Administrative data have high variation in validity for recording heart failure

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BACKGROUND: Many studies have relied on administrative data to identify patients with heart failure (HF).

OBJECTIVE: To systematically review studies that assessed the validity of administrative data for recording HF.

METHODS: English peer-reviewed articles (1990 to 2008) validating *International Classification of Diseases* (ICD)-8, -9 and -10 codes from administrative data were included. An expert panel determined which ICD codes should be included to define HF. Frequencies of ICD codes for HF were calculated using up to the 16 diagnostic coding fields available in the Canadian hospital discharge abstract during fiscal years 2000/2001 and 2005/2006.

RESULTS: Between 1992 and 2008, more than 70 different ICD codes for defining HF were used in 25 published studies. Twenty-one studies validated hospital discharge abstract data; three studies validated physician claims and two studies validated ambulatory care data. Eighteen studies reported sensitivity (range 29% to 89%). Specificity and negative predictive value were greater than 70% across 17 studies. Nineteen studies reported positive predictive values (range 12% to 100%). Ten studies reported kappa values (range 0.39 to 0.84).

For Canadian hospital discharge data, ICD-9 and -10 codes 428 and I50 identified HF in 5.50% and 4.80% of discharge records, respectively. Additional HF-related ICD-9 and -10 codes did not impact HF prevalence.

CONCLUSION: The ICD-9 and -10 codes 428 and I50 were the most commonly used to define HF in hospital discharge data. Validity of administrative data in recording HF varied across the studies and data sources that were assessed.

Key Words: Administrative data; Heart failure; Hospital discharge data; Validity

Heart failure (HF) has been widely studied because of its high mortality and morbidity rates (1-4). Studies on HF have relied on multiple data sources such as surveys, disease registries, hospital charts and administrative data. Of these sources, administrative data have been increasingly used for health services utilization and outcome evaluation.

Administrative data result from implementing health care delivery, enrolling members into health insurance plans and reimbursing health care providers for services (5). The types of administrative data depend on the health care system and the funding structure. For example, Canada has a nationally funded health care system that collects hospital discharge data at a national level, while insurance registry, physician services and emergency room visit information is collected at a provincial level. Although these data are not intended for research, they are widely used in surveillance and outcome studies. Therefore, the validity of the research results rely on the quality of the data. Data quality is critical for interpreting variation across studies from different geographical areas.

The purpose of the present study was to systematically review the literature pertaining to the validity of administrative data for recording

Une forte variation de la validité des données administratives pour documenter l'insuffisance cardiaque

HISTORIQUE : De nombreuses études se fient à des données administratives pour repérer les patients souffrant d'insuffisance cardiaque (IC).

OBJECTIF : Procéder à une analyse systématique des études qui ont évalué la validité des données administratives pour documenter l'IC.

MÉTHODOLOGIE : Des articles révisés par des pairs rédigés en anglais (1990 à 2008) validant les codes de données administratives de la *Classification internationale des maladies* (CIM)-8, 9 et 10 étaient inclus dans l'étude. Un comité d'experts a déterminé les codes du CIM qui devraient être inclus pour définir l'IC. La fréquence des codes du CIM pour l'IC était calculée au moyen de jusqu'à 16 champs de codage diagnostique inscrits dans les données canadiennes sur les congés des patients pendant les exercices financiers 2000-2001 et 2005-2006.

RÉSULTATS : Entre 1992 et 2008, plus de 70 codes de CIM différents pour définir l'IC ont été utilisés dans 25 études publiées. Vingt et une études ont validé les données canadiennes sur les congés des patients, trois études, les réclamations des médecins et deux études, les données sur les soins ambulatoires. Dix-huit études ont fait état de la sensibilité (plage de 29 % à 89 %). La spécificité et la valeur prédictive négative étaient supérieures à 70 % dans 17 études. Dix-neuf études ont indiqué une valeur prédictive positive (plage de 12 % à 100 %). Dix études ont précisé les valeurs kappa (plage de 0,39 à 0,84).

