Country-of-birth differences in adverse health behaviours among people with type 2 diabetes

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Abstract

Objective: To identify differences in patterns of adverse health behaviours among people with type 2 diabetes according to country or region of birth.

Methods: Population-based study of 23,112 individuals with type 2 diabetes aged 45 years and older, from New South Wales, Australia. Self-reported questionnaire data and logistic regression models were used to estimate odds ratios for adverse health behaviours according to country or region of birth, adjusted for confounding factors.

Results: People with diabetes born in the Middle East and in the United Kingdom (UK) were more likely to be current smokers than those born in Australian, while those from Asia were less likely to be smokers. Relative to Australian-born people with diabetes, those born in the Middle East were more likely to have insufficient physical activity, while those born in Oceania, North West Europe and the UK were less likely. People with diabetes from Asia, North Africa, the Middle East and Sub-Saharan Africa were less likely to consume alcohol than those born in Australia, but people born in the UK were slightly more likely to consume alcohol. People with diabetes born in the UK, Asia, and North Africa were more likely than those born in Australia to have an inadequate intake of fruit and vegetables.

Conclusion: Adverse health behaviours among people with type 2 diabetes varied markedly according to country or region of birth. Promoting smoking cessation and increasing physical activity levels among people with diabetes who were born in Middle Eastern countries are clear priorities.

Key words: country of birth, adverse health behaviours, type 2 diabetes

Lifestyle modification, particularly reducing adverse behaviours such as smoking, alcohol consumption, unhealthy diet and sedentary lifestyle, is essential as part of a diabetes management program.[1] Among people with type 2 diabetes, smoking is linked to exacerbating glycemic control and insulin resistance,[2] accelerating the development of microvascular complications including nephropathy and end-stage renal disease,[3] higher incidence of neuropathy[4] and increased risk of cardiovascular disease and related mortality.[5] Alcohol use among people with diabetes can worsen glycemic control and increase the incidence of complications such as disturbances in fat metabolism, nerve damage and eye disease.[6,7] Physical activity is crucial for the management of diabetes as it helps weight and glycemic management and reduces the risk of cardiovascular diseases.[8,9] A recent meta-analysis of 34 studies showed that aerobic exercise alone or combined with resistance training significantly improved glycated haemoglobin (HbA1c), systolic blood pressure, triglycerides and waist circumference.[10] In terms of diet, a systematic review including 20 studies showed improvements in glycemic control in people consuming low-carbohydrate, low-GI, Mediterranean and high-protein diets, with the greatest weight loss seen in those having low-carbohydrate and Mediterranean diets.[11]

Previous studies around the world have demonstrated that ethnicity and socioeconomic status are important determinants of diversity in the occurrence of diabetes[12] and both are considered to be independent predictors of type 2 diabetes.[13-16] Ethnic disparities in diabetes complication rates have also been demonstrated in studies, mainly from the US.[17-19] These may be explained by differences in health literacy, lifestyle factors and diabetes self-care, as well as access to quality clinical services. In particular, language and cultural barriers may influence self-care behaviours. For example, qualitative research among Indian and Pakistani people with diabetes found that lack of time as well as social rules and cultural expectations – such as the prioritisation of obligations to kin, restrictions on (women) leaving the home (especially to enter mixed-sex settings) and lack of socialisation into sporting and other outdoor activities – affected undertaking physical activity as part of lifestyle advice for their diabetes care.[20]

Australia is one of the most ethnically and culturally diverse countries in the world. In 2009, about one quarter (5.8 million people) of the Australian resident population (22 million people) was born overseas, of which more than half were from a non-English-speaking origin.[21] Understanding ethnic differences in adverse health behaviours among people with diabetes will help target interventions to modify lifestyle for high-risk population groups. However, little comparative information exists for contemporary multi-ethnic populations. This paper addresses this information gap using data from the 45 and

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Up Study, a large-scale population-based study in New South Wales (NSW), Australia.

Methods

Data source

This analysis used self-reported baseline questionnaire data from the Sax Institute's 45 and Up Study, a cohort of 267,153 men and women aged 45 years and over from NSW. The study is described in detail elsewhere.[22] In brief, participants were randomly sampled from the database of Australia's universal health insurance provider, Medicare Australia, which provides virtually complete coverage of the general population, including some temporary residents and refugees. Around 11% of the NSW population aged 45 years and over (about 18% of those approached) enrolled in the study**.** Participants joined by completing a baseline questionnaire between Jan 2006 and April 2009 and giving signed consent for follow-up and linkage of their information to a range of health databases.

