The Relationship of Lifestyle to International Trends in CHD

FREDERICK H EPSTEIN

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Three components of lifestyle—nutrition, smoking and alcohol drinking patterns—have been related to rates of decline or increase of coronary heart disease (CHD) mortality in 27 countries during the past 10 to 25 years. In almost all of the countries with major falls or rises in CHD mortality, there are, respectively, corresponding decreases or increases in animal fat consumption, with reciprocal changes in the consumption of vegetable fats. Countries with moderate or small mortality declines show variable patterns of fat consumption. The prevalence of smoking is declining among men and remains unchanged or is increasing slightly among women in most countries, suggesting that *differences* in the rate of decline between countries or between the sexes are not related to an appreciable degree to differences in the change of smoking habits; however, the mortality changes in any individual country are most probably influenced by smoking. The consumption of alcoholic beverages increases almost everywhere and cannot be related quantitatively to the secular CHD mortality trends. These findings support in general the presently recommended courses of action for the prevention of premature CHD.

SCOPE

This review of the relationship between lifestyle and coronary heart disease (CHD) mortality trends, with emphasis on the last 10 years, is confined to a consideration of nutritional habits, smoking and alcohol consumption. It is not implied that these are the only important components of lifestyle that affect secular CHD trends. They are, however, the components that are most amenable to quantification and large-scale international comparisons. Moreover, nutrition and smoking have been established as being key determinants of the disease because of a cause-and-effect relationship. With regard to alcohol, it is less clear whether or to what extent a causal relationship exists, but it is nevertheless likely that drinking habits reflect patterns of lifestyle that are relevant to the problem.

There exist large amounts of information on nutrition, smoking and alcohol collected during one period of time. Data on time trends, however, are more scarce. In this review, attention is limited to available data on trends.

NUTRITION

It is notoriously difficult to obtain reliable information

Institute of Social and Preventive Medicine, University of Zurich, Sumatrastrasse 30, CH 8006 Zurich, Switzerland.

on nutritional habits, especially over time. The best data come from nutritional surveys in defined populations, but they have been gathered in only a relatively few countries. The present emphasis is on a global view and, for this reason, use is made of the yearly records published by the United Nations Food and Agriculture Organization (FAO). These data are based essentially on food supplies and do not necessarily reflect what people actually eat. The limitations of such data are generally well recognized, but they remain a unique and valuable source.

According to present knowledge about atherogenesis, the most important single dietary component responsible for differences in the frequency of the disease is dietary fat. Other important dietary constituents are correlated to a large though varying degree with the amount of fat in the diet. The time trends in the consumption of animal and vegetable fats in 27 countries between 1961 and 1985 are summarized in a set of bar diagrams (Figures 1A, B and C), based on FAO data.[1] There are three charts, according to whether the countries showed major CHD mortality declines (between 38% and 18%), moderate to no declines (13% to 0%), or increases in CHD mortality (between 11% and 60%). The rates of change, in decreasing or increasing order, apply to coronary (ischaemic) heart disease mortality among men between 1972 and 1984, based on advance data of the World

Figure 1
The trends in the consumption of fats of animal and vegetable origin between 1961 and 1985 in 27 countries
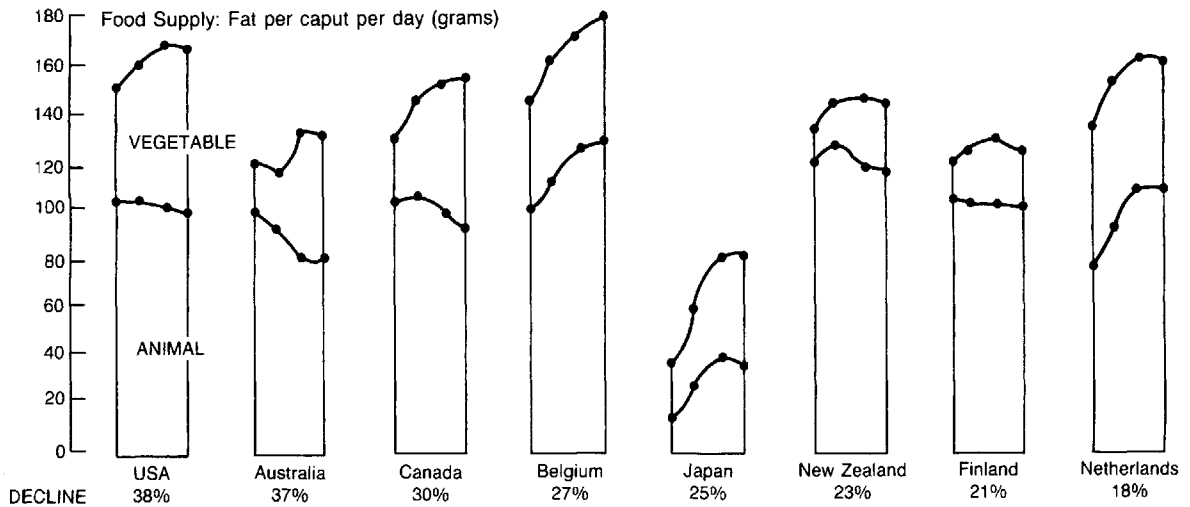
The horizontal lines in the bar diagrams connect 4 time points: 1961-1963, 1969-1971, 1979-1981, 1983-1985.

