HEALTH

QUESTION

Chronic diseases, such as coronary heart disease, cancer and diabetes, are the leading causes of illness, disability and death in Australia, and accounted for 17 of the 20 top causes of death in 2013 (the latest available statistics). Strategies to help reduce the impact of chronic disease and associated risk factors are a focus for all Australian governments.

Key risk factors associated with chronic disease include poor diet, physical inactivity, tobacco smoking, excessive alcohol consumption, high body mass and high blood pressure. These risk factors are largely preventable and can be reduced or eliminated through behavioural changes or managed with medical treatments. Population health strategies targeting risk factors are wide-ranging, from guidelines and legislation to health programs and media campaigns.

DIABETES

Diabetes is a chronic condition marked by high levels of glucose in the blood. The main types of diabetes are type 1, type 2 and gestational diabetes. The prevalence of diabetes has tripled in the past 30 years, with an estimated 1.2 million people in Australia and 422 million people worldwide currently living with diabetes. Type 2 diabetes is the most common form, occurring when the body becomes resistant to insulin or insulin production is reduced, and is the leading cause of preventable cardiovascular disease with an estimated 1 in 3 people developing it at some stage in their lifetime.

Over time, elevated blood glucose levels can lead to serious damage to the heart, blood vessels, eyes, kidneys and nerves. If left undiagnosed or poorly managed, diabetes can lead to coronary heart disease, stroke, kidney failure, limb amputations or blindness.

Type 2 diabetes cannot be cured, but blood sugar, blood pressure and cholesterol levels can be monitored and managed by adopting a healthy diet, reducing weight, cessation of smoking and increasing physical activity. Medications, including insulin injections, are used as the disease progresses.

The Australian Bureau of Statistics conducts a national health survey approximately every five years, which collects information on the proportion of those surveyed who have been diagnosed with diabetes (diabetes incidence):

Year	Type 1 Diabetes	Type 2 Diabetes	Other/ Unknown	Total Diabetes
1995	0.5%	1.1%	0.8%	2.4%
2001	0.5%	2.3%	0.1%	3.0%
2004-05	0.5%	2.9%	0.1%	3.5%
2007-08	0.4%	3.3%	0.1%	3.8%
2011-12#	na	na	na	4.2%

does not include results for newly diagnosed diabetes – see below

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The most recent 2011-12 survey was the largest and most comprehensive health survey ever conducted in Australia. For the first time, the survey included biomedical data involving the collection of a range of blood and urine tests from survey participants on a voluntary basis which were tested for various chronic disease and nutrient biomarkers.

The sample size in the blood glucose results was approximately 9,000 persons. In some cases, the blood and urine tests produced a diabetes diagnosis which was previously unknown to the participant (newly diagnosed) which can be used to estimate the prevalence of undiagnosed diabetes in the population. The survey produced total diabetes incidence rates (% of population) by age group in 2011-12, comprising both known diabetes (self-reported) and newly diagnosed diabetes (not previously known to the participant):

Age Group	Known Diabetes (self-reported)	Newly Diagnosed	Total Diabetes Incidence
18-34	0.4%	0.2%	0.6%
35-44	2.3%	0.4%	2.7%
45-54	3.8%	0.8%	4.6%
55-64	6.0%	2.3%	8.3%
65-74	12.7%	2.3%	15.0%
75+	10.2%	1.1%	11.3%
All	4.2%	0.9%	5.1%

Other studies have indicated that mortality rates for those with diabetes are approximately

$$q_x^d = \left\{ 5 - \frac{minimum\ (age,75)}{20} \right\} \cdot q_x$$

where q_x^d = mortality rate at age x for persons with diabetes

and q_x = mortality rate at age x for persons without diabetes

YOUR TASK

You are an Actuary working for an actuarial consulting firm. Your firm has been engaged by the Australian Federal Government Department of Health to assist them with understanding the implications of increasing diabetes prevalence by developing an experimental model to forecast diabetes prevalence and the impact of increasing diabetes prevalence on future mortality.

They have also asked you to explore and recommend possible uses of the model, identifying potential users of the model, key assumptions and qualifications, and any further data that would be needed to improve the experimental model (either from future national health surveys or elsewhere).

Prepare your report for the Department of Health, including your experimental model forecast results for diabetes prevalence and impact on future mortality.

END OF QUESTION

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