The study questionnaires can be viewed online at www.45andup.org.au. The study received ethical approval from the University of NSW Human Research Ethics Committee for its collection of baseline data.

Definition of variables

All data used in this study were self-reported. People with diabetes were identified on the basis of answers to the questions "Has a doctor EVER told you that you have diabetes?" and "If YES please cross the box and give your age when the condition was first found". Participants were classified as having type 2 diabetes if they responded "yes" and reported an age at diagnosis of 25 years or older.[23,24]

The main independent variable of interest was country or region of birth, classified according to the Australian Bureau of Statistics (ABS) Standard Australian Classification of Countries (SACC)[25] as follows: Australia, rest of Oceania and Antarctica, United Kingdom, rest of North-West Europe, Southern and Eastern Europe, North Africa and the Middle East, South-East Asia, North-East Asia, Southern and Central Asia, the Americas and Sub-Saharan Africa.

The dependent variables were, successively: current smoking; insufficient physical activity (less than five sessions per week);[26] alcohol consumption (one or more drinks per week; participants who drank less than one drink per week were instructed to record zero consumption); and inadequate consumption of fruit and vegetables (less than five servings of fruit and vegetables per day).[27]

Sessions of physical activity were calculated as the sum of the total number of times per week spent walking or doing moderate activity, plus double the number of times per week spent doing vigorous activity.[28]

A range of potential confounding and mediating variables were considered. Age was grouped into four categories: 45–54, 55–64, 65–74 and ≥75 years. Education was classified into four groups: no education; school intermediate, higher or leaving certificate (Level I); trade, apprenticeship, certificate or diploma (Level II); and university and higher (Level III). Work status was categorised into three groups: in paid work; retired; and other. Annual household income was categorised as: >$50,000; $20,000 to <$50,000; <$20,000; and not disclosed. BMI was classified into three categories: healthy weight (25>BMI≥20), overweight (30>BMI≥25) and obese (BMI≥30). BMI scores of less than nine and more than 50 were considered as invalid records and excluded from analysis; BMI <20 also was excluded because of small participant numbers. History of stroke, hypertension, and heart disease was defined on the basis of answers to the question "Has a doctor EVER told you that you have stroke, hypertension or heart disease?"

Statistical analysis

Separate multiple logistic regression models were built for each of the dependent variables (smoking, alcohol consumption, inadequate physical activity, inadequate intake of fruit and vegetables). Two models were built for each outcome: the first was adjusted for age and sex only, while the second (fully adjusted) model included age, sex, history of heart disease, stroke or hypertension, BMI and the other adverse health behaviours.

Crude and adjusted odds ratios (aORs) with 95% confidence intervals were estimated. All analyses were performed using the STATA statistical package Version 11.

Results

The analysis data set included data for 262,332 participants of the 45 and Up Study, of whom 23,112 (8.81%) reported having diabetes. Table 1 gives the distribution of adverse health behaviours among people with diabetes according to country and region of birth, demographic variables, disease history and BMI category. Smoking was more frequent among younger people with diabetes (45–54 years old), alcohol intake was more prevalent among those in the age range 55–74 years and inadequate intake of fruit and vegetables was more prevalent among people less than 65 years of age, while insufficient physical activity was higher among the oldest age group (75+ years). Males with diabetes were more likely than females with diabetes to be smokers, to consume alcohol and to have an inadequate intake of fruit and vegetables, but they were less likely to have insufficient physical activity.

The distribution of adverse health behaviours among people with diabetes varied by country or region of birth. Current smoking was most prevalent among people from the Middle East (18.7%) and least prevalent in people born in Sub-Saharan Africa (3.7%). Alcohol use was more prevalent among people with diabetes born in North-West Europe, including the United Kingdom (UK). People with diabetes from North Africa and the Middle East were the most likely to report insufficient physical activity.

Unhealthy behaviours except alcohol intake were more prevalent among people with type 2 diabetes without any education, while alcohol consumption was likely to be reported by people with diabetes with higher levels of education. Smoking, alcohol intake and inadequate fruit and vegetable consumption were more frequent among people with diabetes who were engaged in paid employment. People with diabetes in the lowest income category were more likely to be current smokers and to have a sedentary lifestyle, but alcohol consumption was more frequent among those with an annual income of more than $50,000.

