Title

Marked differences in cardiovascular risk profiles in middle-aged and older Chinese residents: Evidence from a large Australian cohort

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ABSTRACT

Objective

To examine and compare the prevalence of cardiovascular disease (CVD) and major cardiovascular risk factors among Chinese, mixed-Chinese and non-Chinese Australians and to examine the associations of risk factors with CVD outcomes across these groups.

Methods

Using data from 266,696 Australian participants from the 45 and Up Study (2006-2009), this study investigated cardiovascular risk among Chinese (n=3454), mixed-Chinese (n=1,062) and non-Chinese (n=262,180) participants. Poisson regression models with a robust error variance were used to estimate prevalence ratio (PR) and 95% confidence intervals (CI) for CVD (coronary heart disease (CHD) and stroke) and six risk factors (hypertension, diabetes, high cholesterol, smoking, overweight/obesity, physical inactivity) by ethnicity using non-Chinese participants as the reference group. Each outcome was adjusted for socio-demographic characteristics.

Results

Compared with non-Chinese Australians, Chinese had lower prevalence of CHD (prevalence ratio [PR] =0.67; 95% CI 0.59-0.75) and stroke (PR=0.67; 0.51-0.88). Of the risk factors, Chinese had higher prevalence of diabetes (PR=1.25; 1.12-1.39), smoking (PR=1.22; 1.04-1.43) and physical inactivity (PR=1.48; 1.41-1.55) but lower prevalence of hypertension (PR=0.90; 0.86-0.95), high cholesterol (PR=0.87; 0.79-0.95) and overweight/obesity (PR=0.46; 0.43-0.48). Mixed-Chinese had higher prevalence of CVD and worse CVD risk profiles compared with Chinese.

Conclusions

There are marked differences in the prevalence of CVD and risk factors among Chinese, mixed-Chinese and non-Chinese. The noticeable variations in CVD risk between Chinese and mixed-Chinese indicate that conventional classification of treating all Chinese as homogeneous could be misleading. More investigation into the health outcomes of mixed ancestry is warranted.

KEY QUESTIONS

What is already known about this subject?

Chinese immigrants represent a large proportion of migrant population in Western countries. Limited evidence suggests that Chinese immigrants may have different cardiovascular risk profiles as compared with Europeans.

What does this study add?

Distribution of cardiovascular risk factors differed among Chinese, mixed-Chinese and non-Chinese Australians. Chinese had higher prevalence of diabetes, smoking and physical inactivity compared with non-Chinese Australians, while mixed-Chinese had worse CVD risk profiles compared with Chinese.

How might this impact on clinical practice?

These findings provide a more nuanced understanding for clinicians calculating an individual's cardiovascular risk. They provide a focus for culturally-appropriate primary and secondary prevention programs, and highlight risk factors that should be actively screened for and managed, to prevent future rise in CVD among Chinese immigrants. Future clinical research and practice should consider the likely influence of mixed Chinese ethnicity on the individual's unique risk profile.

Marked differences in cardiovascular risk profiles in middle-aged and older Chinese residents: Evidence from a large Australian cohort

INTRODUCTION

Cardiovascular disease (CVD) is a leading cause of mortality and morbidity worldwide. In particular, CVD is a major health problem among migrant populations in developed countries [1]. Research has shown that immigrants tend to have a higher risk for CVD than the host population and the overall prevalence, mortality, prognosis and risk factors for CVD vary among subgroups of immigrants [2]. However, the current knowledge about CVD prevalence and risk factors is mainly drawn from populations of European ancestry [3]. Given the mass migration of Asian populations over recent decades, it is timely to investigate cardiovascular risk profiles among specific ethnic groups so that assessment and therapeutic options are clinically and culturally appropriate.

Chinese immigrants form a large proportion of the migrant population in Western countries. For example, in Australia, Chinese are the third largest group of overseas-born residents after those from the United Kingdom (UK) and New Zealand [4]. Chinese ethnicity is often considered to confer lower risk of CVD, attributed to the more favorable risk profiles compared to Europeans [5, 6]. Conversely, some evidence suggests that Chinese ethnicity is not associated with lower risk of CVD compared with Europeans [2]. Studies from the UK and United States (US) demonstrate that the prevalence of certain risk factors such as diabetes and physical inactivity are higher in Chinese immigrants compared with the host population [7, 8]. Furthermore, diabetes has been shown to be associated with a more severe form of coronary heart disease (CHD) in people of Chinese ethnicity compared to Europeans [3].

