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Original Article

Diabetes mellitus prevalence is increasing in South Asians but is stable in Chinese living in Singapore and Mauritius

Highlights

- Singapore and Mauritius are multiethnic island states at different stages of economic development and provide a useful model in which to explore the relative contribution of ethnicity and socioeconomic factors to diabetes.
- Despite different socioeconomic settings in Singapore and Mauritius, we observed rising diabetes prevalence among South Asians but stable prevalence in Chinese in both countries.
- These findings provide further evidence that ethnicity may contribute to the development of diabetes.

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Abstract

Background: Asia is experiencing a type 2 diabetes epidemic, but prevalence differs by ethnicity and level of socioeconomic development. Singapore and Mauritius have implemented comprehensive campaigns to address this public health problem. We compared diabetes and obesity prevalence trends among Chinese and South Asians living in Singapore and Mauritius to determine the contribution of ethnicity and economic development to diabetes.

Methods: Age-specific data from serial national population-based surveys in Singapore and Mauritius between 1987 and 2010 were used to estimate age-standardized diabetes and obesity prevalence. Modified Breslow–Cox proportional hazard models were used to obtain rate ratios for diabetes risk factors.

Results: In Singapore, the age-standardized prevalence of diabetes remained stable for Chinese (men: 14% in 1992, 13% in 2010; women: 12% in 1992, 10% in 2010), but increases were observed for South Asians (men: 20% in 1992, 26% in 2010; women: 18% in 1992, 20% in 2010). There were similar patterns in Mauritius. In both countries, obesity prevalence trends were stable for Chinese women, but increased for Chinese men and South Asians. Associations between obesity and diabetes were stronger in Chinese than South Asians regardless of country.

Conclusions: Despite different socioeconomic settings in Singapore and Mauritius, we observed rising diabetes prevalence among South Asians but stable prevalence in Chinese in both countries. This provides further evidence that ethnicity contributes to the development of diabetes, and that there should be an increased emphasis on future prevention strategies targeting South Asian populations in these countries.

Key words: diabetes mellitus, obesity, prevalence.

<A>Introduction

Diabetes mellitus is a major public health problem worldwide estimated to affect 8.4% of the world's population.[1] Diabetes in Asia, particularly in India and China, has been of particular concern because prevalence is markedly high and rates are expected to increase further in the next decade.[1] Asia is a diverse continent, with countries having multiethnic populations. Moreover, similar ethnic populations in different Asian countries may share genetic heritage

but experience different environmental conditions.[2] This heterogeneity may account for variable diabetes rates among different ethnicities and countries across Asia.[2] One study showed that South Asians in India and Singapore have a higher age-specific prevalence of diabetes at a younger age than do Chinese in China and Singapore.[3]

Singapore and Mauritius are multiethnic island states at different stages of economic development and provide a model in which to explore the relative contribution of ethnicity and socioeconomic factors to diabetes. In the present study, we compared trends in the prevalence of diabetes and obesity over the period between 1987 and 2010, as well as the strength of relationships for diabetes risk factors, among Chinese and South Asians in high-income Singapore and upper middle-income Mauritius to explore the relative contribution of ethnicity and environmental factors to diabetes in these countries.

<A>Methods

<B>Study populations

Data from serial national population-based surveys conducted in Singapore and Mauritius were used.

Four independent national cross-sectional health surveys, recruiting 16 796 Singapore residents aged 18–79 years, were conducted at 6-yearly intervals from 1992 to 2010. The respective response rates were 73%, 65%, 57%, and 58%.[4] In Singapore, 74% of the resident population is Chinese and 9% is South Asian. Analyses were restricted to Chinese (originating from southeastern provinces of China, namely Fujian, Guangdong, and Hainan, mostly of Han Chinese ancestry) or South Asian (originating from the southern part of India, mostly of Tamil ancestry) participants aged 25–75 years at the time of the survey (n = 11 034). For the diabetes prevalence analysis, participants with missing diabetes information were excluded (n = 215). For the diabetes risk factor analysis, participants with missing information on anthropometric measurements, smoking, alcohol use, or educational status (n = 1258) were also excluded. In all, 9561 participants from Singapore were included in the risk factor analysis (1992, n = 2400; 1998, n = 3291; 2004, n = 2467; 2010, n = 1403).