Smoking and insufficient physical activity were more prevalent among people with diabetes who also had a history of stroke, and alcohol consumption was most frequent among those who reported hypertension. Almost one-third of people with diabetes with a history of stroke, hypertension or heart disease did not consume adequate fruit and vegetables. Smoking was more frequent among people with diabetes who had a healthy weight. Insufficient physical activity was more prevalent among obese people with diabetes, but this group was less likely than others to consume alcohol. Almost one-third of all people with diabetes in any weight category did not consume adequate quantities of fruit and vegetables.

Table 2 presents the results of modelling. Results of age and sex-adjusted and fully-adjusted models were similar. After adjusting for all other variables, people with diabetes born in the Middle East (aOR 2.53 95%CI 1.74-3.67) and the UK (aOR 1.41 95%CI 1.16-1.71) were more likely to be current smokers than those born in Australia. People with diabetes born in the UK were slightly more likely to consume alcohol (OR 1.13 95%CI 1.02-1.26). Those born in the Middle East (aOR 1.48 95%CI 1.23-1.57) were more likely to report insufficient physical activity than their Australian-born counterparts. People with diabetes who were born in the UK (aOR 1.14 95%CI 1.02-1.27), Asia (aOR 1.48 to 1.86) and North Africa (aOR 1.79 95%CI 1.18-2.73) were more likely than those born in Australia to have an inadequate intake of fruit and vegetables.

In contrast, people born in some countries and regions reported lower levels of adverse health behaviours than the Australian-born. Compared to Australia-born people with diabetes, people with diabetes born in South-East Asia were less likely to smoke (aOR 0.60 95%CI 0.39-0.92) and those born in the rest of Oceania and Antarctica (aOR 0.67 95%CI 0.52-0.87), rest of North-West Europe (aOR 0.79 95%CI 0.65-0.96), and the UK (aOR 0.84 95%CI 0.75-0.95) less likely to report insufficient physical activity. People with diabetes from North Africa (aOR 0.30 95%CI 0.18-0.48), the Middle East (aOR 0.47 95%CI 0.34-0.64), Asia (aOR 0.22 to 0.35) and Sub-Saharan Africa (aOR 0.64 95%CI 0.45-0.92) were less likely to consume alcohol compared to Australia-born counterparts.

Discussion

This study examined the relationship between adverse health behaviours among people with type 2 diabetes according to country or region of birth in a large multi-ethnic population sample. After adjusting for age, sex, educational attainment, work status, household income, body mass index and history of cardiovascular disease, it demonstrated significant differences between country of birth groups in the prevalence of current smoking, insufficient physical activity, alcohol consumption and inadequate intake of fruit and vegetables. However, there was no country or region of birth that performed 'poorly' across all measures.

Unfortunately, there are very few existing studies with which to compare our findings. The applicability of findings from studies of migrant populations in the US and Europe is limited because of differences in the ethnic minority populations, host country health systems, and the contexts in which migration occurred (e.g. skilled migration vs. asylum seekers).

In this study, when compared to Australia-born people with diabetes, current smoking was almost three times more frequent among

Table 1: Adverse health behaviours among people with diabetes according to country/region of birth, demographic variables, disease history and BMI category.

