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Transitions of Care: Completeness of the Interoperability Data Standard for Communication from Home Health Care to Primary Care

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Abstract

Data sharing is necessary to address communication deficits along the transitions of care among community settings. Evidence-based practice supports home healthcare (HHC) patients to see their primary care team within the first two weeks of hospital discharge to reduce rehospitalization risk. A small subset of patient data collected at HHC admission is mandated to be transmitted to primary care, predominantly by fax. Using qualitative analysis, we assessed completeness of the United States Core Data for Interoperability (USCDI) interoperability standard, as compared to the patient data collected by the primary care team (topics) and HHC (classes) during the initial visit; and offer interoperability recommendations. Findings indicate the USCDI does not cover 74% of the 19 faxed HHC classes that mapped to the primary care topics, and 95% of the 38 not-faxed HHC classes. We offer USCDI recommendations to address these interoperability gaps.

Keywords: communication, home health care nursing, home health nursing, primary health care, continuity of patient care/standards, transition of care, nursing informatics, documentation

Introduction

Data sharing across transitions of care is necessary to address fragmented care delivery along the health care continuum. Much of the patient care is provided in community settings where, due to information silos and lack of interoperability, data communication deficits exist along the transition of care among community settings. These deficits are becoming more apparent as health care organizations move towards value-based care where hospitalizations and readmissions are key quality and cost drivers. To support data sharing, the United States Core Data for Interoperability (USCDI) replaces the Common Clinical Data Set (CCDS)¹ as a data standard in transitions of care.² USCDI support for data communication among community settings warrants investigation.

Home healthcare services (HHC)³ and a primary care team visit are transition-in-care components for over one million Medicare patients annually discharged from hospital to home. Evidence-based practice supports HHC patients seeing their primary care team within the first two weeks of hospital discharge^{4,5} which has been shown to reduce rehospitalization risk in patients with heart failure⁶ and sepsis.⁷ Accordingly, the Centers for Medicare and Medicaid (CMS) reimburses providers for a patient office visit within 14 days of hospital discharge, the Transition of Care (TOC) visit.⁸ Patients with medical and/or psychosocial problems requiring at least moderate medical decision-making receive services⁹ which results in lower mortality and cost of care.⁸ Evidence and CMS regulations highlight TOC visit importance. Left unsaid are the specifics of what information is needed for the TOC visit – for medical decision-making and prospective analysis e.g., re-hospitalization risk.

A rich set of information relevant to TOC clinical decision-making is collected during the HHC visit as structured data yet little of this data is transmitted to the primary care team. During the first (admission) visit HHC clinicians conduct medication reconciliation, assessment, and documentation of patient cognitive and functional capabilities and patient safety in the CMS Outcome and Assessment Information Set (OASIS¹⁰). To finalize the admission, a minimal OASIS data subset is faxed to the primary care physician to request clinician order sign-off for HHC reimbursement. The faxed form (the '485') is difficult to interpret due to the paucity of structured data, preponderance of narrative text, and asynchronicity of receipt in relation to the TOC patient visit. The brevity of the typically 20-minute TOC visit limits the information physicians can gather as they address acute and chronic illnesses. Yet important information is in the OASIS. For example, a recent literature review identified OASIS data that predicts re-hospitalization risk.¹¹ Another example is HHC identifies a patient living with cognitive deficits which affect medication ingestion. This information could inform the primary care team of the need for additional resources to ensure the patient's safe pill consumption. This communication occurs verbally, if at all: No formatted or structured documentation of this information, paper or electronic, reaches the physician office.

Lack of HHC and primary care EHR interoperability promulgates information siloes. The result is potential missed clinical opportunities (not having information in the right place at the right time) and lack of data for research such as re-hospitalization risk predictive analytics. Data flow deficits between HHC and primary care can impact patient

outcomes, and hospital and practice CMS reimbursement. The USCDI may address the needed interoperability from HHC to primary care. We undertook an investigation of USCDI completeness as compared to HHC patient information (a) currently communicated to primary care through the 485 form and mapped to the TOC; and (b) which could be communicated from OASIS for the TOC visit. From this analysis we seek to provide HHC-to-primary care interoperability recommendations.