Mauritius has a population of 1.3 million people, comprising 68% of South Asian origin (including Bihar, Tamil Nadu, Andhra Pradesh, Telangana, and Maharashtra in India), 3% of Chinese origin (primarily originating from the Guangdong area, mainland China), 27% of African origin (Creole), and 2% of Franco-Mauritian origin. The Mauritian population-based surveys invited men and women aged 25–75 years to participate and were conducted in 1987, 1992, 1998, 2004, and 2009 using similar protocols. Detailed recruitment methods

have been published previously.[5,6] Sixty percent of participants contributed observations to more than one survey in 1987, 1992 and 1998, with 27% contributing data to all three 1987, 1992, and 1998 surveys.[5] In 2004, participants were recruited from seven existing clusters used in earlier surveys and seven new clusters were randomly selected. In 2009, nine index clusters were chosen: one randomly selected from each of nine districts and two additional clusters adjacent to the index clusters.[6] Response rates were over 85%.[5,6] The Mauritian analyses were restricted to participants who reported being Chinese or South Asian. For the diabetes prevalence analysis, observations were excluded if: (i) information about diabetes status was missing (n = 616); (ii) the study site information was missing (n = 2); and (iii) the woman was pregnant (n = 86). For the diabetes risk factor analysis, observations were also excluded if: (i) information on anthropometric measurements was missing (n = 135); and (ii) data on smoking, alcohol use, or education were missing (n = 358). This analysis included 20 071 observations from Mauritius (1987, n = 3584; 1992, n = 4627; 1998, n = 3878; 2004, n = 3605; 2009, n = 4377).

<B>Measurements

Venipuncture was used to collect blood for determination of fasting plasma glucose (FPG; after an overnight fast of at least 8 h) in all participants, and 2-h plasma glucose following a 75-g oral glucose tolerance test (OGTT) in participants without diabetes, or in those with diabetes but not taking medications for diabetes. For the Singapore surveys, all blood specimens for plasma glucose measurement were collected in fluoride–oxalate tubes and dispatched daily to a central laboratory for centrifugation and analysis on the same day.[4] Plasma glucose levels were measured using the Roche Modular DP analyzer with an enzymatic colorimetric method.[4] The same method was used for the four surveys. For the Mauritian surveys, specimens for glucose analysis were also collected in fluoride–oxalate tubes, and glucose was assayed on-site using a glucose analyzer (YSI, Yellow Springs, OH, USA) using a glucose oxidase method in 1987, 1992, 2004, and 2009. In 1998, glucose was assayed within 4 months at a central laboratory using the same technology, and results were adjusted according to quality control measures taken during 1987 and 1992 from on-site results.

Glucose tolerance status was determined according to World Health Organization (WHO) 2006 diagnostic criteria.[7] Diabetes was classified if participants had FPG ≥7.0 mmol/L or 2-h plasma glucose ≥11.1 mmol/L, or reported a history of diabetes and were using blood glucose-lowering medication.

All participants underwent anthropometric measurements (weight, height, and waist and hip circumference). Body mass index (BMI) was classified according to the WHO criteria for Asian populations[8] as follows: underweight, <20.0 kg/m^2 (rather than <18.5 kg/m^2 because there were too few diabetes cases with a very low BMI); normal, 20.0–23.0 kg/m^2; overweight, 23.0–27.5 kg/m^2; and obese, ≥27.5 kg/m^2. Analyses were repeated using European BMI classifications.[8] Furthermore, waist : hip ratio European categories (≤0.90 and >0.90 for men; ≤0.85 and >0.85 for women), waist : hip ratio Asian categories (≤0.90 and >0.90 for men; ≤0.80 and >0.80 for women[9]), waist circumference European categories (<95, 95–102, and >102 cm for men; <80, 80–88, and >88 cm for women), waist circumference Asian categories (<90 and ≥90 cm for men; <80 and ≥80 cm for women[9]), and waist : height ratio (≤0.5 and >0.5) were assessed.

Alcohol consumption was classified as none, less than weekly, and weekly or more frequent. Smoking status was categorized as never, ever and current smoker.

<B>Ethics

The Mauritius survey protocols were approved by the International Diabetes Institute Ethics Committee (Melbourne, Vic., Australia), the Ministry of Health, Mauritius, and the University of Mauritius Research Ethics Committee. The Singapore surveys were approved by the Singapore Health Promotion Board Medical Dental Board Ethics Committee. All participants provided informed written consent.

