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Coronary heart disease: what hope for the developing world?

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Coronary heart disease (CHD) is the leading cause of death worldwide with the greatest absolute contribution of deaths coming from low-income and middle-income populations.¹ At the outset of the global epidemic, early in the 20th century and continuing for a few decades, CHD rates steeply increased stemming from the prosperity and societal-level changes that industrialisation and urbanisation brought to populations.² These same populations experienced a near universal regression of rates in the latter portion of the century due to a combination of population approaches for prevention as well as advances in medical care. Notably, these countries and populations are typically categorised as high income in the present day. The current concern in high-income countries is whether the decreased rates of CHD have plateaued, especially in the light of major risk factors including obesity, hypertension and type 2 diabetes being on the rise in younger populations.³ With these data in hand, it will be prudent to closely monitor these younger, high-income populations for any reversal of these historical positive trends.

In low-income and middle-income countries, there has been a precipitous increase in CHD due to the natural progression of ongoing nutrition and epidemiological transitions. The question as these countries develop is whether modernity itself exacerbates CHD rates or does the adoption of western dietary and lifestyle habits in today's globalised world individually impact the rates? Recent evidence suggests a multitude of avenues linked to westernisation or globalisation and a poorer CHD risk profile are increasingly prevalent in low-income and middle-income countries. Specifically, there is greater consumption of poor quality dietary commodity foods, increased smoking rates, increased heavy alcohol consumption, increased sedentary pastimes and decreased physical activity levels, as well as the rising tide of obesity.^{4–7} Indeed, the causes of this global epidemic have largely been established to originate in these lifestyle factors and their direct impact on established and novel pathways of clinical cardiovascular risk.⁸

The recent published data from the Singapore Chinese Health study (SCHS) may inform low-income and middle-income developing populations experiencing the nutrition and epidemiological transitions and the concomitant increase in CHD rates. Singapore has undergone rapid development since becoming an independent country in 1965, is one of the most developed nations of the world and current day rates of CHD mirror western countries.

⁹ This trend in Singapore corresponds with the rapid economic development and

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concomitant shifts from a traditional lifestyle towards a westernised lifestyle and increased life expectancy since the country became independent in 1965.¹⁰¹¹ Thus, the Singaporean Chinese experience may be a bellwether for low-income and middle-income populations who are in the midst of rapid social and economic development and the related shifts in lifestyle.

The most recent published research from our team provides novel insight on the relationship between nutrition transitions and CHD mortality. We examined the association between Western-style fast food intake habits and risk of CHD mortality in a cohort of middle aged and older Chinese Singaporeans.¹² Western-style fast food is often linked with poor cardiometabolic health in the popular and scientific press despite few studies directly examining it as an independent exposure.¹² It is a factor in dietary patterns portending increased cardiovascular disease (CVD) risk in US populations.¹³ However, research examining Western-style fast food intake in relation to cardiometabolic outcomes is scant compared with the ubiquity of the food and its contribution to usual dietary patterns in populations around the globe.

In our research, we analysed data from 52 584 Chinese men and women without a history of cancer, CVD and diabetes, as well as extreme caloric intakes in the SCHS, a prospective cohort study. A baseline, in-person interview included questions on usual diet, demographics, height and weight, use of tobacco, usual physical activity, menstrual and reproductive history (women only), medical history and family history of cancer. A section from the food frequency questionnaire specifically inquired about the intake of Western-style fast food items (hamburgers/cheeseburgers, French fries, pizza, other sandwiches, deep-fried chicken and hot dogs). We summed the intake of these items and examined the frequency of intake in relation to CHD mortality risk. On one hand, participants who reported more frequent intake of Western-style fast food were younger, less likely to be hypertensive, more educated, smoked less and more likely to be physically active (a different cardiovascular risk profile from Western populations who consume fast food frequently). On the other, they had a subtly less prudent dietary profile. In a Cox regression model fully adjusted for demographics, lifestyle-related factors, including body mass index, and dietary confounders, we observed a significant, strong, dose–response association between increasing Western-style fast food intake and risk of CHD mortality (figure 1). The undue influence of the poor nutritional profile of Western-style fast food is the underlying hypothesized mechanism for this association.

The findings from our study may provide context for populations that have recently undergone or are undergoing nutrition transitions and are experiencing the parallel changes in health. Western-style fast food intake in east and Southeast Asia started becoming somewhat prominent in the late 1980s and early 1990s, providing a chance to participate in American culture,¹⁴ which is very different from the historical dietary culture of these populations. Rapid international expansion of Western-style fast food outlets is ongoing.¹⁵ This increase in availability may be desirable to some people from a cultural perspective,¹⁴ but as our research shows there may be a downside to this aspect of nutrition transition with much greater CHD risk. Of note, in this same population, we observed no association between the population's own 'fast food' (snacks and dim sum) and CHD mortality. This

food is similar in composition to Western-style fast food, as most snack and dim sum foods are savoury pastries such as steamed or deep-fried dumplings, filled buns, noodles, sweet pastries and meat dishes. The import of westernised dietary habits reflects a significant economic and developmental achievement for low-income and middle-income countries. However, our research suggests that this aspect of global dietary acculturation contributes to the impending CHD epidemic in this developing pocket of the world and is an issue that merits closer attention.