A previous Australian study of cardiovascular risk factors among Chinese immigrants was limited to small samples [9]. While, a recent Australian study on cardiovascular risk factors [10] reported data for aggregated Asian groups without distinguishing Chinese from other Northeast Asian groups, and this discounts the potential influence of genetic and cultural

factors. Furthermore, among this large ethnic group in Australia, the associations of cardiovascular risk factors with a CVD diagnosis have not been previously examined.

Existing research on CVD and risk factors largely focuses on the differences between discrete ethnic groups [11]. There is a paucity of research that explores CVD risk among people of mixed ethnic backgrounds. Research on mixed ethnic populations can offer important insights into the interacting effects of culture with genetic backgrounds [11, 12]. Moreover, populations with mixed ancestry have grown rapidly in Western countries, such as Australia [4] and the UK [13]. Mixed ethnic groups, however, are not clearly defined and are greatly underrepresented in many surveys and clinical studies [14].

This study aims to address the gaps in the current knowledge on CVD risk among Chinese Australians. We examine the prevalence of CVD and major cardiovascular risk factors among Chinese, mixed-Chinese and compare them with "non-Chinese" Australians. We also examine the associations of risk factors with CVD outcomes and compare these across groups.

METHODS

Sampling and Procedures

The 45 and Up study is a large, population-based, prospective cohort study of residents aged 45 years and older living in New South Wales (NSW), the most populous state in Australia [15]. Baseline data were collected between February 2006 and April 2009. Participants were randomly sampled from the enrolment database of Medicare Australia. This national healthcare system includes all Australian citizens and permanent residents, along with some temporary residents and refugees [15]. Eligible participants were mailed an information leaflet, the study questionnaire and the consent form. A total of 266, 696 participants completed the baseline questionnaires [15]. A more detailed description of the 45 and Up study has been provided elsewhere [15].The study was approved by the NSW Population and Health Service Research Ethics Committee (reference no. HREC/10/CIPHS/33).

Categorising participant's ethnicity

Participants were defined as "Chinese" only when they reported Chinese as their sole ancestry. Those who reported Chinese ancestry and other ancestries were categorized as "mixed-Chinese", in which 68 % were mixed with European ancestry (Figure 1). The remaining participants were categorized as "non-Chinese", which is composed predominantly of people of European or Australian ancestry (93%) (Appendix 1).

Cardiovascular disease

For the purposes of this study, CVD includes CHD and stroke. Participants were defined as having CHD if they reported 1) physician-diagnosed heart disease or 2) recent treatment for heart attack or 3) history of heart operation. Stroke was defined as self-reported physician-diagnosed stroke.

Cardiovascular risk factors

We examined six major cardiovascular risk factors: hypertension, diabetes, high cholesterol, current smoking, overweight/obesity and physical inactivity. Cardiovascular risk factors were operationalised both as single risk factor and an overall CVD risk index score (e.g., ≥ 2 risk factors, ≥ 3 risk factors). Hypertension, diabetes, and high cholesterol were defined as a self-reported, physician-diagnosed condition or recent treatment of that condition.

Current smoking was defined by answering "yes" to "Are you a current smoker?" Overweight/obesity were defined as body mass index (BMI) ≥ 25kg/m². Although it has been suggested that a BMI ≥ 23 kg/ m² would be best to define overweight among Chinese adults [16], we used BMI≥ 25 kg/ m² as the cut-off point for this analysis, to facilitate comparison with non-Chinese and mixed-Chinese. BMI was calculated from self-reported height and weight, which has a good agreement (kappa=0.80) with objectively derived BMI categories in the study participants [17]. Physical inactivity was defined as less than a total of 150 minutes of walking, moderate-intensity, or vigorous-intensity physical activity (bouts of at least 10 minutes) in the previous week. Physical activity levels were assessed using the Active Australia Survey [18] which has adequate validity when total

minutes/week of moderate-to-vigorous physical activity was assessed against an accelerometer (Spearman rho=0.52[19]).

