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Identification of higher hospital costs and more frequent admissions among mid-aged Australian women who self-report diabetes mellitus

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ABSTRACT

Objective: To ascertain whether the hospital costs for mid-aged Australian women who self-reported diabetes mellitus (DM) and who had one or more hospital admission during an eight and a half year period were higher than the hospital costs for other similarly aged non-DM women.
Methods: The sample comprised 2,392 mid-aged women, resident in New South Wales (NSW) Australia and participating in the Australian Longitudinal Study on Women's Health (ALSWH), who had any NSW hospital admissions during the eight and a half year period 1 July 2000 to 31 December 2008. Analyses were conducted on linked data from ALSWH surveys and the NSW Admitted Patient Data Collection (APDC). Hospital costs were compared for the DM and non-DM cohorts of women. A generalized linear model measured the association between hospital costs and self-reported DM.
Results: Eight and a half year hospital costs were 41% higher for women who self-reported DM in the ALSWH surveys ($p < 0.0001$). On average, women who self-reported DM had significantly ($p < 0.0001$) more hospital admissions (5.3) than women with no reported DM (3.4). The average hospital stay per admission was not significantly different between the two groups of women.
Conclusions: Self-reported DM status in mid-aged Australian women is a predictor of higher hospital costs. This simple measure can be a useful indicator for public policy makers planning early-stage interventions that target people in the population at risk of DM.

1. Introduction

Diabetes mellitus (DM) is one of four high priority non-communicable diseases (NCDs) identified by the World Health Organization (WHO) for global policy action. The other three NCDs are cardiovascular disease (CVD), cancer and chronic respiratory disease. These four conditions alone are responsible for 82% of all premature NCD deaths worldwide [1]. Diabetes mellitus is a costly disabling chronic condition for which the numbers are increasing rapidly with ageing populations and lifestyle change underscoring risk factors such as tobacco smoking and obesity [2,3]. Between 1990 and 2010, DM rose from 15th to 9th place in a listing of global causes of death. In 2010 DM was one of the top ten causes of disability, and the fourteenth largest cause of Disability Adjusted Life Years [4].

Diabetes mellitus comprises metabolic conditions which exhibit elevated plasma glucose levels that occur as a result of defective insulin production or action [5]. There are three main types of DM – Type 1, Type 2 and gestational. Type 1 is an auto-immune disease that destroys insulin producing cells in the pancreas and is responsible for 3–5% of all DM worldwide [6]. Type 2 DM is due to a combination of insulin resistance and insulin deficiency accounting for more than 90% of cases worldwide. Type 2 DM commonly affects adults in mid-age. The condition can be prevented and managed by behaviour change, such as stopping tobacco smoking, adhering to a healthy diet, and engaging in physical activity. The third group, gestational DM, affects an estimated one in 25 pregnancies worldwide. Untreated this can lead to higher rates of maternal and infant deaths and foetal abnormalities [6].

People with DM experience elevated risks of acute and chronic illnesses – including vascular, circulatory, visual, neurological,

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renal, skin and depressive disorders – relative to their peers without DM [7]. When the condition is poorly controlled, risks increase for life-threatening complications such as heart disease, stroke, lower limb amputation, blindness and vision impairment, and kidney disease [6]. The health toll that DM imposes on women is significant, particularly in terms of CVD complications for which women have a poorer prognosis and experience greater disability compared with men [8].

Diabetes mellitus not only kills and disables, but it imposes huge social and economic burdens on individuals, families, business, governments and healthcare systems [6,9]. In 2013, healthcare expenditure on DM accounted for 10.8% of all healthcare expenditure world-wide [3]. Systematic reviews and meta-analyses covering major NCDs (Type 2 DM, coronary heart disease, stroke, cancer, chronic obstructive pulmonary disease and chronic kidney disease) have identified substantial macro-economic productivity loss in terms of: reduction in the able workforce, NCD-related expenditure and loss of income [10], significant financial burden on healthcare budgets and national welfare systems, [11] and major household impoverishment due to NCDs [12].

Hospital costs for patients with a diagnosis of DM are significantly higher than costs of hospital care for non-DM patients [13,14]. This evidence comes from studies in which DM status is defined and diagnosed clinically in hospital settings. The approach may underestimate the true cost difference because it does not accurately classify patients who may have DM but were not given a hospital diagnosis of DM. This is likely to be the case for people with Type 2 DM. We do not therefore know whether there are also differences in hospital costs by DM status when cases are ascertained by self-report in community settings.

