Madurai Area Physicians Cardiovascular Health Evaluation Survey (MAPCHES) – an alarming status

A Mathavan MD[1], A Chockalingam PhD[2], S Chockalingam BSc[3], B Bilchik MD[4], V Saini MD[4]

A Mathavan, A Chockalingam, S Chockalingam, B Bilchik, V Saini. Madurai Area Physicians Cardiovascular Health Evaluation Survey (MAPCHES) – an alarming status. Can J Cardiol 2009;25(5): 303-308.

BACKGROUND: Studies have shown that South Asians are highly susceptible to cardiovascular diseases (CVDs). There is very little information available about the prevalence of risk factors for CVD in the physician population, a group that might be expected to be more aware of cardiovascular risk and health status.
AIM: To evaluate the prevalence of cardiovascular risk factors – including metabolic, dietary and behavioural – among the physician population in southern India.
METHODS: Approximately 4000 physicians of differing specialties from eight southern districts in Tamilnadu, India, in and around the city of Madurai were listed. Of these, 1600 were randomly selected to participate in a cross-sectional survey, of which 1514 physicians agreed to participate. The survey included demographic questionnaires, objective measurements of blood pressure, fasting blood sugar, fasting lipids and waist circumference, and questionnaires about their dietary and behavioural habits.
RESULTS: Complete data were available for 1433 physicians. Using a blood pressure cut-off value of 130/85 mmHg or higher, the study recorded a prevalence of 41% among men and 23% among women. On applying the International Diabetes Federation criteria for the metabolic syndrome for the South Asian population, the present study identified 49% of female physicians and 41% of male physicians as having the metabolic syndrome. Only 17% were physically active. Less than one-half of them consumed vegetables. Nearly 31% of male physicians were smokers.
CONCLUSION: Analysis of these data suggests that the risk for CVD and stroke is at epidemic proportions in a cohort of well-educated physicians who are in the highest quintile of income.

Key Words: *Cardiovascular diseases; Hypertension; Metabolic syndrome; Physicians' health; Randomized population survey*

Le sondage MAPCHES sur l'évaluation de la santé cardiovasculaire des médecins de Madurai : Un état alarmant

HISTORIQUE : Les études démontrent que les Asiatiques du Sud sont très susceptibles aux maladies cardiovasculaires (MCV). On possède très peu d'information sur la prévalence des facteurs de risque de MCV au sein de la population des médecins, un groupe qu'on supposerait plus conscient du risque cardiovasculaire et de l'état de santé.
OBJECTIF : Évaluer la prévalence des facteurs de risque cardiovasculaire, y compris les facteurs métaboliques, diététiques et comportementaux, au sein de la population de médecins du sud de l'Inde.
MÉTHODOLOGIE : On recensait environ 4 000 médecins de diverses spécialités provenant de huit districts du sud de Tamilnadu, en Inde, de la ville de Madurai et des environs. De ce nombre, 1 600 ont été choisis au hasard pour participer à un sondage transversal, et 1 514 ont convenu d'y participer. Le sondage incluait des questionnaires démographiques, des mesures objectives de la tension artérielle, la glycémie à jeun, la lipidémie à jeun et le tour de taille, ainsi que des questionnaires sur les habitudes alimentaires et comportementales.
RÉSULTATS : Les données complètes étaient disponibles à l'égard de 1 433 médecins. Au moyen d'une valeur seuil de pression artérielle d'au moins 130/85 mmHg, l'étude a enregistré une prévalence de 41 % chez les hommes et de 23 % chez les femmes. Lorsqu'on applique les critères de la Fédération internationale du diabète au sujet du syndrome métabolique au sein de la population sud-asiatique, la présente étude a permis de repérer que 49 % des médecins de sexe féminin et 41 % de ceux de sexe masculin avaient le syndrome métabolique. Seulement 17 % faisaient de l'activité physique. Moins de la moitié consommaient des légumes. Près de 31 % des médecins de sexe masculin étaient fumeurs.
CONCLUSION : D'après l'analyse de ces données, le risque de MCV et d'accident vasculaire cérébral atteint des proportions épidémiques au sein d'une cohorte de médecins bien éduqués qui font partie du quintile de revenu le plus élevé.