Covariates

Covariates include the following variables: age group, sex, educational attainment ("school certificate or lower"; "higher school, trade, or diploma"; "university degree or higher"), marital status ("married/living with a partner" or "other"), location of residence ("major city" versus "regional/remote") based on the Accessibility/Remoteness Index of Australia [20], health insurance ("having private health insurance" or "no private health insurance"), and other language spoken at home (yes to "Do you speak a language other than English").

Statistical analysis

All statistical analyses were performed using SPSS 22 (IBM). Poisson regression models with a robust error variance were used firstly to estimate prevalence ratio (PR) and 95% confidence intervals (CI) for CHD, stroke, six risk factors and CVD risk index score (≥ 2 risk factors and ≥ 3 risk factors) by ethnicity using non-Chinese Australians as the reference group, and secondly to examine the cross-sectional associations between risk factors and CVD between these three groups. Due to small number of stroke events in among mixed-Chinese, we used CVD as the outcome by combining CHD and stroke. Given that some risk factors (e.g. smoking) are more prevalent in Chinese men than women [21], sex-stratified analyses were also performed.

RESULTS

Participant characteristics

Using data from 266,696 Australian participants from the 45 and Up Study (2006-2009), we investigated cardiovascular risk among Chinese (n=3,454), mixed-Chinese (n=1,062) and non-Chinese (n=262,180). Descriptive characteristics of the three groups demonstrate that Chinese and mixed-Chinese were younger compared with non-Chinese Australians (Table 1). Chinese participants were also more likely than the other two groups to have a university or higher degree, private health insurance and tended to live in the major cities.

Mixed-Chinese participants, except for those of younger age, had a similar profile to non-Chinese participants. Nearly 95% of Chinese were born outside of Australia and some 85% spoke a language other than English at home while more than half of mixed-Chinese were born in Australia and spoke English at home.

Table 1 Descriptive characteristics of participants in the 45 and Up Study by ethnicity

	Chinese (n=3,454) % (n)	Mixed-Chinese (n=1,062) % (n)	Non-Chinese (n=262,180) % (n)
Age (Mean/SD)	58.9 (10.7)	59.5 (10.5)	62.8 (11.2)
45-54	45.7 (1,580)	40.3 (428)	28.9 (75,650)
55-<64	29.7 (1,026)	34.1 (362)	32.2 (84,423)
65-<74	13.8 (477)	13.8 (147)	21.9 (57,427)
75-<84	8.3 (287)	9.7 (103)	13.9 (36,489)
≥ 85	2.4 (84)	2.1 (22)	3.1 (8,191)
Sex			
Male	45.6 (1,575)	39.5 (419)	46.4 (121,711)
Female	54.4 (1,879)	60.5 (643)	53.6 (140,469)
Education attainment			
School certificate or lower (<10 years)	17.0 (578)	29.5 (306)	34.5 (89,076)
High school/trade/diploma	40.7 (1,381)	44.5 (461)	42.3 (108,985)
University or higher	42.3 (1,438)	26.0 (269)	23.2 (59,779)
Marital status			
Married/living with a partner	81.6 (2,820)	76.8 (816)	74.1 (194,222)
Other	18.4 (634)	23.2 (246)	25.9 (67,958)
Location of residence			
Major city	93.4 (3,222)	66.5 (706)	44.3 (116,168)
Regional/remote	6.6 (226)	33.5 (355)	55.7 (145,816)
Private health insurance			
Yes	67.9 (2,346)	58.4 (620)	63.3 (166,021)
No	32.1 (1,108)	41.6 (442)	36.7 (96,155)
Birth place			
Australia Born	5.6 (192)	50.7 (519)	76.7 (199,095)
Non Australian born	94.4 (3,220)	49.3 (533)	23.3 (60,593)
Other language spoken at home			
Yes	85.2 (2,942)	43.6 (463)	8.4 (22,030)
No	14.8 (512)	56.4 (599)	91.6 (240,147)

Self-reported CVD

After adjusting for sex, age, educational attainment, private insurance and remoteness, Chinese had the lowest prevalence of CHD and stroke among three groups (Table 2 &3). While mixed-Chinese had an intermediate prevalence of CHD, they had a notably increased prevalence of stroke (PR 1.24; 95% CI 0.89-1.74). A similar pattern was also observed in sex-specific analyses with male mixed-Chinese having the highest prevalence of stroke (Table 2 & 3).