Methods

The authors conducted deductive qualitative analysis to meet the objectives in two steps. First, they assessed the extent to which HHC patient data currently communicated on the 485 provides the information needed for the TOC, and the completeness of the USCDI relative to the 485 data that mapped to the TOC. Second, they mapped OASIS data not communicated on the 485 to the TOC, and assessed completeness of the USCDI relative to the OASIS data that mapped to the TOC. The current version of OASIS, Version D, was used in the analysis. The authors' perspective was that of a primary care physician knowledgeable about HHC OASIS data who was considering the HHC information the primary care team might need. The perspective was not that of a physician more narrowly interpreting the TOC topics as it is currently implemented. An example of the former is medication self-administration issues, and example of the latter is medication list. The chosen perspective was selected to provide insight into the potential value of HHC data to the primary care team.

Completeness of USCDI coverage of 485 data mapped to the TOC

In the absence of a CMS TOC document, we used a primary care medical society TOC.¹² It contained information descriptions (referred herein as topics) and lacked structured data fields. This analysis focused on TOC activities or decisions which require data (e.g., Obtain and Review Discharge Information⁹). TOC topics could be interpreted as having some overlap, for example, implying review of the same data (e.g., Obtain and Review Discharge Information, and Review Need for Follow-up on Pending Testing or Treatment both include review of clinical status). The TOC contained 9 clinical information topics distributed among 3 domains as follows. The four clinical status topics were:

- Obtain and Review Discharge Information
- Review Need for Follow-up on Pending Testing or Treatment
- Interact with Other Clinicians who will Assume or Resume Care of the Patient's System-specific Conditions
- Establish or Re-establish Referrals for Specialized Care

The two functional status topics were:

- Educate the Patient and/or Caregiver to Support Self Management, and Activities of Daily Living (ADL)
- Provide Assessment and Support for Treatment Adherence and Medication Management

The three service needs topics were:

- Identify Available Community and Health Resources
- Facilitate Access to Services Needed by the Patient and/or Caregivers
- Assist in Scheduling Follow-up with Other Health Services

The topic, Communicate with Agencies and Community Services Used by the Beneficiary, was excluded from the analysis as it is not currently interpreted as referring to 485 information due to the asynchronicity.

The 485 communicates 19 specified structured and unstructured data (classes). Information sources are 13 OASIS classes for the structured data, and unstructured, non-OASIS EHR data for 10 classes. Some 485 classes have multiple OASIS classes as data sources. The classes are in 3 domains: clinical status, functional status, and safety. The thirteen 485 clinical status classes include 9 OASIS-sourced classes (i.e., Primary Diagnosis/Other Diagnoses [3 questions], Cognitive, Behavioral and Psychiatric Symptoms [4 questions], Living Arrangements [1 question], Hospitalization Risk [1 question]) and 5 EHR-sourced classes (i.e., Orders for Discipline and Treatments, Prognosis, Medications List, Allergies, Nutritional Requirements). The 5 functional status classes include 4 OASIS-sourced classes (i.e., Goals/Rehabilitation Potential/Discharge Plans) and 4 EHR-sourced classes (i.e., Mental Status, Functional Limitations, Activities Permitted, Durable Medical Equipment [DME] and Supplies). Note that Goals are not specified as to whether patient or clinician goal. The single safety class was from EHR data (i.e., Safety Measures).

The USCDI contains standards at incremental levels of adoption: Version 1, Draft Version 2, Level 2, Level 1 and Comments.¹³ Version 2 is the focus of this analysis as it is the most current proposed standard and incorporates Version 1 which has been adopted. Levels suggest data elements that are in discussion to be incorporated in subsequent

versions. Comments contain data elements that have adoption hurdles, including insufficiently defined use cases and implementation or development burdens.¹³ Excluded from the analysis, but of note, Comments includes functional class (e.g., Mental, Mobility, Self Care, and Instrumental ADL [IADL]). The USCDI contains data classes and elements. Elements which were qualifiers for classes (e.g., dosage as a qualifier for medication) were excluded from the analysis. Referring to ONC documentation,¹³ the authors reviewed classes to identify those relevant to HHC and TOC patient information. Excluded USCDI classes were: Provenance, Implantable Device Identifier, and Patient Demographics. The retained USCDI classes were 14 structured classes, all in the clinical domain, including Medications List, Problems, Procedures, (Patient) Goals, and Care Team Member.

