensure interrater reliability.

For each case study, qualitative and quantitative data will be collected in the form of background documents, patient chart reviews, semi-structured interviews, focus groups, observations, check lists, debriefments, and surveys (see Table 4).

Table 4. Case Study Data Collection

Type	Description	Purpose and link to aims
Facility Background	The project coordinator and investigators conducting the site visit will begin to compile background information on the facility as soon as a visit date is set. Sources of information will include VHA Support Service Center (VSSC) for performance metrics (e.g. 30-day risk standardized readmission rate) and the facility webpage and sharepoint (e.g., for unit structure, inpatient discharge policies, care transition-related pilots). Investigators will also add	Facility background documents will inform site visit planning and data gathering activities, and serve as broader context for the case study.

	information about site specific roles, care transition processes (e.g. discharge planning), and readmission-reduction efforts gathered during pre-site visit interviews (see below).	
Patient Chart Reviews	Project staff and investigators performing chart reviews will be assigned two to three patients to perform chart reviews through the electronic health record on the VHA's Compensation and Pension Record Interchange (CAPRI). The following chart note types will be reviewed for each hospitalization: medicine history and physical, nursing admission, social work screening/assessment, interdisciplinary treatment team plan, nursing discharge, social work discharge, pharmacy discharge, medicine discharge, discharge summary, post-discharge primary care nurse follow-up call, and any site-specific care transition notes. Chart reviews involve two steps and use structured forms in REDCap (32): 1. Chart note type review: for each index admission and readmission, reviewers identify and review two to three instances of the note types of interest (see above). Structured reviews occur through a REDCap form. Each note is assessed for whether they contain (a) documentation of widely agreed upon readmission risk factors and (b) co-signers. 2. Patient case study: for each patient, reviewers will read additional notes to type a brief, de-identified case study narrative of the patient's course during and after the admission(s). Reviewers will use an additional structured REDCap form to document patient specific readmission risk factors and characteristics (e.g. non-VHA insurance coverage). The case study narrative will also be copied into this form.	Recently discharged patients' chart notes will be reviewed for two primary purposes: (1) to identify if, where, and how sites' systematically capture and communicate information about widely agreed upon readmission risk factors and (2) to synthesize information gleaned through specific patient case reviews to create individual case profiles. The latter will describe, for example, the documentation of index admission regarding what plans were in place, how robust were the plans, how well did they consider issues likely to arise, what issues did arise, and for the readmissions, cause of readmission and preventability (6,7,33). This information will inform our understanding of organizational relationships (e.g. who is communicating) and sensemaking (e.g. what information is available for sensemaking about risk for readmissions).
Service Leader Interviews	Service leaders will participate in interviews using a guide that collects basic information about service composition and processes, as well as middle level supervisors to contact about front line recruitment. Leaders involved in efforts to reduce hospital readmissions at the facility or who are knowledgeable about facility care transition practices, will be invited to answer additional questions about historical	These interactions will serve to (a) inform service leadership of the project and ensure their support of the participation of their service staff and (b)

	and current care transition processes at their facility (see Additional file 1). Interviews generally will occur by phone or Microsoft Lync or Skype for Business. Interviews with leadership that do not take place before the site visit, will occur on site in a private setting of the participants' choosing. The interviews will last between 10 and 30 minutes. When possible, interviews will be audio recorded and transcribed; written notes will be taken and typed up when audio recordings are not available.	identify the best ways to recruit staff for interviews and focus groups, and observe care transitions. These interviews will also inform our understanding of organizational relationships and processes.
Front Line Provider Interviews	Semi-structured interview guides will cover the history of care transitions at the facility, what motivated and who was involved in those changes, sensemaking around specific patient cases, and current care transitions processes and support at the facility (see Additional file 1). Interviews will last between 20 minutes to an hour. Interviews will take place in private spaces within the facility and be audio recorded. Audio recordings will be transcribed.	Front line provider interviews will provide information about organizational processes, relationships, and sensemaking.
Focus Groups	One to two, interdisciplinary focus groups will be held at each site. Staff will be purposively sampled so that focus groups have representatives from the services of interest. One investigator will facilitate the focus group, while at least one investigator assists. The investigators will follow a focus group script (see Additional file 1) that probes into care transition processes, sensemaking around readmissions, and staff relationships. Focus groups will be held in facility meeting rooms and last one hour. Focus groups will be audio recorded and transcribed.	The mixed role compositions of the focus groups will provide opportunities for the team to document group interactions, and for the identification of group norms, differences, attitudes, and priorities (34). They will provide specific information about organizational relationships and sensemaking.
Observations of Care Transitions Work	Observations may last between 10 minutes (e.g. patient education) and several hours (e.g. medical team rounds). Investigators record their observations in field notes (27). Objective field notes will focus on interactions between people, the qualities of those interactions (e.g., roles interacting, who says or does what), and how and what information is communicated. After observations are completed, investigators will fill in gaps in handwritten notes and add contextual information (e.g. description of setting). Analytic notes may also be written (e.g., questions for follow-up, comparing and contrasting with other data), but will be differentiated from objective data by italics or brackets. Written field notes will be taken during the observation and later typed.	Observation notes will also serve to inform the site's care transition process checklist, as well as assessment of relationships and sensemaking.
Checklist for Care	The checklist (see Additional file 2) contains items that during proposal preparation work were gleaned processes	This checklist will help us to quickly quantify how