Cardiovascular disease (CVD) (including stroke) is the leading cause of death and disability worldwide (1). While the mortality and morbidity from coronary artery disease (CAD) has been falling in the western world, it has been climbing to epidemic proportions elsewhere to the point that nearly 70% to 80% of the burden of CVD is borne by developing countries (2,3). A number of studies conducted in India have reported increasing levels of cardiovascular risk factors such as high blood pressure, hyperlipidemia, diabetes mellitus and obesity (4-11). The prevalence of dyslipidemia and diabetes are at particularly high proportions. By 2020, it is expected that India will have more than 50% of the CVD cases in the world (12). Various factors believed to contribute to this rising epidemic include urbanization of rural areas, large-scale migration of rural populations to urban areas, an increase in sedentary lifestyles, abdominal obesity, the metabolic syndrome, diabetes, inadequate consumption of fruits and vegetables, increased consumption of fried, processed and fast foods, tobacco abuse, poor awareness and control of cardiovascular risk factors such as hypertension, unique dyslipidemia (high triglyceride and low high-density lipoprotein [HDL] cholesterol levels), and possible genetic predisposition. The effect of established, as well as novel, risk factors is multiplicative, not just additive (13).

Many of the studies performed in India were in the general urban population across all socioeconomic sectors. Systematic studies or surveys of the health of physicians treating large numbers of patients in India are rare. The first such study (12), recently published, reported on a highly select group of young physicians who were participating in a continuing medical education program. Some data exist on lifestyles and related diseases among physicians from various western countries (14-19). Based on the INTERHEART study (20), we are aware that nine modifiable risk factors account

[1]*Apollo Hospital, Madurai, Tamilnadu, India;* [2]*Faculty of Health Sciences, Simon Fraser University, Burnaby, British Columbia;* [3]*Somayya Foundation, Karaikudi, Tamilnadu, India;* [4]*Harvard School of Public Health & Lown Cardiovascular Foundation, Boston, Massachusetts, USA*
Correspondence and reprints: Dr Arun Chockalingam, Simon Fraser University, Blusson Hall, 11016–8888 University Drive, Burnaby, British Columbia V5A 1S6. Telephone 778-782-7176, fax 778-782-5927, e-mail achockal@sfu.ca
Received for publication February 25, 2009. Accepted March 20, 2009

TABLE 1
Population distribution and study participants in the Madurai Area Physicians Cardiovascular Health Evaluation Survey (MAPCHES) study

	Population, n			Study population, n		
District	Men	Women	Total	Men	Women	Total
Dindigul	966,201	952,759	1,918,960	122	53	175
Karur	464,489	469,302	933,791	30	22	52
Madurai	1,295,124	1,267,155	2,562,279	328	231	559
Ramanatha-puram	582,068	601,253	1,183,321	72	32	104
Sivaganga	565,594	585,159	1,150,753	36	24	60
Theni	553,118	541,606	1,094,724	77	29	106
Thirunelveli	1,372,482	1,429,112	2,801,194	176	62	238
Virudhunagar	870,820	880,728	1,751,548	101	38	139
Total	6,669,496	6,727,074	13,396,570	942	491	1433

Data from reference 21

TABLE 2
Determination of the metabolic syndrome using Adult Treatment Panel (ATP) III and International Diabetes Federation (IDF) criteria

	Defining level	
Risk factor	ATP III*	IDF†
Blood pressure, mmHg	≥130/85	≥130/85
Triglycerides, mmol/L	>1.70	>1.70
High-density lipoprotein cholesterol, mmol/L	<1.04 for men <1.30 for women	<1.04 for men <1.30 for women
Abdominal obesity: Waist circumference, cm	>102 for men >88 for women	>90 for men >80 for women
Fasting blood glucose, mmol/L	>6.11	>5.55

*Data from references *25 and †26*

for 90% of CVD mortalities worldwide, including South Asians living in India and elsewhere.

To evaluate the prevalence of risk factors for CVD among a well-educated and high-income sector of the population, we conducted a cross-sectional survey of practicing physicians living in and around Madurai, a South Indian city. As part of the survey, we also recorded information about their beliefs and behaviour regarding their own cardiovascular health. Here, we present the biological and behavioural data.