<B>Statistical Analysis

Analyses included participants aged 25–74 years, except for the 1992 and 1998 Singapore surveys, which had participants aged 25–69 years only. Age-specific prevalence estimates for diabetes and obesity were calculated using survey commands to account for the sampling design of the surveys. Age-specific prevalence estimates were directly standardized to the WHO 2000 standard population[10] to obtain overall and strata (ethnicity and gender)-specific estimates for each survey year independently. There were no Chinese men aged 25–34 years in the 1998 Mauritius survey, so the age-specific prevalence estimate for this stratum was based on the group aged 35–44 years. We also plotted diabetes prevalence according to 10-year age groups and 10-year birth cohorts from 1920 to 1980 stratified by ethnicity for each country to determine whether there were any observed birth cohort effects on diabetes prevalence.

The modified Breslow–Cox proportional hazard model with robust variance[11] was used to obtain rate ratios for smoking, alcohol consumption, and measures of obesity. Rate ratios were obtained by pooling data from different survey years for each country. Repeated visits were treated as separate events.

Adjustment variables were age (continuous), gender, and educational status. Self-reported educational status was categorized as ≤6, 7–10, and ≥10 years in Singapore, and as ≤3, 4–6, 7–9, 10–12, and ≥12 years in Mauritius.

The Singapore and Mauritius analyses were performed using R version 3.0.0 (R: A Language and Environment for Statistical Computing, R Core Team, R Foundation for Statistical Computing, Vienna, Austria, 2015, https://www.R-project.org) and Stata version 12.1 (StataCorp. 2011. Stata Statistical Software: Release 12. College Station, TX: StataCorp LP) respectively.

<A>Results

The magnitude and trend of diabetes prevalence in Chinese and South Asian men were similar in the two countries over the study period. Diabetes prevalence in Chinese men of both countries (Fig. 1a) showed a decreasing trend in the 1990s before increasing in 2004 (14% [1992], 10% [2004], and 13% [2010] in Singapore; 19% [1992], 11% [2004], and 19% [2009] in Mauritius). Diabetes prevalence increased for South Asian men in both countries (Fig. 1c), with similar magnitude (20% [1992] and 26% [2010] in Singapore; 19% [1992] and 26% [2009] in Mauritius). Prevalence in Chinese women in both countries was stable (Fig. 1b). Prevalence in South Asian women increased slightly, with similar magnitudes in both countries (Fig. 1d; 18% [1992] and 20% [2010] in Singapore; 18% [1992] and 23% [2009] in Mauritius).

Obesity prevalence (BMI ≥27.5 kg/m^2) among Chinese women (Fig. 1b) was similar in Singapore and Mauritius, with minimal increase during the observation period. Obesity prevalence increased for South Asian women (Fig. 1d; 25% [1992] and 42% [2010] in Singapore; 22% [1987] and 34% [2009] in Mauritius). Similar increasing obesity prevalence was observed for South Asian men (Fig; 1c; 25% [1992] and 29% [2010] in Singapore; 10% [1987] and 23% [2009] in Mauritius) and Chinese men (Fig. 1a; 10% [1992] and 21% [2010] in Singapore; 15% [1987] and 18% [2009] in Mauritius). The prevalence of obesity was lower, but trends were similar when using European BMI categories (data not shown).

Figure 2 shows the age group-specific diabetes prevalence by birth cohorts in Singapore and Mauritius according to ethnicity. The data revealed that among South Asian

men in both Singapore and Mauritius aged >65 years at the survey examination, those born later (i.e. in the 1940s) had higher diabetes prevalence compared with those born earlier (i.e. in the 1920s; 75% vs 38%, respectively, in Singapore; 61% vs 34%, respectively, in Mauritius). This was similarly observed for those aged 55–64 years (50% vs 36%, respectively, in Singapore; 42% vs 30%, respectively, in Mauritius). In contrast, among those in younger age groups at the survey examination, diabetes prevalence was either similar across different birth cohorts or showed a decline in later birth cohorts. This trend was also observed in South Asian women in Singapore, but not in Mauritius. Later Singaporean Chinese male and female cohorts experienced lower age group-specific diabetes prevalence compared with earlier birth cohorts, particularly among those aged >55 years at survey examination. The same trend of lower age group-specific prevalence in later compared with earlier birth cohorts was observed in Mauritian Chinese women (19% vs 29% for those aged 55–64 years at survey), but the latest Mauritian and Singaporean Chinese male birth cohorts appeared to have higher rates of diabetes, resulting in U-shaped birth cohort age group-specific curves for those aged 35–44 years (Fig. 2).

Measures of obesity exhibited the strongest associations with diabetes among risk factors evaluated in both Chinese and South Asians (Table 1). Obesity measures tended to show stronger associations with diabetes in Chinese compared with South Asians in both countries (although wide confidence intervals precluded a conclusion on significant differences between the ethnic groups; Table 1). Alcohol and smoking showed weak or null associations with diabetes in Chinese and South Asian men and women in both countries (Table 1).