Transition Processes	from the published papers and manuals for care transitions starting with the systematic review by Hansen (13), matching across studies and arriving at a comprehensive list. Care transitions on the list will be scored as present, absent, or inconsistent. During the 5-day site visit, site investigators will independently fill out the checklist. At the completion of the site visit, investigators will meet to identify on a structured checklist the established care transition processes they observed and heard about during the site visit to create an agreed upon version. This version will be entered in REDCap by the project coordinator.	many and which care transition processes are used at each facility.
Debrief with Facility Leaders	Exit debriefs will consist of 40-minute presentations by the project PI and 20 minutes of questions and discussion with invited facility leaders. Debriefs will follow a general format: (1) explanation of the study and its methods; (2) description of care transition resources, processes, and special programs or initiatives to reduce readmissions at the site; (3) preliminary identified challenges to reducing readmissions; and (4) feedback. When possible, they will be audio recorded and detailed summary notes recorded for analysis.	Leadership debriefments provide leaders an opportunity to fill in what they might see as gaps or errors in the investigators' understanding, to sensemake about the information presented, and to reflect on priorities and processes at their facility.
Frontline Provider Surveys	The survey items consist of: work relationship scale developed in our previous study of learning and relationships(35), relational coordination adapted from Gittell's health care work (36) and an adapted version of the Safety Organizing Scale as a measure of sensemaking (24). (see Additional file 3) Work Relationships Scale (WRS)*:* A 15 item scale developed to assess the perceived quality of working relationships in health care settings developed in a previous study by our group. We drew upon the organizational behavior literature to develop an original set of 19 items reflecting the 7 characteristics of work relationships identified among high-functioning PC clinics by Lanham et al (20). The 15 item scale is associated with patient satisfaction with care in the PC environment (35). In our survey, to avoid redundancy with items from the other instruments (see below), we have reduced this to a 9 items to which participants respond on a five point scale (from strongly disagree to strongly agree). Relational Coordination (RC) Survey: The RC survey includes questions that examine 7 dimensions that were developed through inductive field research, and which have been validated in several studies. Items are rated by participants on a 5-point scale indicating the frequency to which each dimension exists in their care setting (e.g., frequency: 1=Never, 5=constantly). This instrument has been found to	Results of this survey will be considered markers of relationships among staff participating in patient care transitions and the care transition team's ability to make sense.

	be reliable for use in airline and healthcare industries with Cronbach's alpha of .80 and .86 respectively (37). Adapted Safety Organization Scale: This scale measures behaviors related to sensemaking and improvising around patient safety, for example, how the team reacts to a crisis situation (24). Participants respond to 8 statements, such as "We talk about readmissions and ways to learn from them," using a 7-point scale (from not at all to a very great extent). This scale was developed for nursing use in inpatient setting and modifications were made to change language to be appropriate to care transitions. Participants will complete the survey on paper or through the online web application REDCap. Paper copies will be personally distributed and collected by investigators while conducting activities on site (e.g. during discharge planning meetings, at interviews and focus groups). Web links to the survey will be provided through email. Completed surveys are anonymous and will not include any respondent's personally identifiable information.	

Qualitative Data Analysis

For each case study, qualitative analysis will overlap with data collection processes. Early findings will inform site-specific adjustments to on-site data collection protocols. Qualitative data analysis will take two forms: memoing and coding.

Memoing: The team will keep a variety of memos during data collection and analysis (see Table 5). Memos record reflexive comments about methods, data, and theory (38). Memos will provide early opportunities for writing about and making connections within the case study data. Some memos will be written by individual researchers (e.g. chart review memos), while others will be

created by several researchers through discussion (e.g., meeting memos, facility reflections). Memos will be periodically reviewed at team meetings to inform ongoing data collection, qualitative coding, and model building. They also serve to help document team sensemaking.

Table 5. Memo types

Memo Type	Description
Meeting memos	Detailed summary meeting notes will be kept during team meetings. As described by Eisenhardt (27), team meetings can be useful for overlapping data collection and analysis. These meeting notes will document, for example, how and why data collection protocols change, what researchers are learning about a specific site, and how what they are learning informs theory and agent-based model building. This information will be extracted as memos.
Chart review memos	While conducting chart reviews, researchers will write memos to record and reflect on (a) care transition processes evident in the notes (e.g., readmission risk assessment, discharge education, post-discharge follow-up), (b) provider communication (e.g., co-signing practices, discrepancies in what providers report), (c) sensemaking (e.g., providers documented concerns, how patients' situations are described), and (d) questions or issues for team follow-up. These memos will serve to help the team document what they know so far about care transition processes at the site, identify questions for follow-up, and reflect on specific cases and provider relationships and sensemaking.
Facility reflections	These 1 to 2 page documents will be written by investigators conducting the site visits during post-visit meetings. Reflections will be organized by headings derived from the agent based model. These headings will evolve as the agent based model develops (see below). Examples of possible headings include: institutional history and leadership, structures and routines, and information flow and exchange. These analytic memos (38) document and summarize what the team thinks they know about the site, what patterns they observed during data collection, and what gaps might exist in their knowledge. Site reflections will inform the final site case study, data collection methods and approaches at future sites, and ongoing analysis and model building (see below).

Qualitative Coding: Transcripts will be analyzed using NVivo software (39). We will develop a code book using deductive and inductive approaches. An initial codebook will be created based

on the original model (see Figure 1). It will be modified as additional elements and patterns are observed through memoing, code report reading, and model building.

Coding will proceed in a stepped fashion. For the first two sites, six team members (LP, JP, PN, HL, EF, and the project coordinator) will code all interview and focus group transcripts. For each site, a random sample of 20% of transcripts will be independently coded by two members of the team. Pairs will check for concordance and discrepancies will be discussed by the team, and the codebook updated as needed in bimonthly coding meetings. For the final seven sites, three team members (HL, the project coordinator, and a research assistant) will code the remaining transcripts. They will check for concordance on at least 10% of a random sample of transcripts for each site. Areas of discrepancy will be discussed and resolved by the full research team during weekly team meetings.