FIGURE 1A   *Countries with DECLINES in ischaemic heart disease mortality among men between 38% and 18% during the period 1972-1984.*

Health Organization, kindly supplied by Mr K Uemura. The final report of these data[2] contains slightly different percentages, being based on a different time period (1970-1985). Five of the eight countries with major declines (Figure 1A) show, in accordance with expectation from the theory, declines in animal fat consumption, sometimes associated with an absolute or relative increase in fats of vegetable origin. The small amount of vegetable fat in the New Zealand diet is noteworthy. For the US, the FAO data agree well with an assessment of *individual* food intake in 1977 and 1985, which showed a decline of energy from total fat, amounting to about 5% in men, 4% in women and 3% in children.[3] The data from Belgium and the Netherlands are puzzling; they show an increase in total fat consumption due to an increase in animal fat. Detailed analyses of nutritional changes in Belgium indicate that the consumption of dairy products has decreased, which is associated with an increase in unsaturated fatty acids. These changes would not necessarily be reflected in the overall animal and vegetable fat consumption data, especially since the changes mentioned affected primarily the Flemish-speaking part of the population.[4] In the Netherlands, there was a steady decline of the intake of dairy products between 1947 and 1980, with a decrease in visible fats starting around 1970; other animal foods, however, showed a steady increase beginning in 1947.[5] Further data from the Netherlands, collected by cross-

checked dietary histories in the town of Zutphen, indicated only slight changes in nutrient intake between 1960 and 1985 (Kromhout D, personal communication).

Countries with moderate rates of decline or no decline (Figure 1B) tend to show increases in animal fat consumption. In Portugal, total fat consumption is still quite low. The consonant nutrition and mortality pattern in the UK is well recognized. In Scandinavia, the trends have been more favourable in Norway than Sweden[5] which tallies with the fact that the CHD mortality decline in Sweden has been delayed. In Denmark, the absolute reduction in animal fat intake between 1980 and 1984 is actually very small, amounting to only 5 grams.[1] More detailed data from Denmark indicate little favourable change between 1952 and 1982.[5] The emerging small declines in CHD mortality in Switzerland, Austria, Iceland and Italy, while encouraging in being in the right direction, should not yet be interpreted in terms of any dietary trends, whether favourable or unfavourable.

In the countries with increasing CHD mortality, the picture is very clear: There are uniformly steep increases in animal fat consumption, with vegetable fat supply remaining constant (Figure 1C). In Poland, another country with increasing mortality (not shown in the figure), total fat consumption in 1984 was lower than that in Hungary—105 versus 140 grams.[1] Total animal and vegetable fat supplies changed little in Pol-