METHODS

The study was conducted in eight southern districts (Madurai, Sivaganga, Virudhunagar, Dindigul, Karur, Ramanathapuram, Thirunelveli and Theni) of the state of Tamilnadu (India), centred on the city of Madurai, a major metropolis. Approximately 4000 physicians from the Medical Practitioners list were identified in these eight districts serving a population of approximately 13.35 million. This list included all physicians with different levels of medical education ranging from MBBS, postgraduation (MD, MS, DNB, MRCP), specialty training after postgraduation education (DM, MCh, DNB) as well as indigenous medical training such as Ayurvedic and Siddha medicine.

All physicians were sent a letter of information about the study and were informed that they would have a potential opportunity to participate in the study. Using a random number generator, study subjects were identified in each district, with a 40% representative sample, for a total of 1600 physicians. Of these, 1514 physicians agreed to participate in the study (response rate of 94.5%). Table 1 shows the population of each of these districts (21) and the number of physicians who entered the study with complete records.

The study protocol was reviewed and approved by the Ethics Review Board of the Apollo Hospital, Madurai. All participating physicians signed a consent form before entering the study. Study coordinators and phlebotomists met the physicians at their doorstep at the appointed date and time to collect fasting blood samples, blood pressure measurements and administer the questionnaire. Questions included personal information (name, age, sex), medical specialty, type of practice, working hours, food habits, behavioural habits such as smoking, alcohol intake and physical activity, and their knowledge of cardiovascular health. The fasting blood samples were spun on the spot using a portable centrifuge. Plasma samples were placed in dry ice and shipped to the central laboratory at Apollo Hospital for analysis. The study coordinators and field workers measured blood pressure and pulse using World Health Organization-approved manual semiautomatic blood pressure monitors (Microlife BP 3 ASl-2; Microlife Corporation, Switzerland) according to Canadian blood pressure measurement guidelines (22). The first recording was discarded, and the average of the second and third readings was entered. The coordinators also measured the physician's height and weight using a portable, calibrated, electronic scale. The waist circumference measurements were obtained using standard tape measures as per Canadian guidelines (22).

TABLE 3
Age and sex distribution of the entire cohort

Age group, years	Men, n	Women, n	Total, n
<35	15	13	28
35–44	349	239	588
45–54	320	165	485
55–64	233	85	318
65+	65	10	75
Total	982	512	1494

Blood samples were not collected from 81 physicians who had taken either coffee or tea just before the scheduled appointment. Thus, 1433 (942 male and 491 female) blood samples were analyzed for fasting blood glucose (FBG) and lipid profile (total cholesterol, low-density lipoprotein cholesterol, HDL cholesterol and plasma triglycerides). Because blood pressure was recorded on their doorstep, the influence of white coat hypertension was considered negligible. Complete data were available for a total of 1433 physicians.

Although more than one-half of Indians living in India are lifelong vegetarians, CAD rates are similar among vegetarians and nonvegetarians. This is in sharp contrast to Western vegetarians who tend to have very low rates of CAD. The consistently higher rates of CAD among Asian Indians in several countries, compared with people of other ethnic origin who share the same environment, may indicate a possible genetic susceptibility or a genetic-environment interaction (23). To assess this question further, the dietary habits of the participating physicians were assessed, including the number of times per week they ate nonvegetarian food and the type of meat they preferred to eat.

The data were analyzed using the SPSS statistical package (SPSS Inc, USA). The metabolic syndrome is a cluster of CAD and diabetes risk factors including larger waist circumference, elevated blood pressure, elevated triglycerides, low levels of HDL cholesterol and high FBG levels (24). The metabolic syndrome is calculated using two methods, namely Adult Treatment Panel (ATP) III guidelines (25) and International Diabetes Federation (IDF) criteria (26). The cut-off values for abdominal obesity – determined by the waist circumference – and FBG are different between the two methods whereas the blood pressure, triglycerides and HDL cholesterol are the same (Table 2). The IDF criteria are more stringent than the ATP III in terms of waist circumference and FBG but are the same for blood pressure and lipid parameters. Because Asian Indians are people of small build, the IDF criteria have been considered by many to be more appropriate.

RESULTS

Table 3 shows the age and sex distribution of the participants. Of the 1514 participants, 20 did not provide either their date of birth or age. Nearly 35% of the participants were women. Nearly 5% were older than 65 years of age and another 40% were older than 55 years of age.