Quantitative Data Analysis

Quantitative data analysis will be conducted on data collected through patient chart reviews, staff surveys, and observations. Knowing readmission rates can change rapidly, at the end of data collection we will also acquire from the VA data warehouse each site's current 5-year readmission rate trend to ensure each site is correctly categorized (as improving or worsening). We will adjust categorization as necessary. Statistical tests will be conducted in Stata IC 14 (40).

Chart notes: At each site, we will determine the likelihood each note type documents the different readmission risk factors and identify which, if any, providers are usually co-signed to the note. We will evaluate findings across and within note types, and across facilities. Findings will also be compared with qualitative data (e.g. interview data related to coordination practices and sensemaking related to readmission risk).

Staff surveys: The survey's three scales will be scored as described in Table 6, and the scores compared between sites. As response rates allow, some within site comparisons may also be made. Results will be triangulated with observation, interview, and focus group data.

Table 6. Scoring frontline provider surveys

Survey Instrument	Scoring
Work Relationship Scale (WRS)	Due to survey burden and partial overlap with other scales (see below), the original 15 item work relationship scale was reduced to 9 items based on the original Rasch item analyses and areas of overlap with items on the other scales. Items 1,2,4,5,8,9,11, 14 and 15 of the original items were retained and references to clinic were changed to team (35). A new Rasch item analysis and principal components analysis will be conducted to assure that unidimensionality has been retained. Total scores will be calculated per respondent (possible range 9-45), averaged across respondents for each facility, and facilities will be compared using SAS PROC Mixed.
Relational Coordination (RC) Survey	RC scores are first calculated for each individual by summing the scores of all roles (e.g. care transitions staff, inpatient attending, outpatient primary care nurse, etc.) for each dimension (e.g. frequent communication) and then dividing by the number of responses. The overall RC score for each participant is derived by calculating the mean of the seven individual scores (range 1-5) (37). RC scores at the facility level are calculated for each functional group (e.g., care transitions manager, hospitalist, primary care nurse or physician) by calculating the mean of each dimension for all members of the functional group, and then a facility RC mean. The primary analyses will use the facility mean score, and secondary analyses will examine variation in RC scores among functional groups (care transitions staff, inpatient attendings, primary care teams).
Adapted Safety Organization Scale	Originally described by Vogus and Sutcliffe (41) as a measure of self-reported behaviors enabling a safety culture in hospital nursing units. Original respondents were RNs only. Questions 1,3, and 4 were used unmodified. Questions 2,4, 7, 8 and 9 were modified to be focused on care transitions and preventing readmissions. For example, the original question 2 was "we talk about mistakes and ways to learn from them." The modified version is "we talk about readmissions and ways to learn from them." The original question 5 was dropped as it dealt only with inpatient nursing shift report giving. The responses were kept the same. As for the Work Relationship Scale above, a Rasch item analysis and principal components analysis will be conducted to assure that unidimensionality has been retained. Total scores will be calculated per respondent (possible range 8-56), averaged across respondents for each facility, and facilities will be compared using SAS PROC Mixed.

Observation note scoring: Within their field notes, site investigators will identify the following types of observations for structured scoring: (1) discharge planning meetings; (2) staff-to-staff interactions; and (3) staff-to-patient discharge education. Notes from each observation will be entered into scoring logs and scored according to relationship and sensemaking features (see Table 7). The scoring systems are based on the Lanham (42) and Situation, Task, Intent, Concern, and Calibrate frameworks (43). Project staff will enter scoring into REDCap. Two investigators experienced with applying these frameworks to observations in medical settings (LL and HL) will train the team on how to recognize behaviors that match these characteristics. Consistency in scoring will be established through use of the codebook and during multiple rounds of team scoring. For the first two sites, during weekly meetings following data collection, a sample of roughly 5% of the observations will be independently scored by each team member. Scoring will be compared and discrepancies discussed until the group has reached consensus. Clarifying discussions about scoring will be documented in meeting notes and fed back to improve the scoring guide. Visual inspection of the distribution of all variables will be performed. Where appropriate, power transformations will be applied to variables outside of assumptions of parametric statistics. Group differences will be determined using ordinary or generalized least squares (OLS or GLS) regression with the relevant covariates.

Table 7. Relationship and sensemaking characteristics to be scored during observations

Characteristic	Behaviors we will observe	Metric
RELATIONSHIPS		
Trust	Saying "I don't know" Asking for help Accepting others' clinical judgments if person is a peer or lower in hierarchy Mistrust	Interactions will be given a “-1,” “0” or “1” based on the presence of negative behaviors, absence of behaviors or positive behaviors
Diversity	Number / level of team members who contribute to plan	

Respect	Extent to which team members listen to each other, allow each other to talk without interruption, and consider each other's suggestions	reflecting each relationship characteristic
Rich / Lean communication	Using verbal communication with others not in the room or with each other outside the meeting Type of communication with other staff members and with consultants	
Social / task relatedness	Whether staff talk about work and non-work topics / personal lives Jokes made Laughter	
Heedful inter-relating	Acknowledging the potential /actual impact of their behaviors on how others get their jobs done or on patient care or disposition planning.	
Mindfulness	Responding to each other's ideas for the evolving plan. Helping each other with tasks. Suggesting new ideas or discussing how the team might do things differently.	
SENSEMAKING		
Situation	Assesses patient's situation	Teams will be given a "0" or "1" based on the use or non-use of each sensemaking element
Task	Develops a plan about what needs to get done (objectives) based on assessment of patient.	
Intent	Statement of rationale for the plan.	
Concern	Discusses concerns / things that could go wrong / things where plan might fall short with patient. Develops a contingency plan.	
Calibrate	Asks for feedback from each other about the plan based on concerns.	
Social vs. solitary	Shared decision-making between staff, patient, and /or family. May be between 2 staff members. Must come to a shared understanding.	
Degree of identity definition	Performs tasks outside of hierarchical role	
Backward-noticing	Discussion of prior patients with similar presentation or issues, or prior situation of the current patient	

