In each region, male mortality rates were higher than the corresponding female rates. The difference between the male and female rates was statistically significant for those born in Australia, New Zealand, United Kingdom and Ireland, North and West Europe, Southern Europe, Eastern Europe and Central Asia, Other Africa, North-East Asia and Southern Asia.

In their study of mortality from 1994–1996, Strong et al. (1998) found that underlying cause diabetes mortality rates were 16% and 11% (males and females respectively) lower for 'UK & Ireland-born people'; 32% and 87% higher for people born in 'North & West Europe, the former USSR and Baltic States'; and 12% and 37% higher for people born in 'Asia' than the Australian-born rates.

Diabetes death rates are difficult to compare internationally, and usually underestimate the true extent of deaths caused by diabetes (Colagiuri et al. 1998). This is because the mortality burden of diabetes often presents itself in associated problems such as renal disease, heart disease and stroke (AIHW 1998).

Discussion

Rates of diabetes differ widely between Australians of different regions of birth and the level of difference varies between population health indicators. It is difficult to explain why diabetes prevalence, hospital separation and mortality rates vary so much, amongst regions of birth, but could be due to disparities in access; and utilisation and attitudes to healthcare including hospitals, diabetes management services, and diabetes educational resources (von Hofe et al. 2002).

Males and females born in the Middle East and North Africa had the highest standardised prevalence ratios (3.60 and 2.43 respectively) and the highest incidence rate ratios (1.73 and 2.30) of diabetes compared to Australian-born males and females (Table 4). Men from Southern Europe and Eastern Europe and Central Asia; and women from the United Kingdom and Ireland had the lowest standardised prevalence ratio compared to Australian-born people (0.85 and 0.71 respectively), though these differences were not all significant. Men and women from the United Kingdom and Ireland and North and West Europe had incident rates significantly lower than Australian-born people.

It is unfortunate that prevalence rates for South Pacific Island-born people are unavailable, as these people have the highest hospitalisation (2.22 males and 2.62 females) and mortality (2.25 and 2.98) rate ratios compared to Australian-born people. The second highest hospitalisation rate ratios are for males and females born in the Middle East and North Africa (2.07 and 1.52 respectively); and Middle Eastern-born people also have the second highest mortality rate ratios (1.96 and 2.51) (Table 4).

Rates of diabetes prevalence, incidence, hospitalisations and mortality for men and women born in the Middle East and North Africa were consistently higher than Australian-born rates. However, this expected uniform pattern was not apparent across all regions of birth. For example, men born in the United Kingdom and Ireland reported 17% more diabetes than Australian-born men, but had 21% less hospitalisations and 13% less mortality than Australian-born men. Similarly, men born in Southern and Eastern Europe and Central Asia had lower prevalence rates compared to Australian-born men, yet had higher hospitalisation and mortality rates than their Australian-born counterparts.

A picture of diabetes in overseas-born Australians

Table 4: Age-standardised rate ratios, by region of birth

	Ratios (Australian-born=1.00)							
	Prevalence[a] 2001		Incidence of insulin-treated diabetes 1999–2001		Hospitalisations 1999–00		Mortality 1997–2000	
Region of birth	Males	Females	Males	Females	Males	Females	Males	Females
UK & Ireland	1.17	0.71	0.71*	0.74*	0.79*	0.64*	0.87*	0.87*
North & West Europe	1.26	0.55			0.91*	0.89*	1.07	1.25*
Southern Europe	0.85	1.46*	1.33[b]*	1.33[b]*	1.53*	1.12*	1.42*	1.93*
Eastern Europe & Central Asia					1.09*	0.70*	1.27*	1.35*
Middle East	3.60*	2.43	1.73*	2.30*	2.07*	1.52*	1.96*	2.51*
North Africa							1.68*	2.20*
South-East Asia	1.87*	1.54	1.17	1.37*	0.69*	1.15*	0.88	1.17
Southern Asia			1.70[C]*	2.27[C]*	1.26*	1.14*	1.33*	1.48*
All other countries	1.56	0.57	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
New Zealand	n.a.	n.a.	0.96	1.35*	0.66*	0.50*	n.a.	n.a.
South Pacific	n.a.	n.a.			2.22*	2.62*	2.25*	2.98*
Other Africa	n.a.	n.a.	1.15	1.02	1.00	0.77*	1.00	0.87
North-East Asia	n.a.	n.a.	0.93	1.32	0.56*	0.67*	0.81*	0.96
Americas	n.a.	n.a.	1.01	0.98	1.02	0.77*	0.73*	0.79

(a) From self-reported data. Ratios for prevalence data were calculated using the indirect method of standardisation, rather than the direct method used for hospitalisations and mortality. Therefore the prevalence ratios are based of observed cases to expected cases, whereas the hospitalisation and mortality ratios are of estimated rates.

(b) Does not include Central Asia.

(c) Includes Central Asia.