Table 2 Prevalence of self-reported coronary heart disease (CHD) by ethnicity in the 45 and Up Study (2006-2009)

Ethnicity	CHD %(n)	Unadjusted PR 95%CI	p value	Adjusted PR 95%CI	p value
Overall					
Non-Chinese	13.6(35716)	1		1*	
Mixed-Chinese	10.3(109)	0.75 (0.63-0.90)	0.002	0.93 (0.78-1.11)	0.411
Chinese	7.1(245)	0.52 (0.46-0.59)	<0.001	0.67 (0.59-0.75)	<0.001
Male					
Non-Chinese	18.6 (22682)	1		1**	
Mixed-Chinese	14.6(61)	0.78 (0.62-0.99)	0.037	0.86 (0.69-1.08)	0.202
Chinese	9.7 (153)	0.52 (0.45-0.61)	<0.001	0.64 (0.55-0.74)	<0.001
Female					
Non-Chinese	9.3 (13034)	1		1**	
Mixed-Chinese	7.5(48)	0.81 (0.61-1.06)	0.118	1.04 (0.79-1.36)	0.783
Chinese	4.9(92)	0.53 (0.43-0.64)	<0.001	0.72 (0.59-0.88)	0.001

*PR, Prevalence ratio, adjusted for age, sex, education, private insurance, marital status and remoteness

**PR, Prevalence ratio, adjusted for age, education, private insurance, marital status and remoteness

Table 3 Prevalence of self-reported stroke by ethnicity in the 45 and Up Study (2006-2009)

Ethnicity	Stroke %(n)	Unadjusted PR 95%CI	p value	Adjusted PR 95%CI	p value
Overall					
Non-Chinese	3.2 (8369)	1		1*	
Mixed-Chinese	3.0(32)	0.94 (0.67-1.33)	0.741	1.24 (0.89-1.74)	0.207
Chinese	1.5(52)	0.47 (0.36-0.62)	<0.001	0.67 (0.51-0.88)	0.004
Male					
Non-Chinese	3.8(4633)	1		1**	
Mixed-Chinese	4.8(20)	1.25 (0.82-1.93)	0.301	1.51 (0.99-2.29)	0.055
Chinese	1.8(29)	0.48 (0.34-0.69)	<0.001	0.67 (0.46-0.96)	0.027
Female					
Non-Chinese	2.7(3736)	1		1**	
Mixed-Chinese	1.9(12)	0.70 (0.40-1.23)	0.216	0.97 (0.55-1.70)	0.903
Chinese	1.2(23)	0.46 (0.31-0.69)	<0.001	0.68 (0.45-1.02)	0.061

*PR, Prevalence ratio, adjusted for age, sex, education, private insurance, marital status and remoteness

**PR, Prevalence ratio, adjusted for age, education, private insurance, marital status and remoteness

Self-reported risk factors

There were significant differences in the cardiovascular risk profiles among Chinese, mixed-Chinese and non-Chinese (Table 4). When compared with non-Chinese, Chinese had significantly higher prevalence of diabetes (PR 1.25; 95% CI 1.12-1.39), physical inactivity (PR 1.48; 95% CI 1.41-1.55) and current smoking (PR 1.22; 95% CI 1.04-1.43), but lower prevalence of hypertension, high cholesterol and lower risk factor index scores. Mixed-Chinese had a higher prevalence of most risk factors compared with Chinese participants, including having the highest prevalence of diabetes (PR 1.37; 95% CI 1.15-1.63) among the three groups. However, both Chinese and mixed-Chinese had a substantially lower prevalence of overweight and obesity than non-Chinese. In sex-stratified analysis, the pattern in which risk factors were distributed among Chinese, mixed-Chinese and non-Chinese varied between males and females. For example, Chinese men were most likely to be current smokers (PR 1.47; 95% CI 1.24-1.74) while mixed-Chinese females had higher prevalence of diabetes (PR 1.68; 95% CI 1.34-2.09) (Appendix 2).

