ICD-10-CA/CCI coding algorithms for defining clinical variables to assess outcome after aortic and mitral valve replacement surgery

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Implementation of the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Canada* (ICD-10-CA) and the *Canadian Classification of Interventions* (CCI) coding system presents challenges for using Canadian administrative data. Thus, a multi-step process was conducted to develop ICD-10-CA/CCI coding algorithms to define nine comorbidities and three procedures. These clinical variables have been used in ICD-9-CM data for risk adjustment in assessment of outcomes after aortic and mitral valve replacement surgery. Among patients included in the ICD-9-CM data during 1999 and 2001 and in the ICD-10-CA/CCI data during 2002 and 2003 in a Canadian Health Region, frequencies of the nine comorbidities and the three procedures remained generally similar across databases. The newly developed ICD-10-CA/CCI and previous ICD-9-CM coding algorithms are comparable in detecting these clinical variables. However, performance of ICD-10-CA/CCI coding algorithms in risk adjustment should be evaluated in a larger database.

Key Words: ICD-9-CM; ICD-10; Outcome; Risk adjustment; Valve surgery

Les algorithmes de codage de la CIM-10-CA/CCI pour définir les variables cliniques permettant d'évaluer les issues après une chirurgie de remplacement d'une valvule aortique ou mitrale

L'implantation du système de codage de la *Classification statistique internationale des maladies et des problèmes de santé connexes, 10^e révision, Canada* (CIM-10-CA) et de la *Classification canadienne des interventions en santé* (CCI) présente des défis pour ce qui est de l'utilisation des données administratives canadiennes. C'est pourquoi un processus à échelons multiples a été entrepris pour élaborer des algorithmes de codage de la CIM-10-CA/CCI afin de définir neuf comorbidités et trois interventions. Ces variables cliniques ont été utilisées dans les données de l'ICD-9-CM pour rajuster le risque dans l'évaluation des issues après une chirurgie de remplacement d'une valvule aortique ou mitrale. Chez les patients faisant partie des données de l'ICD-9-CM en 1999 et 2001 et des données de la CIM-10-CA/CCI en 2002 et 2003 au sein d'une région sanitaire canadienne, la fréquence des neuf comorbidités et des trois interventions demeurerait généralement similaire entre les bases de données. Les nouveaux algorithmes de codage de la CIM-10-CA/CCI et les anciens algorithmes de codage de l'ICD-9-CM sont comparables pour déceler ces variables cliniques. Cependant, le rendement des algorithmes de codage de la CIM-10-CA/CCI pour rajuster le risque devrait être évalué dans une base de données plus vaste.

Canada has been using the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Canada* (ICD-10-CA) to code diagnoses, and the *Canadian Classification of Interventions* (CCI) to code procedures in hospital discharge administrative data (1). ICD-10-CA/CCI reflects new clinical knowledge and employs an alphanumeric coding system. Many codes in ICD-9-CM are not automatically convertible to corresponding ICD-10-CA/CCI codes, creating challenges when using administrative data for longitudinal or comparative research. Hassan et al (2) reported 22 comorbidities and three procedures for risk adjustment in assessment of outcomes after aortic and mitral valve replacement surgery. These clinical variables were defined using ICD-9-CM codes. Recently, the corresponding ICD-10-CA codes for 13 of these 22 comorbidities were reported elsewhere (3), including congestive heart failure, peripheral vascular disease, cerebrovascular disease, chronic pulmonary disease,

rheumatological disease, peptic ulcer disease, diabetes, diabetes with chronic complications, hemiplegia or paraplegia, renal disease, liver disease, cancer and hypertension. The present paper reports on a study conducted by the author to develop ICD-10-CA/CCI coding algorithms for defining the remaining nine comorbidities and three procedures.

One coder and the investigator (HQ) independently coded the nine comorbidities and three procedures by searching all codes relevant to each clinical variable using the ICD-10-CA/CCI computerized code finder (4). Then, the identified codes were examined and the investigators decided on whether to include specific codes. This process involved discussion and frequent reference to both the ICD-9-CM and ICD-10 manuals. The final list of ICD-10-CA/CCI codes is presented in Table 1.

The ICD-9-CM and ICD-10-CA/CCI coding algorithms were applied to hospital discharge ICD-9-CM data in 1999/2001 fiscal years and ICD-10-CA/CCI data in 2002/03

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TABLE 1

International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) and Tenth Revision, Canada (ICD-10-CA), including the Canadian Classification of Interventions (ICD-10-CA/CCI) coding algorithm and prevalence of clinical variables (%)

Clinical variables	Codes ICD-9-CM	Codes ICD-10-CA/CCI	Prevalence in ICD-9-CM data			Prevalence in ICD-10-CA/CCI data	
			1999 (n=56067)	2000 (n=46215)	2001 (n=56585)	2002 (n=58805)	2003 (n=61460)
Active endocarditis	421.x, 424.9	I33.x, I38.x	0.11	0.10	0.10	0.12	0.12
Concomitant coronary artery bypass graft on current admission	36.1, 36.2	CCI: 1IJ76.x	1.17	1.19	1.20	1.21	1.02
Myocardial infarction (old)	412.x	I25.2	4.37	3.94	4.90	4.19	2.94
Myocardial infarction (recent)	410.x	I21.x, I22.x	2.97	3.24	3.34	3.57	3.66
Previous coronary artery bypass graft or previous percutaneous coronary intervention	V45.81, V45.82	Z95.1, Z95.5	3.34	2.69	3.69	3.34	2.64
Previous valve surgery	V42.2, V43.3	Z95.2, Z95.3, Z95.4	0.43	0.36	0.49	0.42	0.41
Pulmonary hypertension	415.0, 416.0, 416.8	I26.0, I27.0, I27.2, I27.8	0.66	0.60	0.66	0.47	0.53
Rheumatic aortic valve insufficiency and/or stenosis	395.x	I06.x	0.04	0.03	0.04	0.02	0.02
Rheumatic mitral valve insufficiency and/or stenosis	394.x	I05.x	0.14	0.14	0.13	0.18	0.13
Shock	785.51, 785.59	R57.x	0.53	0.46	0.52	0.37	0.39
Tricuspid valve insufficiency and/or stenosis	397.0, 424.2	I07.x, I36.x, I08.1, I08.2, I08.3	0.44	0.35	0.31	0.37	0.28
Unstable angina	411.1	I20.0	2.79	2.48	2.30	2.02	1.72

fiscal years from Calgary Health Region hospitals (Alberta), respectively. The first 16 diagnostic and 10 procedure coding fields were extracted for each hospital separation for patients 18 years of age and older. For patients with more than one admission in each fiscal year, only the first admission for the patient was included.

The frequencies for most of the clinical variables were very similar across ICD-9-CM and ICD-10-CA/CCI coding algorithms (Table 1). The slight variations between the 2001/02 fiscal year for pulmonary hypertension (0.66% versus 0.47%), shock (0.52% versus 0.37%) and unstable angina (2.30% versus 2.02%) may be related to time change or data quality.

These findings indicated that newly developed ICD-10-CA/CCI and previous ICD-9-CM coding algorithms are comparable

in detecting clinical variables. However, performance of ICD-10-CA/CCI coding algorithms in risk adjustment should be evaluated in a larger database.

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