A related relevant issue to the westernisation of diet in the developing world is the similar patterns of higher tobacco and alcohol consumption that strongly correlate with the westernisation of diet and greater overall prosperity.⁴ The evidence from the rapidly developed Singapore¹² and other developing countries shows that the adoption of unhealthy western eating habits and increased tobacco and alcohol use initialises in the upper income groups and then shifts and embeds into the lowest income groups.⁴ In a sense, these primary 'westernised' risk factors for CHD are all tied together in the way they are imported and incorporated in life in developing populations from industry.⁴ What hope do these low-income and middle-income populations have to stave off any impending CHD epidemic when they are the largest and the fastest growing markets for Western-style fast and junk foods, tobacco products and western alcohol brands?

It is here where the Singaporean Chinese experience may also inform for prevention efforts in these rapidly developing populations. We examined the combined association of six lifestyle factors with the risk of CHD mortality in participants from the SCHS.⁹ A protective level of each factor was independently associated with CHD mortality. Protective lifestyle factors were represented by a dietary pattern plentiful in vegetables, fruits and soy foods; higher relative levels of physical activity; light-to-moderate alcohol consumption; average usual sleep of 6–8 h per day; no history of smoking and normal weight (ie, not underweight or overweight). In combination, a marked decrease in the rate and risk of dying as a result of CHD was observed with each additional protective lifestyle factor in healthy and high-risk participants (table 1). Overall, data from this large cohort of Chinese adults highlight that multiple modifiable lifestyle factors are of paramount importance in improving population-wide cardiovascular risk reduction in both primary and secondary prevention. This is highly analogous to other high-income populations where a significant potential for prevention of CHD exists and has occurred. These data present a theoretical knowledge advantage for current low-income and middle-income populations undergoing rapid social and economic development. The data suggest that they need not experience the full onslaught of the CHD epidemic and concomitant economic and societal impact. The underlying issue of curbing and ultimately preventing the impending CHD epidemic in these developing populations is one more of awareness and feasibility. In these low-income and middle-income populations, resources are scarce, the overall governmental structure is generally more fragmented and many aspects of the nutritional and epidemiological transition are widely popular.

Thus, there are questions surrounding the impending CHD epidemic in low-income and middle-income developing populations. How will the CHD epidemic run its course in these low-income and middle-income developing populations? Will it be worse than the historical experience of current day high-income populations or does this documented experience

make it possible to reduce the future burden in developing populations? How much do the global industries that sell the products of ‘westernisation’ contribute to increasing CHD rates in these low-income and middle-income populations?⁴ Do all arrows point to this as a prime opportunity to implement population-wide prevention measures?⁷ Ultimately, the data from current day high-income westernised nations provide an argument to implement population approaches for prevention now rather than later, as it will have the least effect on inequality and best utilises scarce resources in these low-income and middle-income populations.¹⁶ The recent Singaporean Chinese experience provides a further argument for population approaches that increase the prevalence of healthy lifestyle factors, and that specific attention to components of westernisation (ie, Western-style fast food) is important for CHD risk in non-westernised populations. With this wealth of historical and recent data related to CHD prevention, there is certainly hope that the developing populations of the world need not experience the full-scale epidemic. Time will tell if this hope becomes reality.

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Figure 1.

HR and 95% CI of coronary heart disease (CHD) mortality according to intake frequency of Western-style fast food items—further dose-response evaluation and Singapore Chinese Health Study N = 52 584 (1397 deaths due to CHD): respective N (no. of deaths due to CHD) for none, one to three times per month, one time per week, two to three times per week and four times or more per week is 25 810 (784), 21 133 (503), 3006 (51), 1824 (42) and 811 (17), respectively. Results represent fully adjusted model (age, sex, year of interview, dialect, education, smoking, alcohol, sleep, physical activity, BMI (kg/m²) and nutritional factors (intake of soft drinks, juice, eastern snacks and dim sum, vegetables, fruits, soy foods, rice, noodles, other pork and red meat and total energy)).

Age-adjusted and sex-adjusted cardiovascular disease (CVD) mortality rates and HR and 95% CI of CVD mortality according to the number of protective lifestyle factors in healthy Chinese men and women: Singapore Chinese Health Study (SCHS)

Table 1

Number of protective lifestyle factors	0	1	2	3	4	5/6	
N	415	3589	11353	15998	9764	2937	
Total CVD mortality (ICD-9 390–459)							
No. of CVD deaths	55	264	616	630	325	81	
Standardised rate *	110	57	41	29	24	20	p trend
HR (95% CI)	1.00	0.60 (0.45 to 0.84)	0.50 (0.38 to 0.67)	0.40 (0.30 to 0.53)	0.32 (0.24 to 0.43)	0.24 (0.17 to 0.34)	<0.0001
Coronary heart disease (CHD) mortality (ICD-9 410.0–414.9, 427.5)							
No. of CHD deaths	29	152	335	324	158	41	
Standardised rate *	58	33	22	15	12	10	p trend
HR (95% CI)	1.00	0.67 (0.45 to 0.99)	0.53 (0.36 to 0.78)	0.40 (0.27 to 0.59)	0.30 (0.20 to 0.45)	0.23 (0.14 to 0.37)	<0.0001
Cerebrovascular disease mortality (CERE) (ICD-9 430–438)							
No. of CERE deaths	18	61	193	180	103	28	
Standardised rate *	36	13	13	8	8	7	p trend
HR (95% CI)	1.00	0.41 (0.24 to 0.69)	0.46 (0.28 to 0.74)	0.33 (0.20 to 0.54)	0.30 (0.18 to 0.50)	0.25 (0.14 to 0.46)	<0.0001

Model adjusted for age, sex, year of enrolment, dialect, education, marital status and energy intake.

* Standardised rate=age-standardised and sex-standardised CVD/CHD/CERE mortality rate per 10000 person-years using person-year time, age and sex distributions of SCHS.