Pour ce qui est des données canadiennes sur les congés des patients, les codes 428 et I50 du CIM-9 et du CIM-10 ont permis de recenser une IC dans 5,50 % et 4,80 % des dossiers de congé, respectivement. Les autres codes liés à l'IC du CIM-9 et du CIM-10 n'avaient pas de répercussions sur la prévalence d'IC.

CONCLUSION : Les codes 428 et I50 du CIM-9 et du CIM-10 étaient les plus utilisés pour définir l'IC dans les données de congé hospitalier. La validité des données administratives pour documenter l'IC variait selon les études et les sources de données évaluées.

HF and apply the *International Classification of Diseases* (ICD) HF definitions to Canadian hospital discharge abstract data to explore the prevalence of HF across ICD code definitions.

METHODS

Literature review

Search strategy: Only English language articles that compared the validity of ICD codes in administrative databases (eg, physician claims data, hospital discharge) with a reference standard (eg, chart review, registry, survey, case notes) were included. The literature search focused on articles published from 1990 to 2008. To identify peer-reviewed journal articles, both the Ovid MEDLINE database and EMBASE were searched. Because validation studies were not indexed consistently with standard MeSH terms, the following key search terms were used: 'admin data', 'administrative data', 'population surveillance', 'heart failure', 'congestive heart failure', 'hospital data', 'physician claims', 'claims', 'hospital discharge', 'validation' and 'registries'. Next, Boolean operators were used to join search terms within the database search engines to locate articles. The reference lists from these articles were scanned to identify any additional articles that met

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the study criteria. Finally, using the articles identified, the authors were contacted by e-mail to identify any additional related articles. The articles selected from the citations and abstracts were reviewed by one investigator (SQ) to ensure they met the study criteria. When a decision could not be made regarding applicability, two other researchers (HQ and CB) were consulted to review the article for inclusion or exclusion. In cases for which it was unclear whether the publication used administrative data for validation, the article was excluded.

Data abstractions: Studies were abstracted to review measures of validity including sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV). When not reported, these measures were calculated using data within the article. For cases in which ICD codes were missing, an attempt was made to contact the corresponding authors for further details. Validity is an expression of the degree to which a parameter reflects what it is intended to measure (6). In validation studies, it is the ability of administrative databases to distinguish between diseased versus non-diseased. Sensitivity measures how well administrative data detect the presence of a disease for individuals who actually have the disease according to a reference standard, while specificity refers to how well the administrative data avoid the problem of falsely classifying individuals as diseased when they do not have the disease. Agreement was assessed by the kappa statistic, which was classified as poor (kappa less than 0.2), fair (kappa 0.2 to 0.39), moderate (kappa 0.4 to 0.59), good (kappa 0.60 to 0.79) and very good agreement (0.8 to 1.00) (7). In addition, the following descriptive data were abstracted from the studies: author, year of publication and data collection, study location, sample size, ICD version and codes, reference/'gold' standard and administrative data.

Application of HF ICD codes in Canadian hospital discharge data

The review showed great variation in ICD codes for HF definition. To ensure that all HF-related ICD codes were captured, four physicians independently reviewed a list of ICD-9-Clinical Modification and ICD-10 codes that were extracted from HF validation studies. These physicians have extensive experience with using administrative data to conduct cardiology research. For each diagnostic code, the physicians decided whether the code should be used to identify patients with HF in administrative data, responding with "yes", "no" or "unsure". Based on these responses, a list of ICD codes was analyzed in the Canadian national hospital Discharge Abstract Database for fiscal years 2000/2001 and 2005/2006 to determine whether inclusion of these codes would change the frequency of documented HF. The Discharge Abstract Database contains up to 16 diagnosis fields for ICD-9 data in 2000/2001 and 25 diagnosis fields for ICD-10 data in 2005/2006. The province of Quebec was excluded from the 2005/2006 data because the province was using the ICD-9 catalogue at that time. The frequency of discharge records for each diagnosis code was calculated. Descriptive statistical analyses were performed using SAS version 9.1 (SAS Institute Inc, USA).

