Concordance of Electronic Health Record (EHR) Data Describing Delirium at a VA Hospital

Joshua Spuhl[1,2], Kristina Doing-Harris, PhD[1,2], Scott Nelson, PharmD[1,2], Nicolette Estrada, RN, PhD[1], Guilherme Del Fiol, MD, PhD[1,2], Charlene Weir, RN, PhD[1,2]
George E. Wahlen VA Medical Center, Salt Lake City UT
University of Utah, Department of Biomedical Informatics, Salt Lake City UT

Abstract

BACKGROUND: Delirium is a common syndrome in elderly hospitalized patients that is correlated with poor outcomes and higher costs yet health care teams often overlook its diagnosis and treatment. Poor data quality in EHR systems can be contributing to this as a common tool teams use to communicate and record data about their patients.
METHODS: Data were gathered from 30 patients chosen randomly that spanned various data domains in the EHR. These were analyzed for concordance as an indicator of data quality.
RESULTS: Concordance was high between the physician and nursing narrative documentation. The other domains of data were drastically less concordant.
DISCUSSION: The low concordance between structured and narrative data domains suggests that clinicians are forgoing the features available in modern EHR systems and opting to work in narrative. For informatics, this can be troubling as narrative data are difficult to compute.

Background

Delirium is a transitory syndrome that is characterized by a sudden and temporary change in mental status exhibiting a deficiency in cognition or attention. Individuals with this syndrome can have symptoms such as distracted attention or difficulty holding conversations. Highly prevalent in hospitalized patients, especially in those over age 65 [1], delirium has been shown to correlate with increased hospital length of stay, increased mortality at discharge and at 12 months, reduced independence, and greater risk of institutionalization [1-4]. Delirium is a significant burden for nursing staff, as sitters or increased monitoring is often required to care for the patient [5]. All of these effects lead to higher costs of care and poorer outcomes [6], making prevention, mitigation and treatment a high priority. Risk factors of delirium include medications, acute disease, location (e.g. intensive care units), age over 65, and comorbidities [6].

The transitory nature of delirium makes it difficult to diagnose and treat, as the affected individual may not display symptoms during any particular evaluation by a health care provider. Over 50% of delirium may go undetected [7] and 50% of patients are discharged home with delirium [2]. Difficulties in detection make a definitive diagnosis of delirium difficult to ascertain. Therefore, the diagnosis of delirium is largely a subjective process that varies depending on the experience of the health care provider working with the individual [7]. Many objective tools exist that can assist with diagnosis, such as the Confusion Assessment Method (CAM), and can consistently evaluate and score a subject's level of delirium [8]; however, these tools are not typically utilized unless initial signs and symptoms of delirium are already detected [9]. Specialized teams of mental health experts can also be engaged to improve the diagnosis of the presence of delirium and to explore mechanisms for treatment. However, these consults must be ordered which again relies on initial detection of symptoms. These factors, coupled with delirium's inconsistent presentation, make routine identification and diagnosis poor and unreliable. Awareness of the risk factors and symptoms must be present at all times by all members of the health care team to detect any subtle signs of its presence. Medications and infection are the two most common cause of delirium. Early detection would significantly decrease patient harm for both situations. Furthermore, once symptoms are identified they must be communicated to the entire team so appropriate prevention and mitigation can be enacted. Without this constant awareness and communication, the immediate risk of an adverse event due to delirium is increased significantly [10].

Communication within the health care team regarding delirium remains poor [10]. Many different forms of communication exist through which team members can convey suspicion or progression of delirium. While some of the communication occurs face-to-face, facilities that utilize electronic health records (EHRs) can capture some communication electronically and make it available to the entire team. The EHR becomes a comprehensive record

of the patient's status and progress. Health care team members utilize the EHR to stay current with their patients. Ultimately, the EHR is a tool for communication for the individual clinician, team and institutional level stewardship

Previous studies show that documentation quality within an EHR is generally poor. Data are often recorded inconsistently or not read by other team members [11, 12]. The result is that clinicians must expend considerable energy and cognitive effort in looking for inconsistent information, validating the information and ensuring accuracy [13]. Currently no tools exist that display the degree to which recorded information is inconsistent, a valuable tool to support decision-making for clinicians. In the case of delirium, its transitory nature coupled with it being a change in mental status (making determination of baseline data a key piece of information), as opposed to physical ailment, lead to vagueness and uncertainty regarding the quality of mental health data. As a result, it is commonly undiagnosed and untreated. Given the difficulty of identifying delirium and the deficiency of quality in EHR documentation, it is not surprising that delirium is grossly undertreated.

Data concordance plays a major role in documentation quality [14]. We conducted this study to determine the concordance of data on delirium as an indicator of document quality within the Veterans Affairs (VA) EHR system. We compiled data from International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) codes, problem lists, physician and nursing narrative notes, physician orders, and CAM assessments.. By examining the concordance of data on delirium we can inform health care team members about discrepancies. This information may motivate them to improve the quality of the data in the EHR.