TABLE 4
Education and income profiles by sex

Monthly income in Indian rupees	Education, n													
	Superspecialty		MD		MS		MBBS		Ayurvedic		Siddha		Other	
	M	W	M	W	M	W	M	W	M	W	M	W	M	W
Missing	2	1	–	–	–	–	3	4	–	–	–	–	–	–
10,000–25,000	13	3	33	27	10	3	134	117	7	1	15	7	16	13
>100,000	14	1	7	2	4	–	9	8	–	–	–	–	–	–
25,000–50,000	85	9	143	62	102	13	258	215	3	–	2	1	26	2
50,000–75,000	18	4	21	3	20	–	26	12	–	–	–	–	2	–
75,000–100,000	5	–	7	4	4	–	7	5	–	–	–	–	1	–
Total	137	18	211	98	140	16	437	361	10	1	17	8	45	15

M Men; W Women

TABLE 5
Age and sex distribution of blood pressure (BP) for two criteria (<140/90 mmHg and ≥140/90 mmHg)

	Men					
	BP <140/90 mmHg			BP ≥140/90 mmHg		
Age group, years	n	SBP, mean ± SD	DBP, mean ± SD	n	SBP, mean ± SD	DBP, mean ± SD
<35	13	123.1±9.0	81.0±5.3	0	–	–
35–44	291	117.6±8.2	78.5±6.5	14	146.0±6.1	99.0±7.0
45–54	237	118.6±9.7	79.2±6.8	24	161.7±6.7	98.6±7.7
55–64	180	121.7±9.4	77.6±6.7	20	148.4±8.5	96.2±5.2
65+	50	124.3±9.5	77.3±6.2	11	154.1±11.3	98.7±8.0
Total	771	119.4±9.3	78.5±6.6	69	153.4±10.5	98.0±6.9
	Women					
	BP <140/90 mmHg			BP ≥140/90 mmHg		
Age group, years	n	SBP, mean ± SD	DBP, mean ± SD	n	SBP, mean ± SD	DBP, mean ± SD
<35	12	109.8±7.8	74.0±7.0	0	–	–
35–44	211	112.4±9.6	74.0±7.3	8	147.8±9.8	96.8±6.0
45–54	136	117.5±11.0	76.7±7.4	12	149.8±7.9	95.7±6.0
55–64	65	119.7±10.4	74.6±6.9	4	153.3±16.0	93.8±2.9
65+	7	124.1±10.9	74.6±6.4	1	143.0±0.0	98.0±0.0
Total	431	115.2±10.6	74.9±7.3	25	149.4±9.7	95.8±5.4

DBP Diastolic BP; SBP Systolic BP

Table 4 shows the educational profiles and monthly income of these participants. Income data were not obtained from 10 physicians. Of the 1514 participants, 94% had a university degree or further postgraduate training while 6% had indigenous medical qualifications from Ayurvedic or Siddha medical training institutions. As the table illustrates, all physicians reported a monthly income of more than 10,000 Indian rupees (INR), which places them in the highest quintile of the population in the region. Thus, this cohort belongs to a high socioeconomic stratum. Of particular interest from Table 4 is that approximately 27% of these physicians, predominantly with indigenous training and basic medical training (MBBS) and serving as general practitioners, reported a monthly income of less than INR 25,000. Approximately 3% of the physicians with postgraduate and specialty training reported a monthly income of INR 100,000 or more, in the highest income bracket.

Table 5 shows the mean blood pressure values of the study physician population by age and sex using standard cut-off values of systolic blood pressure less than 140 mmHg and diastolic blood pressure less than 90 mmHg. As can be seen from this table, 771 male and 431 female physicians had a healthy blood pressure while 69 male and 25 female physicians had elevated systolic and diastolic blood pressures (140/90 mmHg or higher). However, when the ATP III guidelines and IDF criteria for blood pressure of 130/85 mmHg or greater were adopted, the prevalence of hypertension was 41% for male and 23% for female physicians. The mean value of blood pressure for men was 124.4/81.6 mmHg while women had a mean blood pressure of 119.2/77.3 mmHg.