Objective 2. Creating, Verifying and Validating an Agent Based Model (ABM) of Sensemaking Regarding Transitions of Care and Prevention of Readmissions

Complex, nonlinear systems are difficult to study with traditional analytic methods because of multiple interactions among variables, feedback loops, path dependency, and contingencies in any dynamic process; there is often no set of equations that can be solved to predict

characteristics of the system (44). A more effective way to examine nonlinear behavior in complex systems is to simulate it by building a model and then running the simulation multiple times to explore the space of possible system trajectories (44). In our study of sensemaking and readmissions, the interdependencies among the patients, health care providers, resources (VHA and non-VHA) and leadership support are clearly nonlinear. Individuals who make sense of the ways in which readmissions occur illustrate this by mentioning different aspects they consider to be critical: patient context, patient understanding and motivation, resource availability, effective communication between health care providers, stage of disease, failures in a system for which they (patient or provider) have little control. These aspects interact in variable ways in the context of different patients. Vest et al. identified the plethora of variables that contribute to readmissions before even addressing the interdependencies (45). Additionally, the literature demonstrates that classical prediction models of readmissions perform poorly (46). We suggest that these explanatory gaps in the literature are due at least in part to a mismatch of analytic strategy to type of system being studied. We see readmission as an emergent outcome of nonlinear interactions among these many aspects of clinical and organizational processes. Through modeling and simulation, we will be better able to understand and evaluate factors contributing to readmissions. While any single case may be difficult to predict, modeling will allow us to identify leverage points in the system that the data demonstrate are particularly sensitive to sensemaking effectiveness. These leverage points could then be considered potential targets for interventions. Through modeling and the subsequent ability to run it numerous times (simulation), we will be able to extend the case study sample to make it more generalizable to better understand how readmissions occur across the care transition interventions, patient circumstances, and facility environments. Through modeling and simulations we are able to

create a laboratory that will allow us to understand better how readmissions occur, helping us to identify gaps in our knowledge as well.

ABM is a version of nonlinear dynamic modeling, a computer implementation of complexity concepts, in which autonomous agents interact in an environment to produce emergent--sometimes surprising--system properties over time (47–49). Since Epstein and Axtell's pioneering work in the late 1990s,(50) it has been applied to research on human groups under the rubric of "artificial societies" (44). ABM is an ideal approach to our research questions for several reasons: first, as noted earlier, our data regarding health care provider interactions are non-linear, making it potentially more difficult to represent patterns and interdependencies using more traditional approaches. ABMs are grounded in non-linear mathematics, assuming interactions and contingencies in a manner that more accurately reflects clinical systems. Second, ABMs allow us to create a broader space of outcomes from rich observations that may be low in number but high in information, accounting not only for the facilities and teams within facilities that we sample, but other types of findings that result from experimenting with parameter changes. Formalizing the interactions leads to a generalization of the processes we observed. Thus, ABMs enable us to leverage small samples to create broader understandings. Third, we can model interactions across levels and over time to explore emergent outcomes. ABMs are laboratories for structure-agency interactions that allow us to understand these multiple levels.

Proposed Modeling Work

Conceptual Work: While data are being collected, our research team will meet regularly to identify the parameters, agent characteristics and interaction patterns. Our starting point will be the conceptual model of care transitions shown in Figure 1. As we develop the ABM, we will iteratively build on our conceptual model using the qualitative data being collected. We will

begin developing the ABM after our first few site visits, and refine the model with each subsequent visit. Constructing the model in this way will complement our qualitative data collection and help us identify areas where more intensive inquiry might be necessary. Initial tasks for building the model will include identification of:

Types of agents to be included: In ABM agents can and, in our case, will have correspondence to real world actors, both individuals and organizational units. We will start with the general categories of patients, inpatient providers, outpatient providers, and care transitions personnel. We will then refine the specific individuals contained in these categories, and add any additional categories or types of individuals as we collect and analyze our qualitative data.

Interactions and interdependencies among agents: We will create rules of interaction between the agents in the model based on our site visit data, starting with the initial site visits and refining these interactions with subsequent site visit data. Interactions will focus on the sensemaking activities and categories we observe in the site visits. Those sensemaking attributes were detailed in above in the sections on Observations of Care Transitions Work and Qualitative Data Analysis.

Boundaries and characteristics of the environment: Our model will be built to simulate a single organizational entity. We will create a model to allow ourselves the ability to adjust these characteristics and assess their impact through our simulations. We intend to simulate critical facility characteristics and will use the first year to consider the types of qualitative characteristics we will obtain during the site visits as well as the quantitative data already available for VHA facilities such as culture (annual employee survey), learning and improvement culture (Voice of VHA survey), number of care transition processes used routinely (from our prior UM survey and verification for study sites), demographics of Veterans served,

and facility admission rates. We will also consider known parameters used in traditional readmission prediction models, although most of these parameters focus on the patient such as comorbidities, prior health care use, functional status, socioeconomic status (45,46). Organizational characteristics relate back to the technical processes of care and system resources noted on our conceptual model.