RESULTS

Literature review

The literature search identified 2596 citations for review (Figure 1), with 47 citations related to the study objectives. Of 25 studies published between 1992 and 2008, nine were completed in Canada, 11 in the United States, and one each in Sweden, Portugal, the United Kingdom, Australia and Denmark. The sample size across the studies ranged from 126 to 58,816 patients (Table 1).

More than 70 ICD codes were used to define HF in the studies. Of these studies, 17 validated ICD-9 codes only, three validated ICD-10 codes only, one study examined ICD-8 codes, and four validated both ICD-9 and ICD-10 codes. Two studies (8,9) did not report the ICD codes used. ICD-8 and -9 code 428, and ICD-10 code I50 were commonly used across studies.

From 25 validation studies, 19 used the medical chart review as the reference standard (Table 2). The remaining six studies (10-15) relied

Figure 1) Flow diagram illustrating the selection of articles that were reviewed

on surveys, registries or recoded records. Methods for determining HF presence varied across studies, especially when chart review was used as the reference standard. Seven studies accepted HF diagnosis documented in the chart (12,16-21) and four studies used documented HF diagnosis or a combination of clinical judgement based on information in the chart (eg, test results, diagnostics) (22-25). Eight studies (15,25-31) ascertained HF presence based on diagnostic criteria used by scoring systems from Framingham, Carlson, Boston, the National Health and Nutrition Examination Survey (NHANES), the New York Heart Association (NYHA) or the European Society of Cardiology (ESC). Four studies (25-27,32) further classified HF according to levels of evidence such as definite or possible HF using the ESC or Boston criteria. Two studies compared the PPV against different clinical definitions of HF, and found that the PPV varied between criteria used (Lee et al [30], 94% Framingham versus 89% Carlson; McCullough et al [31], 56% NHANES versus 64% Framingham versus 83% NYHA).

Twenty-one studies validated hospital discharge data, three studies (9,14,21) examined physician claims data and two studies (8,21) examined ambulatory care data. One study (14) linked multiple administrative data sources (facility, physician claims and pharmacy).

Six studies (10,12,21,25,30,31) defined HF using the principal diagnosis or main diagnosis, or most responsible diagnosis only. Four studies (13,16,27,11) examined the difference between using the principal or major diagnosis versus secondary diagnoses. Information about the number of diagnosis fields or position of diagnosis in the coding field was not reported in the remaining studies.

Eighteen studies reported sensitivity values ranging from 29% to 89%, and PPV ranging from 12% to 100%. Specificity was higher than 70% across 14 studies and NPV was higher than 74%. Kappa was reported in 10 studies, ranging from 0.39 to 0.84, suggesting fair to very good agreement.

Analysis of Canadian hospital discharge databases

The results of the physician's review on HF code are shown in Table 3. In 2000/2001, 180,055 (5.5%) of all discharges were coded with HF (ICD-9-Clinical Modification code 428) in any one of the 16 diagnosis fields, with 34% (n=60,723/180,055) of discharges in the first diagnosis field. In 2005/2006, there were 118,029 (4.8%) discharges with ICD-10 code I50 in any of the coding fields, with 36% (n=42,490/118,029) of discharges in the primary diagnosis field. Adding other HF-related ICD codes to 428 or I50 did not change the proportion significantly (from 5.50% to 5.53% for ICD-9 data, and from 4.80% to 4.90% for ICD-10 data).