TABLE 6
Mean values of physiological variables by sex

Variable unit	Men		Women	
	n	Mean ± SD	n	Mean ± SD
Waist circumference, cm	989	92.6±10.9	508	89.0±11.8
BMI, kg/m^2	989	26.1±3.5	508	26.4±4.0
TC, mmol/L	942	4.79±1.06	491	4.76±0.95
LDL-C, mmol/L	942	3.04±0.86	491	2.99±0.74
HDL-C, mmol/L	942	1.10±0.20	489	1.18±0.21
Triglycerides, mmol/L	940	1.83±1.11	490	1.43±0.73
FBG, mmol/L	942	6.52±1.84	491	6.41±1.58
TC/HDL-C	942	4.4±0.9	489	4.1±0.9
LDL-C/HDL-C	942	2.8±0.8	489	2.6±0.7

BMI Body mass index; FBG Fasting blood glucose; HDL-C High-density lipoprotein cholesterol; LDL-C Low-density lipoprotein cholesterol; TC Total cholesterol

Table 6 shows the mean values of waist circumference, body mass index (BMI), as well as FBG and lipid parameters. As can be seen from

TABLE 7
People at risk for the metabolic syndrome as calculated by Adult Treatment Panel (ATP [25]) III and International Diabetes Federation (IDF [26]) criteria

		Men, n			Women, n		
Risk factor	Criteria	Total	At risk	%	Total	At risk	%
Blood pressure, mmHg	≥130/85	992	409	41.2	510	115	22.5
Low-density lipoprotein cholesterol, mmol/L	>3.37	942	504	53.5	491	201	40.9
High-density lipoprotein cholesterol, mmol/L	<1.30 (women); <1.04 (men)	942	441	46.8	491	371	75.6
Triglycerides, mmol/L	>1.70	942	501	53.2	491	160	32.6
Fasting blood glucose*, mmol/L	>6.11	942	423	44.9	491	161	32.8
Fasting blood glucose†, mmol/L	>5.55	942	542	57.5	491	232	47.3
Waist circumference*, cm	>88 (women); >102 (men)	992	133	13.4	509	277	54.4
Waist circumference†, cm	>80 (women); >90 (men)	992	597	60.4	509	417	81.9

**Cut-off from ATP III criteria; †Cut-off from IDF criteria*

TABLE 8
Prevalence of the metabolic syndrome as calculated by Adult Treatment Panel (ATP [25]) III and International Diabetes Federation (IDF [26]) criteria

Using ATP III criteria				Using IDF criteria			
Number of risk factors	Men, n	Women, n	Total, n	Number of risk factors	Men, n	Women, n	Total, n
0	85	22	107	0	81	42	123
1	273	142	415	1	253	173	426
2	250	137	387	2	292	155	447
3	214	105	319	3	208	89	297
4	104	68	172	4	108	32	140
5	16	17	33	Total	942	491	1433
Total	942	491	1433	With waist circumference and two risk factors, n (%)	387 (41.10)	238 (48.50)	625 (100)
Three or more risk factors, n (%)	334 (35.50)	190 (38.70)	524 (100)				

this table, the population mean BMIs of both men and women were above 26 kg/m^2.

Table 7 lists the number of male and female physicians with values for risk factors above the cut-off defining the metabolic syndrome by either ATP III or IDF criteria. According to this table, 47% of male physicians had abnormal HDL levels (less than 1.04 mmol/L) while 76% of female physicians exhibited an HDL abnormality (HDL less than 1.30 mmol/L). In terms of fasting triglycerides, 53% of male physicians had abnormally high (greater than 1.70 mmol/L) values compared with 33% of female physicians. The prevalence of abdominal obesity has a strong correlation with CAD. Using waist circumference as the marker for abdominal obesity, 13.4% of male physicians and 54.4% of female physicians were considered to have abnormal values using ATP III guidelines. However, when strict IDF criteria were applied, 60% of male and 82% of female physicians exhibited abdominal obesity.

Table 8 records the prevalence of metabolic risk factors as stratified by the two definitions (ATP III and IDF). ATP III defines a person as having the metabolic syndrome when three or more risk factors are present, whereas the IDF criteria require two or more risk factors in the presence of increased waist circumference (25,26). Using ATP III guidelines, 36% of male and 39% of female physicians were identified as having the metabolic syndrome. However, when the IDF criteria were used, the prevalence of the metabolic syndrome jumped to more than 40% in both the male and female physician populations (41% and 49%, respectively).

