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OBESITY PREVENTION IN SINGAPORE: COLLABORATIVE EFFORTS AMONG GOVERNMENT, HEALTH PROFESSIONALS AND THE COMMUNITY

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Obesity has reached global epidemic proportions over the past 10 years. As countries become more affluent, their populations tend to adopt caloric balance problems that have plagued the USA and Western Europe. Obesity is classified as the second most serious reversible health problem, after smoking in the world today. The relationship between obesity and cardiovascular diseases is well documented. The increase in obesity in Asian countries is remarkable. In 2004, the prevalence of obesity in the adult population in Singapore increased upto 16% (high risk category: $\geq 27.5\text{kg/m}^2$) and prompted many forms of government action, encouraging collaboration between businesses, the educational system and non-governmental organizations. This paper reviews the rise of obesity in Singapore and some of the approaches being implemented to address this concern. Singapore, a multiethnic country, with Chinese, Indian and Malay populations, has to address diversity in customs, diet and religions to combat obesity. The collaborative efforts of various organizations such as the Ministry of Health (MOH), Ministry of Education (MOE) and the Health Promotion Board (HPB) have successfully improved the health status of Singaporeans. The fact that the rise in obesity in Singapore is lower than in other neighboring Asian countries attests to the partial success of the collaborative efforts.

Keywords: Obesity, physical activity, prevention, diet, overweight, body mass index, Singapore.

Introduction

Singapore is a multi-racial tropical island with a booming economy and excellent infrastructural facilities. The population has risen by 66% since 1990, and totalled 5.08 million in 2010 (Department of Statistics, Singapore, 2010). As the global epidemic of obesity developed over the past decades and the number of obese adults worldwide increased to over 300 million, the prevalence rate of obesity in Singapore has also doubled from 1992 to 2004 reaching 16% in the high risk category ($\geq 27.5\text{kg/m}^2$) and 36.7% in the moderate risk category ($23\text{kg/m}^2 \leq$ body mass index (BMI) $\leq 27.4\text{kg/m}^2$; Epidemiology and Disease Control Division, 2004). Heart disease is the second leading cause of death after cancer among Singaporeans (Ministry of Health; MOH, 2007a), and various previous studies have established that, out of the many possible causes, obesity is the most common cause of cardiovascular diseases (CVD) (Mokdad *et al.*, 2003; Bassuk and Manson, 2006).

In response to the growing issue of obesity, the Singapore government through agencies such as the MOH, Ministry of

Education (MOE) and the Health Promotion Board (HPB) has worked directly with public health professionals, non-governmental organizations, businesses, local communities and schools to combat obesity. Because of these collaborative efforts, Singapore's health care system was ranked the best in Asia in 2000 by the World Health Organization (WHO, 2000), and 6th out of 192 countries in a global survey to assess world health systems, ahead of the United States of America (USA) which ranked 37th. The Joint Commission International set up their Asia Pacific Headquarters in Singapore and has accredited three medical centres and ten hospitals in this city (Economic Development Board, Singapore, 2009).

To describe Singapore's collaborative approach in preventing and controlling obesity, this paper describes how the Singapore healthcare system has helped to reduce obesity by implementing physical activity and nutritional programs to encourage adults and/or children to stay active and make healthy diet choices, and how prevention programs have been tailored to target different race groups who are at higher risk of CVD due to higher rates of obesity.

Singapore Healthcare System

Singapore's healthcare system includes both public and private healthcare facilities and provides three levels of healthcare services. With over 2,000 facilities, the healthcare system provides primary care, hospital care, and

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intermediate and long term care to their patients (Table 1). While the majority of Singapore’s healthcare facilities are privately owned, the public healthcare facilities fall under five broad clusters which included 8 hospitals, 8 specialist clinics, 1 medical centre and 18 polyclinics giving a total of 35 governmental health facilities (MOH, 2007b). The 35 public healthcare facilities provide qualitative and affordable healthcare services at all three levels. In addition to outpatient and inpatient care, the Singapore healthcare system provides intermediate and long-term care for the elderly to improve quality of life (Table 1).

Although Singapore has fewer hospitals (per million population) and doctors (per 10,000 population) than China, Japan, and the USA, these facilities provide high quality services and have managed to maintain a low death rate and infant mortality rate, and increased life expectancy when compared to the China, Japan, and USA (Figure 1).

The main reason for such an excellent healthcare system in Singapore is its higher average private cost than average public expenses (percent of total healthcare expenditures). First, Singapore emphasizes the need for individuals to take

Table 1. Intermediate and long term health care services in Singapore.