Figure 1 (continued)
The trends in the consumption of fats of animal and vegetable origin between 1961 and 1985 in 27 countries
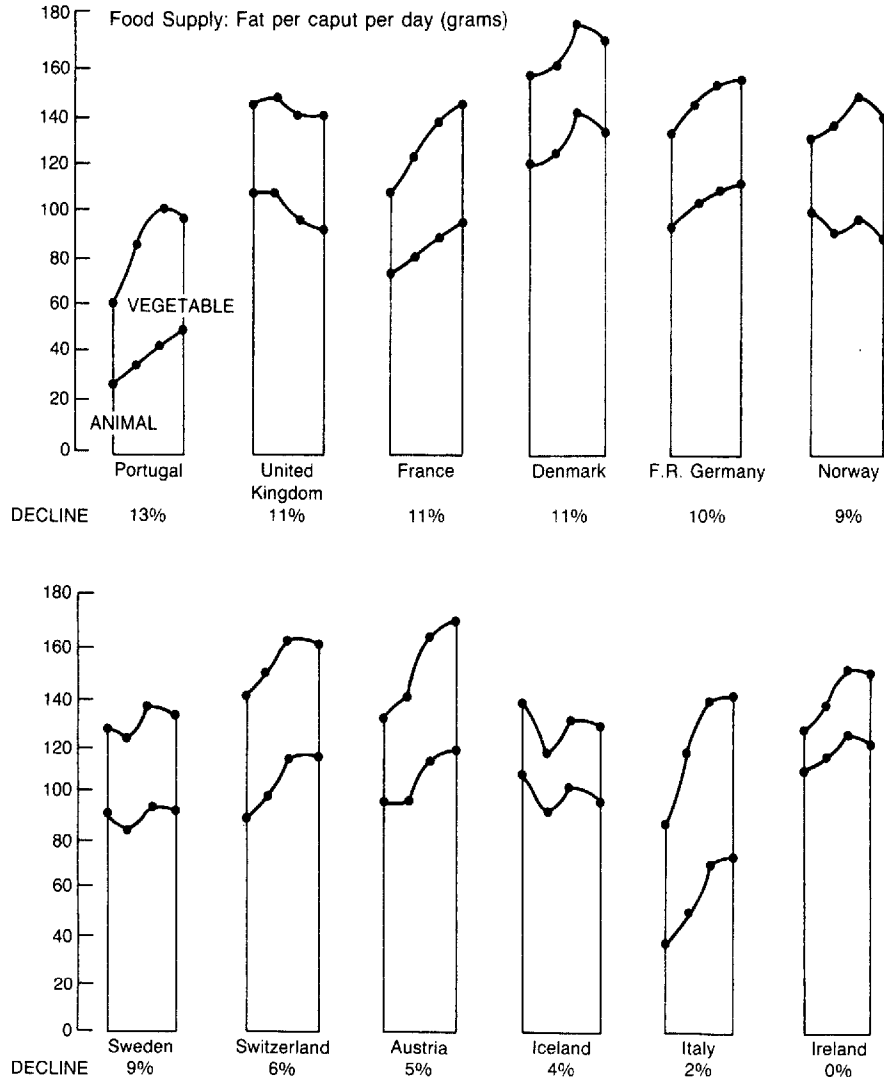

FIGURE 1B *Countries with DECLINES in ischaemic heart disease mortality among men between 13% and 0% during the period 1972–1984.*

and from 1970 to 1980 and 1984, being, respectively, 101, 114 and 105 grams, and 80, 89 and 82 grams.[1] These findings are borne out by data from the Institute of Food and Nutrition in Warsaw.[5] However, the proportion of calories derived from fat increased since 1970, as reported by Rywik *et al.* in Section III.

It is fair to say that countries with marked declines in CHD mortality tend to show a decrease in animal fat and, to a lesser extent, an increase in vegetable fat supply. At the other end of the scale, increases in CHD

mortality are associated with increases is animal and total fat supplies. Where there are apparent exceptions, they should not be used for questioning the underlying theory but seen as a sign of a need to explain these seeming discrepancies. In the countries with CHD mortality declines in the intermediate range, the picture, as might be expected with a multifactorial disease, is less uniform. Thus, the data neither unequivocally support the theory or run counter to it in any way. On the contrary, in this range, alternative

