ASSESSING THE VALIDITY OF DIAGNOSTIC CODES IN A COHORT OF DIABETICS ADMITTED TO HOSPITAL IN QUEBEC (2000-2011)

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Background

- Administrative clinical data increasingly used to conduct observational studies related to health care and policy
  - Used in a number of research areas (ex: health outcomes, disease surveillance, health economics)
- Captures most of the patient population for a given jurisdiction (ex: province)
- Administrative clinical data to inform policy evaluation
  - Quebec: team-based model of primary care practice introduced to increase access to family physicians

Background

- Ambulatory care sensitive conditions (ACSCs) to study this question
- Patients with specific ACSCs may have distinct experiences in accessing primary care
  - Focus on diabetes: public health priority in Quebec
- Hospitalization for ACSCs potentially avoidable and costly
  - Average cost: $5,700 per admission ~ $541M per year (CIHI, 2012)

Background

- Sources of administrative clinical data:

1. Hospital admissions data

- *Advantage:* diagnostic and medical procedure codes recorded by archivists upon review of patient medical chart
- *Disadvantage:* information limited to hospitalization period

2. Medical service claims

- *Advantage:* captures the full continuum of care (ambulatory & hospital based care)
- *Disadvantage:* diagnostic codes are not normally validated (not linked to physician payment)

Objectives

In a cohort of diabetics admitted to hospital following an emergency department visit in Quebec between 2000 and 2011, we aim to:

1. Validate diagnostic codes in medical service claims data for diabetes complications using hospital admissions data as the gold standard

2. Validate diagnostic codes before and after the conversion to ICD-10-CA in hospital admissions data in 2006

Study Considerations

- 2006: Quebec updates diagnostic coding to ICD-10-CA
  - Only affects hospital admissions data
  - Validity may differ pre/post ICD-10-CA conversion

- Regional trends of emergency department use
  - Validity may differ by regional status
  - Regional categories used in analysis (grouping 18 health and social services regions)
    - University
    - Peripheral
    - Intermediate
    - Remote

Methods

- Databases used:
  - Hospital admissions data *(gold standard)*
  - Medical service claims
- Database linkage by unique patient identifying number
- Validated algorithm to extract diabetes cohort *(prevalent and incident cases)*
  - 1996 to 2011: case definition period
- Gestational diabetes excluded from cohort definition

Methods

- Validation study
  - Study covers 12 fiscal years (April 1, 2000 to March 31, 2012)

- Billable acts occurring in the following health and social services regions were excluded:
  - Northern Québec, Nunavik, Cree Territories
  - Outaouais

- 2 previously validated algorithms used to identify unique visits to the emergency department and an admission to hospital following an emergency department visit