<A>Discussion

The present study shows that diabetes and obesity prevalence trends increased for South Asians but remained stable in Chinese in both countries, despite different socioeconomic settings. In both countries, the age-specific prevalence of diabetes remained stable between 1987 and 2010 for Chinese populations, whereas we observed increasing prevalence for South Asian populations. Older South Asian men in both countries had higher diabetes prevalence in later birth cohorts compared with earlier birth cohorts, and middle-aged Chinese men in both countries showed U-shaped diabetes prevalence, whereby diabetes prevalence increased in recent birth cohorts. Women were observed to have little change in diabetes prevalence across birth cohorts in both countries, except for older South Asian women in Mauritius, for whom trends were similar to those for South Asian men. In

Singapore, obesity prevalence remained stable for Chinese women, but increases were observed for Chinese men and South Asian men and women. In Mauritius, similar patterns were observed. Measures of obesity were more strongly associated with diabetes compared with alcohol consumption and smoking, regardless of ethnicity or country. Furthermore, measures of obesity were stronger predictors of diabetes in Chinese compared with South Asians in both countries.

Although an upwards trend in diabetes prevalence over the past two decades has been observed in other predominantly Chinese populations, such as mainland China[12] and Taiwan,[13] we did not observe the same marked increases in diabetes prevalence for Chinese in either Singapore or Mauritius. Consistent with the findings of the present study, increasing diabetes prevalence has also been reported in predominantly South Asian populations in India.[14]

Adverse environmental effects early in fetal development may contribute to changes in physiology and metabolism, which consequently increase metabolic disease risk in adulthood.[15] Analysis of the present birth cohort data shows higher diabetes prevalence in later birth cohorts (i.e. 1940s) compared with those born earlier (i.e. 1920s) for older-aged South Asian men in both countries and South Asian women in Singapore. These observations could be consistent with the nutritional deprivations caused by World War II in the 1940s. We did not observe the same birth cohort trends in older Chinese, which may indicate that the epigenetic influences may have been somewhat tempered by national diabetes prevention programs. Nevertheless, an upward trend in diabetes prevalence for middle-aged Chinese men from both countries born in more recent decades indicates that ongoing diabetes prevention initiatives need to be maintained.

Over the past decade, both Singapore[16,17] and Mauritius[18] have implemented national strategies to improve diabetes screening and to raise public awareness of diabetes and obesity. The present study, which shows diabetes prevalence increasing for South Asian, but not Chinese, populations in Singapore or Mauritius, demonstrates that national strategies for diabetes prevention may have had a stronger impact on Chinese populations compared with South Asian populations. This indicates that future initiatives in these countries may need a greater focus on South Asian populations.

Economic development and urbanization in Asia is associated with a reduction in physical activity and adoption of a diet high in refined and processed foods, and hence a greater prevalence of diabetes.[2] Thus, we hypothesized that diabetes trends would increase at a greater level in Singapore than in Mauritius, reflecting the greater economic development

and urbanization in Singapore (Table 2). Instead, the data show similar trends in both countries. The reasons for this are not clear. One possibility could be that the effects of modernization and urbanization on diabetes incidence occur early in a country's development, and further modernization has lower incremental effect on diabetes prevalence. It is also possible that, because we measured prevalence trends rather than incidence, higher diabetes mortality rates may have resulted in a greater lowering of the diabetes prevalence in Mauritius compared with Singapore. However, age-specific prevalence trends of diabetes were similar in both countries (data not shown). Finally, it is also possible that the health promotion strategies implemented in Singapore have had a greater impact on diabetes prevalence compared with Mauritius, but we could not test this.

In both countries, the well-known associations between general and abdominal obesity and diabetes prevalence[19] were confirmed. The data suggest that the effects of general and central obesity are stronger in Chinese compared with South Asians, a finding reported by others,[20,21] suggesting that obesity-related pathways for diabetes are more important in Chinese than in South Asians.