Levels of model*:* One of the rationales in studying transitions of care as an exemplar is the multiple individuals and teams that interact with the patient and the system to make the care transitions successful. A benefit of ABM is that it allows us to consider levels of interactions, and the system-level outcomes that emerge from these levels of interactions. In building the model, we will need to address how different parts interact with the next to produce the product of interest—successful or unsuccessful care transitions. Care transition teams and Veterans interact with inpatient teams as well as outpatient teams, resource providers (such as prosthetics and pharmacy), home care providers, institutional providers, and patient caregivers. Additionally, leadership determines extent of resources available at many of these levels. We will define the levels and how they will feed into each other. Again, we will use our conceptual model of care transitions as the starting point. Processes of care and the organizational characteristics will form this level. The formal interactions or organizational structure will also be reflected here. The agents will interact in this level, producing emergent outcomes of sensemaking that are grounded in their interactions and inter-relating. These sensemaking patterns will form the second level of the model. From them, care transition outcomes will emerge, forming the model outputs. In our model, the two outcomes will be a successful care transition or a readmission.

Feedback loops can be created within the levels of the model. For example, as either successful care transitions or readmissions occur, these outcomes can feed back into how the agents' sensemaking processes. We will specifically collect data on these types of feedback loops during our site visits. (See questions about feedback to care transitions staff above.) These feedback effects will be modeled using standard best practices from the System Dynamics modeling methodology, which concentrates on how to model systems with nonlinear feedback loops (51–53).

Modeling software: We will use NetLogo software to create our model. NetLogo is a freely available software that has been under development for two decades and is widely used for ABM (54). It is now in Version 5 and has become a sophisticated language for modeling intelligent autonomous agents interacting in "live" environments. With the most recent versions, NetLogo extensions have been incorporated that enable more sophisticated agents and with hybrid capabilities enabling combined agent-based and discrete-event simulation. These capabilities will allow us to create a robust model that best represents the relevant processes of care and agent interactions.

Model Verification and Refinement: As we develop the model, we will make our understanding of the interdependencies between different levels more explicit. Because we will begin to conceptualize and create the model in parallel with data collection, we will be able to use ongoing site visits to refine aspects of our model.

Additionally, we will perform verification to ensure that the associations and interdependencies between levels of the model are expressed in the way we intend. Verification "concerns whether the program is working as the researcher expects it to" (44). Our model will act as a thought-

experiment laboratory that forces us to clarify and formalize the interactions in which we are interested. The verification will support this clarification.

Model simulation and sensitivity testing*:* We will use simulation to deepen our understanding of the ways that provider sensemaking influences care transition outcomes. We will be able to vary the following parameters: organizational factors, including patient population characteristics and other facility-level data; care transition practices; sensemaking practices. We will assess the impact of parameter variation on our outcome of interest—readmissions and successful care transitions. During this time simulations will be run for multiple "facilities" to expand the generalizability of our qualitative sample, using different combinations of individual and facility characteristics to understand how sensemaking emerges, and how sensemaking then impacts care transition outcomes.

Model verification and boundary testing*:* During this period, we will present our model results to our local site PIs from 10 sites as well as our Systems Reengineering organizational partners for input as to the face validity of the findings of the simulations. These presentations will follow a formal, focus group process to ensure that we capture all concerns and feedback regarding the model. We will use this feedback to further refine the model.

Study Status

Data collection at the first case study site began in July 2015 and continued through December 2017. Qualitative and quantitative data analysis, and Agent based modeling work began during this period and were ongoing at the time of writing.

Ethics and Dissemination

The Institutional Review Board (IRB) of the University of Texas Health Science Center at San Antonio, the administrative body responsible for protecting the rights and welfare of people

participating in human subjects research at our institution, approved this study (approval number: 14-258H). Participation in this study is voluntary and participants are not compensated for their participation. Written consent and HIPPA forms are obtained for patients participating in interviews. As permitted by our IRB, VA staff participating in research activities (e.g., interviews, surveys, observations) are given an information form about the study, assured confidentiality, and asked to give verbal consent to participation.

Findings from our work will be disseminated through manuscripts in peer reviewed journals, at professional conferences, and in short reports distributed to stakeholders and study participants. Our data will not be made available in repositories.

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Authors' contributions

JP, LL, HL, PN, and EF provided conceptual and methodological expertise to the design of the study protocol. JP and LP were major contributors to writing the manuscript. All authors read, edited, and approved the final manuscript.

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Competing interests statement

The authors declare that they have no competing interests.