* Indicates significantly different from Australia.

Note: shaded areas represent combined regions of birth.

There are multiple explanations as to why the patterns in the data in Table 4 are not consistent across regions of birth. Usually, an increased prevalence of diabetes and associated complications would be expected to lead to more frequent hospitalisations and higher mortality rates (DHAC & AIHW 1999). Alternatively, Strong et al. (1998) suggest that high prevalence and low hospitalisation rates may reflect poor management of diabetes complications rather than less complications. Using this hypothesis, high prevalence and high hospitalisation rates may not correspond with high mortality rates.

People born in the United Kingdom and Ireland have the most similar prevalence of diabetes to Australian-born people compared with other regions of birth. This could be a combination of sharing similar cultures and genetic backgrounds. Karvonen et al. (1993) suggest that genetic backgrounds play a role in the risk of diabetes.

The 'healthy migrant effect' is a phenomenon of migrants arriving in Australia with good health (measured by life expectancy and disease burden), reinforced by enforced health stipulations and eligibility criteria (AIHW: Singh & de Looper 2002). However, the patterns of diabetes among overseas-born Australians shown in this bulletin portray a more complicated picture, as some groups appear to suffer disproportionably from diabetes compared to Australian-born people. This could be explained by biological and genetic risk factors, such as a maternal inheritance mechanism; differing behavioural risk factors including changing lifestyle after migration; environmental risk factors such as some groups having a relatively low socio-economic status (SES) within Australia; or combinations of these, for example diabetes risk factors such as obesity and physical inactivity, are associated with low SES and lifestyles of increased urbanisation (Riste et al. 2001).

The rate of self-reported diabetes prevalence is higher among overseas-born people who arrived in Australia before 1991 (5.4%) compared with those who migrated between 1991 and 2001 (2.1%) (ABS 2002b). As diabetes is more prevalent in older age groups, an older average age of people who migrated to Australia before 1991 compared to those after 1991 may explain some of the difference between the two rates. Another explanation may be the length of time spent in Australia—a longer duration in Australia could erode the initial healthy migrant effect. These could be areas for further analysis.

One possible explanation for the increased rates of diabetes amongst some minority ethnicities in developed countries is the 'thrifty genotype' hypothesis. The traditional hunter-gatherer role of American Pima Indians, Australian Aboriginals, and Pacific Islanders peoples is believed to be incorporated in their genes. The thrifty genotype definition reflects that the hunter-gatherer genes store fat and calories which are accumulated during times of plenty to prepare for leaner times. In a western culture, the same peaks and troughs of food availability do not apply, and a high fat and caloric diet is difficult to avoid (Zimmet et al. 2001). Therefore, the increase in these peoples' diabetes prevalence could be due to metabolic causes.

Conclusion

Australia is a multicultural nation with 28% of its population overseas-born (ABS 2002a). However, proportionally more overseas-born people than Australian-born report having diabetes; approximately 35% of people who reported having diabetes in 2001 were born overseas. In particular, diabetes incidence, hospitalisations and/or mortality are more common among people born in the South Pacific Islands, Southern Europe, Middle East, North Africa and Southern Asia.

The data presented here provide information for use by policy makers and to support other epidemiological research that attempts to determine why diabetes patterns differ amongst ethnicities and how migration between countries affects the combination of genetic, behavioural and environmental risk factors for diabetes.

Appendixes

Appendix A: Data sources and methods

Australian Bureau of Statistics National Health Surveys, 1995 and 2001

The 1995 and 2001 National Health Surveys (NHSs) were conducted by the Australian Bureau of Statistics (ABS). They were designed to obtain national information on the health status of Australians, their use of health services and facilities, and health-related aspects of their lifestyle. The 1995 survey collected information from a sample of 57,600 people (ABS 1996) and the 2001 survey collected information from approximately 26,900 respondents (ABS 2002b).

Australian Diabetes, Obesity and Lifestyle Study (AusDiab Study)

The AusDiab Study was conducted in 1999–2000, by the International Diabetes Institute and was partially funded by the Commonwealth Department of Health and Aged Care. It is the most comprehensive survey to date on the prevalence and impact of diabetes. The survey collected information on self-reported and measured diabetes and cardiovascular risk factors, health knowledge, attitudes, and health services utilisation and practices. The study collected information from 11,247 adults aged 25 years and over throughout Australia (excluding the Australian Capital Territory).

National Diabetes Register

The National Diabetes Register, held at the Australian Institute of Health and Welfare, is a database that holds information about people who use insulin as part of their treatment of diabetes. It includes people who began to use insulin from 1 January 1999. Data for the register are obtained from two main sources: the National Diabetes Services Scheme, administered by Diabetes Australia, and the Australasian Paediatric Endocrine Group (APEG) State-based registers. At December 2001, the register contained information on about 23,000 people.