I. Primary: Provide outpatient services, primary medical treatment, preventive healthcare and health education	
Governmental Polyclinics (18)	Private Clinics (about 2000)
II. Hospitals: Acute inpatient and specialist outpatient services and a 24-hour emergency department, and treatment for special cases	
Governmental Hospitals (8) Specialty clinics(8), Medical centre (1)	Private Hospitals (16)
III. Intermediate and Long Term: Step down care for elderly in Singapore, managed by Voluntary Welfare Organisation or private operators	
Residential <ul style="list-style-type: none"> • Community hospitals • Chronic sick hospitals • Nursing homes • Inpatient hospice care • Sheltered home for ex mentally ill* • Respite care‡ 	Community Based <ul style="list-style-type: none"> • Home Based Services <ul style="list-style-type: none"> • Home medical • Home nursing • Home hospice care services† • Centre Based Facilities <ul style="list-style-type: none"> • Day rehabilitation centre for elderly • Dementia day care centres • Psychiatric day care centres and rehabilitation homes • Ministry of Community Development, Youth And Sports

Adapted from Ministry of Health (2007b).

Notes:

* Care provided to patients with stabilised psychiatric condition;

† Care provided to terminally ill people with an expected survival of six months or less;

‡ Short-term care for family member

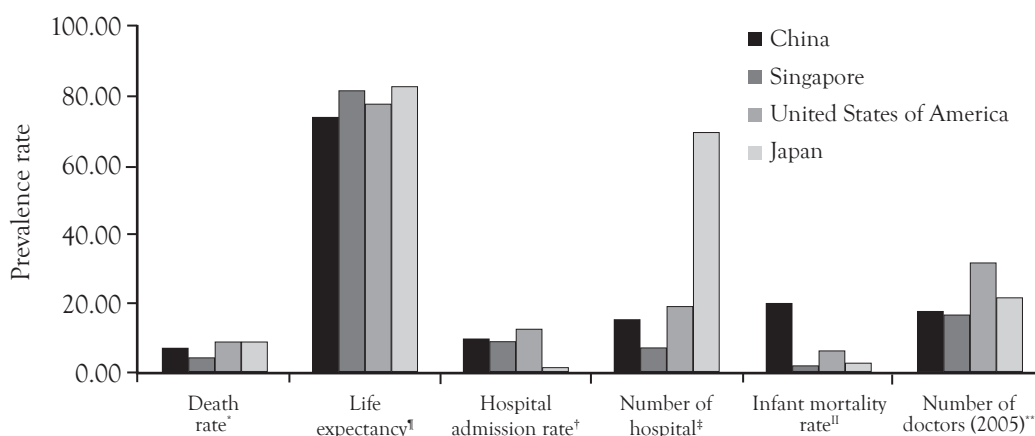


Figure 1. Comparison of health performance in China, Singapore, United States of America, and Japan (Adapted from American Hospital Association 2009; Ministry of Health, China 2010a, 2010b , Statistics and Information Department, Minister’s Secretariat, Ministry of Health, Labour and Welfare, Japan, 2010; Central Intelligence Agency, 2010; American Medical Association 2008; Department of Statistics, Singapore, 2010).

Notes:

^aPer 1,000 population; ^bin years; ^cper 100 population; ^dper 1,000,000 population; ^eper 1,000 live births; ^fper 10,000 population. Hospitals in US are registered US hospitals. Hospitals in Singapore are all public and private sector hospitals. Hospitals in Japan include Sanatoriums for T.B. patients, mental and general hospitals.

care of their own medical expenditures. The Singapore government encourages co-pay health schemes rather than establishing policies that result in higher taxes. The best examples of co-pay health schemes are Medisave, Medishield, Eldershield, and Medifund in which individuals are able to deposit funds to meet a portion of future personal or immediate family members' hospitalisation, surgery and certain outpatient expenses. This practice leads to more private health expenditure rather than the financing of healthcare using the government's tax revenue. As a result, Singapore's low public health expenditure is reflected by a tax rate (2% to 26% for individual) that is lower than many other countries (Tucci, 2010; Kim Lim, 2004). Second, regulation of the supply side medicine, including making budget for hospital, controlling the number of doctors per year, and reducing overtreatment of diseases, has managed to limit the healthcare cost in Singapore. In 2005, Singapore's total healthcare expenditures were around \$7.6 billion, which was 3.8% of Singapore's Gross Domestic Product (GDP). Out of this, the Singapore government paid only \$1.8 billion on healthcare services including primary, hospital, intermediate and long term care, which was 0.9% of the GDP. The other sources of health expenditures are employer benefits (35%), governmental subsidies (25%), and out of pocket payments (25%) (Okma *et al.*, 2008). Thus, the reasons behind the success of the Singapore healthcare system are focusing on personal healthcare responsibility and setting interventions for regulation of overtreatment of diseases.

Singapore healthcare has also successfully targeted obesity and its related diseases. Figure 2 represents the schematic overview of how the Singapore healthcare system targets obesity. In order to promote a healthy population,

the Singapore healthcare system has developed health promotion programs implemented by the HPB that specifically target different populations including children, adolescents, adults, and the elderly. These programs have been implemented at various settings including schools, workplaces, industries, communities, and healthcare. Aimed at improving the health of the general population as well as of individuals who are unhealthy or at-risk, the main focus of these programs is to modify the diet pattern and physical activity behaviors, the common causes of obesity (Figure 2).