The authors independently extracted topics (TOC) and classes present on the 485 form and used an Excel spreadsheet (Microsoft Corporation, Redmond, WA) for organization. The authors compared their extractions and resolved differences. They decided to avoid redundant mapping due to overlapping TOC topics by mapping 485 data to the more closely mapped TOC topic. Drawing on the physician author's clinical expertise and working collaboratively, the authors categorized the extracted topics and classes from each source into domains present on either source (i.e., clinical status, functional status, home safety) and classes within each domain (e.g., for clinical status: Medications List, Problems). For example, the domain clinical status included the following classes within the topic of medications from the designated sources: TOC- provide assessment and support for treatment adherence and medication management; 485- medications; USCDI- medications. The class/ element hierarchy is consistent with that of the USCDI. The authors also characterized each class from each source as structured or unstructured.

The authors, in partnership, identified topics and classes that mapped or did not map between the TOC and the 485. The working description of mapping was if a class was included fully or partially in a topic. An example of a partial mapping is that discharge information includes many classes. Therefore, instead of a single class, many classes (e.g., medication issues, fall risk, ADLs) provide information to the TOC topic, Obtain and Review Discharge Information. Each 485 class was reviewed for mapping to one or more TOC topic which shared the underlying concept. For example, the 485 class 'Medications List' mapped to the TOC topic Obtain and Review Discharge Information which infers inclusion of problems, medications, and allergies. The analysis produced a list of topics and classes, each characterized as mapped or unmapped, and tagged with data source (TOC, 485), domain, and structured/unstructured.

Working together, the authors mapped the listed topics and classes to the USCDI. The mapping indicated completeness of the data standard relative to the TOC information and the currently faxed HHC information. Incompleteness of the standard indicated areas for development of USCDI transitions of care interoperability recommendations.

Completeness of USCDI coverage of OASIS data mapped to the TOC

The OASIS contains 68 questions related to the admission. The authors eliminated 16 demographic and insurance questions, and 1 question lacking clinical relevance (inpatient discharge date). Retained were 51 patient health classes (questions) to assess the patient in domains including clinical status, functional status, home safety, and service needs.¹⁰ All OASIS data is structured. Most question responses are categorical, typically with 3-to-6-point scales. The 34 clinical status classes include Medication Issues, body systems (including emotional and behavioral), and Hospitalization Risk. The 13 functional status classes include ADL/IADL, and Self Management. The 2 home safety classes are Living Arrangements (regarding presence of other people) and Falls Risk. The 2 service needs classes focus on care management related to supervision needed for safety.

Together the authors compared the 485 and OASIS classes, retaining classes unique to OASIS (non-unique classes were mapped above). The examination of retained classes followed the data collection and analysis process described above to identify classes that mapped (fully or partially) and did not map between the TOC and OASIS. For example, the OASIS class Medication Issues did not appear on the 485 and mapped to the TOC topic Obtain and Review Discharge Information. Mapping to the USCDI indicated completeness of the USCDI relative to HHC OASIS data available and not communicated to primary care, suggesting areas for USCDI recommendation development.

Results

The comparison of TOC topics, 485 classes, and USCDI classes is shown in Table 1. Results of the comparison are described below.

