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Incorporating home healthcare nurses' admission information needs to inform data standards

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ABSTRACT

Objective: Patient transitions into home health care (HHC) often occur without the transfer of information needed for critical clinical decisions and the plan of care. Owing to a lack of universally implemented standards, there is wide variation in information transfer. We sought to characterize missing information at HHC admission.

Materials and Methods: We conducted a mixed methods study with 3 diverse HHC agencies. Focus groups with nurses at each agency identified what information supports patient care decisions at admission. Thirty-six in-home admissions with associated documentation review determined the available information. To inform information standards development for the HHC admission process, we compared the types of information desired and available to an international standard for transitions in care information, the Continuity of Care Document (CCD) enhanced with Office of the National Coordinator for Healthcare Information Technology summary terms (CCD/S).

Results: Three-quarters of the items from the focus groups mapped to the CCD/S. Regarding available information at admission, no observation included all CCD/S data items. While medication information was needed and often available for 4 important decisions, concepts related to patient medication self-management appeared in neither the CCD/S nor the admission documentation.

Discussion: The CCD/S mostly met HHC nurses' information needs and is recommended to begin to fill the current information gap. Electronic health record recommendations include use of a data standard: the CCD or the proposed, more parsimonious U.S. Core Data for Interoperability.

Conclusions: Referral source and HHC agency adoption of data standards is recommended to support structured, consistent data and information sharing.

Key words: communication, home health care nursing, home health nursing, continuity of patient care/standards, nursing informatics, documentation, decision-making

INTRODUCTION

For 12 million older adults per year in the United States, transitioning into home health care (HHC) provides skilled nursing care and other therapies to assist patients and their caregivers manage recovery and chronic disease. The process of admitting the transitioning patient to HHC impacts the quality of care and outcomes such as hospital readmissions.[1,2] Problems exist with information transfer during the transition to HHC,[1,3–9] and information needed by HHC nurses is often missing.[10,11] To obtain needed information, nurses tend to rely on the patient or caregivers and this information is often not reliable.[12] From a human information processing perspective, complete and reliable information is the foundation for making consistent and accurate judgments and appropriate clinical decisions[13–15] and for providing safe patient care[16]; therefore, nurses and patients are currently disadvantaged.

Unlike the teamwork common in acute care settings, HHC clinicians operate independently in the home under physician orders. The admission is the first home visit at the start of the HHC episode. Nurses have access to patient information from the referral source and information that agency staff document during the intake process. Nurse work includes medication reconciliation, patient and home safety assessment, and plan-of-care development (patient problems to be addressed during the episode and planned interventions for assessment, education, care coordination, and treatment).

There is limited published work identifying what information nurses need and what is available to them for decision making during the HHC admission. One way to inform data standards is to determine what information is needed to complete the admission. Further, due to a lack of universally implemented standards, there is wide variation in how much and what type of information are communicated and transferred. Therefore, we investigated whether an accepted data standard, designed for transitioning information from acute care to ambulatory providers, could be used as a basis for information transfer during patient transition from the previous clinical setting to HHC.

Knowledge elicitation through focus groups and document review can identify what information nurses need and what they have. In our prior work,[17] 6 HHC nurses who conduct admissions at the same agency described the information needed to make each of 4 important clinical decisions. Ninety percent of the needed information mapped to the identified data standard. Regarding available information, no observation had all of the data standard items present, and these items were missing in varying amounts across the admission documents.

This initial analysis was conducted with an agency that cannot accept electronic data from referring facilities (described in the Materials and Methods). The prior results may have been related to the lack of electronic information transfer. Currently, the industry supports electronic data transmission from referring facility to the HHC agency. Therefore, to consider interoperability as a factor in the data available at the admission, this article extends the prior analysis with 2 additional agencies with the ability to accept electronic data into their HHC electronic health record (EHR) system. We apply the widely used interoperability definition: the "ability to correctly interpret data across information systems or organizational boundaries."[18] Clinical data interoperability is a Meaningful Use objective and a Centers for Medicare and Medicaid Services priority.[19] Since the original study, new standards have been published, and we add those to this analysis.

This study is part of a larger one to characterize HHC nurses' information and decision practices at admission to HHC and to assess EHR impact on these practices. The larger study goal is to develop health information technology recommendations to enhance the HHC admission process and to inform health information technology standards for HHC EHR systems. The purpose of the analysis reported here is to characterize missing information at HHC admission by (1) determining what information nurses need when admitting a patient into HHC; (2) examining the adequacy of the data standard to transfer needed information to HHC; and (3) comparing the effect of interoperability on the occurrence of the data standard items in the admission documents.