Programs Promoting Physical Activity

The link between obesity and physical activity is well documented (Erlichman, Kerbey and James, 2002; Morrill and Chinn, 2004). Recognizing the positive effect of physical activity on reducing the obesity rate, the National Healthy Lifestyle Program (NHLP) was established in 1992 in response to the growing challenge of obesity, physical inactivity and other associated diseases among adults in Singapore. This program instituted a one-month long national campaign every year focusing on physical activity, healthy eating, not smoking and managing stress to combat obesity and major chronic illness and their risk factors. Consequently, the proportion of Singapore residents exercising regularly significantly increased from 16.8% in 1998 to 24.9% in 2004 ($p < .001$) in both women (13.6% to 21.0%; $p < .001$) and men (20.1% to 28.8%; $p < .001$, Epidemiology and Disease Control Division, 1999, 2004).

Following the NHLP, several other health promotion programs have also been implemented either at workplaces or in local communities in Singapore to increase physical activity and reduce obesity among Singapore adults. Table 2

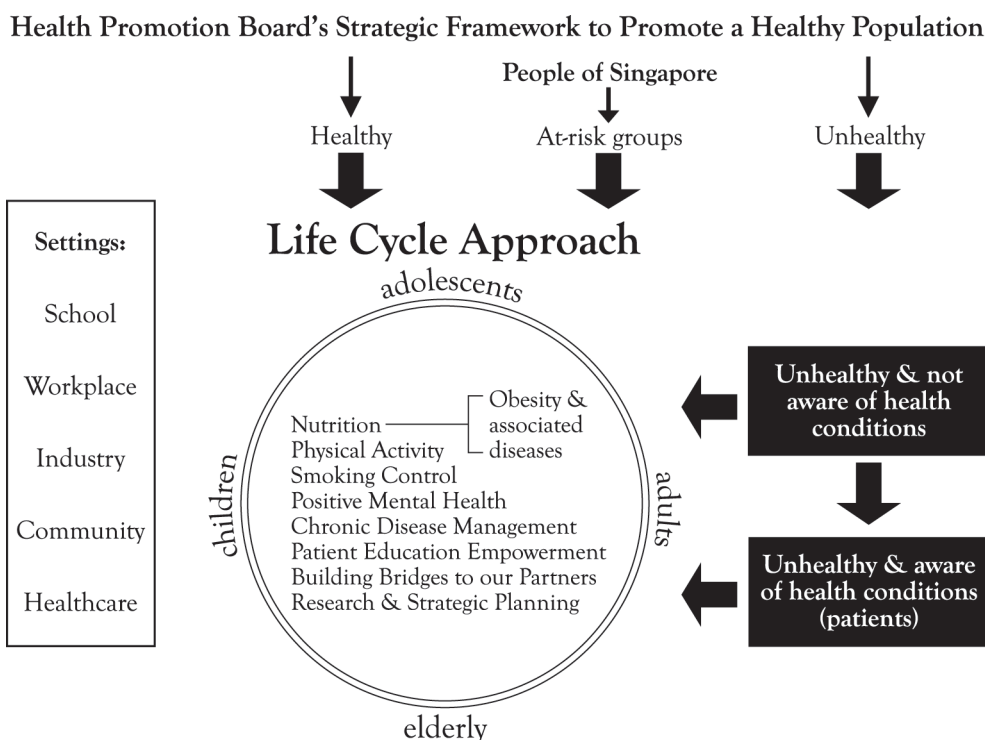


Figure 2. Schematic representation of healthcare system of Singapore to reduce obesity and related diseases (Soon, *et al.*, 2008).

Table 2. Various programs to improve physical activity and reduce obesity among Singaporeans.