The present study provides a useful model for exploring the relative contribution of ethnicity and risk factors associated with socioeconomic development to diabetes prevalence. However, there are limitations. First, differences in survey recruitment methodology between Singapore and Mauritius may impede direct comparisons. In particular, the call-back of older participants in Mauritius surveys may have meant that the later datasets were not representative of the population at that time and there is potential survival bias. Second, the lower response rates in later Singaporean surveys may have affected the representativeness of the obesity and diabetes prevalence estimates. Because diabetes and obesity can be associated with comorbidities, it is possible that some people with these conditions were too unwell to attend the surveys, and this may have led to underestimation of our obesity and diabetes prevalence estimates. However, a sensitivity analysis of data from a non-responder follow-up survey that was conducted after the 2010 National Health Survey in Singapore showed there was little difference in the prevalence of self-reported diabetes between the main survey and non-respondent follow-up survey.[4] Third, possible misclassification of glucose and anthropometric measures could have resulted in non-differential bias, which may have led to an attenuation of study findings. Steps were undertaken to minimize measurement errors through the standardization of survey protocols.[4,6] Fourth, we may have overestimated the relative associations of obesity with diabetes because we were not able to adjust for other potential known and unknown confounders across both countries. Fifth, the weaker

associations observed for smoking and alcohol with diabetes prevalence may have been partly attributable to inaccuracies associated with these self-reported measures. Finally, there were relatively lower numbers of Chinese participants in the Mauritius surveys, reflecting the country's population distribution (Table 2). This resulted in less precision of prevalence estimates and wider confidence intervals for Mauritius Chinese compared with their South Asian counterparts.

<B>Conclusion

Herein we show that diabetes and obesity prevalence trends increased for South Asians but remained stable for Chinese in both Singapore and Mauritius, which implies that environmental factors important to diabetes risk are relatively similar in the two countries despite their differences in socioeconomic development. Although diabetes prevalence remained stable for Chinese populations in both countries, we observed increasing prevalence for South Asian populations. Therefore, future initiatives in Singapore and Mauritius may need to tailor preventive strategies for South Asian populations.

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<A>Disclosure

The authors declare they have no competing interests.

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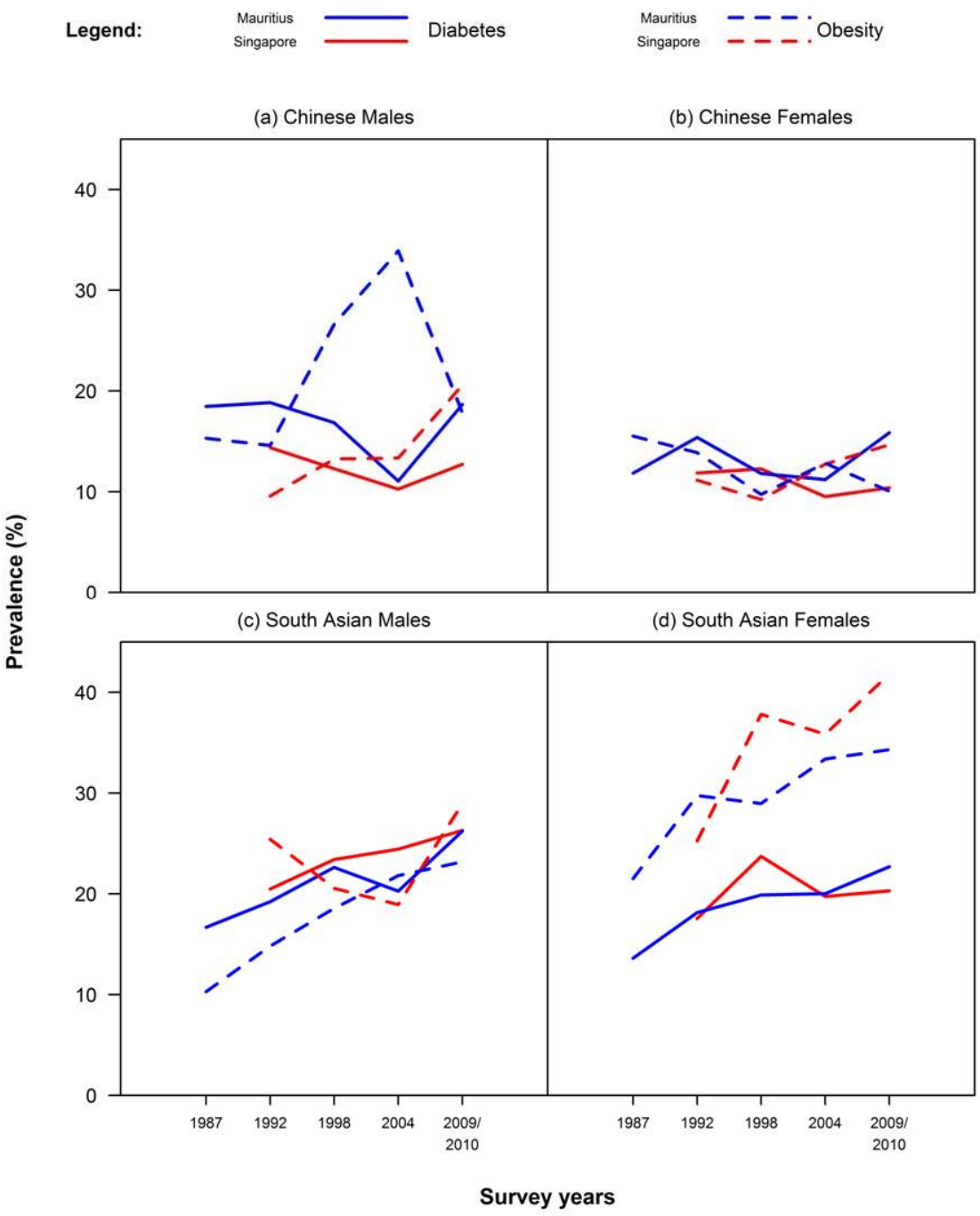