Completeness of USCDI coverage of 485 data mapped to the TOC

Comparison of TOC topics and 485 classes indicated all 19 of the 485 classes mapped to 6 TOC topics, and 3 TOC topics were unmapped. Nine 485 classes mapped to multiple TOC topics, and 4 TOC topics had multiple 485 classes which mapped to them. The nine 485 classes that mapped to multiple TOC topics were: Goals/Rehabilitation

Potential/Discharge Plans, Medications List, Hospitalization Risk, Living Arrangements, Orders for Discipline and Treatments, Functional Limitations, Activities Permitted, DME and Supplies, and Safety Measures. The 4 TOC topics with multiple 485 classes were: Obtain and Review Discharge Information (all 485 classes); Establish or Reestablish Referrals for Specialized Care (3 classes); Educate the Patient and/or Caregiver to Support Self Management and ADL (5 classes); and Identify Available Community and Health Resources (3 classes). Two TOC topics each had a single 485 class which mapped to it: Review Need for Follow-up on Pending Testing or Treatment, and Provide Assessment and Support for Treatment Adherence and Medication Management. The 3 unmapped TOC topics were: Interact with Other Clinicians who will Assume or Resume Care of the Patient's System-specific Conditions, Assist in Scheduling Follow-up with Other Health Services, and Facilitate Access to Services Needed by the Patient and/or Caregivers.

Contrasting TOC topics and USCDI classes indicated all 14 USCDI classes mapped to 5 TOC topics, and 4 TOC topics were unmapped. Eight USCDI classes mapped to multiple TOC topics, and 3 TOC topics had multiple USCDI classes which mapped to them. The 8 USCDI classes that mapped to multiple TOC topics were: Clinical Notes, Medications List, Assessment and Plan of Treatment, Laboratory, Procedures, Diagnostic Imaging, Health Concerns, and (Patient) Goals. The 3 TOC topics with multiple USCDI classes were: Obtain and Review Discharge Information (all USCDI classes); Review Need for Follow-up on Pending Testing or Treatment (6 classes); and Establish or Reestablish Referrals for Specialized Care (6 classes). The two TOC topics with a single mapped USCDI class were: Provide Assessment and Support for Treatment Adherence and Medication Management; and Educate the Patient and/or Caregiver to Support Self-Management and ADL. The 4 unmapped TOC topics were: Interact with Other Clinicians who will Assume or Resume Care of the Patient's System-specific Conditions, and all the service needs topics: Identify Available Community and Health Resources, Facilitate Access to Services Needed by the Patient and/or Caregivers, and Assist in Scheduling Follow-up with Other Health Services.

Looking across the TOC, 485, and USCDI mappings, the single TOC topic to which the 485 classes mapped, but remained unmapped by USCDI classes, was Identify Available Community and Health Resources. While all the 485 classes mapped to the TOC, only 5 of 19 classes (26%) mapped to the USCDI. Four of these five 485 classes directly overlapped with the USCDI classes of Goals, Problems, Medications List, and Allergies. The 485 class Goals/Rehabilitation Potential/Discharge Plans provided additional data beyond the USCDI class Goals. Fourteen 485 classes did not map to the USCDI: 13 were structured and 1 was unstructured (Orders for Discipline and Treatments). The structured classes spanned the clinical (9), functional (4), and safety (1) domains. The unstructured class was in the clinical domain.

Completeness of USCDI coverage of OASIS data mapped to the TOC

Examination of the OASIS and the 485 indicated that of the 51 OASIS classes, 13 (25%) mapped to the 485. The mapped classes were distributed in the following domains: clinical (8), functional (4) and safety (1).

Comparison of TOC topics and the remaining 38 OASIS classes indicated all remaining OASIS classes mapped to 6 TOC topics, and 3 TOC topics were unmapped. Nineteen OASIS classes (50% of remaining classes) mapped to multiple TOC topics, and four TOC topics had multiple OASIS classes which mapped to them. Herein we refer to related OASIS codes classes groupings, e.g., the 5 medication related classes are referred to as Medication Issues. The number of OASIS classes related to a grouping is noted in parentheses. The 8 groupings of the 19 OASIS classes that mapped to multiple TOC topics were: History and Physical (1 OASIS class); Home Therapies (1 class); ADL/IADLs (9 classes); Falls Risk (1 class); Medication Issues (5 classes); Care Management (1 class); and Therapy Need (1 class). The 5 TOC topics with multiple OASIS classes were: Obtain and Review Discharge Information (all OASIS classes); Establish or Re-establish Referrals for Specialized Care (4 classes); Educate the Patient and/or Caregiver to Support Self Management and ADL (9 classes); Provide Assessment and Support for Treatment Adherence and Medication Management (6 classes); and Identify Available Community and Health Resources (4 classes). One TOC topic had a single OASIS class which mapped to it: Review Need for Follow-up on Pending Testing or Treatment. The 3 TOC topics that were unmapped in the 485 analysis remained unmapped in the OASIS analysis.