Year	Program	Setting	Target Population	Major Activities	Main Findings and Success Rate
1992	NHLP and Healthy Lifestyle Ambassador Award (2003)	All Singapore	Various ethnic groups, working and senior citizens	Raise greater awareness to adopt a healthy lifestyles; involves mass participation and usually incorporates a mass physical activity campaign. Healthy lifestyle promotion activities, such as public forums, talks, health fairs and exhibitions such as Central Singapore On Move	After 6 years of follow up, the proportion of Singaporeans who exercise regularly increased from 14% to 16% and obesity remained stable.
1992 2007 1982 2000	TAF HHF NAPFA CHERISH Award and Grant	All Singapore	School population, secondary and pre university level schools	Schools banded according to their fitness index based on NAPFA test (2.4 km walk/run test and pull up for boys/inclined pull up for girls) and percentage of overweight students	Obesity rate decreased from 14% in 1992 to 10% in 2000; almost four-fold increase in schools who participated in the CHERISH award from 2001 to 2007
1998	HEALTH Leader and HEALTH Promoter Award and WHP Grant of \$5,000 (2001)	All Singapore	Working population	Greater community interaction such as sports activities; workplace wellness programs, physical fitness programs and maintenance of health indicators; health education for workers; activity clubs formed at workplace for the staff to take part in its events	Presently there are 350 HEALTH award recipients covering 340,000 employees; Active workforce increased from 14.2% in 1998 to 21.2% in 2004.
2000	NWHPP	All Singapore	Working population, and all ethnicities	Free consultancy services, training courses and educational seminars to organizations on workplace health promotion industry-based promotional campaigns and administers the WHP grant	Private sector WHP program has increased from 45% in 2003 to 59% in 2006 which represents 76% of total private sector workforce compared to 64% in 2003.
2003	Step With@It	All Singapore	Children, adolescents and youth (17-21yrs)	Road shows for public awareness campaign, educational programs and a stepometer device to monitor their program; Hands-on training to teachers and students, demonstrating how to use exercise tools; weekly runs and occasional marathons; encourage Singapore students to incorporate more exercise into their daily lives	Student activity level increased by 50%; participants reached over 250,000 since 2003; benefited 100 primary schools and over 200,000 students
2004	Central Singapore On Move	Central Singapore	People residing or working in central Singapore	Brisk walk on regular basis, for example 1.4km walk	700 participants increased up to 3,000
2004	Sheikarobics, Kebayarobics	All Singapore	Malay males and females	30-minute workout that incorporates silat, a form of martial arts, with aerobics	From 1998 to 2004, obesity rate and high total cholesterol decreased from 23.7% to 21.4% and from 31.1% to 17.7% respectively, among Malay females.
2005	Fitness @ Work	All Singapore	Busy working adults with different fitness levels	One hour weekly workout sessions near workplaces; body combat, cardio kick, body balance, aerobics, and dance forms	More than 250 Singaporeans attend the weekly workout sessions in 2007.

Adapted from HPBOnline 2007a; Woon 2007; Soon et al., 2008; Coca Cola Company 2009; HPBOnline, 2009

Notes:

NHLP, National Healthy Lifestyle Program; NWHPP, National Workplace Health Promotion Program; TAF, Trim and Fit; NAPFA, National Physical Fitness Award Scheme; CHERISH, Championing Effort Resulting in Improved School Health; HHF, Holistic Health Framework; HEALTH, Helping Employees Achieve Life-Time Health; WHP, Workplace Health Promotion.

lists several programs implemented between 1992 and 2007 to encourage more adults to participate in a variety of physical activities (Table 2). As a result of these programs, cholesterol levels decreased from 31% in 1998 to 18% in 2004 based on findings from the National Health Survey (NHS) conducted in 1998 and 2004 in Singapore (Epidemiology and Disease Control Division, 1999, 2004). Additionally, the growth of being overweight adults in Singapore has decreased by 50% from 1998 to 2004 (4.2% increment from 1992 to 1998 and 2.1% from 1998 to 2004). However, the findings on the trend of obesity are not consistent with some other data, due in part to different measures used to define obesity. Some studies indicated percentage of body fat among Singaporean to be 6.9% (based on international cut off point for obesity) in 2004 while others found 16% [prevalence of individuals with a BMI greater than 27kg/m² (new Asian cut off point for obesity)] in Singapore (Epidemiology and Disease Control Division, 1992, 2004), although the overall rate of increment of obesity in Singapore is low compared to other countries.

Programs Promoting Physical Activity among Children

Evidence suggests that physical inactivity rather than high fat diets is a major determinant of obesity for children (Andersen *et al.*, 2006; Blair and Nichaman, 2002; Patrick *et al.*, 2004; Teixeira, Sardinha, Going and Lohman, 2001, Trost, *et al.*, 2002). To tackle childhood obesity, several programs have been developed that concentrate on facilitating an active lifestyle for children by reducing the proportion of sedentary behaviours (Brodersen, Steptoe, Boniface and Wardle, 2007; Graf *et al.*, 2004; Van Mechelen, Twisk, Post, Snel and Kemper, 2000; Parizkova and Chin, 2003).

In 1982, the National Physical Fitness Award (NAPFA) Scheme was first introduced to improve the health of Singapore children. Adolescents who pass the NAPFA with a minimum of a silver grade, prior to conscription into National Service at 18 years old receive an exemption of a month of basic military training as part of the government's national service requirement. In 1996, NAPFA became a part of the scheme 'Sports for Life' and was added as one of the criteria of the Trim and Fit (TAF) program (Singapore Sports Council, 2008).