Figure 1 Age-standardized prevalence of diabetes and obesity (body mass index ≥27.5 kg/m^2) of (a) Chinese men, (b) Chinese women, (c) South Asian men, and (d) South Asian women in Singapore and Mauritius from 1987 to 2010.

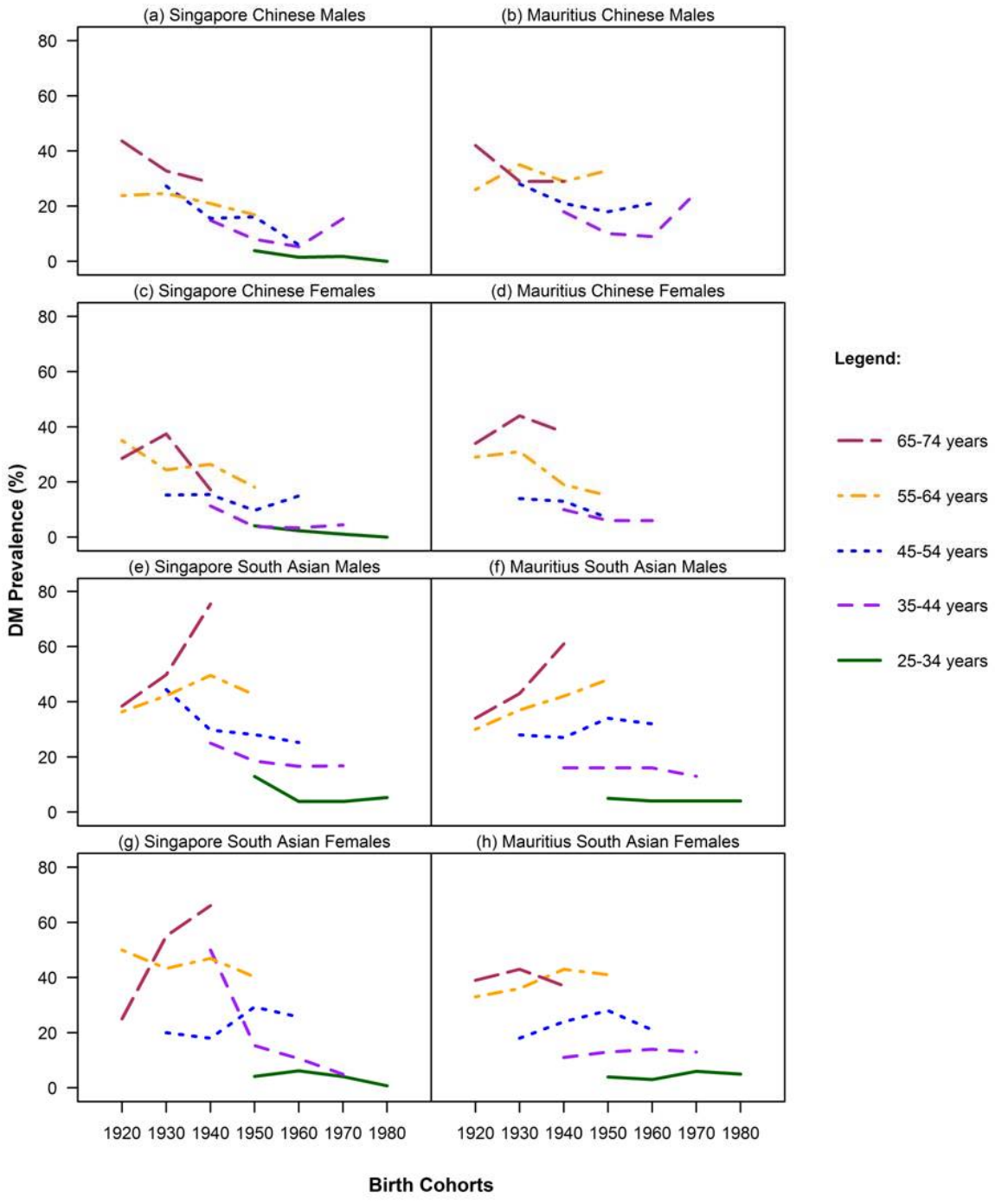

Figure 2 Age group-specific prevalence of diabetes of (a) Singapore Chinese men, (b) Mauritius Chinese men, (c) Singapore Chinese women, (d) Mauritius Chinese women, (e) Singapore South Asian men, (f) Mauritius South Asian men, (g) Singapore South Asian women, and (h) Mauritius South Asian women by birth cohort (calendar year of birth).

Table 1 Ethnic- and gender-specific rate ratios (95% confidence intervals) of potential risk factors for diabetes mellitus in Singapore and Mauritius

	Singapore				Mauritius			
	Chinese men	Chinese women	South Asian men	South Asian women	Chinese men	Chinese women	South Asian men	South Asian women
Body mass index (kg/m^2)								
European								
<20	0.90 (0.21–3.79)	0.00 (0.00–0.01)	0.01 (0.00–0.04)	1.07 (0.24–4.87)	0.58 (0.28–1.20)	0.59 (0.26–1.34)	0.55 (0.47–0.65)	0.54 (0.44–0.66)
20–25	1.00 (reference)				1.00 (reference)			
25–30	1.71 (0.84–3.48)	1.18 (0.60–2.34)	1.32 (0.79–2.20)	1.23 (0.68–2.24)	1.69 (1.27–2.27)	1.97 (1.41–2.76)	1.33 (1.23–1.44)	1.55 (1.42–1.71)
≥30	3.98 (1.89–8.41)	8.90 (4.89–16.22)	1.48 (0.74–3.00)	2.21 (1.13–4.33)	3.15 (2.15–4.62)	3.50 (2.20–5.55)	1.39 (1.22–1.59)	1.89 (1.71–2.09)
Asian								
<20	0.93 (0.20–4.30)	0.01 (0.00–0.02)	0.01 (0.00–0.04)	1.15 (0.24–5.49)	1.13 (0.48–2.62)	0.76 (0.32–1.81)	0.61 (0.51–0.72)	0.62 (0.50–0.77)