TABLE 1
Summary of heart failure validation studies

First author (reference), year of publication	Study location	Year(s) of data collection	Sample size, n	International Classification of Diseases (ICD) version and codes used to define heart failure
Wilchesky (21), 2004	Canada	1994–1996	14,980	ICD-9: 428.0–428.9, 429.3
Austin (10), 2002	Canada	1996–2000	58,816	ICD-9: 428
Lee (30), 2005	Canada	1997–1999	1808	ICD-9: 428.x
Humphries (23), 2000	Canada	1994–1995	817	ICD-9: 428
Juurink (12), 2006	Canada	2002–2004	14,500	ICD-10: I50
Levy (17), 1999	Canada	1994	234	ICD-9: 402, 408, 425, 428, 429
Quan (19), 2007	Canada	2003	4008	ICD-9: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 425.4–425.9, 428.x ICD-10: I09.9, I11.0, I13.0, I13.2, I25.5, I42.0, I42.5–I42.9, I43.x, I50.x, P29.0
Quan (18), 2002	Canada	1996	1200	ICD-9-CM: 428.x
So (20), 2006	Canada	2001–2004	193	ICD-9: 428.x ICD-10: I09.9, I11.0, I13.0, I13.2, I25.5, I42.0, I42.5–I42.9, I43.x, I50.x, P29.0
Birman-Deych (16), 2005	USA	1998–1999	23,657	ICD-9-CM: 428.x, 398.91, 402.01, 402.11, 402.91, 404.01, 404.11, 404.91, 404.03, 404.13, 404.93
Rector (14), 2004	USA	1999–2000	3633	ICD-9-CM: 398.91, 402.01, 402.11, 402.91, 404.01, 404.11, 404.11, 404.91, 404.03, 404.13, 404.93, 428.xx
McCullough (31), 2002	USA	1989–1999	271	ICD-9-CM: 428.xx, 398.91, 402.01, 402.11, 402.91, 404.00, 404.01, 404.03, 404.10, 404.11, 404.13, 404.9, 404.91, 404.93
Fowles (8), 1998	USA	1991–1993	213	Not reported
Jollis (15), 1993	USA	1985–1990	12,937	ICD-9-CM: 428.0, 428.1, 428.9, 398.91, 402.1, 402.11, 402.91
Goff (22), 2000	USA	1988–1994	5083	ICD-9-CM: 398.91, 402.x1, 404.x, 415.0, 416.9, 425.4, 428.x, 429.4, 514, 518.4, 786.0
Heckbert (40), 2004	USA	1994–2000	34,016	ICD-9: 425, 428
Fisher (11), 1992	USA	1984–1985	7050	ICD-9-CM: 402.01, 402.11, 402.91, 428–428.9
Schellenbaum (24), 2006	USA	1989–1993	1209	ICD-9: 428, 997.1, 425, 402.01, 402.11, 402.91, 398.91 ICD-9: 428, 398.91, 402.01, 402.11, 402.91, 404.00, 404.01 REACH study: 404.03, 404.10, 404.11, 404.13, 404.90, 404.91, 404.93
Fowles (9), 1998	USA	1990–1991	1596	Not reported
Kashner (13), 1998	USA	1995	414	ICD-9: 428, 428.0, 428.1, 428.9
Ingleson (27), 2005	Sweden	1976–2001	321	ICD-8: 427.00, 427.10, 428.99 ICD-9: 428 ICD-10: I50, I11.0
Fonseca (26), 2008	Portugal	2001	234	ICD-9: 428, 410–414, 402, 404, 415, 416, 427, 420, 421, 422, 423, 424, 425, 391, 393–398, 745–746
Teng (25), 2008	Australia	1996–2006	1006	ICD-9: 428x, 402.01, 402.11, 402.91, 404.1, 404.3, 425x, 518.4, 514, 391.8, 398.91 ICD-10: I50x, I11.0, I13.0, I13.2, I42x, J81, I01.8, I020
Kumler (29), 2008	Denmark	1998–1999	126	ICD-10: D150.0–D150.9
Khand (28), 2005	United Kingdom	1997–1998	330	ICD-10: I50.1, I50.2, I11.0, I25.5, I42.9

CM Clinical Modification

DISCUSSION

Our review demonstrated high variation in the validity of administrative data for recording HF. The sensitivity and PPV ranged widely, but specificity and NPV were substantially high across studies. This suggests that the validity of administrative data should be considered before analyzing and interpreting results. Differences in validity can be explained by factors related to ICD coding systems, organization, coder's experience, reference standards and type of administrative database.