The results of the 1992 NHS showed a significant increase in the obesity rate (greater than 120% of the median weight for height as indicator of obesity) from 2% in 1976, to 15% in 1992. With collaboration of HPB and MOE, a new program, TAF, was developed in 1992 which aimed to increase physical activity and reduce the obesity rate among children (Toh, Cutter and Chew, 2002). As part of NHLP and integrated into the national education curriculum, TAF controlled the type of food and beverages available in schools and increased physical activities (Swinburn and Bell, 2007). From 1992 to 2000, TAF along with NAPFA and MINDEF (Ministry of Defence) Physical Fitness Performance Award contributed to the decreasing obesity rate of 15.5% in 1992 to 13.1% in 2000 among fifteen to sixteen year olds and from 16.6% in 1992 to 14.6% in 2000 among eleven to twelve year olds (Low, Chin and Deurenberg-Yap, 2009; Toh *et al.*, 2002).

Unfortunately, the TAF program has been shown to negatively affect the self-esteem of some overweight and obese children (The Washington Post, 2007). The obese and overweight children, including those in pre-schools, experienced weight-teasing by peers and were bothered by such episodes (Chia, 2007). Weight-teasing in schools has been associated with eating disorder behaviours that may place overweight children at risk for further weight gain. To address the limitations of TAF, the Holistic Health Framework (HHF) was evolved in 2007 with framework designed to cater to all children including those falling within the normal range as well as those defined as being obese. HHF broadens its application beyond reducing obesity rates and promotes physical fitness by improving the student's general well being and developing intrinsic motivation to lead a healthy lifestyle.

The MOE reviewed the TAF scheme and with the MOH launched a nationwide holistic health program for schools in 2000 called the Championing Effort Resulting in Improved School Health (CHERISH) Award. CHERISH targeted the holistic development of students. Importantly, it echoes the WHO's Health Promoting Schools concept, adopted by many countries. Since the inclusion, CHERISH has successfully improved the health of students and staff and encouraged the government to establish various health initiatives (Table 2). The CHERISH Award was renamed as the joint HPB-MOE bi-annual award in 2006, inspired as a result of WHO's Health Promoting School Initiative program (MOH, 2008). This is an excellent example of the success of the collaborative efforts of two different organizations in improving health in Singapore (Table 2).

In recent years, the increasing popularity of cyber gaming and television viewing among Singapore children are emerging as major areas of concern. Many of these games are essentially passive in nature, therefore playing such games could be a great contributor to obesity among children (Marcou, 2006). In addition, video gaming has been shown to have a positive correlation with the consumption of fast food among preschool children (Taveras *et al.*, 2006). It is well known that Singapore is one of the highest consumers of electronics in the world, and expenditures on electronic consumption has increased from US\$ 442.42 million in 2005 to US\$ 474.33 million in 2008 (Euromonitor International, 2008). Many leading foreign video game companies have established their base in Singapore (Rikvin Consultancy, 2008). Even though there are many available programs such as NAPFA, HHF, and CHERISH to promote and increase the level of physical activity among children, the increasing trends of cyber gaming and television viewing among young Singaporeans is a wake-up call for action. Further efforts are needed to motivate children towards an active lifestyle.

Programs to Improve Nutrition

The proportion of Singaporeans who exceed the recommended intake of dietary fat increased from 32.2% in 1998 to 42.7% in 2004 (Epidemiology and Disease Control Division, 1999, 2004). Major sources of fat in the diet for Singaporeans include stir fried food, dishes containing coconut milk (Nasi Lemak), biscuits, pastries, local snacks

and flavoured rice (chicken rice and Nasi Biryani), and these sources contributed to 50.4% of the total dietary fat intake. Table 3 lists fat content in some of the favourite foods of Singaporeans. The intake of saturated fat in the diet has increased in recent years (Figure 3). About 39% of total fat in the diet was saturated in nature and this exceeded the recommended guidelines for saturated fat of not more than one third or 33% of total dietary fat. Excess intake of selected nutrients may increase the obesity rate which is a risk factor for heart disease and stroke (Epidemiology and Disease Control Division, 2004).

Singaporean Chinese males and females have also been found to have a higher proportion of total cholesterol and a lower proportion of polyunsaturated fatty acid and mono-saturated fatty acid than their Hong Kong and Chinese counterparts (Dwyer *et al.*, 2003). Table 4 shows the cholesterol levels among Singaporeans in 1992, 1998, and 2004.

Although many health programs have been developed to encourage low saturated fat intake and cholesterol levels, the mean serum low density lipoproteins (LDL) among Singaporean CVD patients was 163mg/dl and did not achieve the desired target LDL level (< 100mg/dl) in 2006 (Ho, *et al.*, 2006). To control the obesity and related diseases, there is a need for more effective prevention programs that approach lifestyle modifications including diet and physical activity.

Of all the subtypes of fat, trans fat has the greatest association with weight gain and obesity (Field, Willett, Lissner, & Colditz, 2007). However, the Singapore government has decided not to ban trans fat (which doubles the saturated fat, lowers high density lipoprotein cholesterol and increases LDL cholesterol) and refused mandatory trans fat labelling in the country. This decision might negatively affect the cholesterol lowering goals in Singapore. The Singapore government defended their stand by stating that the Singaporeans' daily intake of trans fat is well within the WHO's recommended level of 1% of dietary energy, compared to the unhealthy level of 2.6% of intake among Americans. Additionally, banning trans fat might lead to substitution of it with saturated fat, which may enhance the level of saturated fat intake. Moreover, trans fat labelling could create trade barriers and limit the Singapore food choices. But, the idea behind choosing correct food products may be important in control of weight and obesity.