20–23	1.00 (reference)				1.00 (reference)			
23–27.5	1.30 (0.54–3.15)	2.40 (0.98–5.89)	1.09 (0.57–2.11)	1.22 (0.55–2.70)	2.76 (1.63–4.69)	2.18 (1.40–3.38)	1.31 (1.19–1.45)	1.52 (1.34–1.73)
≥27.5	3.11 (1.28–7.58)	5.79 (2.11–15.91)	1.12 (0.56–2.24)	1.92 (0.94–3.94)	4.51 (2.63–7.72)	2.87 (1.77–4.65)	1.59 (1.42–1.78)	2.08 (1.84–2.36)
Waist : hip ratio (cm)								
European								
≤0.90 (M), ≤0.85 (F)	1.00 (reference)				1.00 (reference)			
>0.90 (M), >0.85 (F)	2.69 (1.33–5.42)	3.03 (1.22–7.55)	1.40 (0.79–2.49)	1.96 (1.06–3.60)	2.95 (2.11–4.14)	3.12 (2.21–4.41)	1.83 (1.67–2.00)	1.70 (1.57–1.83)
Asian								
≤0.90 (M), ≤0.80 (F)	1.00 (reference)				1.00 (reference)			
>0.90 (M), >0.80 (F)	2.69 (1.33–5.42)	8.66 (2.05–36.67)	1.40 (0.79–2.49)	1.54 (0.70–3.38)	2.95 (2.11–4.14)	2.15 (1.31–3.52)	1.83 (1.67–2.00)	1.80 (1.63–2.00)
Waist circumference (cm)								
European								
<95 (M), <80 (F)	1.00 (reference)				1.00 (reference)			
95–102 (M), 80–88 (F)	3.19 (1.66–6.15)	1.42 (0.57–3.54)	1.12 (0.67–1.88)	2.14 (0.75–6.13)	2.29 (1.72–3.05)	2.51 (1.72–3.68)	1.43 (1.30–1.58)	1.91 (1.73–2.11)
>102 (M), >88 (F)	2.70 (1.03–7.08)	5.65 (2.12–15.04)	1.47 (0.79–2.74)	3.78 (1.40–10.19)	2.51 (1.55–4.07)	3.48 (2.31–5.23)	1.54 (1.35–1.75)	2.46 (2.23–2.71)
Asian								
<90 (M), <80 (F)	1.00 (reference)				1.00 (reference)			
≥90 (M), ≥80 (F)	2.35 (1.28–4.33)	3.24 (1.31–8.01)	1.28 (0.79–2.06)	3.09 (1.16–8.19)	2.27 (1.75–2.95)	2.82 (1.98–4.03)	1.50 (1.39–1.62)	2.16 (1.98–2.37)