The validity of administrative data is extremely important given the increased use of these data for surveillance and outcome research. For population surveillance, those admitted to the hospital with HF will most likely represent severe cases of the disease in the late stages of the diagnosis; therefore, relying solely on the HF-defining ICD codes (428 or I50) in hospital discharge data will underestimate the prevalence of disease (32,33). For the majority of studies reviewed, hospital discharge data were the primary administrative data source

used for validation. More research is needed to examine the validity of outpatient or community data for population surveillance.

More than 70 ICD-8, -9 and -10 codes were used to define HF across the validation studies. The European Cardiovascular Indicators Surveillance Set (EUROCISS) project (34) suggests that validation studies on HF should consider ICD codes for HF, hypertensive heart, other primary cardiomyopathies, alcoholic cardiomyopathy, secondary cardiomyopathy and chronic cor pulmonale. However, ICD-9 code 428 and ICD-10 code I50 accounted for the majority of HF cases in the Canadian hospital discharge data, and other codes had a smaller impact on the prevalence. However, the impact of each code on HF outcomes should be evaluated in the future.

We noticed that the prevalence of HF differed between ICD-9 and ICD-10 data. There are several potential explanations for this difference, possibly related to the learning curve from ICD-9 to the new coding system ICD-10, the declining incidence of HF in that period or improved HF outpatient management. Quan et al (19) evaluated the

TABLE 2
Results of validation studies according to in-hospital discharge data and other types of administrative data

First author (reference)	Reference standard		Administrative data					
	Data source	Heart failure (HF) definition	Coding fields used for definition	Sensitivity, Specificity, PPV, NPV, % % % % k				
Administrative data: In-hospital discharge								
Austin (10)	Fastrak II Acute Coronary Syndrome Registry	CCU discharge diagnosis	Main diagnosis	59	97	65		0.58
Lee (30)	Chart	Framingham Carlson	Main diagnosis			94 89		
Humphries (23)	Chart	A diagnosis of CHF by history, physical examination or laboratory (key word)	16 diagnosis fields (including main diagnosis)*	66		51	97	0.53
Juurlink (12)	Recoded record	Documented HF	Main diagnosis	79		85		0.82
Levy (17)	Chart	Documented HF	15 secondary diagnoses (not including main diagnosis)	65			78	0.84
Quan (18)	Chart	Documented HF	16 diagnoses (ICD-9-CM) (including main diagnosis)	72	99	91	98	0.78
			16 diagnoses (ICD-10) (including main diagnosis)	69	99	90	97	0.76
Quan (19)	Chart	Documented HF	16 diagnoses (including main diagnosis)	77	99	88	97	0.80
So (20)	Chart	Documented HF	16 diagnoses (ICD-9) (including main diagnosis)	82	96	90	93	
			16 diagnoses (ICD-10) (including main diagnosis)	80	98	94	93	
Birman-Deych (16)	Chart	Documented HF	Primary position	33	99			
			Any position	76	97	97	74	
McCullough (31)	Chart	Framingham criteria NHANES score NYHA	Principal diagnosis			64 56 83		
Jollis (15)	Clinical database data	NYHA	30 diagnostic codes and 9 procedure codes	36	96			0.39
Goff (22)	Chart	Documented acute CHF or radiographic evidence of pulmonary edema	Not reported	63 [†] 66 [‡] 67 [§]	95 93 93	84 79 77	87 88 88	
Heckbert (40)	Chart	Chart review for symptoms and signs of CHF and pulmonary edema by chest x-ray; or dilated ventricle or poor ventricular function by imaging studies; HF documentation and receiving medical treatment	Not reported	79	98	45		0.56
Fisher (11)	Recoded record¶	Reabstracted record diagnosis	Any position Principal position	89 85	>95 >95	71 87		
Khand (28)	Case notes: radiology, echocardiography, ECG	ESC criteria Definite HF Probable HF Definite/probable/ possible HF	Any 6 diagnosis fields			64 12 87		
Kashner (13)	Reabstracted record	Medical abstractors defined and consulted with physician if there was disagreement	Principal diagnosis Secondary diagnosis					0.81 0.55
Inglesson (27)	Chart: referral notes, ECG, echocardiography reports, journal records	ESC criteria Definite HF Definite HF Definite HF Definite HF Definite HF or questionable	6 diagnosis fields HF diagnosis in position 1 HF diagnosis in position 2 HF diagnosis in position 3 to 6 HF diagnosis in position 1			82 95 76 63 99		
Fonseca (26)	Case notes: symptoms, physical examination, death/discharge summaries, laboratory, chest radiography/ECG	ESC criteria Definite HF Definite or possible HF	Any position	80	97	83 96	96	