MATERIALS AND METHODS

We conducted focus groups with the nurses to determine what information they need during the admission process and we observed admissions to characterize what was available to the nurses at the start of the admission. Both information sets were compared with a data standard to identify relevant data items. The universal presence of a data item would indicate that regardless of referral source, this data item tends to be communicated along the transition in care. Conversely, the infrequent occurrence of a data item may indicate the need for rigorous implementation of communication of the data item.

The Drexel University Institutional Review Board approved this observational field study. The study reimbursed the agencies for the nurses' time. All nurses and patients who were observed or interviewed volunteered and provided consent for the study. Results are reported as significant at the α = 0.05 level.

Setting

Three Pennsylvania HHC agencies in diverse geographic locations, with different commercial point-of-care EHRs, and with different interoperability capabilities participated. The rural agency was a stand-alone agency without interoperability with any referral source. The suburban and urban agencies were in health systems. The urban agency was in an integrated system with respect to the referring facilities' EHRs. The suburban agency had limited interoperability with its parent hospital and was able to receive a formatted electronic document with summary discharge information and referral information within a standard template. The urban agency had interoperability with its health system's tertiary care hospitals in which the EHR populated the HHC EHR medication list as structured, updatable data. Referral documents received from nontertiary hospitals within the health system were transmitted similar to the suburban agency as electronic documents.

Needed information: Focus groups

To qualitatively analyze information that nurses reported needing during an HHC admission, researchers conducted 1 focus group per agency, with 6 admitting registered nurses at each until saturation (no new concepts) was reached.

Data collection

Details regarding the focus group methods appear in Sockolow et al.[20] Focus groups were audio-recorded. As participants responded to the moderator-posed questions, responses were written on flip charts. In addition, researchers took field notes.

Based on the team's knowledge of the HHC admission process, and in the absence of related literature, we investigated 4 decisions

as use cases to elicit from nurses the information they needed to support their work:

1. Medication reconciliation (constructing the most accurate list of current patient medications, and comparing that list against the patient's discharge orders and the medications found in the home), and assessing patient medication self-management;

2. Problems to include in the plan of care (patient problems to be addressed in the home care episode, and the instructions for assessment, education, and performance of treatments);

3. Visit timing and frequency (establishing the weekly frequency of skilled nursing visits and the total number of follow-up visits); and

4. Inclusion of other disciplines ("Services") (determining which services are needed in the plan of care in addition to skilled nursing, such as physical therapy).

The nurses also reported the information they need to conduct the admission (start of care).

Follow-up phone calls and emails were performed for qualitative member-checking. In addition, 5 nurses from the rural agency who were in the original focus group volunteered to participate in a face-to-face member check session.[21]

Data analysis

Details regarding the focus group data analysis appear in Sockolow et al.[20] The focus group recordings were transcribed. We analyzed the focus group transcripts, flip chart contents, and field notes using thematic content analysis with the Continuity of Care Document (CCD) enhanced with Office of the National Coordinator for Healthcare Information Technology summary terms (CCD/S) as the categorization scheme.[20] We presented the analysis using our custom data visualization method.[21] We used NVivo, version 12 (QSR International, Melbourne, Australia), a qualitative data analysis software to organize themes that emerged and Lucidchart, 2017 (Lucid Software, South Jordan, UT) to create the visualizations.[21] Each theme was tagged with the corresponding clinical decision that evoked the nurse response.

Available information: Admission observations

To quantitatively analyze information actually available to nurses during an HHC admission, researchers observed 36 admissions (6 nurses each admitting 2 patients per agency).

Data collection

For each observation (unique patient admission), available information in documents at the start of the admission (either as hard copy or in the EHR) were photographed or obtained in hard copy from the nurse or the agency. The available documents types (ie, referral, progress note, intake, internal communication) at the start of the admission varied by agency. Referral or progress note (herein referred to as referral) documents were present for all agencies. These documents were sent from the patient's previous clinical setting (eg, hospital, skilled nursing facility, physician office). Referral information at the rural agency was on paper and at the suburban and urban agencies was available on the laptop computer EHR.

Intake documents were available at the rural and urban agencies. They were paper for the former and scanned for the latter. The suburban agency had 2 electronic internal agency documents available, referred to as Case Communication Reports, that were transcribed from external sources. One report summarized referral information. A second report contained insurance information.

Data analysis

For each observation, identification of the information available to the nurse entailed data extraction in the mapping description. Available information was organized by agency and corresponding patient admission.