Figure 1. Model of Care Transitions

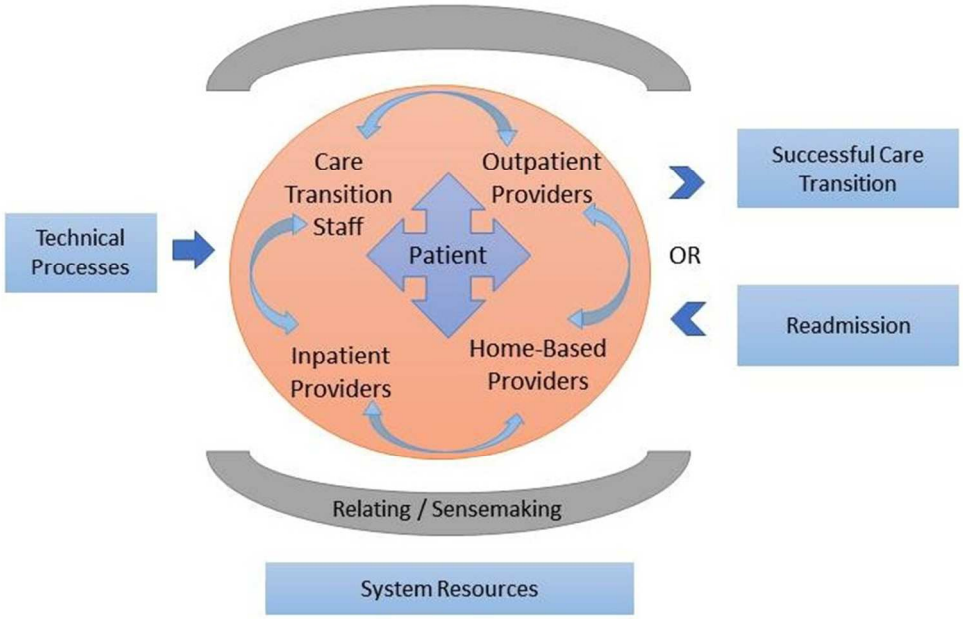

Figure 1. Model of the care transitions process

65x43mm (300 x 300 DPI)

Interview and Focus Group Guides

Thematic areas to be explored in leadership and supervisory interviews:

- *History of care transitions work at this facility*: Tell me the history of care transitions at your facility. What has been the biggest challenge regarding care transitions? The biggest success?

- *Motivation for change in care transitions structure or process*: When changes in the care transitions processes or staffing have been made, what prompted those changes to occur? (Probes: data regarding readmissions, local staff or patient concerns regarding failure of transitions, pressure to improve performance measurement)

- *Key players and description of planning processes*: Who was involved in planning these changes? How did the planning proceed and turn into actual processes?

- *Current organizational "ownership" of care transitions*: In your facility, where do care transitions workers sit organizationally?

- *Facility support for cross-unit cooperation for care transitions*: Care transitions involve cooperation among many different services or organizational units. How has this been addressed in your facility?

- *Organizational priorities*: What are your clinical performance priorities? Were there any initiatives taken last year to meet those priorities? If yes, what were those initiatives? Have you had any local initiatives to decrease unplanned hospital readmissions? If yes, what were those? How do you balance between care transition priorities and other competing priorities?

Thematic areas to be explored with front-line care transitions staff interviews:

- *Work history*: What are your responsibilities as a [job title]? How long have you been a [job title]?

- *Case studies:* Tell me about a patient whose care you were involved with who was readmitted. Tell me a story of a recent patient you thought would end up back in the hospital but has not. Tell me about a patient you thought would do well but ended up being readmitted. (Probes for case studies: Why did he/ she get readmitted? What do you think contributed to his readmission? What, if anything, do you think could have been done to prevent that readmission?)

- *Work processes*: Tell me all of the various tasks you might do for a patient prior to discharge. (Probe on the 16 processes. If this worker does not do them, does anyone else or are they just not done here?) Are patients at this facility assessed for their risk for readmission? If so, how is this done? Who does it? How do you use this information? If a patient you have taken care of has been readmitted, are you informed of this?

- *Work relationships*: When multiple but disagreeing opinions are voiced about a complicated patient's discharge plan, how does the group finalize the plan? When you need to transition a patient to outpatient providers, home health agencies, or SNFs/ rehabs/ CLCs, how do

you communicate the patient's needs? (Probe into rich vs lean communication) How much of your work coordinating patient care with other services gets done inside of meetings?

- *Sensemaking and Improvising*: Tell me about facilitators and barriers to carrying out your work. How do you work around barriers as needed? Tell me some stories about what you did on a particular case to overcome such barriers. Do your coworkers such as the doctors on the inpatient teams or staff in outpatient units work with you on overcoming barriers? Understanding the patient needs better?

- *Institutional history and leadership/information flow and exchange*: What clinical performance measures are you focusing on at this facility? If a new initiative were to come out, how would you hear about it? How do you decide what you need to do differently when these initiatives come out? What kind of feedback do you typically get about how you are doing on these initiatives?

- *Improvement*: Is there anything you think could be done to improve discharge planning/ care transition processes at your facility?

Thematic areas to be explored in patient interviews, before discharge:

- *Issues from the veteran perspective:* How do you feel about being discharged from the hospital today?

- *Relating:* Can you name up to six people who have been most involved in getting you ready to go back home? How did they learn about your needs after you get home? Did these individuals ask you about what kind of help you need at home? How often did they speak with you? Did they speak with your family? How are (these people) working together to meet your needs after you leave the hospital? How are these people working with the providers who take care of you outside of the hospital?

- *Sensemaking:* Did your providers ask you about any concerns you might have about going home? Did your providers talk to you about what you need to watch out for after going home? Did the people taking care of you in the hospital identify things that you need that you weren't aware of? Do you think you have everything you need to go home without any problems? Has anything surprised you about the discharge process? What didn't we ask about that we should have?

Thematic areas to be explored in patient interviews, after discharge:

- *Veteran experience post-discharge*: How have you been doing since you were discharged? Have things gone as expected since you arrived home? Have you had any problems with your [*insert medical diagnosis*]? How did you handle it?

- *Improvement*: Thinking back to the end of your hospitalization, is there anything that could have better prepared you for managing your health at home?

Thematic areas to be explored in care transition staff focus groups:

- *Work processes:* Tell us about inpatient to outpatient care transitions processes related to hospital discharge here. (Probe into who is typically involved) When you think a patient is at high risk for readmission, do you do anything differently? If so, please describe.