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TABLE 2 – CONTINUED

Results of validation studies according to in-hospital discharge data and other types of administrative data

First author (reference)	Reference standard		Administrative data		Sensitivity, Specificity, PPV, NPV, k				
	Data source	Heart failure (HF) definition	Coding fields used for definition		%	%	%	%	k
Administrative data: In-hospital discharge									
Schellenbaum (24)	Chart, x-rays	Documented HF and documented symptoms and evidence of pulmonary edema or record of medical therapy	10 discharge diagnoses		81		54		
Teng (25)	Chart, chest radiography	Definite HF (Boston criteria)	Principal diagnosis				92		
		Definite or possible HF (Boston criteria)	Principal diagnosis				99		
		Documented HF	Principal diagnosis				100		
Kumler (29)	Echocardiography, chart	Defined HF (ESC criteria)	Principal/secondary		29	99	81	90	
Other types of administrative data									
First author (reference)	Reference standard		Administrative data		Sensitivity, Specificity, PPV, NPV, k				
	Data source	Definition	Data source	Definition	%	%	%	%	k
Wilchesky (21)	Chart	Documented HF	Medical service claims (ambulatory, inpatient, clinic)	Main diagnosis	42	96	89		
Rector (14)	Survey	Survey question, "Has a doctor ever told you that you had congestive heart failure?"	Combination of linked data: facility, physicians claims, pharmacy	9 diagnosis fields (facility)					
				4 diagnosis fields (physician)					
				National drug code					
				Diagnosis on 1 claim within 1 year	58	93			
				Diagnosis on ≥2 claims within 1 year	47	95			
				Diagnosis on 1 pharmacy claim	58	78			
				Diagnosis on 1 claim or pharmacy	78	75			
Fowles (8)	Ambulatory medical record	Documented HF	Ambulatory administrative data	Diagnosis on 1 face-to-face claim with primary diagnosis or a pharmacy claim	82	70			
				Diagnosis on 1 face-to-face claim within 2 years	70	91			
				All diagnoses recorded during 24-month period	64	99			
Fowles (9)	Physician records	Documented HF	Medicare Part B claims: claims submitted by primary care physicians	Claims submitted within 12-month period					0.60

*Type 1 – The Canadian Institute for Health Information uses diagnosis typing for each diagnosis code assigned within the Hospital Morbidity Database. Diagnosis type 1 is defined as the condition that existed before admission and satisfies the requirements for determining comorbidity; [†]International Classification of Diseases (ICD)-9 code 428.x; [‡]ICD 9 code 428.x or 402.x; [§]Any congestive HF (CHF) code defined by the authors (ICD-9-Clinical Modification [CM] codes 398.91, 402.x1, 415.0, 416.9, 425.4, 428.x, 429.4, 514, 518.4, 786.0); [¶]Recorded record describes when a trained coder would recode the chart (this was considered to be the reference standard). CCU Cardiac care unit; ECG Electrocardiography; ESC European Society of Cardiology; NHANES National Health and Nutrition Examination Survey; NPV Negative predictive value; NYHA New York Heart Association; PPV Positive predictive value

validity of HF and found little impact of the coding system change from ICD-9 to ICD-10 on HF validity in Canadian data (sensitivity 71.6% in ICD-9 and 68.6% in ICD-10; PPV 90.5% in ICD-9 and 90.2% in ICD-10).