Creating a data standard to compare to the needed and available information

The research team sought to select a data standard against which both the needed and available data sets described above would be compared. We considered the CCD, a current, yet underutilized, international standard for patient summary information.[22] The CCD contains 15 sections of patient-specific data including medications, problems, and procedures organized into common clinical conventions.[17] However, it was designed for information transfer across care settings for physicians,[23] and therefore was not tailored to HHC nurses' needs. We reviewed the HL7 Implementation Guide for the CCD document to identify relevant CCD data items.[24] When compared with the recently announced U.S. Core Data for Interoperability (USCDI) standard,[25] the CCD contains more clinical data fields, with the exception of the data item, patient goals. Because the CCD contains a broader dataset and is already in use for some healthcare transition applications, we chose the CCD as the data standard for this analysis. For completeness, we compared the CCD with the Common Clinical Data Set from the Office of the National Coordinator.[26] The resulting list is the data standard for this study.

Mapping the needed and available information to the data standard

With respect to the needed information, an author and a research team member mapped each information theme from the focus groups analysis to the data standard code considered the best match. The mapping indicated (1) data items for which there was congruence of information needed and information available and (2) completeness of the data standard relative to the information needed and to the information available.

One author selected and documented the codes in Microsoft Office Excel (Microsoft Corporation, Redmond, WA), and a researcher reviewed the matches and mismatches. The clinical decision tagged to the needed information theme was also tagged to the related data standard code.

With respect to the available information, each document's content was mapped to the related data standard code. Coding and mapping were independently reviewed by 2 researchers who compared coding and came to consensus. Researchers met with the observed nurses to clarify information and findings relevant to the available information such as which documents the nurse had available before the admission. Saturation was reached after meetings at the rural and suburban agencies.

Researchers reviewed the resulting data standard mappings, identified where needed information did not map to available information, and developed transitions-in-care information communication recommendations. They identified where the data standard was incomplete with regard to information that the nurses needed, organized the findings in the context of the 4 clinical decisions, and developed data standard recommendations.

Interoperability analysis

Interoperability was present in 2 forms at the 2 agencies receiving electronic data: transmitted or scanned documentation (eg, dis-

charge paperwork pdf), and structured electronic documentation (eg, current medications records with attributes including dosage, frequency, and form). To assess the effect of interoperability on the occurrence of data standard data items in the available information, each observation was characterized as having or not having an interoperable referral source. A 2-sample *t* test was used to test for significance. If model adequacy assumptions were not met, the Wilcoxon rank sum test with continuity correction was used.

RESULTS

Creating a data standard to compare to the needed and available information

Four codes in the ONC's Common Clinical Data Set (physical assessment, smoking status, [clinician] goals, and [clinician] health concerns) did not appear in the CCD. Thus, we enhanced the CCD. The ONC list is a federal standard applicable to EHRs and thus, for completeness, these additional items not present in the CCD were considered in the analysis. We refer to the combined data set of CCD and Common Clinical Data Set as the CCD/S. Table 1 lists the 26 CCD/S items considered as the comparison standard. For readability, CCD/S codes are italicized, and both CCD/S codes and themes are capitalized.

Information needed by nurses to support decision making and CCD/S adequacy

One focus group at each agency attained saturation. Table 2 includes the 53 information themes resulting from the focus groups that discussed decision making during an HHC admission. Examples include (1) Assistance in the Home, (2) Home Environment, and (3) Patient Not Taking Medication on List. Four themes were not applicable. Most (84%; n= 41 of 49) information themes mapped to the CCD/S. Information themes were represented within 6 CCD/S categories: (1) Patient (eg, Diagnosis, Level of Knowledge, Physical Findings, Level of Function—physical and cognitive, Goals, Care Needs), (2) External Resources (eg, Insurance Approval and Requirements, Recommendations from Referral Source, Availability of Equipment), (3) Home Care Agency (eg, Care the Admission Nurse Would Provide, Resources Available from the Agency); (4) Medication Reconciliation (eg, Medication List Availability), (5) Care Giver Availability, and (6) Home Environment Condition (eg, Cluttered).

The 7 unmatched themes were related to medication self-management (eg, High Risk Medication, Patient Ability to Understand Medications). The CCD/S code *Medication* did not include the patient medication self-management concept, and this concept was not explicitly included in any other CCD/S code.

Conversely, the nurses did not identify one-third of the CCD/S codes as needed to support decision making at admission (Table 1). Three of these codes (*Patient Guardian*, *Next of Kin*, and *Emergency Contact*) were related to the patient's support sources. Three additional CCD codes were not mentioned: *Family History*, *Medication Activity* (ie, medication administered), *Supply Activity*. Three of the 4 ONC codes were not mentioned by the nurses: *Smoking Status,* (clinician) *Goals*, and (clinician) *Health Concerns*.