Looking at the possible data flow of OASIS classes to the TOC through the USCDI indicated two findings. Of the 38 OASIS classes not on the 485, two (5%, i.e., History & Physical, Height & Weight) mapped to USCDI classes (i.e., Clinical Notes, Vital Signs). For example, the History & Physical class in OASIS is one component of the Clinical Notes class in the USCDI. In total, 42 OASIS classes (83% of all OASIS classes) did not map to USCDI. They spanned the clinical (29; 57% of all classes), functional (9; 18%), service needs (2; 4%) and safety (2; 4%) domains. All classes are structured.

Table 1. USCDI Coverage of the TOC and Home Health Care Data

| TOC Topic(s) | 485 Class | OASIS Group (Number of Classes) | USCDI Class |
|---|--|--|----------------------------------|
| Obtain and Review Discharge Information; Establish or Re-establish Referrals for Specialized Care; Educate the Patient and/or Caregiver to Support Self-Management and Activities of Daily Living | Goals/Rehabilitation Potential/Discharge Plans | Functional Abilities and Goals (4) | (Patient) Goals |
| Obtain and Review Discharge Information | Primary Diagnosis/ Other Diagnoses (2) | Primary Diagnosis (3) | Problems |
| Obtain and Review Discharge Information; Provide Assessment and Support for Treatment Adherence and Medication Management | Medications List | No Match | Medications List |
| Obtain and Review Discharge Information | Allergies | No Match | Allergies & Intolerances |
| Obtain and Review Discharge Information; Review Need for Follow-up on Pending Testing or Treatment; Establish or Re-establish Referrals for Specialized Care | No Match | History and Physical (1) | Clinical Notes |
| Obtain and Review Discharge Information | No Match | No Match | Immunizations |
| Obtain and Review Discharge Information | No Match | Height and Weight (1) | Vital Signs |
| Obtain and Review Discharge Information; Review Need for Follow-up on Pending Testing or Treatment; Establish or Re-establish Referrals for Specialized Care | No Match | No Match | Health Concerns |
| Obtain and Review Discharge Information; Review Need for Follow-up on Pending Testing or Treatment; Establish or Re-establish Referrals for Specialized Care | No Match | No Match | Assessment and Plan of Treatment |

| TOC Topic | 485 Class | OASIS Group (Number of Classes) | USCDI Class |
|--|-----------------------------------|--|--------------------|
| Obtain and Review Discharge Information; Review Need for Follow-up on Pending Testing or Treatment; Establish or Re-establish Referrals for Specialized Care | No Match | No Match | Laboratory |
| Obtain and Review Discharge Information; Review Need for Follow-up on Pending Testing or Treatment; Establish or Re-establish Referrals for Specialized Care | No Match | No Match | Procedures |
| Obtain and Review Discharge Information; Review Need for Follow-up on Pending Testing or Treatment; Establish or Re-establish Referrals for Specialized Care | No Match | No Match | Diagnostic Imaging |
| Obtain and Review Discharge Information | No Match | No Match | Care Team Members |
| Obtain and Review Discharge Information | No Match | No Match | Smoking Status |
| Obtain and Review Discharge Information; Establish or Re-establish Referrals for Specialized Care; Identify Available Community and Health Resources | Hospitalization risk | Hospitalization risk (1) | No Match |
| Obtain and Review Discharge Information; Establish or Re-establish Referrals for Specialized Care; Identify Available Community and Health Resources | Living Arrangements | Living Arrangements (1) | No Match |
| Obtain and Review Discharge Information | Neuro/Emotional/Behavioral Status | Neuro/Emotional/Behavioral Status (1) | No Match |
| Obtain and Review Discharge Information | When is patient confused | When is patient confused (1) | No Match |
| Obtain and Review Discharge Information | When is patient anxious | When is patient anxious (1) | No Match |