Figure 1 (continued)
The trends in the consumption of fats of animal and vegetable origin between 1961 and 1985 in 27 countries
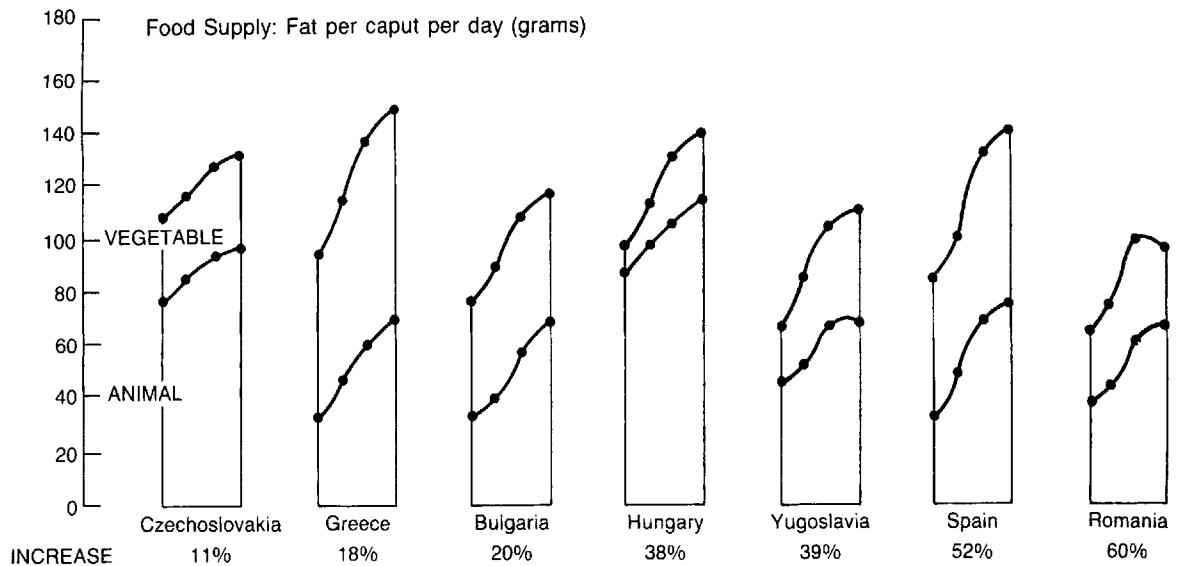

FIGURE 1c   *Countries with INCREASES in ischaemic heart disease mortality among men between 11% and 60% during the period 1972–1984.*

explanations, such as improvements in medical care, suggest themselves, with nutritional habits exerting a supplementary influence.

In the interpretation of these nutritional data, it must be remembered that they are relatively crude and discrepancies or weakened associations are to be expected for this reason. At the same time, the variety of consumption trends in opposite directions dispels the frequent criticism that such data are invalid because they are all subject to a similar secular collection bias.

SMOKING TRENDS
International smoking trends have been assessed in terms of the prevalence of smokers in different countries over time (Tables 1A-C). The countries are arranged in three groups, according to the changes in CHD mortality. Two WHO publications provide the data base.[6,7] All eight countries with major CHD mortality declines show a reduction in the prevalence of smoking among men from the 1970s into the 1980s (Table 1A); this reduction is most marked in the Netherlands, where the rate was initially very high, as in Japan. However, in the Netherlands, the prevalence in 1982 still ranks highest next to Japan. Among women, declines in the prevalence of smoking are slight to negligible in this group. In the intermediate group of countries (Table 1B), prevalence among men declines in each country, most markedly in the UK

which along with Denmark, originally ranked highest. Declines in women are again slight, with some countries showing increases. There are practically no available data on smoking trends in countries with rising CHD mortality (Table 1C).

It is apparent from these data that countries differing widely in changing CHD mortality rates have similar secular smoking trends so that changes in smoking patterns cannot account to an appreciable degree for differences in the steepness of the mortality changes. It has been clear for some time that the almost universal declines in CHD mortality among women are unexplained by women's smoking patterns. None of this means that, in any given country, reduction of smoking in the population will not lead to a reduction in CHD risk! All it means is that factors other than smoking must be responsible in large part for *differences* in the rate of decline of CHD mortality. Corresponding data, relating rising CHD mortality rates to smoking habits, are presently lacking but will be forthcoming from the MONICA Project. The current data take no account of changes in smoking behaviour in narrower age groups and the lag period between these changes and their effect on CHD.

ALCOHOL DRINKING PATTERNS
As mentioned above, it is not established whether there is a causal relationship between alcohol consumption and CHD risk so that it is not certain whether

TABLE 1A   Time trends in the prevalence of smoking in adults (%).
Countries with major declines in CHD mortality.

Country		Time period			Code		
		1	2	3	1	2	3
US	Men	42	38	35	1976	1980	1986
	Women	33	30	30			
Australia	Men	41	40	37	1974	1980	1983
	Women	29	31	30			
Canada	Men	47	41	31	1972	1977	1983
	Women	32	31	28			
Belgium	Men	48	38	35	1974	1980	1984
	Women	26	21	21			
Japan	Men	78	75	70	1972	1976	1980
	Women	16	15	14			
New Zealand	Men	40	35		1976	1981	
	Women	32	29				
Finland	Men	44	38	38	1973	1978	1981
	Women	20	18	21			
Netherlands	Men	75	66	41	1970	1975	1982
	Women	42	40	33			

TABLE 1B   Time trends in the prevalence of smoking in adults (%).
Countries with moderate to no declines in CHD mortality.