Information available at admission

The CCD/S codes distribution among the information documents varied by agency. For example codes such as *Advance Directives* and *Next of Kin* never appeared among the urban observations,

whereas *Patient Caregivers* never appeared among the rural ones. Seven CCD/S codes occurred frequently (for at least 80% of total agency observations): *Assessment*, *Problems*, *Medications*, *Vital Signs*, *Results*, *Encounters*, and *Healthcare Providers.* Most (n = 18) did not appear frequently or at all in the available information documents.

Across the agencies, 13 CCD/S codes were tagged to 1 or more of the 4 clinical decisions. Each decision relied on information related to between 2 and 12 codes. All decisions relied on information related to 2 codes, *Medications*, which occurred in all but 1 observation; and *Functional Status* which occurred in over two-thirds of the observations. However, no code explicitly contained 1 aspect of the Medication Reconciliation decision: Patient medication self-management information. Therefore, nurses did not receive all the needed information in any of the observations. Three decisions (ie, Medication Reconciliation, Visit Timing and Frequency, Problems) identified needing information associated with a third code, *Plan of Care*, which also occurred in over two-thirds of the observations. The Visit Timing and Frequency decision and the Problems decision relied on information related to the most codes (12 and 10, respectively). One of these codes, *Problems*, was only missing in 1 observation. The fourth decision, Services, had the fewest related codes, 2 (ie, *Functional Status*, *Medications*), which appeared in all decisions.

The other 13 CCD/S codes were not tagged to a clinical decision. Among these codes, 2 addressed additional information needed for the start of care: *Allergies* and *Immunizations*. The remaining CCD/S codes which mapped neither to a clinical decision nor to the start of care were (1) *Patient Guardian*, (2) *Next of Kin*, (3) *Emergency Contact*, (4) *Family History*, (5) *Social History,* (6) *Supply Activity*, (7) *Results*, (8) *Procedures*, (9) *Healthcare Providers*, (10) *Smoking*, and (11) *Health Concerns*.

Interoperability

There were more noninteroperable (21: 12 rural, 6 suburban, 3 urban) observations than interoperable (15: 6 suburban, 9 urban). CCD/S code occurrence in available information documents from the referral sources for the 21 patients referred from noninteroperable locations was compared with the 15 interoperable ones. The Wilcoxon rank sum test with continuity correction indicated no statistically significant difference between the number of code occurrences by interoperability (W = 342, P = .573).

However, 2 findings emerged from the analysis. Where we expected interoperable observations to have more information, only 3 CCD/S codes (ie, *Problems, Medications, Results*) were present among all these observations. In contrast, no code was universally present among noninteroperable observations. Yet, for some codes, more noninteroperable observations contained the code as compared with interoperable observations (ie, *Family History, Supply Activity, Goals, Advance Directive*). Second, 1 code (*Advance Directive*) present in the noninteroperable observations was not present in the interoperable observations.

DISCUSSION

We undertook this study to inform transition in care to HHC data standards. We used 4 clinical decisions to compare the information that HHC nurses said they needed at admission and had available to a data standard, the CCD/S.

Table 1. CCD codes mapped to focus group information themes

CCD/CCDS code	CCD/CCDS code meaning	Needed information theme mapped to CCD/CCDS code
Payer	Entity responsible fiduciary for the financial aspects of a patient's care	Insurance coverage
Advance directive	Assert findings (eg, resuscitation status is Full Code) rather than orders	Full code or DNR (code status)
Patient guardian	A patient guardian shall be present	UNMATCHED
Next of kin	One or more next of kin	UNMATCHED
Emergency contact	One or more emergency contact	UNMATCHED
Patient caregivers	One or more patient caregivers	Assistance in home (family)
Functional status	• Ambulatory ability • Mental status or competency • ADLs, including bathing, dressing, feeding, grooming • Home/living situation having an effect on the health status of the patient • Ability to care for self • Social activity, including issues with social cognition, participation with friends and acquaintances other than family members • Occupation activity (eg, working, housework or volunteering, family and home responsibilities, or activities related to home and family) • Communication ability, including issues with speech, writing or cognition required for communicating • Perception, including sight, hearing, taste, skin sensation, kinesthetic sense, proprioception, or balance	• Cognitive ability • Level of disease knowledge • Patient compliance • Patient at baseline function • ADL status • Home environment (dirty/cluttered) • Gun safety • Domestic violence
Problems	Relevant clinical problems: At a minimum, all pertinent current and historical problems should be listed	• End stage disease process • Diagnosis • Prehospital health baseline • Health history • Admission indication/discharge reason • Emotional status
Family history	Patient's genetic relatives in terms of possible or relevant health risk factors that have a potential impact on the patient's healthcare risk profile	UNMATCHED
Social history	Patient's occupation, personal (eg, lifestyle), social, and environmental history and health risk factors, as well as administrative data such as marital status, race, ethnicity, and religion affiliation.	UNMATCHED
Allergies	Patient's allergies	Allergies
Medications	Patient's current medications and pertinent medication history	• IV administration route • Unwanted medication side effect • Medication frequency • Medication list, accurate meds • New medication • Correct medications in home • High-risk medications
Medication activity	Describe what is administered	UNMATCHED
Supply activity	Describe what has been dispensed	UNMATCHED
Medical equipment	Patient's implanted and external medical devices and equipment that their health status depends on, as well as any pertinent equipment or device history	Equipment needs
Immunization	Patient's current immunization status and pertinent immunization history	UNMATCHED
Vital Signs	Current and historically relevant vital signs, such as blood pressure, heart rate, respiratory rate, height, weight, body mass index, and pulse oximetry	Physical assessment
Results	Results of observations generated by laboratories, imaging procedure, and other procedures	Imaging results Lab work results
Procedures	All interventional, surgical, diagnostic, or therapeutic procedures or treatments pertinent to the patient historically	Procedure reports
Encounters		• Goals from palliative care