Methods

We used a cohort study design to determine the degree of concordance within EHR data. A cohort of 30 patients were randomly chosen out of 528 patients admitted to the two medical units at the VA Medical Center in Salt Lake City, Utah. The cohort consisted of patients who were over the age of 65 (a risk factor for delirium), and an inpatient stays that occurred during the 2013 calendar year. We chose a single, whole, contiguous year to eliminate the possibility of temporal confounding. Finally, patients included were from the Acute Medicine and Telemetry units as these are the main medical units at this facility. We specifically excluded ICU, psychiatry and surgery for this pilot work in order to identify data collection practices on these vulnerable units.

For the 30 randomly selected patients in the cohort, we performed retrospective chart reviews for their most recent inpatient stay. These reviews gathered data from EHR domains including the following: ICD-9-CM diagnosis codes (Table 1 lists the codes used), problem list entries, physician orders, physician and nursing narrative notes, CAM assessments, and mental status assessments. To determine the presence of delirium in diagnosis codes we relied on the set of terms derived from Hope et al. [15], who performed a similar enumeration (but did not randomly select patients). As in this study, orders for restraints and sitters and CAM assessments were included. In addition, we included medication review that was not done in their study. Finally, physician and nursing narrative notes were included since they are predominantly used to collect the status and progress of the patient throughout their stay as well as the thought processes of the health care team.

Once the data were gathered, the narrative note reviews were analyzed for inter-rater reliability to ensure consistent evaluation. We then performed an analysis of heterogeneity between the different data domains. The data were categorized on each patient for each domain with a binary evaluation: evidence of delirium exists or not.

Table 1. ICD-9-CM Codes Considered Evidence of Delirium

Code	Description
290.3	Senile dementia with delirium
291	Alcohol-induced mental disorders
291.0	Alcohol withdrawal delirium
292	Drug-induced mental disorders
292.81	Drug-induced delirium
293	Transient mental disorders due to conditions classified elsewhere
293.1	Subacute delirium
780.09	Other alteration of consciousness

Results

Overall, a total of 10 patients had some reference to delirium in their medical record. Of those 10, 9 had agreement between the narrative notes of nurses and physicians. Within those 9, 3 had ICD9 codes representing delirium and 1 had a problem list entry (it was not one of the patients identified in the ICD9 codes). Table 2 presents the distribution of positive findings.

Table 2. Occurrence of delirium

Source	Cases Identified	Notes Reviewed	Distinct Terms
MD Notes	9	178	15
RN Notes	9	298	14
ICD-9-CM Codes	3		
Problem List Entries	1		
Orders	0		

To test concordance an overall Kappa was computed across all sources using presence/absence as the categories and the sources as the "judges". The Kappa was moderately low, despite a baseline prevalence of about 35%. (Kappa= 0.33). Specific contrasts were done to assess the degree of association between nurses and physicians (82% agreement or Kappa = 0.83) and between ICD9 codes and ANY narrative note (27% agreement and Kappa = 0.36) and between ICD9 and the problem list (Kappa= 0.47). Statistical inference was limited due to small sample size.

Patients in the cohort took an average of 15 (range = 0 to 33) unique medications as outpatients the year prior to their hospitalization. While inpatient, the average number of unique medications remained the same at 15 medications per patient during their stay. The number of unique medications did not correlate with the presence or absence of delirium symptoms in our cohort OR the presence of an ICD-9-CM diagnosis code for delirium. Two patients in the cohort (20% of patients with delirium) received pharmacological treatment with an antipsychotic (haloperidol) to help manage symptoms of delirium/agitation, one with an ICD-9_CM code for delirium and the other without. Both patients had documentation of delirium in the narrative text.

Further assessment of the narrative text (495 progress notes) revealed significant variation in how the different roles used narrative text to document delirium. Nurses almost uniformly used somewhat structured terms, such as oriented times 3 or 4. In contrast, the terms that physicians were used were more collogue and informal. Table 3 lists most of the terms used by the different roles in their text.

Table 3. Terms and references used by different roles in narrative text

MD Terms	RN Terms
changes in mental status	*AAO to self*
confused...delirium	*alert and confused*
delirium in the setting	*confused on lortab*
delirium not worse...yesterday	*disoriented*
fluctuating orientation	*combative*
increasing cognitive impairment	*mittens/agitation*
mild cognitive impairment	*cognitively impaired*
muttering...does not respond to qt.	*showing confusion*
not oriented	*sitter*
seem to be experiencing delirium	*talking to his 1:1 [sitter]*
AAOx1	*cognitive impairment*
aggressive	*aox1*
weird answers	*CAM-ICU Positive*
dementia/tremors/Parkinson's	*sundowner*
hx delirium/delirium precautions	

Discussion

The results show there is a high degree of concordance regarding the presence/absence of delirium within the clinical narrative documentation but little outside of that domain. Differences were found in the nature of the

narrative. In contrast, ICD9 codes only represented a little less than a third of those documented in text and did not particularly correlate with physician notes, orders (there were no orders in this set) or medications. All of the documents for the reviewed patients had minor variability in regards to frequency and agreement of mental status evaluations.