In terms of dietary habits, 75% (72% women and 80% men) reported eating nonvegetarian meals at least three times per week. Less than 2% of the study physicians used olive oil for cooking while 98% consumed various vegetable oils and ghee (clarified butter), which are high in saturated fats. Less than one-half of the study population (40% women and 31% men) consumed vegetables daily while two-thirds or more (71% women and 67% men) ate at least one fruit per day. Almost one-half of the participants (38% women and 41% men) indulged regularly in eating sweets, which are typically store bought, rich in sugar content and often made from milk and ghee, increasing the saturated fat content. Nearly one-half (47% women and 37% men) of the physicians skipped meals due to the pressure of work.

Because women in India traditionally do not smoke, it is not surprising that all smokers in the present study were men. The prevalence rate was 31%. Of these men, 12% smoked regularly while 13% were ex-smokers and 6% smoked occasionally. Of the men who identified themselves as regular smokers, 55% reported smoking five or more cigarettes every day.

Physical activity, as assessed by questionnaire using a minimum duration of 20 min three times per week, was present in only 17% (15% of women and 18% of men) of physicians. This shows a glaring prevalence of sedentary lifestyle (83%) among physicians.

DISCUSSION

Data on cardiovascular risk factors among physicians are sparse. The present study addresses that gap in the physician community from the Southern Indian state of Tamilnadu. Studies indicate that high blood pressure, abdominal obesity, dyslipidemia, diabetes, low intake of fruits and vegetables, and sedentary lifestyle are important determinants of CAD in India (20). The metabolic syndrome, defined by the presence of three or more of the component factors, increases a person's short-term risk of developing diabetes and CAD by three- to fivefold. People with the metabolic syndrome have a 30% to 40% probability of developing diabetes and/or CAD within 20 years, depending on the number of components present (24). Asian Indians develop diabetes at a younger age with lower BMIs and waist circumferences than Caucasians (13). Therefore, to accurately determine the real prevalence of the metabolic syndrome and associated future CVD risk in our sample, the more stringent criteria defined by IDF guidelines are probably more suited to the Indian population. When we applied the IDF criteria, the prevalence of all contributing risk factors for CVD and the metabolic syndrome were

dramatically high in the physician community we studied. The prevalence of the metabolic syndrome has been reported to be as high as 35% among Asian Indians (27), a rate nearly similar to the United States population. These study data confirm that the physician community in India has metabolic syndrome rates upwards of 35% in both men and women, whichever criteria we apply.

An estimated 1.3 million Indians died from CAD in 2000. The projected number of deaths from CAD by 2015 is 2.95 million, of which 14% will be younger than 30 years of age, 31% will be younger than 40 years of age, and 50% will be younger than 50 years of age (28). Furthermore, the 'years of lost life' due to premature cardiovascular deaths in India is projected to increase from 9.2 million in 2000 to 17.9 million in 2030 (29), a twofold increase. The corresponding figures for the United States are 1.6 million and two million, respectively (29). This shows the huge oncoming burden of CVD in the Indian population. The markedly increased cardiovascular risk indicated in the results of our survey suggests that these mortality statistics will likely apply to the physician community as well, adding lost labour power and productivity to the growing burden of the Indian health care delivery system.

Strategies for prevention are clearly needed urgently in the face of this epidemic in low-resource countries such as India. A large amount of previous work has suggested that many of the risk factors in India are amenable to preventive approaches. Previous studies have shown that Asian Indians have higher levels of triglycerides and lower levels of HDL cholesterols, and have suggested that these lipid abnormalities are highly correlated with the severity and prematurity of CAD as well as acute myocardial infarction at a very young age (30). This lipid profile is associated with increased caloric intake, decreased caloric expenditure and weight gain. Moreover, in the INTERHEART study (6), the increased risk in the Indian portion of the cohort was notably attributable to lack of exercise and lack of intake of vegetables. Therefore, control of these and other metabolic, behavioural and dietary risk factors is essential to arrest and reverse the CAD epidemic in the Indian subcontinent (31).

In any strategy of prevention, physicians have a key role in educating patients and the public. Perhaps most important to their success is their status as role models of healthy behaviour.

Many previous studies have shown that physician lifestyle and discussion of that lifestyle with the patient improves patient adoption of healthy habits and outcomes (32-34).