Waist : height ratio								
≤0.5	1.00 (reference)				1.00 (reference)			
>0.5	2.08 (1.02–4.23)	3.64 (1.33–9.97)	1.09 (0.61–1.94)	2.52 (1.04–6.06)	3.64 (2.44–5.44)	3.28 (2.12–5.08)	1.74 (1.58–1.90)	2.51 (2.25–2.81)
Alcohol consumption								
None	1.00 (reference)				1.00 (reference)			
Less than weekly	0.61 (0.31–1.20)	0.41 (0.17–0.99)	0.92 (0.54–1.57)	0.65 (0.35–1.23)	0.81 (0.60–1.07)	0.76 (0.55–1.06)	1.19 (1.09–1.30)	0.82 (0.74–0.90)
Weekly or more frequent	0.65 (0.27–1.57)	0.08 (0.01–0.60)	1.07 (0.60–1.94)	1.14 (0.14–9.10)	0.73 (0.46–1.16)	1.50 (0.65–3.44)	1.17 (1.07–1.29)	0.64 (0.39–1.05)
Smoking status								
Never smoker	1.00 (reference)				1.00 (reference)			
Ex-smoker	2.08 (1.06–4.08)	0.01 (0.00–0.03)	1.35 (0.69–2.64)	0.03 (0.00–0.51)	1.47 (1.04–2.08)	1.23 (0.52–2.91)	1.12 (0.99–1.25)	1.13 (0.77–1.66)
Current smoker	1.70 (0.72–4.00)	1.97 (0.60–6.51)	0.87 (0.49–1.53)	3.24 (0.97–10.84)	0.81 (0.57–1.16)	1.50 (0.59–3.80)	0.90 (0.83–0.98)	0.92 (0.65–1.31)

Rate ratios were obtained by pooling data from different survey years for each country. Estimates shown were adjusted for age and education status.

Table 2 Socioeconomic differences between Singapore and Mauritius

	Singapore	Mauritius
Population size[A]	5.1 million	1.3 million
Ethnic composition[B]	74.2% Chinese, 13.3% Malay, 9.2% South Asian, 3.3% Others	68% South Asian (Indo-Mauritian), 27% African (Creole), 3% Chinese (Sino-Mauritian), 2% Franco-Mauritian
GDP per capita[A] (US$)	40 941	7462
Adult literacy rate[C] (%)	95	88
Life expectancy at birth[A] (years)	82	73
Infant mortality rate[A] (/1000 live births)	2	13
Neonatal mortality rate[A] (/1000 live births)	1	9
Maternal mortality ratio[D] (/100 000 live births)	9	36
Urban population[A] (%)	100	43
Working population[E] (%)	65.6	59.2
Estimated calorie intake per capita per day[F,G] (kcal)	2624	2930
Common causes of mortality[H]	Cancer, ischemic heart disease, pneumonia, cerebrovascular disease (including stroke), accidents, poisoning, and violence	Diabetes mellitus, acute MI and other ischemic heart diseases, cerebrovascular disease, hypertensive disease, heart failure

[A]Data are 2010 estimates from World Development Indicators.[22]

[B]Data are estimates from The World Factbook.[23]

[C]Data are 2005–10 estimates from World Development Indicators.[22]

[D]Data are 2008 modeled estimates from World Development Indicators.[22]

[E]Economically active population in 2008 from the Labour Force Survey.[24]

[F]Mean daily energy intake among adult Singapore residents in 2010 from the National Nutrition Survey 2010.[25]

[G]Daily dietary energy supply per person in Mauritius in 2006–08 from the FAO Statistical Yearbook 2012.[26]

[H]The top five principal causes of death in 2010.[27,28]

GDP, Gross Domestic Product; MI, myocardial infarction.