Characteristics	Total %(N)	Current smoking %(N)	Alcohol intake %(N)[a]	Insufficient physical activity %(N)[b]	Inadequate intake of fruit & vegetables %(N)[c]
Country/region of birth					
Australia	72.4 (16,735)	6.7 (1,114)	49.6 (8,307)	27.7 (4,631)	29.6 (4,953)
Rest of Oceania & Antarctica	1.9 (448)	26 (5.8)	46.9 (210)	19.9 (89)	28.1 (126)
United Kingdom	9.4 (2,163)	163 (7.6)	54.2 (1,172)	24.6 (531)	31.6 (683)
Rest of North West Europe	3.4 (784)	8.0 (62)	53.7 (421)	23.0 (180)	34.3 (269)
South East Europe	4.7 (1,093)	7.6 (82)	46.3 (506)	28.4 (310)	30.0 (328)
North Africa	0. 5 (124)	6.5 (8)	31.5 (39)	40.3 (50)	45.2 (56)
The Middle East	1.1 (255)	18.7 (47)	32.6 (83)	36.1 (92)	30.6 (78)
South East Asia	2.1 (489)	5.8 (28)	26.4 (129)	21.1 (103)	40.1 (196)
North East Asia	1.2 (269)	4.5 (12)	23.8 (64)	23.4 (63)	42.0 (113)
South Central Asia	1.6 (364)	5.3 (19)	38.7 (141)	22.3 (81)	40.4 (147)
Americas	1.0 (224)	6.3 (14)	48.2 (108)	28.1 (63)	31.3 (70)
Sub Saharan Africa	0.7 (164)	3.7 (6)	45.7 (75)	20.1 (33)	33.5 (55)
Age					
45–54	14.4 (3,330)	14.4 (474)	45.4 (1,510)	26.9 (897)	34.1 (1,135)
55–64	29.3 (6,771)	9.3 (625)	50.5 (3,416)	25.5 (1,723)	32.2 (2,183)
65–74	30.7 (7,096)	5.0 (351)	50.7 (3,600)	24.0 (1,704)	28.1 (1,993)
75+	25.6 (5,912)	2.2 (130)	46.1 (2,728)	32.2 (1,902)	29.8 (1,762)
Sex					
Male	43.3 (10,013)	7.1 (928)	60.9 (7,975)	25.7 (3,366)	36.8 (4,814)
Female	56.7 (13,099)	6.6 (653)	32.8 (3,280)	28.6 (2,860)	22.6 (2,260)
Education[d]					
None	18.9 (4,278)	8.8 (372)	38.5 (1,647)	33.1 (1,416)	31.2 (1,336)
Level I	34.5 (7,790)	7.1 (553)	46.1 (3,588)	26.9 (2,092)	30.1 (2,347)
Level II	30.9 (6,984)	6.4 (446)	54.3 (3,790)	25.2 (1,763)	31.1 (2,170)
Level III	15.7 (3,538)	4.8 (169)	55.9 (1,976)	22.6 (799)	30.0 (1,060)
Work status					
In paid work	17.8 (4,051)	8.9 (358)	53.1(2151)	25.7 (1,040)	1,352 (33.4)
Retired	50.7 (11,565)	4.4 (505)	50.1(5795)	26.9 (3,110)	3,422 (29.6)
Other	31.5 (7,203)	9.9 (706)	44.0(3169)	27.5 (1,982)	2,197 (30.5)
Income					
<20,000	34.2 (7,472)	8.6 (636)	41.3 (3,088)	29.4 (2,193)	32.5 (2,428)
20,000–50,000	26.6 (5,801)	5.8 (336)	52.8 (3,063)	24.3 (1,409)	28.6 (1,657)
>50,000	20.8 (4,548)	6.6 (297)	61.7 (2,806)	23.5 (1,067)	33.2 (1,510)
not disclosed	18.4 (4,005)	5.7 (227)	43.9 (1,757)	28.7 (1,149)	28.1 (1,124)
Disease history (yes)					
Heart Disease	23.8 (5,496)	6.2 (338)	48.7 (2,676)	30.4 (1,671)	31.1 (1,711)
Hypertension	60.5 (7,924)	6.2 (615)	55.6 (5,567)	27.4 (2,717)	33.3 (3,334)
Stroke	8.11 (1,874)	7.6 (141)	46.4 (870)	34.5 (647)	33.2 (622)
Body Mass Index					
Healthy weight	18.9 (3,984)	7.3 (290)	50.2 (2,001)	20.7 (825)	30.9 (1,232)
Overweight	37.3 (7,860)	6.4 (497)	54.3 (4,271)	23.3 (1,832)	30.8 (2,424)
Obese	41.9 (8,822)	6.8 (598)	45.0 (3,968)	32.0 (2,819)	30.1 (2,652)

a. More than one drink per week

b. Less than five sessions of physical activity per week

c. Less than five servings of fruit and vegetables per day

d. Level I: School intermediate, Higher or leaving certificate, Level II: Trade, Apprenticeship, Certificate or diploma, Level III: University and Higher

people with diabetes born in Middle Eastern countries and 1.5 times more common in those born in the UK. In contrast, a study in Sweden[29] found that people with diabetes born in the Middle East were less likely to smoke than Swedish people (16.9% versus 18.3%), but this difference was not statistically significant. In a study in the Netherlands, Turkish migrants with diabetes were less likely to smoke than Dutch people.[30] This difference might be explained by the relatively low rate of smoking (6.7%) in Australia-born people in our study compared with the native-born groups in the Swedish and Dutch studies, limited adjustment for confounding factors in those studies, or perhaps by differing compositions of the Middle-East-born groups between studies.