Our study confirms a previous report that Indian physicians have a significant elevated risk for cardiovascular disease (12). Our study extends that work by documenting important elements in the diet and exercise profile of physicians, which are undoubtedly contributing to the prevalence of these risk factors.

Our study raises a number of questions. First, because continuing education is not mandatory in India for renewing a license to practice medicine, are the physicians' knowledge and attitudes toward their personal cardiovascular health in this contemporary era on par with their Western counterparts? Second, if a physician is knowledgeable, is it the pace and stress of work that prevents the adoption of healthy lifestyles? Finally, the epidemiological transition that occurred in the Western countries first had its effects on the upper classes before time, education and research led to improved behaviours. Our data unequivocally show that physicians are a part of the upper income strata of society and are therefore not immune to the behavioural effects of social networks in societies in the midst of the transition.

Information about the prevention of heart attacks and strokes is readily available to the public. The government of India has introduced legislation against smoking in public places. In spite of the medical knowledge about cardiovascular risk factors, the physicians' lack of adopting a healthy lifestyle and their poor behavioural habits represent a challenge for the medical community.

The present study reveals alarming risk levels for CVD in a physician population of South India, which can be attributed in part to the frequent consumption of meat and sweets coupled with lower consumption of vegetables and abysmal levels of physical activity. Although work-related stress was not assessed in the present study, nearly one-half of the physicians indicated that they missed their meals or had irregular eating habits due to time pressures. The prevalence of high-risk factors among physicians from the Madurai area correlates with the levels seen among the general public. If physicians are to lead in efforts to prevent the CVD epidemic in South Asia, they need to lead by example and heal themselves first.

ACKNOWLEDGEMENTS: The authors express their deep sense of gratitude to Dr Bernard Lown for motivating them to carry out the present study and providing moral courage throughout. They are very grateful to all the physician participants from the eight southern districts of Tamilnadu, India. They express their heartfelt thanks to Mr DB Karthikeyan and his team for their dedicated efforts in interviewing the study physicians and collecting the blood samples as well as inputting the data into a database. The Apollo Hospital Corporation (Madurai) is sincerely thanked for providing the biochemical analysis of all blood samples collected in the study.

REFERENCES

1. Chockalingam A, Balaguer-Vintro I, Achutti A, et al. The World Heart Federation's white book: Impending global pandemic of cardiovascular diseases: Challenges and opportunities for the prevention and control of cardiovascular diseases in developing countries and economies in transition. Can J Cardiol 2000;16:227-9.
2. World Health Organization. Preventing Chronic Disease: A Vital Investment. Geneva: World Heath Organization, 2005.
3. Enas EA. Coronary artery disease epidemic in Indians: A cause for alarm and call for action. J Indian Med Assoc 2000;98:694-5, 697-702.
4. Ramachandran A, Snehalatha C, Latha E, Satyavani K, Vijay V. Clustering of cardiovascular risk factors in urban Asian Indians. Diabetes Care 1998;21:967-71.
5. Mohan V, Sandeep S, Deepa R, Shah B, Varghese C. Epidemiology of type 2 diabetes: Indian scenario. Indian J Med Res 2007;125:217-30.
6. Joshi P, Islam S, Pais P, et al. Risk factors for early myocardial infarction in South Asians compared with individuals in other countries. JAMA 2007;297:286-94.
7. Gupta R, Joshi P, Mohan V, Reddy KS, Yusuf S. Epidemiology and causation of coronary heart disease and stroke in India. Heart 2008;94:16-26.
8. Misra A, Pandey RM, Devi JR, Sharma R, Vikram NK, Khanna N. High prevalence of diabetes, obesity and dyslipidaemia in urban slum population in northern India. Int J Obes Relat Metab Disord 2001;25:1722-9.
9. Guptha R, Gupta VP, Sarna M, Prakash H, Rastogi S, Gupta KD. Serial epidemiological surveys in an urban Indian population demonstrate increasing coronary risk factors among the lower socioeconomic strata. J Assoc Physicians India 2003;51:470-7.
10. Gupta R. Recent trends in coronary heart diseases epidemiology in India. Indian Heart J 2008;60(Suppl B):B4-B18.
11. Prabhakaran D, Jeemon P, Mohannan PP, Govindan U, Chaturvedi V, Reddy KS. Management of acute coronary syndromes in secondary care settings in Kerala: Impact of quality improvement programme. Natl Med J India 2008;21:62-6.
12. Ramachandran A, Snehalatha C, Yamuna A, Murugesan N. High prevalence of cardiometabolic risk factors among young physicians in India. J Assoc Physicians India 2008;56:17-20.
13. Enas EA, Singh V, Munjal YP, Bhandari S, Yadave RD, Manchanda SC. Reducing the burden of coronary artery disease in India: Challenges and opportunities. Indian Heart J 2008;60:161-75.
14. Kay MP, Mitchell GK, Del Mar CB. Doctors do not adequately look after their own physical health. Med J Aust 2004;181:368-70.
15. Nyman K. The health of general practitioners. A pilot survey. Aust Fam Physician 1991;20:637-41, 644-5.
16. Wachtel TJ, Wilcox VL, Moulton AW, et al. Physicians' utilization of health care. J Gen Intern Med 1995;10:261-5.

