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Prevalence of disability in Australian elderly: Impact of trends in obesity and diabetes

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ABSTRACT

Objective. We aimed to estimate the impact of past and future changes in obesity and diabetes prevalence in mid-life on disability prevalence for adult Australians.

Methods. We analysed data from the Australian Diabetes, Obesity and Lifestyle study (AusDiab) including participants aged 45–64 years, disability-free at baseline (1999/2000) with disability information at follow-up (2011/12) ($n = 2107$). We used coefficients from multinomial logistic regression to predict 10-year probabilities of disability and death from baseline predictors (age, sex, obesity, smoking, diabetes and hypertension). We estimated the prevalence of disability attributable to past (1980) and expected future (2025) changes in obesity and diabetes prevalence using the life table approach.

Results. We estimated that the prevalence of disability for those aged between 55 and 74 years would have been 1697 cases per 100,000 persons less in 2010 (10.3% less) if the rates of obesity and diabetes observed in 2000 had been as low as the levels observed in 1980. However, if instead the prevalence of obesity and diabetes had been as high as the levels expected in 2025, then the prevalence of disability would have been an additional 2173 per 100,000 persons (an additional 13.2%).

Conclusions. We demonstrate, for the first time, a substantial potential impact of obesity and diabetes trends on disability amongst those aged 55–74 years. In Australian adults by 2025 we estimate that around 26% of disability cases would have been avoidable if there had been no change in obesity and diabetes prevalence since 1980. A similar impact is likely around the world in developed countries.

Introduction

Obesity and diabetes, two known predictors of disability (Wong et al., 2015), have increased in prevalence over the last three decades with obesity increasing more rapidly amongst the younger adult population (Gordon-Larsen et al., 2010; Ogden et al., 2006). These trends pose a challenge to an ageing population. Significant lifestyle predictors in mid-life for disability in old age include obesity, diabetes, smoking and hypertension (Wong et al., 2015). Whilst there have been improvements in smoking prevalence and better management of hypertension over time, based on trends in the first decade in the 21st century in the United States of America and Australia, obesity has been projected to increase between 34% and 43% in adults (Huffman et al., 2012; Walls et al., 2012; Magliano et al., 2008) by 2020–2025. Diabetes and glucose intolerance have also been projected to increase rapidly over the same time period (Magliano et al., 2008).

Recent trends of disability in the United States have shown an increase in disability amongst those aged 40–64 years and 55–64 years (Hung et al., 2011; Martin & Schoeni, 2014; Freedman et al., 2013). It is likely that this will impact on the population's productivity, pension schemes, health and aged care resources. Similar trends, measured as quality adjusted life expectancy, years lived with disability or compression of morbidity, have been demonstrated in both middle-aged adults as well as those aged over 65 years (Wen & O'Rance, 2008; Crimmins & Beltrán-Sánchez, 2011; Van Baal et al., 2006; Stewart et al., 2009). The recently updated Global Burden of Disease Study reported a shift in the burden of disease from premature death to years lived with disability (Murray et al., 2012). Projection studies for disability adjusted life expectancy and compression of morbidity over the next decade have

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concluded that even with declining smoking trends, the impact of obesity will lead to increased years lived with disability or compression of morbidities(Van Baal et al., 2006; Stewart et al., 2009). If current obesity trends continue, we can anticipate a rise in onset of new disability as our population ages. This has important implications with regard to those around retirement age in terms of their ability to prolong their productive years and continuing to live independently. To date, whilst there has been an analysis of the impact of obesity and smoking trends on life expectancy, little is known of the future impact of mid-life obesity and diabetes on the prevalence of disability. Disability, particularly in terms of limitations to activities of daily living (ADL), is an important general health measure as it relates to loss of independent living with early onset resulting in early retirement and disability pensions (Burdorf et al., 2014).

We aimed to estimate the likelihood of surviving free of disability up to age 75 years in Australia based on mid-life obesity and diabetes prevalence. We modelled the contemporary population using longitudinal data from the Australian Lifestyle, Obesity and Diabetes study (AusDiab) and estimated changes in disability prevalence associated with future (2025) and past (1980) midlife obesity and diabetes levels.

Methods

Study population

The Australian Diabetes, Obesity and Lifestyle study (AusDiab) commenced in 1999/2000 and involved 11,247 adults aged 25 years and over, from 42 randomly selected clusters across Australia. In brief, demographic and medical information were collected by questionnaire, and blood pressure and anthropometrics were measured. Blood tests included a 75 g oral glucose tolerance test and fasting blood samples were collected. The baseline questionnaire included the SF-36 (Ware & Sherbourne, 1992), where participants self-reported on limitations to a range of activities, including bathing or dressing. These were the only two self-care ADLs covered in SF-36 and we defined disability at baseline as those who responded 'limited a lot' to bathing or dressing (from available responses of (1) no, not limited at all; (2) yes, limited a little and (3) yes, limited a lot).

