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Effect of change in coding rules on recording diabetes in hospital administrative datasets

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ABSTRACT

Aim: During 2008–2011 Australian Coding Standards mandated a causal relationship between diabetes and inpatient care as a criterion for recording diabetes as a comorbidity in hospital administrative datasets. We aim to measure the effect of the causality mandate on recorded diabetes and associated inter-hospital variations.
Method: For patients with diabetes, all admissions between 2004 and 2013 to all New South Wales acute public hospitals were investigated. Poisson mixed models were employed to derive adjusted rates and variations.
Results: The non-recorded diabetes incidence rate was 20.7%. The causality mandate increased the incidence rate four fold during the change period, 2008–2011, compared to the pre- or post-change periods (32.5% vs 8.4% and 6.9%). The inter-hospital variation was also higher, with twice the difference in the non-recorded rate between hospitals with the highest and lowest rates (50% vs 24% and 27% risk gap). The variation decreased during the change period (29%), while the rate continued to rise (53%). Admission characteristics accounted for over 44% of the variation compared with at most two per cent attributable to patient or hospital characteristics. Contributing characteristics explained less of the variation within the change period compared to pre- or post-change (46% vs 58% and 53%). Hospital relative performance was not constant over time.
Conclusion: The causality mandate substantially increased the non-recorded diabetes rate and associated inter-hospital variation. Longitudinal accumulation of clinical information at the patient level, and the development of appropriate adoption protocols to achieve comprehensive and timely implementation of coding changes are essential to supporting the integrity of hospital administrative datasets.

1. Introduction

Hospital administrative data with admitted patients' information are widely used for service planning, resource distribution, research and quality improvement purposes. In particular, casemix or risk adjustment methods utilise inpatients' demographic and diagnostic data to provide fair comparisons, resource allocation and reimbursements [1,2].

The rise in diabetes prevalence is associated with excess hospitalisation, morbidity and mortality [3–5] and financial burden on healthcare systems [6,7]. Reliable data on diabetes related hospital admissions are essential to inform innovative interventions and casemix-based investigations. However, findings suggest patients with diabetes are under recorded in administrative datasets; patient, admission and hospital characteristics contribute to the associated discrepancies [8–12]. Such discrepancies and variations are inadvertently potential biases when comparisons and funding rely on patient profile and hospital outcome [1,13,14].

Moreover, change in disease classification, clinical coding standards, and the rules governing the coding of documented morbidities from clinical notes affect the content of clinical records and related morbidity admission rates [15–18]. In Australia, any documented diabetes in clinical notes that is not the cause of admission (principal diagnosis) must be coded as a comorbidity (secondary diagnosis) in administrative datasets [19]. However, between July 2008 and June 2012, only those diabetes conditions that affected patients' treatment and care within that episode of care (i.e., the presence of a cause and effect relationship between diabetes and required care) were to be coded as comorbidities [20,21]. This

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change, introducing a causality mandate, aimed to reflect the diabetes conditions that are significant in delivery of care rather than their prevalence among inpatient populations. Consequently, for this period large drops in annual diabetes related admission rates were reported in Australian hospitals compared to the prior or subsequent time periods [22,23]. However, neither the effect of altered rules in the coding of diabetes nor the variation in the effect among hospitals has been explored. Such investigations can provide insight into the consequences of systematic changes in clinical coding practices.

This study aimed to measure the incidence of non-recorded diabetes conditions in administrative hospital datasets and demonstrate the effect of change in coding rules on non-recorded diabetes incidence and inter-hospital variation in this metric. We used record linked data for all admitted patients in all acute public hospitals across New South Wales (NSW), Australia, over a ten-year period, inclusive of the period with major changes in rules governing the coding of diabetes as comorbidity.

2. Methods

2.1. Data source and study population

NSW residents number over seven million and the state is the largest health jurisdiction in Australia, with approximately 500 healthcare facilities and up to three million admissions per annum. We used NSW public hospital admissions records from the linked Admitted Patient Data Collection (APDC) database between 2004 and 2013 financial years (2004–2013 FY) comprising all separations from 1st July 2004 to 30th June 2014, here referred to as admissions, from all healthcare facilities in NSW. Record linked APDC includes a unique patient identifier that enables the identification and linkage of patient-specific admissions [24]. Each admission (episode of care) record includes information on patient demographics, morbidities and procedures, hospital characteristics and mode of separation (discharge, transfer or death). Australia uses a modified version of the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, standard (ICD-10-AM) to record morbidities; up to 51 diagnoses can be recorded in NSW public hospital administrative datasets [20]. Linked APDC records were obtained from the NSW Admitted Patient, Emergency Department and Deaths Register, which was established under the public health and diseases registers provisions of the NSW Public Health Act 2010 and is maintained by the NSW Ministry of Health. Record linkage was carried out by The Centre for Health Record Linkage (CHeReL) [24]. The study was approved by the data provider. The data were accessed remotely through Secure Analytics for Population Health Research and Intelligence (SAPHaRI) system made available by Centre for Epidemiology and Evidence, NSW Ministry of Health [25].