This study addresses the above issues with respect to a cohort of Australian women participating in the Australian Longitudinal Study on Women's Health (ALSWH). No comparable data were available for Australian men. We linked DM cases and non-cases from the ALSWH to hospital inpatient records. The aim of the study is to ascertain whether the hospital costs for mid-aged Australian women who self-reported DM, and had one or more hospital admission during an eight and a half year period, were higher than the hospital costs for other similarly aged non-DM women. This information is important and useful for public policy-makers in targeting populations at risk of DM with health promotion interventions.

2. Methods

2.1. Study population

The Australian Longitudinal Study on Women's Health is a national prospective cohort study that surveys changes in the health and well-being of Australian women born 1973–1978, 1946–1951 and 1921–1926 [15]. In 2012–13 more than 10,000 young women aged 18–23 were recruited to form a new cohort. The ALSWH has been collecting longitudinal data on functional capacity, physical and mental health, health service use, demography, lifestyle, behaviours and socioeconomic characteristics since 1996. Women in the ALSWH are representative of Australian women from all walks of life. The ALSWH data analysed here are from questionnaires mailed to respondents at three-year intervals. Full details of the study materials and data access procedures are available at the Women's Health Australia website [16].

This study population comprised women in ALSWH born between 1946 and 1951, the 'mid-aged cohort', who: recorded a residential address in the state of New South Wales (NSW) Australia in the ALSWH baseline survey 1 (1996) and answered one or more subsequent surveys (2–5) conducted in 1998, 2001, 2004 and 2007 (n = 4,027). Inclusion in the study sample required one or more hospital admissions in the period 1 July 2000 to 31 December 2008. We further excluded 1,635 women who had no hospital admissions in this period giving a final study sample of 2,392. See explanation later in this section.

2.2. DM assessment

Diabetes mellitus status was established from responses to questions about doctor-diagnosed DM at ALSWH surveys 1–5. The questions asked whether the women had ever been previously diagnosed (by a doctor) with DM at survey 1. Subsequent surveys asked whether women had a DM diagnosis in the past three years. A separate question about Impaired Glucose Tolerance (IGT) was asked in surveys 3–5 and women were asked whether they had ever had gestational DM at survey 5. For the purpose of this analysis, women who reported having had a doctor diagnosis of DM or IGT on one or more of the five ALSWH surveys were defined as having DM based on self-report. Other women, including those reporting only gestational DM, were classified as never having been diagnosed with DM. Although the reliability of self-report can be questioned, a study undertaken on the ALSWH mid-aged cohort found high agreement between self-report of DM and administrative records [17]. The data do not distinguish between Type 1 and Type 2 DM. Because more than 90% of people with DM have the Type 2 kind and this is more highly prevalent in mid- and older-aged adults, we expected that the majority of women in our study sample who self-reported DM had Type 2.

2.3. Hospital costs and admission assessment

The Centre for Health Record Linkage brokered one-to-many probabilistic linkage (with 99% accuracy) between longitudinally linked ALSWH records and chronological sequences of acute hospitalisations recorded in the NSW Admitted Patient Data Collection (APDC) between 1 July 2000 and 31 December 2008 inclusive. The APDC includes demographic data, clinical information on diagnoses and procedures coded under the ICD Tenth Revision, Australian Modification (ICD-10-AM) and comprehensive information about the costs of all hospital inpatient stays. The APDC data analysed here cover NSW public acute hospitals only. Inter-hospital transfers were treated as the same admission. Linked data on non-hospital healthcare costs such as those from the Pharmaceutical Benefits Scheme (PBS) or Medical Benefits Schedule (MBS) were not available for this study. The focus was on hospital costs. We compared non-zero hospital costs for the two groups of women. Hence only women who had hospital admissions (i.e. non-zero hospital costs) in the study period were included. Zero inflated models are sometimes appropriate, for example when fitting count data [18]. However adjusting for zero hospital costs here would have added unnecessary methodological complexity.

Resource use for hospitals was measured by hospital admissions (for acute episodes of care), lengths of hospital stay (computed as the difference between admission and separation dates and plus one day for non-overnight admissions) and the costs of care ($A 2007–08) based on the Australian Refined Diagnosis Related Groups (AR-DRGs) Version 5.1 2007–08 cost weights [7]. The DRG cost weights are derived using algorithms that capture information about age, sex, diagnoses, length of stay and mode of discharge. The weights provide a standardised means of quantifying the average costs of hospitalisations with similar resource use [19].

2.4. Potential confounding variables

Variables from ALSWH describe the health and socioeconomic characteristics of women in the study sample by self-reported DM