Community Based Nutritional Programs for Adults

In Singapore, half of the population eats at hawker centres at least six times a week (Epidemiology and Disease Control Division, 2004). The Healthier Hawker Food Program (HHFP) was developed in 2006 to encourage such centres to prepare their signature dishes by replacing major ingredients with healthy ingredients without compromising taste, cost and accessibility. HPB encourages the use of healthier cooking oil by covering 10% of the cost to make it affordable for hawker centres. The participating stalls can then display the 'Healthier Choice Symbol' on their food hygiene certificate. HPB also established the Healthier Dining Program (HDP) in 2003 to increase the availability

of healthy dishes that minimize the use of salt, sugar, and fat, and increases the amount of vegetables (Table 5). A list of participating restaurants and caterers has also been published on the HPB website. HPB is also successfully working with various fast food chains to provide healthier options to customers. Some other programs, such as the 'Ask For' program encourages the public to ask for healthy food (Table 5). To motivate the public to choose healthy foods, since June 2003, customers who ask for healthy foods get a 10% discount on their favourite dishes (HPBOnline, 2003). Other excellent examples of programs include "Towards Healthy Family Meal" which promoted healthy cooking and eating in collaboration with culinary professionals and people's association. One of the initiatives of this program is 'Healthy Cooking with Kitchen Diva Mdm Asmah Laili' which encourages Singaporeans to stay trim by practicing some tips.

Key strategies have been used by HPB to promote appropriate nutritional levels. The government is undertaking initiatives to educate the public about trans fat and saturated fat products and has introduced many programs (Table 5) to make individuals aware of the various types of hazardous fats. Out of those efforts, the 'Healthier Food Fair' is an effective program aimed at educating the public on choosing high quality foods to remain healthy (HPBOnline, 2007c). The Singapore government is also considering applying the concept of the "Traffic Light System" proposed by an international authority on obesity in which foods low in sugar and fat are labelled green, while foods with high sugar and fat are labelled red (Nie, 2007).

School Based Nutritional Programs for Children

To increase access to healthier food choices, HPB established the Model School Tuck Shop Program (MSTP; Table 5). HPB provides healthier food guidelines to schools in order to limit the salt, fat and sugar content in food offered to children at the schools' tuck shops as well as to promote the consumption of fruits and vegetables. The schools that continuously adhered to the eight nutritional and dietary guidelines, as evaluated by HPB nutritionists and dieticians, are awarded with the MSTP award (Soon, *et al.*, 2008).

Targeting High Risk Populations

Singapore is a multi-ethnic country which has 2.7 million Chinese, 490 thousand Malays, 319 thousand Indians, and 85 thousand people of other races (Singh, 2007). The prevalence of obesity in Singapore differs according to ethnicity (NHS 1992, 1998 2004), with the highest rates among Malays (19.1%), followed by Indians (13.4%) and Chinese (4.2%). One possible reason for the high obesity rate among Malays could be Ramadan, a holy month. Fasting (abstaining from food and drink during the daylight hours) during this month is among the five duties of those practicing the Islamic faith. Paradoxically, it has been found that caloric intake, and lipid intake ($p < .001$), LDL-C, ($p < .0001$), and total cholesterol (TGs; $p < .001$) levels were increased during Ramadan fasting (Khaled, Bendahmane and Belbraouet, 2006; Lamine *et al.*, 2006; Finch, Day, Razak and Rogers, 1998).

Table 3. Most popular dishes in Singapore with their dietary composition.

Dish Name	Description	Per serving (g)	Total fat (g)	Saturated fat (g)	Cholesterol (mg)	Monounsaturated fat (g)	Polyunsaturated fat (g)	Carbohydrate (g)
Chicken Rice	Chicken, roasted, with skin, served with rice and chilli sauce	382	23	8.7	47	9.1	3.7	75
Mee Goreng	Yellow noodle, egg, bean sprout, onion, cucumber, peas, tomato, cabbage, cooked in tomato and chilli sauce	309	20	8.3	135	8.6	2.6	61
Nasi Goreng, Malay style	Cooked rice with eggs, mixed vegetables and tomato sauce, stir-fried	377	27	11.3	200	11.7	3.0	103
Nasi Lemak	Rice cooked in coconut milk, wrapped inside a banana leaf with fried egg, anchovies and chilli sauce	210	14	7.6	76	4.2	1.3	80
Laksa Lemak	Thick rice vermicelli, served with thick coconut milk gravy with added spices, taukwa and meat	650	40	14.2	104	13.8	4.2	58

Adapted from: Oakley & Samuel Brown (2009), Richmond (2003), HPBOnline (2007b).