Country		Time period			Code		
		1	2	3	1	2	3
UK	Men	68	46	36	1970	1976	1984
	Women	44	38	32			
France	Men	62	50		1976	1980	
	Women	33	26				
Denmark	Men	68	60	57	1972	1975	1980
	Women	49	46	44			
FRG	Men	54	49	44	1973	1978	1984
	Women	26	28	29			
Norway	Men	56	52	46	1970	1975	1980
	Women	37	39	39			
Sweden	Men	55	52	47	1972	1976	1979
	Women	34	38	34			
Switzerland	Men	51	45	46	1975	1979	1981
	Women	29	31	29			
Austria	Men	46	33		1972	1981	
	Women	13	22				
Italy	Men	60	53	54	1965	1975	1980
	Women	13	—	17			
Ireland	Men	49	40	39	1972-3	1978-9	1981/2
	Women	37	31	32			

TABLE 1C   Time trends in the prevalence of smoking in adults (%).
Countries with increases in CHD mortality.

Country		Time period		Code		
		1	2	1	2	Comment
Czechoslovakia	Men	61	57	1974	1984	One district
	Women	29	14			
Spain	Men	58	58	1981	1986	Data for Catalonia
	Women	20	23			

changes in alcohol consumption *per se* will influence CHD risk. All the same, examination of these patterns is worthwhile in their own right and as a possible indicator of underlying causal mechanisms. International patterns of alcohol consumption between 1950 and 1970 have been extensively analysed by Sulkunen[8] who divided countries into those where wine, beer or spirits is the main source of alcohol. It is evident that consumption in terms of absolute alcohol rose in nearly all countries up to 1970.

In order to obtain a more current picture, changes in alcohol consumption between 1960 and 1981 have been calculated from WHO data[9] using the same subdivision into countries, with major declines, intermediate declines, and increases in CHD mortality. In countries with major declines (Table 2A), it is seen that the consumption of wine, beer and spirits has risen between 1.1 to 6.3-fold, depending on the country and type of alcohol. These data must be seen in conjunction with the absolute baseline consumption in 1960, shown in the left-hand part of the tables. In all of these non-wine drinking countries, wine consumption has at least doubled or tripled, beer consumption has but modestly increased and spirit consumption has increased to about the same degree (around 1.5 to 2-fold).

In most of the 'intermediate decline' countries (Table 2B), the baseline consumption of wine and spirits tended to be higher than in the 'major decline' countries. In the wine-drinking countries, the consumption of wine has declined slightly but it increased from a low level in the others. Spirits have increased to about the same degree as in 'major decline' countries, starting, however, from a higher level of intake. Beer consumption has increased to about the same extent, whether initial consumption was higher or lower. In the countries with increase in mortality (Table 2C), there has been but a little increase in wine consumption, with increases in spirit consumption; data on the trends in beer consumption are mostly lacking.

It is difficult to obtain a comprehensive picture of these trends. Even if there were data in which the total absolute alcohol content derived from the three types of beverages had been combined into one overall measure, its value would be questionable since there are at least some indications that different kinds of alcoholic beverages may have different effects, whether in terms of pharmacological differences or in terms of the personality or gender of the people who drink them. The trends that emerged by 1970[8] have probably continued, leading to a 'homogenization' of drinking patterns in relation to the types of beverages consumed. In addition, the more recent data (Table 2)

TABLE 2A   *Changes in the consumption of alcoholic beverages between 1960 and 1981 among people aged 15 years and older. Countries with major declines in CHD mortality.*

Country	Litres per capita in 1960			Consumption in 1981, as a multiple of consumption in 1960 (consumption in 1960 = 1.0)		
	Wine	Beer	Spirits†	Wine	Beer	Spirits
USA	5.0	83.9	3.0	2.2	1.5	1.4
Australia	7.4	145.6	1.1	3.4	1.3	1.4
Canada	3.1	89.6	2.3	3.6	1.3	1.9
Belgium	10.3	147.4	1.1	2.6	1.1	2.4
Japan	—	—	(4.2)*	—	—	—
New Zealand	(20.3)*	—	1.5	—	—	1.6
Finland	1.9	35.7	1.9	3.6	2.1	2.2
Netherlands	2.7	34.0	1.6	6.3	3.5	2.1

* in 1981.
† absolute alcohol.