Table 1.. continued

CCD/CCDS code	CCD/CCDS code meaning	Needed information theme mapped to CCD/CCDS code
	Any healthcare interaction, regardless of setting, between a patient and a practitioner pertinent to the patient's current health status or historical health history	• In hospice program • Amount previous teaching received • Rehospitalization
Plan of care	Pending orders, interventions, encounters, services, and procedures for the patient, limited to prospective, unfulfilled, or incomplete orders and requests	• Patient desired outcomes (palliative/hospice) • What we're to perform • Nursing frequency • Community resource needs • Recommendations from referral • Lab work needed • Other therapies needed • Upcoming medical appointments • Teaching needs
Healthcare providers	Healthcare providers involved in the current or pertinent historical care of the patient	UNMATCHED
Assessment	Explanation of the results of the study; A nursing assessment includes information of the objective and subjective data	Physical assessment (of patient)
Smoking status	Yes/no answer if patient smokes or not	UNMATCHED
(Clinician) Goals	Goals as mentioned from clinician's perspective	UNMATCHED
(Clinician) Health concerns	Health concerns from clinician's perspective	UNMATCHED

ADLs: activities of daily living; CCD: Continuity of Care Document; CCD/S: Continuity of Care Document enhanced with Office of the National Coordinator for Healthcare Information Technology summary terms; DNR: do not resuscitate; IV: intravenous

Our investigation indicated that most of the information that HHC nurses said they needed at admission to support the 4 important clinical decisions were represented within the CCD/S. Nurses did not identify 3 of the additional 4 codes from the ONC Common Clinical Data Set as useful. Based on these findings we recommend using the existing CCD standard augmented with the CCDS code, *Assessment*, to electronically transfer the needed codes from the referral source to HHC. The intent is to improve the amount and quality of information available at the HHC admission.

We also recommend the addition of information about medication self-management capability to attain completeness, enable transmittal of structured data, and better meet HHC admission nurses' information needs. The lack of medication self-management information in referral documents was an important finding. Nurses reported needing this information to support all 4 clinical decisions. Missed medications, wrong doses, and other medication errors due to inability to self-manage medication can lead to adverse events and unfortunately are too common during transitions in care.[8] Patients who cannot self-manage medications may need to be visited earlier or more often, may need a social work consult to help with obtaining or affording medications, and could need medication management added to the care plan as a problem. Therefore, timely medication reconciliation would be important. Our study highlights the importance of this missing CCD concept, and that it be made explicit in the CCD instead of possibly being recorded in a subsection such as "medication instructions" or "plan of care." Explicit CCD specification would support data transmittal from the hospital EHR. Furthermore, patient medication self-management may be relevant in other settings, particularly mental health. Unfortunately, medication self-management information is not included in the impending USCDI standard.[25] Electronic transfer of this information could increase efficiency, prevent errors, and also alert nurses to patients likely to have issues with medications, a risk factor for readmission.[27]

This lack of medication self-management information indicates a need for communication of medication self-management capability data across settings to assist the next level of care in understanding what patient challenges exist. Receipt of physical function and cognition data as standardized measurements, as specified by the Impact Act, may reduce variability in assessment thereby improving the quality of these data for the HHC nurse. The Act requires a uniform comprehensive assessment across all post–acute care settings. However, acute care settings, a common HHC referral source, are excluded from the mandate.[28] At present, the Impact Act is not a solution to the absence of standardized patient assessment information across the transition from acute care to HHC.