Of all admissions to NSW facilities within our study period (25,646,224 admissions for 6,246,154 patients), we only considered admissions to acute public hospitals, which accounted for 14,168,113 (55.2%) admissions for 4,123,531 (66%) patients at 80 hospitals. We then identified all hospital admissions for all patients with diabetes. Patients who had at least one admission with a recorded diabetes condition over the study period were considered as patients with diabetes (229,960 patients; 5.5% of all NSW patients) and all their hospital admissions (2,347,608; 16.5% of all NSW admissions) were included. Admissions to community facilities, multipurpose, non-acute or sub-acute centres, psychiatric and rehabilitation facilities, nursing home and hospices and children's hospitals were excluded.

2.2. Non-recorded diabetes identification and covariates

We used diabetes diagnoses codes from ICD-10-AM that included impaired glucose regulation (E09), diabetes mellitus type 1 (E10) and type 2 (E11), and other specified or unspecified diabetes mellitus (E13-E14), to identify patients with diabetes and to determine whether diabetes was recorded among morbidities at admission. We included impaired glucose regulation cases as they were included in the changed rules. Admissions with a length of stay less than 24 h and patients with a pregnancy related diabetes code were excluded. For each patient with diabetes, the earliest and the latest admissions with a recorded diabetes condition (first and last index admissions respectively) were identified. A non-recorded diabetes incidence was defined as any admission with a non-recorded diabetes condition occurring: (a) between the first and the last indices, or (b) within six months of the last index admission (follow-up period). For patients with diabetes who only had one index admission, the second criterion was applied. We acknowledge that a non-recorded diabetes condition when the causality mandate on coding comorbidities was in effect (2008–2011) should have been intentional and a correct non-recorded incidence, as opposed to any incident that occurred during the periods prior to or after the mandate when not recording a diabetes condition would have been incorrect. All admissions occurring after the first index admission were included in the denominator of the non-recorded diabetes incidence rate. This minimised any overestimation caused by counting admissions prior to diagnosis and false positives (where a patient had no diabetes but the condition was recorded). Any diabetes-type specific analyses were limited to patients without a change in diabetes-type over the study period.

To address casemix, three sets of covariates – patient, admission, and hospital related – were considered for all admissions. Patient demographic variables included age, sex and socio-economic status. We utilised a Statistical Local Area level disadvantage index of Socio-Economic Indices for Areas (SEIFA) with the lower values indicating more disadvantage [26]. SEIFA scores were categorised into four classes (1st quartile: most disadvantaged to 4th quartile: least disadvantaged areas). Admission covariates included admission type (surgical, medical, and other), admission source (emergency, planned, and other), length of stay (2–5, 6–10, and over 10 days) and number of recorded morbidities categorised by quartiles for that admission. Hospital characteristics included location (metropolitan vs. rural) and peer group. Public hospital peer groups comprised "A1": principal referral group, usually teaching hospitals; "B": major metropolitan and non-metropolitan; "C1": district group 1; and "C2": district group 2. Hospital peer groups contained similar sized hospitals, ranging from those treating more than 25,000 acute casemix weighted admissions per annum in the principal referral group through to those treating between 2000 and 5000 acute casemix weighted admissions in the district groups [27]. Time was captured annually and periodically. According to the change in rules governing the coding of diabetes (causality mandate), three periods were set: pre-change (2004–2007), during change (2008–2011), and post-change (2012–2014).

2.3. Statistical analysis

We employed Poisson mixed models to evaluate adjusted non-recorded diabetes incidence rates (IR), trends, rate ratios (IRR) and inter-hospital variation and associated trends through inclusion of covariates, categorical years and periods, and random intercept and slope components at hospital level. Adjusted IRs were estimated by multiplying IRRs obtained from the models and the crude IR at the reference year (2004) or period (pre-change, 2004–2007). A series of models were constructed to examine year- and period-specific incidence rates, inter-hospital variations and the contribution of