TABLE 2B   *Changes in the consumption of alcoholic beverages between 1960 and 1981 among people aged 15 years and older. Countries with moderate to no decline in CHD mortality.*

Country	Litres per capita in 1960			Consumption in 1981, as a multiple of consumption in 1960 (consumption in 1960 = 1.0)		
	Wine	Beer	Spirits†	Wine	Beer	Spirits
Portugal	119.7	(50.8)*	—	0.9	—	—
UK	2.1	109.1	0.9	5.1	1.3	2.4
France	171.5	47.1	2.7	0.7	1.2	1.2
Denmark	4.1	95.2	(1.9)*	5.0	1.8	—
Fed. Rep. Germany	13.8	122.7	2.4	1.8	1.5	1.5
Norway	1.6	33.1	1.8	3.4	1.8	1.1
Sweden	4.2	39.9	2.9	3.7	1.4	1.2
Switzerland	48.6	93.9	2.0	1.3	0.96	1.3
Austria	26.9	92.1	3.2	1.7	1.5	0.6
Iceland	(8.9)*	—	2.5	—	—	1.4
Italy	144.4	—	1.3	0.7	—	1.9
Ireland	—	96.1	1.2	—	1.8	2.3

* in 1981.
† absolute alchohol.

TABLE 2C   *Changes in the consumption of alcoholic beverages between 1960 and 1981 among people aged 15 years and older. Countries with increases in CHD mortality.*

Country	Litres per capita in 1960			Consumption in 1981, as a multiple of consumption in 1960 (consumption in 1960 = 1.0)		
	Wine	Beer	Spirits†	Wine	Beer	Spirits
Czechoslovakia	18.3	137.1	1.4	0.96	1.3	3.8
Greece	55.9	—	—	0.99	—	—
Bulgaria	(28.2)*	—	1.8	—	—	1.4
Hungary	39.9	(111.4)*	1.9	1.1	—	3.3
Yugoslavia	31.5	—	2.6	1.2	—	1.1
Spain	70.4	—	2.8	1.2	—	1.5
Romania	29.7	(60.4)*	1.5	1.3	—	1.8

* in 1981.
† absolute alcohol.

leave no doubt that alcohol consumption is rising in essentially all countries, leaving open whether the rise, in terms of *absolute* alcohol, is quantitatively different in the three groups of countries. It would not seem, on visual inspection, that the countries with major declines have overall changes in alcohol consumption that are appreciably higher or lower than those in the countries with intermediate declines. The data for countries with increasing rates (Table 2C) are too incomplete even for superficial assessment. On balance, the question of whether changes in alcohol consumption are correlated, either negatively or positively, with changes in CHD mortality cannot be definitively answered in terms of present data.

CONCLUSIONS
Among the lifestyles that are or may be related to secular changes in CHD mortality, nutritional habits, smoking patterns and drinking patterns have been selected for the present analysis. The dietary changes in animal fat consumption during the most recent 15-year period in 27 countries reflect the view that marked declines or increases in CHD mortality are correlated, respectively, with reductions or increases in the intake of animal fats. CHD mortality declines of lesser degree are less obviously related to dietary changes and may be due as much to secondary as to primary prevention. Changes in smoking habits do not help to explain *differences* in the rates of decline or increase in CHD mortality but have, in all likelihood, contributed to the declines of mortality in the countries in which they have occurred. Changes in drinking patterns, in terms of the consumption of wine, beer and spirits, bear no consistent relationship to changes in CHD mortality.

In general, these findings support the present courses of action at the community level toward the primary prevention of CHD. With regard to nutrition, a major need is the establishment of reliable surveillance systems of eating habits and eating patterns in representative samples of the population. While the smoking habit becomes less common among men in most countries, the rate of decline is very slow; among women, a real dent remains to be made. Although a causal relationship between alcohol consumption and CHD risk has not been definitely established, national alcohol consumption trends should be closely monitored. A trend toward increasing consumption is present in most countries; a shift of the alcohol consumption curve toward the right will almost inevitably lead to an increase in the number of heavy drinkers, with all its undesirable consequences.[10]

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