Table 4 Prevalence of risk factors by ethnicity in the 45 and Up Study (2006-2009)

Risk factors	Prevalence % (n)	Unadjusted PR (95% CI)	p value	Adjusted PR* (95% CI)	p value
Hypertension					
Non-Chinese	37(96,935)	1.00		1.00	
Mixed-Chinese	34(361)	0.92 (0.85-1.00)	0.050	1.01 (0.93-1.10)	0.739
Chinese	28.8(994)	0.78 (0.74-0.82)	<0.001	0.90 (0.86-0.95)	<0.001
Diabetes					
Non-Chinese	9.0(23,526)	1.00		1.00	
Mixed-Chinese	11.1(118)	1.24 (1.04-1.47)	0.014	1.37 (1.15-1.63)	<0.001
Chinese	9.3(321)	1.04 (0.93-1.15)	0.512	1.25 (1.12-1.39)	<0.001
High cholesterol					
Non-Chinese	15.2(39,871)	1.00		1.00	
Mixed-Chinese	14.9 (158)	0.98 (0.85-1.13)	0.766	1.04 (0.90-1.20)	0.635
Chinese	12.1(419)	0.80 (0.73-0.87)	<0.001	0.87 (0.79-0.95)	0.002
Current smoking					
Non-Chinese	15.3(19,093)	1.00		1.00	
Mixed-Chinese	18(72)	1.18 (0.96-1.45)	0.127	1.01 (0.82-1.25)	0.901
Chinese	17.7(131)	1.16 (0.99-1.35)	0.066	1.22 (1.04-1.43)	0.015
Overweight/obesity					
Non-Chinese	62.4(151,106)	1.00		1.00	
Mixed-Chinese	44.9(445)	0.72 (0.67-0.77)	<0.001	0.73 (0.68-0.78)	<0.001
Chinese	27.6(909)	0.44 (0.42-0.47)	<0.001	0.46 (0.43-0.48)	<0.001
Physical inactivity					
Non-Chinese	25.7(67,416)	1.00		1.00	
Mixed-Chinese	30(319)	1.17 (1.07-1.28)	0.001	1.20 (1.09-1.31)	<0.001
Chinese	34.8(1,203)	1.36 (1.29-1.42)	<0.001	1.48 (1.41-1.55)	<0.001
≥2+ risk factors					
Non-Chinese	46.3(121,268)	1.00		1.00	
Mixed-Chinese	40.5(430)	0.88 (0.81-0.94)	<0.001	0.92 (0.86-0.99)	0.030
Chinese	32.5(1,121)	0.70 (0.67-0.74)	<0.001	0.78 (0.74-0.81)	<0.001
≥3+ risk factors					
Non-Chinese	18.9(49,501)	1.00		1.00	
Mixed-Chinese	16.1(171)	0.85 (0.74-0.98)	0.023	0.90 (0.79-1.04)	0.157
Chinese	12(414)	0.64 (0.58-0.70)	<0.001	0.74 (0.68-0.81)	<0.001

PR=prevalence ratio, calculated using Poisson regression models with a robust error variance
*Adjusted for age, sex, education, private health insurance, marital status, and remoteness

Associations between risk factors and CVD

Important associations were identified between risk factors and CVD outcomes among the three groups (Table 5). Hypertension, diabetes, high cholesterol and higher risk factor index scores had the strongest associations with CVD in all three groups. However, the association between overweight/obesity and CVD was stronger in mixed-Chinese than in non-Chinese. Sex-stratified analysis shows that hypertension, diabetes and higher risk factor index scores had stronger associations with CVD in Chinese males and mixed-Chinese females (Appendix 3) than other sub-groups.

Table 5 Associations between cardiovascular disease (CVD) risk factors and CVD outcomes by ethnicity in the 45 and Up Study (2006-2009)