| TOC Topic | 485 Class | OASIS Group (Number of Classes) | USCDI Class |
|--|---|---|--------------------|
| Obtain and Review Discharge Information | Cognitive, Behavioral, and Psychiatric Symptoms | Cognitive, Behavioral, and Psychiatric Symptoms (1) | No Match |
| Obtain and Review Discharge Information; Review Need for Follow-up on Pending Testing or Treatment | Orders for Discipline and Treatments | No Match | No Match |
| Obtain and Review Discharge Information | Prognosis | No Match | No Match |
| Obtain and Review Discharge Information | Mental Statuses | No Match | No Match |
| Obtain and Review Discharge Information | Nutritional Requirements | No Match | No Match |
| Obtain and Review Discharge Information; Educate the Patient and/or Caregiver to Support Self-Management and Activities of Daily Living | Functional Limitations | No Match | No Match |
| Obtain and Review Discharge Information; Educate the Patient and/or Caregiver to Support Self-Management and Activities of Daily Living | Activities Permitted | No Match | No Match |
| Obtain and Review Discharge Information; Educate the Patient and/or Caregiver to Support Self-Management and Activities of Daily Living | Durable Medical Equipment (DME) and Supplies | No Match | No Match |
| Obtain and Review Discharge Information; Educate the Patient and/or Caregiver to Support Self-Management and Activities of Daily Living; Identify Available Community and Health Resources | Safety Measures | No Match | No Match |
| Obtain and Review Discharge Information; Provide Assessment and Support for Treatment Adherence and Medication Management | No Match | Home Therapies (1) | No Match |
| Obtain and Review Discharge Information | No Match | Sensory Status, Pain Impact on Activity (2) | No Match |

| TOC Topic | 485 Class | OASIS Group (Number of Classes) | USCDI Class |
|--|------------------|--|--------------------|
| Obtain and Review Discharge Information | No Match | Integumentary Status- ulcers (9) | No Match |
| Obtain and Review Discharge Information | No Match | Respiratory Status (1) | No Match |
| Obtain and Review Discharge Information | No Match | Elimination Status (4) | No Match |
| Obtain and Review Discharge Information | No Match | Depression Screening (1) | No Match |
| Obtain and Review Discharge Information | No Match | Disruptive Behavior (1) | No Match |
| Obtain and Review Discharge Information; Educate the Patient and/or Caregiver to Support Self Management and Activities of Daily Living | No Match | ADL/IADLs (9) | No Match |
| Obtain and Review Discharge Information; Establish or Re-establish Referrals for Specialized Care; Identify Available Community and Health Resources | No Match | Falls Risk (1) | No Match |
| Obtain and Review Discharge Information; Provide Assessment and Support for Treatment Adherence and Medication Management | No Match | Medication Issues (5) | No Match |
| Obtain and Review Discharge Information; Establish or Re-establish Referrals for Specialized Care; Identify Available Community and Health Resources | No Match | Care Management (1) | No Match |
| Obtain and Review Discharge Information; Establish or Re-establish Referrals for Specialized Care; Identify Available Community and Health Resources | No Match | Therapy Need (1) | No Match |

Discussion

We examined transitions of care patient data needed in patient-centered primary care (TOC), available in home health care (OASIS) and communicated from HHC to primary care (485) to assess the completeness of the transitions of care

data standard (USCDI). This analysis is operationally relevant: Conducting the TOC evaluation within the first two weeks of the HHC patient's hospital discharge is a CMS requirement associated with reduced re-hospitalizations.⁸

Findings indicate a deficit in the information needed for decision-making during the TOC visit. Data faxed from HHC did not map to three of the nine TOC topics. Furthermore, HHC data is unlikely to be available in the primary care TOC visit workflow. HHC information is not communicated electronically as structured data and can be sent days before and even after the TOC visit.

