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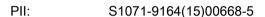Smith, Tyler C

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Using administrative mental health indicators in heart failure outcomes research; a comparison of clinical records and ICD-9 coding

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Title Page

Using administrative mental health indicators in heart failure outcomes research; a comparison of clinical records and ICD-9 coding.

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TITLE: Using administrative mental health indicators in heart failure outcomes research; a comparison of clinical records and ICD-9 coding.

ABSTRACT

Background: Use of mental indication in health outcomes research is of growing interest to researchers. This study, as part of a larger research program, quantified agreement between administrative ICD-9 coding for, and 'gold standard' clinician documentation of, mental health issues (MHI) in hospitalized heart failure (HF) patients to determine the validity of mental health administrative data for use in HF outcomes research.

Methods: A 13% random sample (n=504) was selected from all unique patients (n=3769) hospitalized with a primary HF diagnosis at four San Diego County community hospitals between 2009-2012. MHI was defined as ICD-9 discharge diagnostic coding between 290-319. Records were audited for clinician documentation of MHI.

Results: 43% (n=216) had mental health clinician documentation; 33% (n=164) had ICD-9 coding for MHI. ICD-9 code bundle 290-319 had 0.70 sensitivity, 0.97 specificity, and a Kappa of 0.69 (CI: 0.61-0.79). More specific ICD-9 MHI code bundles had Kappas ranging from 0.44 to 0.82 and sensitivities between 42-82%.

Conclusion: Agreement between ICD-9 coding and clinician documentation for a broadly defined MHI is substantial, and can validly 'rule in' MHI for hospitalized heart failure patients. More specific MHI code bundles had fair to almost-perfect agreement, with a wide range of sensitivities for identifying patients with a MHI.

Keywords

BACKGROUND AND OBJECTIVE

Outcomes research is increasingly becoming an important source of information about modifiable risk factors that influence health outcomes for heart failure patients. Research has shown that mental health issues are common among heart failure patients, (1-6) and a host of prospective (3,7-10) and observational outcome (11-14) studies have associated mental health issues with increased morbidity, mortality and risk for readmission. Many heart failure outcomes studies measure mental health status using diagnoses and procedure (ICD-9) codes 290-319 (11,15,16). However, ICD-9 data are created for billing purposes and have a potential for selection bias, such as trend towards higher-paying diagnoses (17) and inaccuracies related to the procedure for creating the coding structure. (18).

To date there are no studies that have validated the accuracy of ICD-9 codes 290-319 as a measure of mental health status for use in heart failure health outcomes research. The purpose of this study was to evaluate the agreement between ICD-9 codes for mental health issues and clinician documentation for hospitalized heart failure patients. The findings have implications for model building and inferences made in studies utilizing these data.

METHODS

This retrospective cohort study was conducted as part of a larger health outcomes study examining predictors of readmission for hospitalized heart failure patients. The larger study includes heart failure patients admitted to any of four general hospitals aligned with Sharp HealthCare, a not-for-profit integrated community health system based in San Diego, California that serves more than 27% of the county's 3 million-plus residents each year. The index heart failure admission for the larger study occurred between January

2009 and December 2012, and was defined as the first Sharp hospitalization with any CMS-determined heart failure ICD-9 code in the first discharge diagnosis position. Mental health issues were defined as ICD-9 codes 290-319 in any discharge diagnosis position from 1-30, as this definition is frequently used in outcomes research focused on heart failure patients. (11,15,16) Total sample size for the larger study was 3769 unique HF patients. Based on a common rule for sample size calculation (19) this study used an Excel Macro to randomly select 13% of patients with and without an ICD-9 coded mental health issue, stratified by hospital and study time frame, resulting in a final sample size of 504 patients.

Classification of ICD-9 mental health codes

Patient mental health ICD-9 codes (290-319) were refined into seven different categories based on review of the literature and consensus among investigators: drug/alcohol use; depression; dementia; tobacco use; anxiety; major disorder; and other. All ICD-9 codes were then transformed for each patient by creating a separate column for each category in the dataset and placing a 0=no or 1=yes in each column's cell for each patient. This ensured patients were appropriately coded for more than one mental health category if applicable, for example depression and alcohol/drug use.

Audit of clinical records

The principal investigator and three nursing students audited the patient records. The audit was conducted in a systematic way using methods aligned with the literature on effective and rigorous chart review. (20) Once all patient data were extracted, the reviewers and investigators (one with an extensive history of epidemiologic research focused on mental health issues) collectively examined the data and agreed on texts describing a mental health issue. All included texts were then transformed into the

appropriate mental health categories previously defined: patients could be listed as having more than one category if the documentation warranted.