- *Sensemaking:* What do you do well here with regard to care transitions and prevention of readmissions? Are there particular types of patients or situations for whom you see readmissions here at <facility name>? Is there a process in place to discuss/debrief on readmissions (perceived preventable or otherwise) at this facility? If so, please describe.

- *Work Relationships:* Is there usually agreement among ward nursing, UM staff, care transition staff, and physicians about patients' readiness for discharge or post-discharge patient needs? When there is not agreement, how do you reach resolution? Do you feel comfortable speaking up if you disagree with the decisions on those issues? When there is a lack of agreement, what are some common types of reasons for the disagreement? (Probe)

- *Case Studies:* What is your most memorable readmission? Why? Please describe.

- *Improvement:* Do you think there is room for improvement here? If so, where/how? Tell us about a time/case when you were not sure about how well the patient might do in terms of staying out of the hospital. Tell us about those uncertainties. How did you, as a team, deal with those uncertainties? Did you do anything different? Tell us about any step/initiative that you took to prevent readmission for this individual.

***ORGANIZATION*: Checklist of care transition processes observed at facility**

Facility: _____

Date: _____ Observer:_____

Check boxes if occurrence of element of care processes were undertaken or routinely used at facility during the entire visit.

Technical Process	**Observed?**	**Source**	**Staff Responsible**	**Notes (describe quality of process, contradictions or confirmations in data sources)**
Pre-discharge patient education	Y N Inconsistent			
Use of teach-back method with patients	Y N Inconsistent			
Increased emphasis on patient education about diagnoses, self-management and medications throughout hospitalization	Y N Inconsistent			
Communication of medical plans in front of patients (nurse to nurse hand-offs, nurse to physician, bedside rounds, etc.)	Y N Inconsistent			
Implementation of a discharge checklist	Y N Inconsistent			
Use of a checklist to assess readmission risk	Y N Inconsistent			
Implementation of discharge planning rounds	Y N Inconsistent			

Technical Process	Observed?	Source	Staff Responsible	Notes (describe quality of process, contradictions or confirmations in data sources)
Medication reconciliation prior to discharge	Y N Inconsistent			
Assignment of medication reconciliation to pharmacist	Y N Inconsistent			
Utilization of discharge/care transitions case manager	Y N Inconsistent			
Printed follow-up instructions which might include medication reconciliation, follow-up appointments, self-care tasks or action plan for management of symptoms	Y N Inconsistent			
Post discharge follow-up appointments to PCP and for diagnostic testing made prior to discharge	Y N Inconsistent			
Direct communication with PCP or other PACT team members	Y N Inconsistent			
Potential benefits of referral to telehealth assessed as part of discharge planning process	Y N Inconsistent			
Need for rehabilitation services routinely assessed during discharge planning	Y N Inconsistent			
Rehabilitation services scheduled prior to discharge	Y N Inconsistent			

Technical Process	Observed?	Source	Staff Responsible	Notes (describe quality of process, contradictions or confirmations in data sources)
Assessment for advance care planning (palliative / hospice)	Y N Inconsistent			
Enlisting social and community supports (home health services, Meals-on-Wheels, day care services, housing, etc.) for post-discharge care	Y N Inconsistent			
Post-discharge patient hotline available?	Y N Inconsistent			
Post-discharge home visit available?	Y N Inconsistent			
Post-discharge phone call from hospital (who, time frame)	Y N Inconsistent			
Post-discharge phone call from PACT team mentioned	Y N Inconsistent			

***STAFF*: Care Transitions Survey Guide**

*Your participation in the survey is **voluntary**. Your responses are **anonymous** and will be kept strictly **confidential**. The results will be reported in summary form and not as individual responses.*

Facility: _____

Ward/Service: _____

Date: _____

Please indicate your individual professional role below.

◯ Staff physician
◯ Resident / Intern
◯ NP/PA
◯ RN
◯ LVN
◯ Social worker
◯ Pharmacist
◯ Clerk
◯ Other (Specify:_____)

Please indicate any additional functional roles you may serve. Select all that apply.

◯ Case manager
◯ Utilization Management (UM)
◯ Palliative care
◯ Discharge planning
◯ PACT team
◯ Other (Specify:_____)

In what setting do you work?

◯ Inpatient care
◯ Primary care
◯ Other outpatient care (Specify:_____)

Safety Organizing Scale

Item	Not at all	To a very limited extent	To a limited extent	To a moderate extent	To a considerable extent	To a great extent	To a very great extent
1. We have a good "map" of each other's talents and skills	○	○	○	○	○	○	○
2. We talk about readmissions and ways to learn from them	○	○	○	○	○	○	○
3. We discuss our unique skills with each other so we know who on the team has relevant specialized skills and knowledge	○	○	○	○	○	○	○
4. When attempting to resolve a problem, we take advantage of the unique skills of our colleagues	○	○	○	○	○	○	○
5. We discuss alternatives as to how to best transition patients from the hospital to outpatient settings	○	○	○	○	○	○	○
6. We discuss ways to prevent high risk patients from being readmitted	○	○	○	○	○	○	○
7. When failures occur in transitioning patients from the hospital to outpatient settings, we discuss how we could have prevented them	○	○	○	○	○	○	○
8. When difficult disposition issues arise, we rapidly pool our collective expertise to attempt to resolve it	○	○	○	○	○	○	○

Relational Coordination Survey

1. How <u>frequently</u> do people in each of these groups communicate with you about patients transitioning from the hospital to outpatient settings?

	Never	Rarely	Occasionally	Often	Always	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT team members	1	2	3	4	5	N/A
Other individuals or services involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4	5	N/A

2. How frequently do the people in these groups communicate with you in a timely way about patients transitioning from the hospital to outpatient settings?