	Unadjusted PR (95% CI) Risk factor vs no risk factor	P value	Adjusted PR* (95% CI) Risk factor vs no risk factor	P value
High BP				
Non-Chinese	2.22 (2.16-2.29)	<0.001	1.80 (1.75-1.86)	<0.001
Mixed-Chinese	2.64 (1.91-3.63)	<0.001	2.05 (1.47-2.85)	<0.001
Chinese	3.21 (2.56-4.01)	<0.001	2.00 (1.58-2.55)	<0.001
Diabetes				
Non-Chinese	2.21 (2.14-2.29)	<0.001	1.72 (1.67-1.79)	<0.001
Mixed-Chinese	2.35 (1.64-3.37)	<0.001	1.89 (1.29-2.77)	0.001
Chinese	2.83 (2.19-3.66)	<0.001	1.81 (1.39-2.36)	<0.001
High cholesterol				
Non-Chinese	2.60 (2.04-3.33)	<0.001	2.16 (2.10-2.23)	<0.001
Mixed-Chinese	1.76 (1.22-2.53)	0.003	1.47 (1.02-2.02)	0.038
Chinese	2.50 (2.43-2.58)	<0.001	2.09 (1.64-2.67)	<0.001
Current smoking				
Non-Chinese	0.73 (0.69-0.77)	<0.001	0.87 (0.82-0.92)	<0.001
Mixed-Chinese	0.52 (0.25-1.08)	0.079	0.79 (0.37-1.67)	0.531
Chinese	0.45 (0.22-0.91)	0.025	0.52 (0.26-1.04)	0.064
Overweight/obesity				
Non-Chinese	1.23 (1.19-1.28)	<0.001	1.26 (1.21-1.30)	<0.001
Mixed-Chinese	1.74 (1.24-2.45)	0.001	1.66 (1.20-2.32)	0.003
Chinese	1.18 (0.91-1.51)	0.211	1.12 (0.88-1.44)	0.359
Physical inactivity				
Non-Chinese	1.19 (1.15-1.22)	<0.001	1.14 (1.10-1.18)	<0.001
Mixed-Chinese	1.21 (0.86-1.68)	0.276	1.03 (0.73-1.46)	0.872
Chinese	1.27 (1.01-1.59)	0.043	1.22 (0.97-1.52)	0.087
≥2+ risk factors				
Non-Chinese	2.12 (2.08-2.16)	<0.001	1.75 (1.72-1.78)	<0.001
Mixed-Chinese	2.66 (1.90-3.71)	<0.001	2.19 (1.57-3.06)	<0.001
Chinese	2.51 (2.00-3.14)	<0.001	1.79 (1.43-2.24)	<0.001
≥3+ risk factors				

Non-Chinese	2.32 (2.25-2.38)	<0.001	1.97 (1.91-2.02)	<0.001
Mixed-Chinese	2.19 (1.56-3.06)	<0.001	1.80 (1.28-2.55)	0.001
Chinese	2.79 (2.19-3.55)	<0.001	2.04 (1.06-2.58)	<0.001

PR=prevalence ratio, calculated using Poisson regression models with a robust error variance

* Adjusted for age, sex, education, private health insurance, marital status, and remoteness

DISCUSSION

Our study is the first to explore a range of modifiable cardiovascular risk factors in a large cohort of Chinese, mixed-Chinese, and non-Chinese adults in Australia. We found heterogeneous distribution of risk factors among the three groups and demonstrated that Chinese had marked different risk factors profiles compared with non-Chinese Australians. Furthermore, the noticeable variations in CVD risk between Chinese and mixed-Chinese groups indicate that it may be misleading to treat all Chinese as homogeneous by imposing a single ethnicity in identifying participants. Further investigation on the health outcomes of people with mixed ancestry is warranted.

Our participants of Chinese ethnicity had a lower risk for CHD and stroke, which is consistent with previous studies [2], however, they were not shown to have better cardiovascular risk factors profiles compared to non-Chinese. In contrast, Chinese had considerably higher prevalence of diabetes, physical inactivity and current smoking when compared to non-Chinese. Moreover, mixed-Chinese generally had worse cardiovascular risk profiles compared to Chinese participants.

The greater prevalence of diabetes in Chinese compared with non-Chinese was consistent with the studies from the US and UK [7, 8]. Several factors may have contributed to this higher prevalence. People of Asian ethnicity are reported to have higher genetic predisposition to diabetes [22] and migration to western countries is associated with changes in lifestyle, such as adoption of Western diet [23], characterised as increased consumption of fats, sugars and soft drinks [9, 23]. Moreover, physical inactivity and smoking are well-recognised risk factors for developing type 2 diabetes [24, 25] and their higher prevalence among Chinese in this study may have contributed to a higher prevalence of diabetes. Interestingly, the higher prevalence of diabetes in Chinese immigrants to

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Australia echoes the rapid surge in diabetes in China; a 3-fold increase in prevalence from 1994 to 2008, attributed to economic development and acceleration in urbanisation [21].