Analysis

Cohen's Kappa (21) was calculated to determine the agreement between ICD-9 coding and clinical documentation (the gold standard) for mental health issue beyond that expected by chance. We also calculated the sensitivity (proportion of patients with a clinician documented mental health issue that also had ICD-9 coding for a mental health issue), specificity (proportion of patients without a clinician documented mental health issue that also did not have ICD-9 coding), positive predictive values (proportion of patients with ICD-9 coding for mental health issues who also had clinician documentation), and negative predictive values (proportion of patients without ICD-9 coding for a mental health issue who actually had clinician documentation) for all mental health categories using the ICD-9 and audit data.

RESULTS

Table 1 shows the demographic characteristics for the total Sharp index hospitalization population and this study's sample. There was no significant difference between the study sample and the population in any demographic characteristics. Two hundred sixteen (43%) audit patients had a documented general mental health issue recorded in the clinical record. One hundred sixty four (33%) audit patients had one or more ICD-9 code(s) for mental health issue extracted, which aligns with the total heart failure index admission population (n=1285, 34%). See Table 2 for details of the analyses comparing audit and ICD-9 data of mental health issues as a general classification and for each category.

Cohen's Kappa for mental health issue as a general classification was 0.69 (CI: 0.62 - 0.75). This is interpreted as substantial agreement between clinician documentation and ICD-9 coding for a general mental health issue. (22) Positive predictive value was 0.95, negative predictive value was 0.80, and sensitivity was 0.70. Cohen's Kappa for specific categories ranged from 0.30 (CI: -0.15 – 0.75) for 'other', to 0.82 (0.73 – 0.91) for dementia. The Major Disorder specific mental health category showed the highest sensitivity (.82), while Depression (.43) and Other (.40) showed the lowest sensitivity (see Table 2).

DISCUSSION

It is increasingly recognized that mental health issues are associated with (a) incidence of heart failure (2,12) and (b) poorer patient outcomes such as increased physical decline, hospitalization and mortality. (3,7-11,13,14,23) It is therefore important to account for mental health issues in research focusing on heart failure patients. Administrative data is frequently used in outcomes research to determine the influence of patient factors and/or care delivery processes on important care outcomes such as comorbidity, readmission and mortality. However, it must be understood that administrative data is collected for billing purposes and may be flawed in terms of clinical precision and reliability, which in turn can significantly affect internal and external validity of research using such data. (24)

This study determined the validity of administrative ICD-9 coding data as a measure of mental health status for use in health outcomes research for hospitalized heart failure patients. The sample was a diverse community based population hospitalized specifically for an exacerbation of heart failure. We found substantial agreement between ICD-9 coding for a broad and very inclusive measure of mental health status and clinician documentation

(Kappa .69, sensitivity .70, specificity .95). This broad mental health measure, defined as any ICD-9 code between 290-319, is frequently used in outcomes research focused on heart failure patients (see for example 11,15,16), and includes ICD-9 codes for depression, anxiety, major disorders (such as schizophrenia and personality disorders), drug and alcohol abuse, dementia, and tobacco use. Analyses of these more specific mental health categories showed fair (other), moderate (depression, anxiety, drug/alcohol abuse) and substantial (major disorder, smoking) levels of agreement with clinician documentation (see Table 2), while dementia had almost perfect agreement (Kappa .82, sensitivity .76, specificity .99). The variation in agreement for the specific categories could be due to the relative rareness of these specific mental health issues and the potential for the Kappa calculation to not be as efficient in these types of analyses. That is, as the prevalence decreases, the maximum Kappa values achievable decreases. (25)

LIMITATIONS

The study sample was taken from the larger population of all patients hospitalized with heart failure patients in four hospitals based in an urban county representing a diverse ethnic and cultural demographic. It is recognized that the sample is relatively small and may not be generalizable to other heart failure populations across the country (for example VA heart failure patients). This study used audit of clinician documentation for mental health issue as the gold standard. While the audit methodology was rigorous and inclusive, no level of rigor can uncover what has not been documented. It is known that mental health issues are under-diagnosed and under-treated in cardiac populations, (14) therefore this study may underrepresent the true prevalence of mental health issues in this population.

CONCLUSION

The findings of this study suggest that use of a broad, inclusive measure of mental health issue, defined as patient having any ICD-9 code between 290-319, has substantial agreement, average sensitivity and excellent specificity to 'rule in' mental health issue for hospitalized heart failure patients. Specific mental health categories ranged from moderate to almost perfect agreement and varied widely in their sensitivity, or ability to identify mental health issues. Therefore, as noted in other validation studies, (26-29) specific mental health categories should be carefully considered before use in outcomes studies.