In the current study, people with diabetes who were born in the Middle East were more likely to report insufficient physical activity than Australian-born participants. This was consistent with a study in Sweden that found the proportion of people with diabetes who had ≥3 hours of total physical activity in the winter was lowest in those coming from the Middle East.[29] Results of a study of people with diabetes in the US showed that Mexican Americans and African Americans were more likely to report no physical activity[31] and another study from the US reported that blacks were less likely to exercise (OR 0.63, 95%CI 0.51, 0.79), while Hispanics and 'others' were not significantly different from whites.[32] Little or no comparative information about physical activity levels in people with diabetes is available from research in other multi-ethnic populations.

Similarly, very little published information is available about ethnic differences in alcohol consumption in people with diabetes. The study in Sweden reported that more than half of the Assyrians/Syrians, compared to 17% of Swedes, reported they never used alcohol.[29] In the current study, people with diabetes born in North Africa, the Middle East and Asia were less likely to drink alcohol than those born in Australia, while those born in the UK were more likely to drink alcohol, likely reflecting the influence of religious beliefs.

The current study found that people with diabetes born in the rest of Oceania, Asia and North Africa were more likely than Australian-born participants to report inadequate intake of fruit and vegetables. Results of a study of people with diabetes in the US showed that, with the exception of Mexican Americans, other ethnic groups more likely than whites to eat fewer than five servings of fruit and vegetables per day.[31] In contrast, another US study found no significant racial/ethnic disparities in fruit and vegetable consumption among people with diabetes.[32] These inconsistent findings might relate to differences in collection of dietary information across the different studies.

In general, the patterns of adverse health behaviours according to country of birth observed among people with diabetes in this study reflect the patterns seen in the overall NSW population.[33] There is evidence that smoking is more prevalent among migrants from North African and Middle Eastern countries. For example, the results of a study among the Arabic-speaking population in Sydney showed that more than 50% of both males and females smoked,[34] while another study in the Sydney-based Lebanese community reported that the prevalence of smoking was about 49% among males and 29% among females.[35] This suggests that lifestyle modification interventions targeting high-risk ethnic communities, and those directed more specifically towards people with diabetes from these communities, are likely to yield benefits in terms of primary and secondary prevention of diabetes. A recent clinical trial in the UK demonstrated that health education on diabetes delivered by bilingual health advocates and tailored for immigrant and refugee communities is more effective than standard health education conducted in English.[36]

This study's main strength was its large size, which allowed comparison of adverse health behaviours among people with diabetes from a range of different migrant groups. The limited previous studies of this topic in multi-ethnic populations have either used very broad classifications of race or ethnicity or only focused on one or few ethnic groups.

The study's biggest limitation was that it relied on self-reported information from a questionnaire that was completed in English. Thus, people with poor English-language proficiency were differentially excluded, and participants were likely to represent more highly educated and/or acculturated members of their ethnic communities. Despite adjusting for measures of socioeconomic status, it is likely that this study produced conservative estimates of disparities for country-of-birth groups whose native language was not English. Diabetes

Table 2: Odds ratios for adverse health behaviours among people with diabetes according to country/region of birth.