Methods

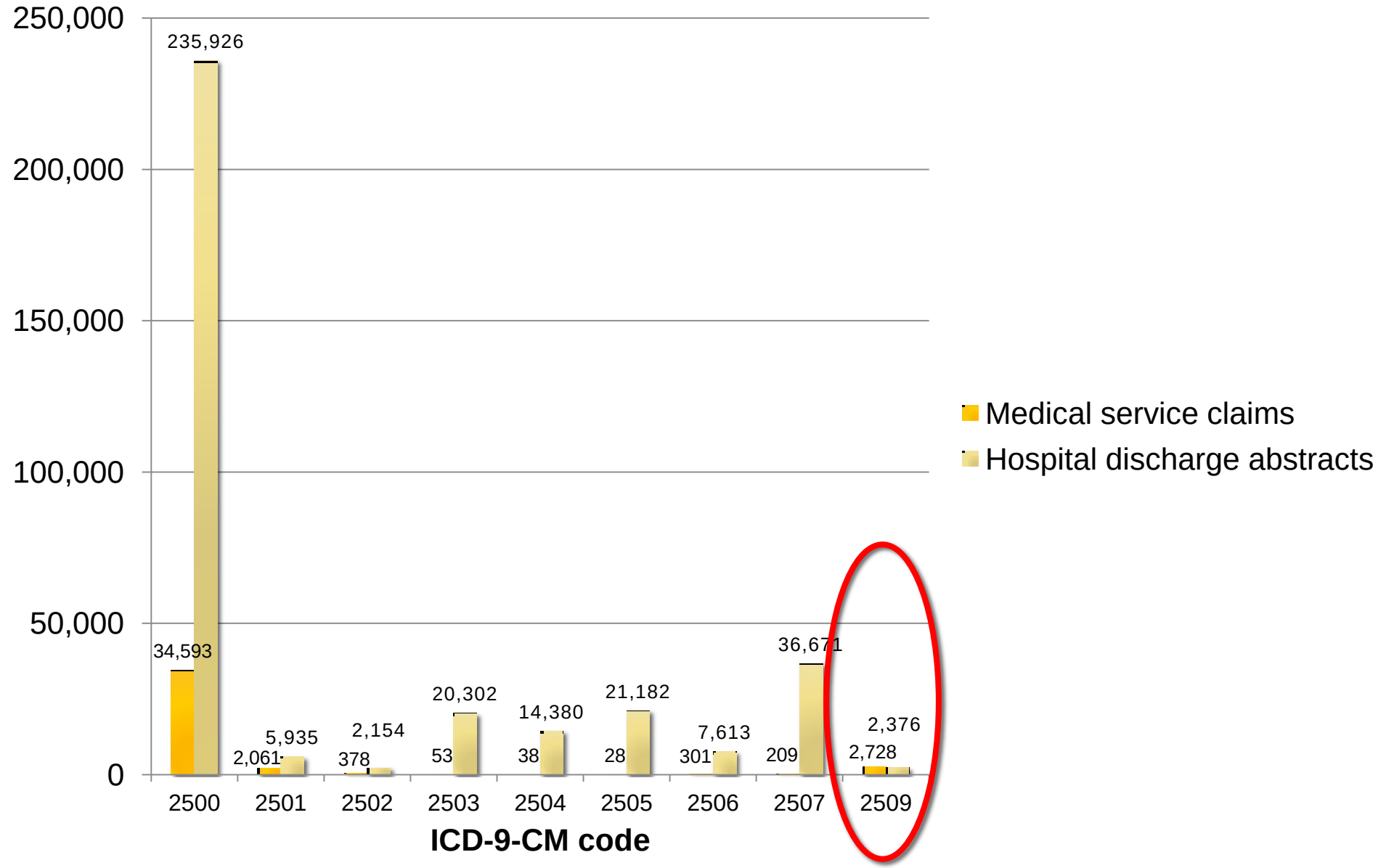
- Converted ICD-10-CA diagnostic codes in hospital admission data to ICD-9-CM codes (2006-2011)
- Comparison between ICD-9-CM and ICD-9-QC
  - Concordant colors indicate common diagnostic coding scheme

ICD-9-CM *(Canada)*	ICD-9-CM *(Quebec)*
2500 DM without mention of complication	2500 DM without mention of complication
2501 DM with ketoacidosis	2501 DM with ketoacidosis
2502 DM with hyperosmolarity	2502 DM with coma
2503 DM with coma	2503 DM with renal manifestations
2504 DM with renal manifestations	2504 DM with ophthalmic manifestations
2505 DM with ophthalmic manifestations	2505 DM with neurological manifestations
2506 DM with neurological manifestations	2506 DM with peripheral ciruculatory disorders
2507 DM with peripheral ciruculatory disorders	2507 DM with other specified manifestations
2508 DM with other specified manifestations	None
2509 DM with unspecified complication	2509 DM with unspecified complication

Methods

- Validation measures:
  - Sensitivity
  - Specificity
  - Positive predictive value (PPV)
  - Negative predictive value (NPV)
- All statistical analyses performed in SAS (9.2)

Frequency of ICD-9-CM Diabetes Codes: Medical Service Claims versus Hospital Admissions Data