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Table 1. Demographics of Total Hospitalized Heart Failure Population and Study Sample

Demographic	Total population (N=3769)		Study sample (N=504)	
	Count/ Mean	Percent/ SD	Count/ Mean	Percent/ SD
F	1789	47.47	238	47.22
Age	73	15.11	73	15.34
LOS	5.35	7.1	5.46	6.33
Race				
Asian	316	8.38	47	9.33
Black	261	6.92	35	6.94
Other	1013	26.88	122	24.21
Pacific islands	39	1.03	9	1.79
Unknown	129	3.42	15	2.98
White	2011	53.36	276	54.76
Ethnicity				
Hispanic	826	21.92	105	20.83
Non Hispanic	2813	74.64	383	75.99
Unknown	130	3.45	16	3.17
Marital status				
Divorced	400	10.61	52	10.32
Married	1525	40.46	191	37.9
Single	620	16.45	84	16.67
Widowed	1121	29.74	159	31.55
Unknown/Other	103	2.73	18	3.57
Primary Diagnosis				
Heart Failure w/complications	1291	34.25	158	31.35
Heart Failure w/major complications	942	24.99	140	27.78
Heart Failure without complications	657	17.43	85	16.87
Other	879	23.32	121	24.01
3M APR-DRG* Severity of illness				
Mild	271	7.19	49	9.72
Moderate	1431	37.97	178	35.32
Major	1679	44.55	225	44.64
Severe	388	10.29	52	10.32
3M APR-DRG* Risk for mortality				
Mild	414	10.98	52	10.31
Moderate	1752	46.48	228	45.24
Major	1207	32.02	172	34.13
Severe	396	10.51	52	10.32
Hospital				

	1	1079	28.63	91	18.06
	2	1913	50.76	329	65.28
	3	78	2.07	8	1.59
	4	699	18.55	76	15.08
Payor					
Commercial		3	0.08	1	0.2
Contract		412	10.94	53	10.52
County medical services		126	3.34	17	3.37
Medi-Cal		500	13.27	61	12.1
Medicare		2602	69.07	362	71.83
Self pay		124	3.29	10	1.98
Comorbidities					
Mental health issue		1285	34.09	164	32.54
MI		118	3.13	18	3.57
PVD		521	13.82	54	10.71
CVD		232	6.16	33	6.55
Dementia		45	1.19	9	1.79
COPD		1545	40.99	198	39.29
Connective tissue disease		87	2.31	15	2.98
Peptic ulcer disease		28	0.74	5	0.99
Mild liver disease		167	0.04	19	0.04
Diabetes		1632	0.43	222	0.44
Paraplegia		17	0.45	1	0.2
Renal disease		1477	39.19	210	41.67
Cancer		203	0.05	26	0.05

* All Patient Refined Diagnostic Related Group

Primary diagnosis defined via ICD-9 coding.

Mental health issue defined as ICD-9 codes 290-319. Other comorbidities defined as per Charlson Index

Table 2. Agreement between audit and ICD-9 data for mental health issues

	Audit Count (%)		ICD-9 Count (%)		Kappa	Kappa CI	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
Mental health issue overall	216	(43)	164	(33)	0.69	0.62 - 0.75	0.70	0.97	0.95	0.80
Depression/anxiety/major disorder	95	(19)	80	(16)	0.58	0.48 – 0.69	0.60	0.95	0.70	0.92
Depression	58	(12)	41	(8)	0.45	0.31 – 0.60	0.43	0.96	0.61	0.93
Anxiety	26	(5)	21	(4)	0.44	0.23 – 0.66	0.42	0.98	0.52	0.97
Major disorder	11	(2)	18	(4)	0.61	0.38 – 0.84	0.82	0.98	0.50	1.00
Smoking	50	(10)	51	(10)	0.66	0.54 – 0.78	0.70	0.96	0.69	0.97
Drug/alcohol abuse	43	(9)	29	(6)	0.51	0.34 – 0.67	0.47	0.98	0.66	0.95
Dementia	54	(11)	44	(9)	0.82	0.73 – 0.91	0.76	0.99	0.93	0.97
Other	5	(1)	8	(2)	0.30	-0.15 -0.75	0.40	0.99	0.25	0.99

Highlights

- Outcomes research uses ICD-9 codes to capture mental health issues
- This study compared ICD-9 codes to "gold standard" clinician documentation
- There was substantial agreement with clinical documentation
- ICD-9 codes can validly identify mental health issues in heart failure patients