To reduce the level of obesity in Malays, the Singaporean government has begun a media campaign targeting this population. This media campaign included programs such as “Gaya Sihat” and “Sajjan”, hosted by celebrity chefs to educate the community on how to prepare traditional dishes with healthier ingredients. Other programs include “Ragam Sihat”, a radio program to raise awareness for healthy eating, and “Rentak Sihat”, a program for providing tips to Malay TV viewers about diet, nutrition, food preparation and simple exercises to keep fit and healthy. After these efforts were initiated, the obesity level dropped from 23.7% in 1998 to 21.4% in 2004 among Singapore Malay women (Epidemiology and Disease Control Division, 2004).

Obesity rates among various ethnicities are creeping up in Singapore, however, in comparison to Malays from Malaysia, Indians from India and Chinese from China, the increment in the obesity rate among Singaporean Malay, Indian and Chinese, respectively, is still low (Figure 4).

Conclusion

Obesity is a multi-dimensional disease which occurs due to a number of factors, such as a sedentary lifestyle, poor nutrition including higher saturated fat and cholesterol, greater stress and depression, poor socioeconomic status and lack of education. The incidence of this disease is increasing in countries throughout the world, and it is especially serious in Asian countries. Obesity often leads to increased risk of CVD, diabetes and cancer, so it is extremely prudent for governments to address this growing epidemic.

While this review may reflect view points of the authors, it is evident that Singapore has been making serious inroads to reduce the level of obesity among both children and adults and improve the overall health status of the population. Obesity in Singapore children has decreased from 14% in

1992 to 10% in 2000 (Ministries of Health and Science and Technology and the National Bureau of Statistics of the People’s Republic of China, 2004). In addition, the rise in obesity in Singapore is lower than that in other neighbouring Asian countries which may also partially attest to its success in combating obesity.

There are a number of factors that have contributed to Singapore’s success in reducing the overweight and obesity rates as well as improving the nutritional habits of individuals. First, and perhaps most important, is that Singapore has one of the world’s most effectively integrated social, cultural, environmental, political and economic systems. This enables coherence in the actions of the society to bring attention and focus on issues that contribute to the well being of its population.

Second, Singapore has promoted many innovative programs and services. As a country, Singapore often leads the world in creating and testing new ways to address problems, concerns and issues. Many and varied programs discussed in this paper are a testament to the creativity of efforts aimed at promoting greater well being of its citizenry. In particular, Singapore has been very effective at promoting sustainable programs that are framed in a holistic fashion. As a result, resources are often linked; government works directly with businesses and non-governmental organizations in a collaborative fashion to develop programs, solve problems and promote the general welfare of the public. An example is the school system as a fundamental part of the process of change. Government health programs, often designed by the Ministry of Health, become an integral part of the educational curriculum offered to children and youth. By promoting a collaborative ethic among all of Singapore’s institutions, a great deal has been accomplished in the area of health. Health problems are not ignored until they reach epidemic status, but rather are addressed in a systematic

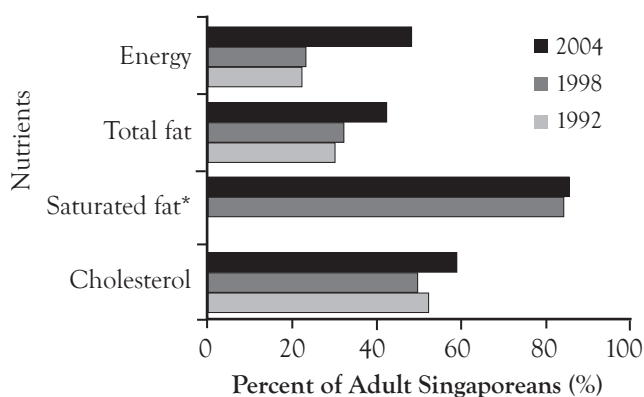


Figure 3. Comparison of the proportion of adult Singaporeans with excess intake† of selected nutrients in 1992, 1998 and 2004 (Adapted from Epidemiology and Disease Control Division, 1999, 2004).

Notes:

†Data for saturated fat for the year 1992 is unavailable.
 *Cholesterol ≥ 100 mg per 1000 kcal of Recommended Dietary Allowance (RDA); Saturated fat $\geq 1/3$ of the total fat intake from saturated fat; Total fat: 25% to 30% of total energy; Total energy: 2599 kcal and 2050 kcal of RDA for males and females, respectively.

Table 4. Cholesterol intake level (mg) among Singaporeans in various years*

Risk Factor/Disease	1992	1998	2004
Overall	296.7	283.3	287.8
Gender			
Male	347.2	321.1	313.6
Female	245.6	244.6	248.6
Ethnic Group			
Chinese	300.3	289.3	289.6
Malay	315.6	281.3	314.4
Indian	223.3	221.7	225.8

*Recommended intake for cholesterol should not exceed 100mg per 1000kcal of energy requirement

fashion emphasizing prevention through the promotion of collaborative ventures.