We found that of nine Canadian studies, six demonstrated high PPV estimates (greater than 85%) and two studies reported PPV values of 51% and 65%. The variation can be partially explained by the variation in reference standards for validating HF across studies. Some studies used HF recorded in the patient's chart as a reference standard, while other studies defined HF based on clinical or diagnostic evidence in the chart. Studies that relied on chart documentation of HF are likely to produce higher sensitivity values but lower PPVs than those that defined HF using a consistent clinical definition (Framingham, NYHA, Boston and ESC criteria). However, previous studies (35-37) have shown that clinical information is often missing in the patient chart,

which can leave the diagnosis questionable. Furthermore, many countries have shown that diagnostic tests are not consistently conducted in all patients with suspected HF (38). Diagnosis of HF is challenging, and cases can be misclassified under other diseases because symptoms can be nonspecific to HF, particularly in the elderly (39).

Various administrative data definitions were used to define HF across studies, and this can explain much of the variability across the results. For example, many studies used a variety of ICD codes to define HF with ICD-9 and -10 codes 428 and I50 as the only codes being consistently applied across all studies. Some studies (10-12,16,25,29,30) defined HF using the principal/most responsible/major diagnosis alone. Using this method meant including patients with HF who were severe enough to be hospitalized or whose HF contributed to the length of stay most likely to generate high PPV estimates. Other studies (16-20,23,28) defined HF using all available diagnosis coding fields, resulting in inclusion of patients

TABLE 3
Frequency of hospital discharge records with *International Classification of Diseases (ICD)-9/ICD-9-Clinical Modification (CM)* heart failure codes in 2000/2001 and ICD-10 heart failure codes in 2005/2006

ICD-9/ICD-9-CM or ICD 10 codes	ICD catalogue description	Discharge records with the ICD codes	
		n	%
ICD-9 codes			
428.x	Heart failure	180,055	5.50
428.x or 425.4	Other primary cardiomyopathies	192,695	5.69
428.x or 425	Obscure cardiomyopathy of Africa	180,058	5.50
428.x or 425.5	Alcoholic cardiomyopathy	181,104	5.51
428.x or 425.6	Cardiomyopathy in Chagas' disease	180,055	5.50
428.x or 425.7	Nutritional or metabolic cardiomyopathy	180,055	5.50
428.x or 425.8	Cardiomyopathy in other diseases classified elsewhere	180,055	5.50
425.9	Secondary cardiomyopathy, unspecified	180,932	5.51
428.x or any of 425.5–425.9		181,984	5.53
ICD-10 codes			
I50	Heart failure	118,029	4.80
I50 or I41.2, I43.1	Cardiomyopathy in Chagas' disease	118,154	4.80
I50 or I43.2, I43.0	Nutritional or metabolic cardiomyopathies	118,089	4.80
I50 or I43.8	Cardiomyopathy in other diseases classified elsewhere	118,199	
I50 or I42.5	Other restrictive cardiomyopathy	118,126	4.80
I50 or I42.6	Alcoholic cardiomyopathy	118,542	4.81
I50 or I42.7	Cardiomyopathy due to drugs or other external agents	118,184	4.81
I50 or I42.8	Other cardiomyopathies	118,477	4.81
I50 or I42.9	Cardiomyopathy, unspecified	120,926	4.87
I50 or any of I42.5–42.9		122,139	4.90

with HF as a comorbidity or complication. HF is likely to be under coded when HF is present as a comorbidity (ie, it does not contribute to length of stay significantly), which likely generates low PPV estimates.

CONCLUSION

The validity of administrative data in recording HF varies across studies; therefore, researchers or users of the data should consider data validity before addressing research questions.

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