In addition to higher diabetes prevalence, the association of diabetes with CVD was substantially higher for Chinese men than non-Chinese men, which is consistent with previous findings [3, 5]. As diabetes was self-reported in this study the true diabetes rate may be underestimated due to a lack of awareness of diabetes among Chinese who are known to have lower screening rates [5]. This is supported by a UK study [26] which revealed a higher prevalence of undiagnosed diabetes among Chinese (62.5%) compared to participants of European ancestry (57.7%). Similarly, a large population-based study from China [27] reported prevalence of undiagnosed diabetes to be 60.7% (men 61.3%, women 59.8%). It is likely that many Chinese with diabetes go on to develop complications due to late diagnosis, delayed treatment and poor self-management [5].

The higher prevalence of physical inactivity among Chinese compared with non-Chinese in this study is also consistent with research from the UK and US [7, 8]. A recent study from China showed the prevalence of physical inactivity among Chinese was higher than global average [28]. Mortality attributed to insufficient physical activity among Chinese people increased from 2007 to 2010, resulting from unhealthy lifestyles arising from rapid economic changes in China [28].

The results of higher prevalence of current smoking in Chinese were consistent with a survey from Melbourne, Australia [9]. Research from the US suggested that level of acculturation, as indicated by language spoken at home and generational status, was inversely associated with smoking in Chinese Americans [29]. In our study, nearly 95% of Chinese were born outside of Australia and 85% of spoken other language at home, indicating relatively low level of acculturation, which could explain the higher prevalence of cigarette smoking in this group. It should be noted, however, that we did not find a consistently significant association between smoking and CVD prevalence (except for in Chinese men). This may be due to a tendency to quit smoking after a CVD diagnosis, and that those who continue to smoke after a CVD diagnosis are more likely to have died before follow up [8].

In our study, mixed-Chinese generally had worse cardiovascular risk profiles than Chinese which may reveal interactions between genetic susceptibility and cultural influences. The majority of mixed-Chinese had Chinese and European backgrounds (Figure1). The higher prevalence of certain cardiovascular risk factors in mixed-Chinese as compared with Chinese could therefore reflect the influence of European culture and genetic contributions. Moreover, lower socio-economic status (SES) observed in mixed-Chinese as indicated by lower educational attainment and lower private insurance may have also contributed to their adverse cardiovascular risk profile [30]. However, the difference in CVD remained significant after adjusting for SES variables. On the other hand, the higher prevalence of physiological risk factors, such as hypertension, high cholesterol and diabetes, may indicate that this group has more health screening behaviours compared with Chinese Australians, due to fewer language barriers. As most mixed-Chinese speak English at home, they may experience less difficulty in communicating with health professionals and in understanding health information, which may result in more health checks when compared with Chinese.

Strengths and Limitations

Our study draws on a large population-based cohort with substantial numbers of Chinese and mixed-Chinese. The innovation of our study lies in reporting CVD prevalence and cardiovascular risk factors for mixed-Chinese, which is the first to our knowledge. Our study has some limitations. Firstly, the 45 and Up Study questionnaire was only available in English. Therefore, those with lower English proficiency were less likely to be enrolled in this study. Secondly, the association between cardiovascular risk factors and CVD outcomes is based on cross-sectional analysis without causal inferences and should be interpreted with caution. Thirdly, the current measures of CVD outcomes and some cardiovascular risk factors such as diabetes and hypertension were based on self-reported physician diagnosis, and could be differentially underestimated in Chinese participants.

CONCLUSION

The rising burden of CVD and cardiovascular risk factors among Chinese calls for development of better risk assessment tools for this large ethnic group [7]. Culturally-specific programs that aim to improve prevention and early identification/diagnosis of CVD and cardiovascular risk factors should be developed to prevent future rise in CVD among Chinese immigrants. Although the examination of mixed-Chinese in our study may not be generalised to other populations, these findings inform future research on the health outcomes of people with mixed ethnicities.

CONFLICT OF INTEREST DISCLOSURES

None.

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