Our analysis also suggests a paucity of structured HHC patient data – likely to be informative to the primary care team – is currently communicated to primary care. **Thirty-eight** OASIS classes not currently faxed to primary care mapped to TOC topics. This result suggests the prescribed data flow from HHC to primary care (i.e., 485) could be enhanced with important information on topics including living arrangements, falls risk, and medication issues such as self-administration capability. In addition, OASIS has categorical assessment measures which could provide rich information for the primary care team, for example, types and degree of functional limitations. Future research would investigate whether communication of additional structured OASIS data for the TOC would be perceived as useful by the primary care team.

The finding that not all information on the TOC mapped to OASIS (e.g., Medications List) indicates OASIS data was a necessary but not sufficient data source for the TOC. This mismatch suggests an opportunity for future research in other standardized data sources which could provide structured data to the TOC.

The overlap of TOC and HHC patient information reveals opportunities for data sharing, especially in this era of value-based care. Furthermore, promoting interoperability is an aspect of CMS's Value-Based Care program.¹⁴ Comparison of the transitions of care interoperability standard (USCDI) with TOC and HHC patient data indicates the USCDI is incomplete in regards to inclusion of HHC information.

The standard maps either fully or partially to a minority (26%) of HHC classes faxed to primary care. We recommend the USCDI be expanded to include all structured HHC data currently faxed to primary care. Accordingly, we suggest the USCDI, which specifies the Goals class as patient goals, include a class for clinician goals to align with the TOC and 485. We also propose that HHC agencies use the USCDI to electronically transmit data which is currently faxed. However, a barrier to HHC and primary care interoperability is that USCDI use is premised on Health Information Exchanges (HIE) participation, which is hampered by HHC technical and financial resource constraints.

The USCDI mapped either fully or partially to only 5% of HHC classes captured in the OASIS and not faxed to primary care. Further studies are needed to understand the importance to primary care clinicians of HHC data that mapped to the TOC yet not currently contained in the USCDI. The importance of the HHC data may include informing about timely access to additional services, identification of additional resources that may aid in the care of the patient, or additional accommodations that may be needed given the current mental state of the individual. We recommend USCDI expansion to incorporate structured OASIS data not currently faxed and perceived as important by primary care.

Ingesting HHC information into primary care EHRs as standardized, structured data could enable presentation of the information in the TOC at the right time and allow application of data management tools thereby supporting clinician decision-making. Improved transition of care data interoperability could benefit patients in addressing their individual needs with this patient-centered approach, while benefiting health care organizations financially as they apply these approaches to mitigate hospitalizations and hospital readmissions. Improved transmission from HHC to primary care would enable data analytics: decision support, machine learning, and predictive modeling. These capabilities would support development of additional insights, further informing the data capture process, the interpretations generated from the system, and their subsequent presentation to the clinical care team in addressing patient outcomes. Future research is warranted to assess the feasibility of this recommendation, and the impact on primary care workflow and patient outcomes.

This study has limitations related to the information sources. The TOC guidance used in this analysis contained information topics which tend to be broader than data elements, requiring interpretation by the authors. Future work would incorporate in the analysis TOCs from diverse settings to improve specificity of TOC data elements. Similarly, the USCDI Version 2 contains data elements which are open to author interpretation. For example, Assessment and Plan of Treatment does not specify which discipline is the focus, a consideration as physician information content differs from that of nurses. Also, the 485 analysis was limited to structured HHC data and excluded narrative data. It is possible that the excluded text data could contain information needed for the TOC, as EHRs in HHC contain information in addition to that captured in the OASIS.^{15,16}

We illustrate the gaps in communication that can be addressed through interoperability. Current approaches in data analytics have been applied towards calculating hospital risk for individual patients. By incorporating this information into the primary care EHR, additional insights can be developed, further informing the data capture process, the interpretations generated from the system, and its subsequent presentation to the clinical care team in addressing patient outcomes.

Conclusions

The national move towards value-based care with hospitalizations and readmissions as key quality and cost drivers underscores the importance of interoperability along transitions in care. The important primary care TOC visit during the transition from hospital to home has information deficits despite the rich structured patient data collected in home health care. Implementation of USCDI between HHC and primary care could bridge the information silos. Study findings indicate that addressing the inadequate USCDI coverage of HHC data is warranted.

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