The consistent evaluation and recording of mental health status, especially for nurses., in the narrative notes may have been facilitated by the regular use of note templates within VA hospitals. These templates include a section for mental health evaluation. Thus nearly all physician and nurse narrative documents reviewed noted the mental health status of the patient. The only exceptions to this rule were notes documenting a non-routine event such as helping a patient to the bathroom. The ubiquity of mental status evaluations led to the detection of acute episodes of delirium in these narrative notes. The substantial literature attesting to the neglect of delirium detection and treatment made this a welcome finding. The result shows that the VA making a concerted effort to keep mental health status at the forefront of their care model. It also demonstrates that the most concordant and, hence, reliable information is still locked away in narrative notes. This information can only be programmatically utilized through complicated natural language processing (NLP) technologies. Ultimately, we can interpret this concordance as an indicator of high quality narrative documentation at the VA by the nurses.

Discrete and coded data, were almost completely deficient in representing any changes to the patient's mental status. Interestingly these are data most likely to be used for computerized decision support (CDS). Orders for the pharmacological management of delirium did not correspond to the number of patients with documentation of delirium. Medications typically associated with delirium adverse events did not seem to correlate with the presence or absence of delirium either however. However, the study was under powered to detect such a difference. Additionally, only a small percentage of case records were found to have delirium indicated in either the billing ICD-9-CM codes or the active problem list. Other studies, such as Inouye et al., had comparable results. They found ICD-9-CM codes had a sensitivity of 3% and specificity of about 99% [16]. These findings mean that where delirium was coded the code was accurate, but that up to 93% of delirium cases were missed. Typically ICD-9-CM coding is done after the patient has been discharged as a way to enumerate the diagnoses that were treated during the inpatient episode. At non-VA institutions these codes are required to justify charges. However, clinical personnel do not assign ICD-9-CM codes. They are determined by trained coders, who scan the documentation looking for diagnoses. Since Delirium does not often appear on problem lists, the evidence we detected in the narrative notes was related to the recording of mental health status checks. Coders are by law prohibited from generating diagnoses not listed explicitly in the record. Therefore, they may not read them in the level of detail required to find the necessary evidence to contact a physician to inquire whether a patient had delirium. In this case, using concordance as an indicator, the quality of ICD-9-CM codes are poor, leading one to doubt the validity of knowledge, research or otherwise, gained from them.

The lack of delirium being recorded in the problem list is intriguing but not uncommon [17]. Problem lists are a common component in modern EHR systems. They are meant to facilitate a shared mental model of the issues surrounding a patient. The lack of recording suggests that they are seldom used at the VA for delirium. This is unfortunate as there is evidence that shows consistent problem list use improves care [18]. As many CDS systems utilize coded data in problem lists, a lack of accurate information could lend to more harm than good being done for the patient. Government initiatives such as Meaningful Use seek to mandate the use of problem lists. Overall, without a change in the integration of problem lists are integrated into routine patient care they will most likely continue to provide minimal usefulness to the health care team and informatics in general.

There are a few limitations in this study worth noting. The first is that the data analyzed were limited to a single VA hospital and the results may not be generalizable to other hospitals. The methodology with which this VA hospital cares for and document its patients could be unique. We were limited by a small sample size due to the time and expense required to manually review narrative notes. The time and effort limitation reinforces the need for reliable discrete data. Finally, this study focused on delirium, it cannot be assumed that the same pattern occurs for any other diagnoses. Future studies could broaden the scope of this study to determine if similar patterns exist in other health care facilities as well as with other diseases and diagnoses.

Conclusion

This study demonstrates that the highest quality data are those that are the hardest to obtain. Moreover, it reaffirms the clinician's preference for narrative in recording patient information. For initiatives involving CDS, research, or other data dependent ventures the implications of this research are that accessing the information within narrative notes will be vitally important.

The data pertaining to delirium in the VA EHR system have very little concordance between the narrative documents and the discrete coded data, while the narrative domains alone demonstrate a high degree of concordance, but a substantial degree of 'fuzziness". The EHR as a tool to facilitate communication and collaboration between health care team members has not been embraced and continues to function as merely a document repository. This challenges the utility of feature-rich systems compared to the cost to implement and maintain them as well as restates the clinicians' preference for narrative-based information exchange.

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