The less than universal availability of information related to each CCD code needed for all 4 important clinical decisions indicates an information deficit during the transition in care to HHC. This deficit is of concern because making appropriate clinical decisions and providing safe patient care depends on having adequate and accurate information.[11,29,30] Patient outcomes and quality of care may be impacted by the quality and amount of information available to clinicians.[31–33]

We also found that approximately half of the CCD/S codes were not mentioned by nurses as being needed for the 4 decisions. We do not recommend that the unmentioned codes be removed from the CCD/S. Instead, we suggest that future research expand the investigation beyond the 4 important decisions use cases to identify potential use.

Considering current efforts to implement interoperability,[25] unexpectedly, our study did not find a statistically significant difference in information availability from referral sources with interoperability as compared with referral sources without interoperability. A possible reason is that the study may have been underpowered to detect a difference. Future research should support investigating generalizability by including more observations and agencies—both those with interoperability and those without inter-

Table 2. Grouping of focus group themes and their mapping to the CCD/S

Group	Theme	Match CCD/S code?
Care giver	Assistance in the home (assistance level from family, family availability for med teaching)	Patient caregivers
External resources	Insurance coverage (how many visits are approved, how much is covered by insurance, amount of visits allocated by patient's insurance, insurance requires face to face type of insurance)	Payer
External resources	Community resource needs	Plan of care
External resources	Discharge instructions	UNMATCHED
External resources	Equipment needs (availability of equipment)	Medical equipment
External resources	Goals from palliative care	Encounters
External resources	Imaging results	Results
External resources	In a hospice program (hospice care needs)	Encounters
External resources	Procedure reports	Results
External resources	Recommendation from referral	Plan of care
External resources	Upcoming medical appointments	Plan of care
Home care agency	Availability of services	Not applicable
Home care agency	Nursing frequency	Plan of care
Home care agency	Other therapies needed (function and therapy needs, different therapies needed)	Plan of care
Home care agency	What we're going to perform	Plan of care
Home environment	Home environment (if home is dirty or cluttered)	Functional status
Med rec	Correct meds in the home (medication availability, refills needed)	Medications
Med rec	Medication frequency	Medications
Med rec	Medication list (accurate medication list, medications, medications in home)	Medications
Medication self-management	High-risk medication	UNMATCHED
Medication self-management	IV administration route	Medications
Medication self-management	New medication	UNMATCHED
Medication self-management	Patient can't take medications as prescribed (functional ability related meds, ability to take meds)	UNMATCHED
Medication self-management	Patient does not understand medication information over the phone	UNMATCHED
Medication self-management	Patient not taking medication on list (patient medication compliance)	UNMATCHED
Medication self-management	Unwanted medication side effect	UNMATCHED
Patient	ADL status (level of function, ability to manage disease)	Functional status
Patient	Admission indication (reason for discharge)	Problems
Patient	Allergies	Allergies
Patient	Amount of previous teaching received	Encounters
Patient	Cognitive ability (what they're retaining, ability to understand teaching)	Functional status
Patient	Diagnosis (chronic diagnosis, diagnosis list)	Problems
Patient	Emotional status	Problems
Patient	End stage of disease process	Problems
Patient	Fall risk	Problems
Patient	Full code or DNR (code status)	Advance directive
Patient	Health history (heart failure history, history and physical, continual acute or chronic events, frequent PCP visits)	Problems
Patient	Lab work needed (lab work due)	Plan of care
Patient	Lab work results	Results
Patient	Level of knowledge (about their disease, about current disease)	Functional status
Patient	Medication self-administration	UNMATCHED
Patient	Nutrition risk	Problems
Patient	OASIS start of care assessment (OASIS answers, what we're going to assess)	Assessment
Patient	Patient at baseline function (baseline function to determine level of improvement at end of services)	Problems
Patient	Patient compliance	Functional status
Patient	Patient is very chatty	Not applicable
Patient	Patient states the computer takes attention away from them	Not applicable
Patient	Patient's desired outcomes (palliative care or hospice desired)	Plan of care
Patient	Physical assessment (head to toe assessment findings, vital signs, wound care, GI, GU, neurological status, pain level & how it's being managed, abnormal findings, lungs clear/not, edema)	Assessment
Patient	Prehospitalization baseline (patient's health before hospitalization)	Problems
Patient	Re-hospitalization rate	Encounters

Table 2.. continued

Group	Theme	Match CCD/S code?
Patient	Teaching needs (medication teaching help, what we're going to teach)	Teaching needs
Patient	Typing makes patient anxious	Not applicable