17. Richards JG. The health and health practices of doctors and their families. N Z Med J 1999;26:96-9.
18. Baldwin PJ, Dodd M, Wrate RM. Young doctors' health – II. Health and health behaviour. Soc Sci Med 1997;45:41-4.
19. Frank E, Breyan J, Elon L. Physician disclosure of healthy personal behaviors improves credibility and ability to motivate. Arch Fam Med 2000;9:287-90.
20. Yusuf S, Hawken S, Ôunpuu S, et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): Case-control study. Lancet 2004;364:937-52.
21. Government of Tamil Nadu. Population by districts – Tamil Nadu. <http://www.tn.gov.in/economy/eco-jul2001-12.htm> (Version current at April 2, 2009).
22. Hemmelgarn BR, McAlister FA, Grover S, et al; for the Canadian Hypertension Education Program. The 2006 Canadian Hypertension Education Program recommendations for the management of hypertension: Part I – blood pressure measurement, diagnosis and assessment of risk. Can J Cardiol 2006;22:573-81.
23. Singh V, Deedwania P. Dyslipidemia in special populations: Asian Indians, African Americans, and Hispanics. Curr Atheroscler Rep 2006;8:32-40.
24. Wannamethee SG, Shaper AG, Lennon L, Morris RW. Metabolic syndrome vs Framingham risk score for prediction of coronary heart disease, stroke, and type 2 diabetes mellitus. Arch Intern Med 2005;165:2644-50.
25. NCEP III. Third Report of the National Cholesterol Education Program (NCEP) Adult Treatment Panel III (ATP III). Washington: National Institute of Health, 2001.
26. Alberti Kg, Zimmet P, Shaw J. Metabolic syndrome – a new world-wide definition. A consensus statement from the International Diabetes Federation. Diabet Med 2006;23:469-80.
27. Enas EA, Mohan V, Deepa M, Farooq S, Pazhoor S, Chennikkara H. The metabolic syndrome and dyslipidemia among Asian Indians: A population with high rates of diabetes and premature coronary artery disease. J Cardiometab Syndr 2007;2:267-75.
28. Indrayan A. Forecasting vascular disease cases and associated mortality in India. <http://www.whoindia.org/LinkFiles/Commision_on_Macroeconomic_and_Health_Bg_P2_Forecasting_vascular_disease_cases_and_associated_mortality_in_India.pdf> (Version current at November 6, 2008).
29. Reddy KS. India wakes up to the threat of cardiovascular diseases. J Am Coll Cardiol 2007;50:370-2
20. Enas EA, Chacko V, Pazhoor SG, Chennikkara H, Devarapalli HP. Dyslipidemia in South Asian patients. Curr Atheroscler Rep 2007;9:367-74.
31. Deedwania P, Singh V. Coronary artery disease in South Asians: Evolving strategies for treatment and prevention. Indian Heart J 2005;57:617-31.
32. Frank E, Brogan DJ, Mokdad AH, et al. Health-related behaviors of women physicians vs other women in the United States. Arch Intern Med 1998;158:342-8.
33. Woolley FR, Kane RL, Hughes CC, Wright DD. The effects of doctor-patient communication on satisfaction and outcome of care. Soc Sci Med 1978;12:123-8.
34. Frank E, Breyan J, Elon L. Physician disclosure of healthy personal behaviors improves credibility and ability to motivate. Arch Fam Med 2000;9:287-90.