Predictors of disability and death

We used previously published literature to determine the modifiable mid-life predictors for disability and death to include in our analysis — smoking, obesity, diabetes, hypertension and dyslipidaemia (Wong et al., 2015). Smoking history was dichotomised to current (if smoking daily and had over 100 cigarettes in a lifetime) and not currently smoking (includes non-daily smokers such as weekly or monthly). Diabetes status was determined by self-reporting a diagnosis of diabetes made by a doctor or nurse, current treatment with insulin or oral hypoglycaemic agents, having a fasting blood glucose ≥ 7 mmol/L or post-load plasma blood glucose ≥ 11.1mmmol/L. Hypertension was classified on the basis of self-reported treatment for hypertension or a measured blood pressure > 140/90 mmHg. High total cholesterol and triglycerides were defined as levels ≥5.5 mmol/L and 2.0 mmol/L, respectively. Low high-density lipoproteins (HDL) was defined as <1.0 mmol/L. Underweight, normal weight, overweight and obesity were defined by body mass index (BMI) categories of <18.5, 18.5–24.9, 25–29.9 and ≥30 kg/m^2, respectively.

Outcomes

In 2011/12, all eligible, surviving participants of AusDiab (10,337 of original baseline participants) were invited back for re-examination, where, in addition to previous questions on lifestyle and medical history, participants were asked about limitations to ADLs. 59.8% (6186) of these original AusDiab participants who were eligible returned for re-examination in 2011/12. In the 2011/12 follow-up, participants were asked 'During the past month, how much difficulty have you had (performing a range of ADL activities) because of your health?' ADLs included bathing or showering, dressing, eating, toileting and moving in/out of chair/bed. Responses included none, a little, some, a lot or cannot do. We defined disability as reporting at least 'some difficulty' to at least one ADL. AusDiab is linked to the Australian National Death Index and, therefore, we were able to identify which participants died before the follow-up period of 2011/12. For the purpose of our analysis we regarded those eligible for analysis as those aged 45–64 years at baseline ($n = 4915$), who were free of disability ($n = 4868$). Of those 4868, 2676 who survived up to the follow-up period were missing disability data. Our population for analysis was our eligible population who had information on all the baseline variables of interest as well as outcome information on disability status or death ($n = 2107$). We compared the baseline characteristics of those who were deemed eligible for analysis who were included ($n = 2107$) and those who were excluded due to missing information ($n = 2761$). In general those included had similar baseline risk factor profiles to those excluded with the exception of smoking; approximately 17% of those excluded from analysis reported smoking at baseline compared to 11% of those included from the analysis (Appendix 1).

Statistical analysis

We used Stata 12 for descriptive analyses, regression analyses and simulation modelling. First we described our study population according to outcome status (alive, no disability; any disability; death). We used stepwise multinomial regression analyses to ascertain significant predictors for incident disability and death. We adjusted individual predictors for age and sex and only if these showed significant associations with disability or death (referenced to alive, no disability) did we include these predictors in the fully-adjusted model, also adjusted for age and sex. From the fully adjusted regression model, we obtained the coefficients of significant predictors to calculate the 12-year probabilities of incident disability, death and surviving free of disability (Fig. 1).

Simulation of a hypothetical population

In our study population in AusDiab 2000, 24.3% of participants in this 45–64 year age group ($n = 511$) were obese. Scenario 1 refers to a population resembling the 1980 obesity prevalence. To simulate a population with obesity levels similar to those reported in 1980 (an average of 13.5% of 45–64 year olds in 1980 were obese) (Dixon & Waters, 2003) we had to decrease the number of those who were obese in AusDiab to 284 individuals. Therefore we randomly selected 227 individuals from the 511 with obesity in AusDiab to convert to non-obese. To allow for sampling variation, we ran our random sampling 100 times to obtain 100 hypothetical populations with 13.5% obesity. In each new population, we ran our algorithm to calculate the probabilities of incident disability, death and surviving free of disability. We then obtained the mean and range of probabilities from the simulated populations.

As obesity is associated with diabetes (Abdullah et al., 2010) and diabetes has an independent effect on disability (Wong et al., 2013) we further simulated the additional effect on disability from diabetes as a consequent (flow-on) effect of obesity. To account for flow-on effects of obesity on diabetes, we randomly selected a fixed proportion of those converted from obese to non-obese who had diabetes in our above simulation to not have diabetes. This fixed proportion was based on the proportion of those in our sample with obesity at baseline who had diabetes (17.6%). In these new populations, we once again used our algorithm to recalculate the probabilities of incident disability, death and surviving free of disability. These probabilities were used as transition probabilities in our life table models described below.

Based on previous obesity prevalence projections for Australian adults, it is estimated that by 2025, 37.3% of the 45–64 year age group will be obese(Walls et al., 2012). Scenario 2 refers to a population with obesity prevalence projected for 2025. To simulate a population to have obesity prevalence estimated for 2025, we had to increase the number of individuals with obesity to 786. Therefore we randomly selected 275 individuals who were not obese in AusDiab 2000 to convert them to having obesity in our hypothetical population. This resulted in our new population with 37% obesity. As for the simulation for a population resembling the 1980 obesity prevalence, we ran our random sampling 100 times. To account for flow-on effects on diabetes, we assumed the same relationship between obesity and diabetes as above. For these two populations we recalculated the probabilities of incident disability, death and surviving free of disability.

Estimating impact of changing obesity and diabetes prevalence on prevalence of disability

We used a life table approach with 10-year age groups progressing to developing disability or death to age 75. Transition probabilities to new disability or death from no disability were obtained from the above simulated populations. Our regression model estimated 12-year probabilities of new disability and