Validation Measure	All Regions
Sensitivity	8,14%
Specificity	99,71%
PPV	69,87%
NPV	92,99%

Diagnostic codes by varying levels of regional measurement

Validation Measure	Grouping by 2 Regional Categories	
	University/Peripheral	Intermediary/Remote
Sensitivity	8,40%	6,90%
Specificity	99,70%	99,80%
PPV	68%	75%
NPV	93,20%	92,60%

Validation Measure	All Codes			
	Regional Category			
	University	Peripheral	Intermediate	Remote
Sensitivity	8,50%	8,28%	6,82%	7,46%
Specificity	99,66%	93,30%	99,80%	99,77%
PPV	66,79%	69,44%	74,53%	74,46%
NPV	93,10%	93,30%	92,71%	92,27%

Accuracy comparison between short term and long term complications (regional categories)

Validation Measure	Short Term Complications Regional Category			
	University	Peripheral	Intermediate	Remote
Sensitivity	5.41%	4.79%	4.02%	5.74%
Specificity	99.88%	[illegible]	[illegible]	99.87%
PPV	77.78%	80.95%	82.15%	78.95%
NPV	92.89%	91.64%	91.80%	92.58%

Validation Measure	Long Term Complications Regional Category			
	University	Peripheral	Intermediate	Remote
Sensitivity	0.71%	0.72%	0.24%	0.30%
Specificity	99.96%	[illegible]	[illegible]	99.97%
PPV	61.58%	55.49%	46.51%	60.00%
NPV	91.89%	93.40%	91.40%	88.74%

Accuracy comparison pre/post ICD-10-CA conversion (All regions)

Validation Measure	All Regions	
	Pre-2006	Post-2006
Sensitivity	9.65%	7.82%
Specificity	99.48%	99.29%
PPV	92.81%	90.45%
NPV	61.44%	55.53%

Accuracy comparison pre/post ICD-10-CA conversion (Short term vs. Long term complications)

Validation Measure	Short Term Complications All Regions		Long Term Complications All Regions	
	Pre-2006	Post-2006	Pre-2006	Post-2006
Sensitivity	9.23%	7.72%	8.32%	5.92%
Specificity	98.71%	98.80%	98.59%	97.78%
PPV	80.66%	82.66%	79.04%	66.06%
NPV	65.06%	59.08%	62.74%	58.78%

Discussion

- Broadly we note:
  - Slightly higher sensitivity in urban areas
  - Slightly higher PPV in rural areas

- Likely linked to denominators in accuracy calculations

	Gold +	Gold -
Test +	a	b
Test -	c	d

Sensitivity = a / (a + c)

PPV = a / (a + b)

Discussion

- PPV's range from 66% to 90%
  - High likelihood that diagnoses in medical services claims also present in hospital admissions data

- But, sensitivity is generally low
  - Highest value reached for code 2501 (25%), second highest value for 2500 (10% to 11%)
  - Majority of diagnostic codes not identified in medical service claims
    - Competing diagnoses might explain this
  - Sparse numbers and very low sensitivity for long term complications
    - Emergency departments deliver acute care
    - Conditions that may not be identified in an emergency department context: takes time to diagnose (ex: kidney failure, neurological manifestations)

Limitations

- Gold standard may not truly be ‘golden’
  - Archivist coding practices changes over time
- Differences in the purposes of the databases studied
  - Measure of sensitivity may be capturing two different processes
    - False negatives (actual sensitivity)
    - Competing diagnoses: specific diagnosis does not appear in medical service claims if not considered the primary condition of concern
- However, observed pattern of low sensitivity and relatively high PPV is consistent with the literature on diagnostic codes in medical service claims

Conclusion

- Low sensitivity raises concern for bias (unidentified admissions)
  - A reality when dealing with data collected for other purposes
- High PPV for specific codes and regional categories indicates the potential for medical service claims to monitor avoidable hospital admissions among diabetics
- Key finding: consistency in medical service claim coding before and after conversion to ICD-10-CA
  - Consistency in outcome measurement eliminates one source of information bias

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