National Mortality Database

The National Mortality Database, held at the Australian Institute of Health and Welfare, contains information on the cause of death supplied by the medical practitioner certifying the death or by a coroner. Registration of deaths is the responsibility of the state and territory Registrars of Births, Deaths and Marriages. Registrars provide the information to the Australian Bureau of Statistics for coding of cause of death using International Statistical Classification of Diseases and Related Health Problems (ICD) codes (WHO 1977) and compilation into aggregate statistics.

On 1 January 1997, the Australian Bureau of Statistics introduced automatic coding software, which identifies multiple causes of deaths within Australia.

National Hospital Morbidity Database

The National Hospital Morbidity Database contains demographic, diagnostic, procedural and duration of stay information on episodes of care for patients admitted to hospital. The data items are supplied by state and territory health authorities to the

Australian Institute of Health and Welfare for storage and custodianship. The database provides information on the number of hospitalisations for a particular condition or procedure and therefore it is not possible to count patients individually.

These data are coded to the ICD-10-AM First Edition for primary or additional diagnosis of diabetes. Insulin-dependent diabetes mellitus is represented by E10, non-insulin-dependent diabetes mellitus is E11, other specified diabetes mellitus is E13 and unspecified diabetes mellitus is E14 (NCCH 1998).

The hospital morbidity data in this report is for 1999–00 only. This is because a change in coding practice makes direct comparison with prior years problematic.

Hospital separations per unit of diabetes prevalence were calculated to remove the effect of prevalence from hospital separation rates. These were determined using the following formula:

$$Sp = S / P$$

Where: Hospital separations per unit of diabetes prevalence per 100, 000 population = Sp

Age-standardised diabetes prevalence per 100,000 population = P

Age-standardised hospital separation rate per 100,000 population = S

This rate (Sp) was expressed as a ratio to Australian-born people.

Estimated Resident Population by country of birth

The Australian Bureau of Statistics Estimated Resident Population (ERP) data by country of birth for 1997–2000 were used to calculate rates of deaths and hospital separations. At the time of publication, 2001 ERP data by country of birth were not available.

Age-standardised rates

Age-standardised rates are used to remove the influence of age when comparing populations with different age structures by applying age-specific rates to a standard population. This report uses the 2001 Australian population as the standard population and 5-year age groups for age-specific rates.

Direct age-standardisation

Direct age-standardisation is the most common method of age standardisation, and is used in this report for incidence, hospital morbidity and mortality data. The calculation of direct age-standardisation comprises three steps:

Step 1: Calculate the age-specific rate for each age group.

Step 2: Calculate the expected number of cases in each age group by multiplying the age-specific rate by the corresponding standard population for each age group, and divide by 100,000 (or 1,000 for hospital separations).

Step 3: Sum the expected number of cases in each age group and divide this sum by the total of the standard population and multiply by 100,000 (or 1,000 for hospital separations) to give the age-standardised rate.

Indirect age-standardisation

In situations where populations are small or where there is some uncertainty about the stability of age-specific prevalence rates, indirect standardisation has been used. This effectively removes the influence of the age structure, but does not provide a measure of prevalence in terms of a rate. Rather, the summary measure is a comparison of the number of observed cases compared to the number expected if the age-specific prevalence rates of the standard population are applied to the study population. The method used for this calculation is composed of three steps:

Step 1: Calculate the age-specific prevalence rates for each age group in the standard population.

Step 2: Apply these age-specific rates to the number in each age group of the study population and sum to derive the total expected number of cases for the study population.

Step 3: Sum the observed cases in the study population and divide this number by the expected number derived in Step 2 to calculate the Standardised Prevalence Ratio (SPR).

An SPR of 1 indicates the same number of observed cases as were expected (suggesting rates in the study and standard populations are similar). A result greater than 1 indicates more cases than expected. A result less than 1 indicates fewer cases than expected.

Confidence intervals (error bars)

Confidence intervals are an indication of the amount of variation associated with an estimate. The figures in this document show 95% confidence intervals as error bars on each column of the graph. These indicate that if the process that led to the estimated value were repeated many times, in 95% of cases the resulting new estimate would fall within that confidence interval.

Appendix B: Geographical regions

The Australian Standard Classification of Countries for Social Statistics (ASCCSS) (ABS 1990) and the Standard Australian Classification of Countries (SACC) (ABS 1998), were used to specify which countries would populate the geographic regions of study. More detail is available from the Australian Bureau of Statistics (ABS) <www.abs.gov.au>.

As the National Health Surveys are conducted by the ABS, they use the ASCCSS and SACC (1995 and 2001 respectively). The Australian Diabetes, Obesity and Lifestyle Study country of birth variable was collected in a text format, and manually mapped to the regions in ASCCSS. In 1999–2000, the National Hospital Morbidity Database used ASCCSS to code country of birth. The National Mortality Database also used the ASCCSS during the years of analysis. The National Diabetes Register incidence data used a combination of SACC and ASCCSS.

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