Country/region of birth	Current smoking		Alcohol consumption[a]		Insufficient physical activity[b]		Inadequate intake of fruit and vegetables[c]	
	OR* (95% CI)	OR** (95% CI)	OR* (95% CI)	OR** (95%CI)	OR* (95% CI)	OR** (95%CI)	OR* (95% CI)	OR** (95%CI)
Australia	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Rest of Oceania & Antarctica	0.74 (0.49–1.11)	0.77 (0.49–1.19)	0.85 (0.70–1.03)	0.82 (0.66–1.02)	0.67 (0.53–0.84)	0.67 (0.52–0.87)	0.89 (0.72–1.10)	0.95 (0.75–1.20)
United Kingdom	1.34 (1.13–1.60)	1.41 (1.16–1.71)	1.19 (1.08–1.31)	1.13 (1.02–1.26)	0.84 (0.76–0.93)	0.84 (0.75–0.95)	1.10 (1.00–1.22)	1.14 (1.02–1.27)
Rest of North West Europe	1.49 (1.13–1.95)	1.27 (0.92–1.74)	1.10 (0.95–1.28)	1.07 (0.90–1.27)	0.76 (0.64–0.91)	0.79 (0.65–0.96)	1.22 (1.04–1.42)	1.17 (0.98–1.39)
South East Europe	1.45 (1.15–1.95)	1.22 (0.93–1.63)	0.81 (0.71–0.92)	0.87 (0.75–1.01)	1.01 (0.88–1.16)	0.89 (0.76–1.05)	1.00 (0.88–1.15)	0.98 (0.84–1.15)
North Africa	0.95 (0.46–1.97)	0.99 (0.44–2.21)	0.38 (0.26–0.57)	0.30 (0.18–0.48)	1.74 (1.23–2.55)	1.42 (0.93–2.19)	1.83 (1.28–2.62)	1.79 (1.18–2.73)
The Middle East	2.71 (1.94–3.78)	2.53 (1.74–3.67)	0.39 (0.29–0.51)	0.47 (0.34–0.64)	1.52 (1.18–1.97)	1.48 (1.10–2.00)	0.91 (0.69–1.19)	0.78 (0.57–1.06)
South East Asia	0.66 (0.45–0.98)	0.60 (0.39–0.92)	0.37 (0.30–0.45)	0.27 (0.22–0.35)	0.70 (0.56–0.88)	0.82 (0.64–1.06)	1.63 (1.35–1.97)	1.77 (1.43–2.20)
North East Asia	0.60 (0.33–1.08)	0.53 (0.29–1.03)	0.29 (0.22–0.39)	0.22 (0.16–0.31)	0.80 (0.60–1.07)	0.92 (0.66–1.27)	1.72 (1.34–2.21)	1.86 (1.41–2.46)
South Central Asia	0.64 (0.40–1.02)	0.68 (0.41–1.14)	0.52 (0.42–0.65)	0.35 (0.28–0.45)	0.77 (0.60–1.42)	0.89 (0.67–1.18)	1.44 (1.16–1.78)	1.48 (1.16–1.89)
Americas	0.81 (0.47–1.41)	0.77 (0.41–1.43)	0.94 (0.71–1.24)	0.79 (0.58–1.06)	1.06 (0.79–1.42)	1.12 (0.82–1.57)	1.08 (0.81–1.44)	1.16 (0.84–1.54)
Sub Saharan Africa	0.50 (0.21–1.14)	0.41 (0.15–1.12)	0.83 (0.60–1.14)	0.64 (0.45–0.92)	0.67 (0.45–0.98)	0.83 (0.54–1.26)	1.19 (0.85–1.65)	1.26 (0.87–1.82)

OR: age and sex adjusted, OR**: adjusted for age, sex, education, work status, income, BMI, hypertension, heart disease, stroke and (as appropriate) alcohol intake, insufficient physical activity and inadequate intake of fruit and vegetables.*

a. More than one drink per week

b. Less than five sessio ns of physical activity per week

c. Less than five servings of fruit and vegetables per day

status, as well as all predictor variables, was ascertained using self-report. Self-report of diabetes has been demonstrated to be sufficiently accurate to allow use in epidemiologic studies,[37] but it is not known whether the validity of self-report of diabetes or health behaviours varies systematically according to country of birth. Further limitations were the inclusion only of people aged 45 years and over, and the low overall response rate in the 45 and Up Study, although relative risk estimates generated from the study data are consistent with those from representative population survey data.[38]

Conclusion

Despite its limitations, this study has provided the most comprehensive information currently available about health behaviours in people with diabetes in a contemporary multi-ethnic population. People with diabetes from all countries or regions of birth had lower levels than the Australian-born participants of at least one of the adverse behaviours, emphasising the importance of policies and programs aiming to maintain healthy behaviours, rather than simply to improve unhealthy ones. Although people with diabetes had similar patterns of adverse health behaviours to the overall populations from their country of birth, it is of concern that these behaviours persist in people with serious chronic illness who are at high risk of complications. Interventions to promote smoking cessation and increase physical activity levels among people with diabetes who were born in Middle Eastern countries has emerged from this research as a clear priority. It is likely that this finding from Australia is applicable also to other multi-ethnic populations, especially in light of the large proportion of recent humanitarian entrants to many host countries who come from countries of the Middle East, and the high prevalence of diabetes among people from these backgrounds.[15,39,40] Other potential intervention targets in overseas-born populations with high prevalence of diabetes[15] include insufficient physical activity in those born in North Africa and low levels of fruit and vegetable consumption among those born in all Asian regions. High rates of smoking and alcohol use in people with diabetes born in Australia and the UK also indicate the need for a strong continuing focus on secondary prevention across all population groups.

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