CCD/S: Continuity of Care Document enhanced with Office of the National Coordinator for Healthcare Information Technology summary terms; DNR: do not resuscitate; GI: gastrointestinal; GU: genitourinary; IV: intravenous; Outcome and Assessment Information Set; PCP: primary care physician.

operability. Another possible explanation is that interoperability is a nuanced concept along a number of dimensions. For example, we observed different levels of interoperability (ie, electronic document, structured medication records) between agencies and within an agency. A third consideration is that interoperability does not guarantee the completeness of information transferred from the referral source. A fourth is that interoperability does not assure that the communicated data are structured. For example, while the urban health system had the functionality to electronically communicate structured clinical data, this capability was limited to sharing the medication list with the HHC. Therefore, the urban hospitals' EHR did not make available to the HHC EHR all structured data essential for the 4 clinical decisions. This unavailability of structured clinical information was not due to interoperability, as the communication was functionally possible. Instead, this unavailability likely resulted from a decision constraining the data to be communicated along the transition in care. We suggest that while interoperability is necessary for information transmission along the transition in care, interoperability alone is not sufficient: Data standards implementation is needed for the information to be available.

We anticipate that interoperability will replace the use of paper referral and admission documents. Recently Norway implemented point-of-care EHRs interoperable from physician to home care.[34] Accordingly, we recommend EHR redesign to capture structured CCD/S (or USCDI) data to eliminate intake nurse referral data transcription. Further research is needed to ascertain whether, if additional data were included in the CCD/S, nurses would use these data.

CONCLUSION

HHC nurses at 3 diverse agencies who admitted patients relied on admission documents for information to make 4 important clinical decisions included in the plan of care. We found that the CCD was mostly complete with regard to information that nurses needed. We recommend amplifying the CCD (and USCDI) with specific information needed to inform the nurse of needed data not in the CCD: patient medication self-management ability. We also found that, uniformly, not all the information that nurses needed was in the documents available at admission. We suggest that the expanded CCD (or USCDI) be communicated from hospitals to interoperable point-of-care EHRs in HHC as structured data to support communication across the transitions-in-care chasm.

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AUTHOR CONTRIBUTIONS

All authors made substantial contributions to the analysis; drafting the work or revising it critically for important intellectual content; and final approval of the version to be published. In addition, PSS, KHB, and EJB made substantial contributions to the conception and design of the work and to the acquisition and interpretation of data for the work.

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CONFLICT OF INTEREST STATEMENT

None declared.

REFERENCES

1. Melby L, Brattheim BJ, Helleso R. Patients in transition–improving hospital-home care collaboration through electronic messaging: providers' perspectives. *J Clin Nurs* 2015; 24 (23–24): 3389–99.
2. Rogers J, Perlic M, Madigan EA. The effect of frontloading visits on patient outcomes. *Home Healthc Nurse* 2007; 25 (2): 103–9.
3. Bowles KH, Pham J, O'Connor M, *et al*. Information deficits in home care: a barrier to evidence-based disease management. *Home Healthc Manag Pract* 2010; 22 (4): 278–85.
4. Jones CD, Jones J, Richard A, *et al*. Connecting the Dots: a qualitative study of home health nurse perspectives on coordinating care for recently discharged patients. *J Gen Intern Med* 2017; 32 (10): 1114–21.
5. Berland A, Bentsen SB. Medication errors in home care: A qualitative focus group study. *J Clin Nurs* 2017; 26 (21-22): 3734–41.
6. Norri-Sederholm T, Saranto K, Paakkonen H. Medication information flow in home care. *Stud Health Technol Inform* 2016; 225: 359–63.
7. Helleso R, Lorensen M, Sorensen L. Challenging the information gap–the patients transfer from hospital to home health care. *Int J Med Inform* 2004; 73 (7-8): 569–80.
8. Brody AA, Gibson B, Tresner-Kirsch D, *et al*. High prevalence of medication discrepancies between home health referrals and centers for Medicare and Medicaid services home health certification and plan of care and their potential to affect safety of vulnerable elderly adults. *J Am Geriatr Soc* 2016; 64 (11): e166–70.
9. Jones CD, Jones J, Bowles KH, *et al*. Quality of hospital communication and patient preparation for home health care: results from a statewide survey of home health care nurses and staff. *J Am Med Dir Assoc* 2019; 20 (4): 487–91.
10. Satzinger W, Courte-Wienecke S, Wenng S, Herkert B. Bridging the information gap between hospitals and home care services: experience with a patient admission and discharge form. *J Nurs Manag* 2005; 13 (3): 257–64.
11. Arbaje AI, Hughes A, Werner N, *et al*. Information management goals and process failures during home visits for middle-aged and older adults receiving skilled home healthcare services after hospital discharge: a multisite, qualitative study. *BMJ Qual Saf* 2019; 28 (2): 111–20.