	Never	Rarely	Occasionally	Often	Always	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT team members	1	2	3	4	5	N/A
Other individuals or services involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4	5	N/A

3. When problems arise with transitioning patients from the hospital to outpatient settings, how often do the people in these groups work with you to help solve the problem?

	Never	Rarely	Occasionally	Often	Always	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT Team members	1	2	3	4	5	N/A
Other individuals or services involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4	5	N/A

4. How much do the people in these groups know about the work you do in transitioning patients from the hospital to outpatient settings?

	Nothing	A little	Some	A lot	Everything	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT Team members	1	2	3	4	5	N/A
Other individuals or services involved in transitioning patients from hospital to outpatient settings (please identify:_____)	1	2	3	4	5	N/A

5. To what extent do the people in these groups share your goals for transitioning patients from the hospital to outpatient settings?

	Not at all	A little	Somewhat	A lot	Completely	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT Team members	1	2	3	4	5	N/A
Other individuals or services involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4	5	N/A

6. Who is <u>ultimately responsible</u> for the care for a patient?

	Never	Rarely	Occasionally	Often	Always	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT Team members	1	2	3	4	5	N/A
Other individuals or services in involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4	5	N/A

8. How often do you use information from the following sources in making decisions about the discharge of a patient?

	Never	Rarely	Occasionally	Often	Always	N/A
Patients	1	2	3	4	5	N/A
Patient families	1	2	3	4	5	N/A
Physicians	1	2	3	4	5	N/A
NPs/PAs	1	2	3	4	5	N/A
Ward nurses	1	2	3	4	5	N/A
Social workers	1	2	3	4	5	N/A
Pharmacists	1	2	3	4	5	N/A
Case managers	1	2	3	4	5	N/A
Ward clerks	1	2	3	4	5	N/A
Palliative care team members	1	2	3	4	5	N/A
PACT Team members	1	2	3	4	5	N/A
Other individuals or services in involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4	5	N/A
Historical information in EMR	1	2	3	4	5	N/A
Evidence-based guidelines / systematic reviews	1	2	3	4	5	N/A
Summary resources (e.g. UpToDate)	1	2	3	4	5	N/A
Medline / pubmed	1	2	3	4	5	N/A
Web-based search tools	1	2	3	4	5	N/A

9. How do you communicate with the following groups of people?

	In person	On phone	Text pages / electronic orders	Through notes / documentation
Patients	1	2	3	4
Patient families	1	2	3	4
Physicians	1	2	3	4
NPs/PAs	1	2	3	4
Ward nurses	1	2	3	4
Social workers	1	2	3	4
Pharmacists	1	2	3	4
Case managers	1	2	3	4
Ward clerks	1	2	3	4
Palliative care team members	1	2	3	4
PACT Team members	1	2	3	4
Other individuals or services in involved in transitioning patients from hospital to outpatient settings (please identify: _____)	1	2	3	4

Work Relationship Scale

Listed below are a number of statements that could describe **all of the providers and staff who are involved in transitioning patients from the hospital to outpatient settings, referred to as the "team" below**. Please select the response that best describes how much you agree or disagree with the following statements.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
1. This team encourages input from all providers and staff when making changes.	○	○	○	○	○
2. Most people on the team are willing to change how they do things in response to feedback from others.	○	○	○	○	○
3. Most people on the team are comfortable voicing their opinion even though it may be unpopular.	○	○	○	○	○
4. Most people on the team pay attention to how their actions affect others on the team.	○	○	○	○	○
5. This team values people who have different points of view.	○	○	○	○	○
6. Difficult problems are usually solved through face-to-face discussion.	○	○	○	○	○
7. When there is a conflict on the team, the people involved are encouraged to talk about it.	○	○	○	○	○
8. My opinion is valued by others on the team.	○	○	○	○	○
9. The leaders of this organization usually make sure that we have the time and space necessary to discuss changes to improve care transitions.	○	○	○	○	○

COREQ (COnsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
Personal characteristics			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	16
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	18
Occupation	3	What was their occupation at the time of the study?	16
Gender	4	Was the researcher male or female?	N/A
Experience and training	5	What experience or training did the researcher have?	16
Relationship with participants			
Relationship established	6	Was a relationship established prior to study commencement?	18
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	16
Interviewer characteristics	8	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	N/A
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	11
Participant selection			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	12+ (Table 2)
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	12+ (Table 2)
Sample size	12	How many participants were in the study?	N/A
Non-participation	13	How many people refused to participate or dropped out? Reasons?	N/A
Setting			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	15+ (Table 4)
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	15+ (Table 4)
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	12+ (Table 2)
Data collection			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	17 (Table 4)
Repeat interviews	18	Were repeat inter views carried out? If yes, how many?	N/A
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	Table 4
Field notes	20	Were field notes made during and/or after the inter view or focus group?	Table 4
Duration	21	What was the duration of the inter views or focus group?	Table 4
Data saturation	22	Was data saturation discussed?	N/A
Transcripts returned	23	Were transcripts returned to participants for comment and/or	N/A

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
Data analysis			
Number of data coders	24	How many data coders coded the data?	26
Description of the coding tree	25	Did authors provide a description of the coding tree?	N/A
Derivation of themes	26	Were themes identified in advance or derived from the data?	23
Software	27	What software, if applicable, was used to manage the data?	23
Participant checking	28	Did participants provide feedback on the findings?	N/A
Reporting			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	N/A
Data and findings consistent	30	Was there consistency between the data presented and the findings?	N/A
Clarity of major themes	31	Were major themes clearly presented in the findings?	N/A
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	N/A

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.