Third, Singapore has adopted a world view in crafting its vision and focus on health and obesity prevention. Singapore draws best practices from across the world. With a world perspective, Singapore has been enabled to draw, modify and adapt from other programs and services that, when framed collectively, have resulted in one of the world’s best health systems. Programs and services are defined in the context of the Singapore community and strategically planned, organized and delivered with a long term perspective. Programs and services are uniquely offered in such a way as to reflect the culture and customs of the Singapore community. As Singaporeans have responded to the global epidemic of obesity, their efforts provide meaning to Rene Dubos’ famous statement, “think globally, act locally.”

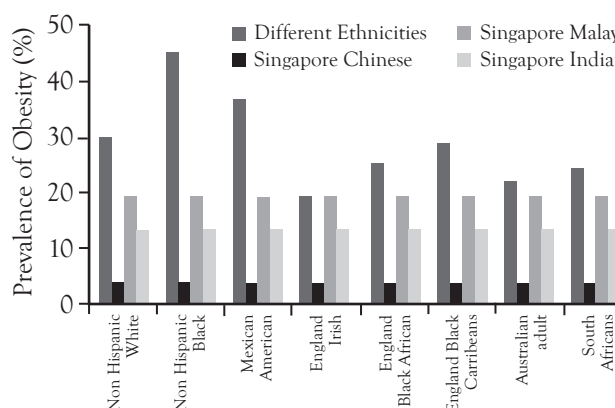
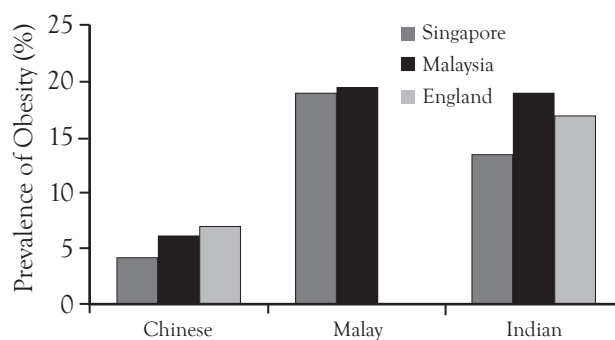


Figure 4. Comparison of the prevalence of obesity in 2004 among different ethnicities with Singaporean Indian, Malay and Chinese (Adapted from Ogden *et al.*, 2006, NHS Health and Social Care Information Centre, Public Health Statistics, 2005, Alberts *et al.*, 2005).

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Table 5. Programs to improve nutritional level among Singaporeans.

Year	Program	Setting	Target population	Major activities	Success Rate
1998	Nutrition Labelling	Food industry and manufacturers in Singapore	Consumers	Label the nutritional content of food to make people aware and ensure a healthier food supply.	Sale of HCS products increased from 29% in 2003 to 50% 2007; 67.4% of people were aware of HCS labels on food products in the market, and 69% of these people had used this symbol to assist them in making healthier food choices.
2002	Ask For Healthy Food Program	All food vendors, hawker centres and restaurants	Customers	Promote hawker centres and other restaurants to offer more vegetables and less fat to customers.	5,756 stall holders at 124 hawker centres and 1,600 stall holders at 112 food court in Singapore have been carrying these labels.
2003	MSTP	Schools in Singapore	Teachers, tuckshop vendors and students	Increase access to healthier food choices.	Between 2003 and 2007, 74% of schools in Singapore have received MSTP status.
2003	HDP	Restaurants	Food industry, restaurant chefs and managers	Increase availability of new healthy dishes and modify a part of the existing dishes on their menus to ensure that they have been prepared with less salt, sugar and oil, and contain more vegetables or fruits.	Table order with at least one increased from 35% in 2004 increased from 35% in 2004 to 62% in 2008.
2006	HHFP	Hawker centres in Singapore	All hawker centre customer	Gives instructions to hawker centres to use more healthy ingredients and replace high saturated fat sources with reduced saturated fat products. Participating stalls carry a healthier choice label on their food hygiene certificate.	Number of vendors participating in this program has increased from 32 in 2006 to 800; Purchasing rate of healthier choice symbol food has increased from 29% in 2002 to 42% in 2005.
2006	HCCP	Employers in Singapore, health facilitator and canteen vendors	Employees	Encourage and help employers to support their employees to choose and eat healthy.	Currently, 45 organizations are connected with the Workplace Canteen Certification Program, and out of them, half are HEALTH Award winners.

Adapted from Soon et al. 2008; Notes: HHFP, Healthier Hawker Food Program; MSTP, Model School Tuckshop Program; HDP, Healthier Dining Program; HEALTH, Helping Employees Achieve Life-Time Health; HCCP, Healthier Canteen Certification Program; HCS, Healthier Choice Symbol

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