12. Romagnoli KM, Handler SM, Ligons FM, Hochheiser H. Home-care nurses perceptions of unmet information needs and communication difficulties of older patients in the immediate post-hospital discharge period. *BMJ Qual Saf* 2013; 22 (4): 324–32.

13. Hursch CJ, Hammond KR, Hursch JL. Some methodological considerations in multiple-cue probability. *Psychol Rev* 1964; 71 (1): 42–60.

14. Cooksey RW. *Judgment Analysis: Theory, Methods, and Application*. New York, NY: Academic Press; 1996.

15. Wickens CD, Carswell CM. Information processing. In: Salvendy S, ed. *Handbook of Human Factors and Ergonomics*. 2nd ed. New York, NY: Academic Press; 1997: 88–129.

16. Ruland C. Clinical decision making in nursing. *Nordic J Nurs Res* 1996; 16 (4): 4–12.

17. Sockolow P, Wojciechowicz C, Holmberg A, et al. Home care admission information: what nurses need and what nurses have. *Stud Health Technol Inform* 2018; 250: 164–8.

18. Renner SA. A community of interest approach to data interoperability. 2001. https://www.mitre.org/sites/default/files/pdf/renner_community.pdf Accessed June 1, 2020.

19. Centers for Medicare and Medicaid Services. Promoting Interoperability Programs. https://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms Accessed February 14, 2020.

20. Sockolow PS, Yang Y, Bass EJ, Bowles KH, Holmberg A, Sheryl P. Data visualization of home care admission nurses' decision-making. *AMIA Annu Symp Proc* 2017; 2017: 1597–606.

21. Yang Y, Bass EJ, Sockolow PS, Bowles KH. Knowledge elicitation of home-care admission decision making processes via focus group, member checking and data visualization. *AMIA Annu Symp Proc* 2018; 2018: 1127–36.

22. HL7. Continuity of Care Record. http://www.hl7.org/implement/standards/product_brief.cfm? product_id=6 Accessed June 1, 2020.

23. Ferranti JM, Musser RC, Kawamoto K, et al. The clinical document architecture and the continuity of care record: a critical analysis. *J Am Med Inform Assoc* 2006; 13 (3): 245–52.

24. Dolin RH, Alschuler L, Boyer S, et al. HL7 Clinical Document Architecture, Release 2. *J Am Med Inform Assoc* 2006; 13 (1): 30–9.

25. Office of the National Coordinator for Health Information Technology (ONC). U.S. Core Data for Interoperability (USCDI). 2019. https://www.healthit.gov/isa/us-core-data-interoperability-uscdi Accessed November 11, 2019.

26. Office of the National Coordinator. §170.315(b)(4) Common Clinical Data Set summary record – create. https://www.healthit.gov/test-method/common-clinical-data-set-summary-record-create Accessed June 1, 2020.

27. O'Connor M, Murtaugh CM, Shah S, et al. Patient characteristics predicting readmission among individuals hospitalized for heart failure. *Med Care Res Rev* 2016; 73 (1): 3–40.

28. Centers for Medicare and Medicaid Services. IMPACT Act of 2014 & Cross Setting Measures. 2018. https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Post-Acute-Care-Quality-Initiatives/IMPACT-Act-of-2014/IMPACT-Act-of-2014-Data-Standardization-and-Cross-Setting-Measures.html Accessed September 28, 2017.

29. Greenfield LJ. Doctors and nurses: a troubled partnership. *Ann Surg* 1999; 230 (3): 279–88.

30. Brown E, Raue P, Mlodzianowski A, Meyers B, Greenberg R, Bruce M. Transition to home care: quality of mental health, pharmacy, and medical history information. *Int J Psychiatry Med* 2006; 36 (3): 339–49.

31. Institute of Medicine. *To Err is Human: Building a Safer Health System*. Washington, DC: National Academy Press; 2000.

32. The Joint Commission on the Accreditation of Healthcare Organizations. The Joint Commission Accreditation Program: Home care national patient safety goals; 2020. https://www.jointcommission.org/standards_information/npsgs.aspx Accessed June 1, 2020.

33. National Quality Forum. Addressing national priorities. 2009. https://www.qualityforum.org/Publications/2014/08/Priority_Setting_for_Healthcare_Performance_Measurement__Addressing_Performance_Measure_Gaps_in_Care_Coordination.aspx Accessed June 1, 2020.

34. Melby L, Hellesø R. Electronic exchange of discharge summaries between hospital and municipal care from health personnel's perspectives. *Int J Integr Care* 2010; 10 (2): e039.