
Research / Recherche

Distribution and prevalence of major risk factors of noncommunicable diseases in selected countries: the WHO Inter-Health Programme

X. Berrios,¹ T. Koponen,² T. Huiguang,³ N. Khaltayev,⁴ P. Puska,⁵
& A. Nissinen² on behalf of the Inter-Health sites⁶

The Inter-Health Programme was launched in 1986 by WHO, with the collaboration of a coordination centre (National Public Health Institute, Finland) to control and prevent chronic noncommunicable diseases (CNCDs) among adults. Programmes for action were organized based on the concept that most major CNCDs share common risk factors and that those that are lifestyle related are modifiable through efficient interventions using multifactorial strategies involving community participation and behaviour changes carried out at the primary health care level. Twelve countries from all WHO Regions have joined the programme. A baseline survey was undertaken in all countries with a common protocol, following the criteria and methods employed in the MONICA Project. Altogether 36 815 men and women aged 35–64 years were included in the present analysis from the following Inter-Health countries: Chile, China, Cyprus, Finland, Lithuanian SSR, Malta, Mauritius, Russian SFSR, United Republic of Tanzania, and USA. In addition to individual country analysis, centralized analysis was carried out at the Finnish National Public Health Institute and the Department of Community Health, Kuopio University, Finland. Reported here are the mean values of blood pressure, body mass index, and serum total cholesterol as well as specific prevalences of smoking, hypertension, obesity, and hypercholesterolaemia.

¹ Department of Public Health, Catholic University of Chile, Santiago, Chile.

² Department of Community Health and General Practice, University of Kuopio, FI-70211 Kuopio, Finland. Requests for reprints should be sent to Professor Nissinen at this address.

³ Food Safety Control and Inspection Institute, Tianjing, China.

⁴ Acting Chief, Noncommunicable Diseases, World Health Organization, Geneva, Switzerland.

⁵ Division of Health and Chronic Diseases, National Public Health Institute, Helsinki, Finland.

⁶ Dr V. Grabauskas, Kaunas Medical Academy, Kaunas, Lithuania; Dr A. Vassallo, Department of Health, Palazzo Castellania, Valletta, Malta; Dr C. Komodiki, Department of Medicine and Public Health Services, Ministry of Health, Nicosia, Cyprus; Dr R.G. Oganov, National Centre of Preventive Medicine, Moscow, Russian Federation; Dr J.W. Farquhar, Stanford Center for Research in Disease Prevention, Stanford University School of Medicine, Palo Alto, CA, USA; Dr Guo Zeyu, Bureau of Public Health, Tianjing, China; Dr Chen Chuming, Chinese Academy of Preventive Medicine, Beijing, China; Dr H.M. Kitange, Regional Commissioner's Office, Ministry of Health, Government Regional Hospital, Morogoro, United Republic of Tanzania.

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Introduction

Important demographic changes have taken place in recent decades in developing countries. These are highlighted by a decrease in fertility rates and an important and steady reduction in infant and maternal mortality, communicable diseases, and general mortality. These changes have resulted in an increase in life expectancy at birth as well as in the absolute number and percent of adult populations (1, 15). This process of ageing of the population, termed demographic transition, is in progress today, although the particular rate varies according to country (2).

In developing countries, health patterns have been strongly influenced by these changes: most of them exhibit a health profile characterized by a transition from a predominance of mortality from infectious and parasitic diseases that are more prevalent among younger age groups, to mortality from

chronic noncommunicable diseases (CNCDs), more prevalent among the adult and elderly population, with persistence of trauma (3). This transition is producing a double burden of diseases in developing countries: the emergence of CNCDs when communicable infectious diseases have not yet disappeared.

CNCDs and injuries, also termed lifestyle diseases (4, 5), are a challenge for public health bodies, not only in industrialized countries, but also in developing countries all over the world. These diseases are, however, preventable, and premature deaths can be avoided if efficient interventions are made on the risk factors associated with them through the promotion of healthy lifestyles. Decades of research have provided the experience and the knowledge to reduce considerably their burden (6–10), and the role of serum total cholesterol, hypertension, and smoking in their development was established in the 1960s and 1970s (11, 12).

As a result, in 1986 WHO initiated a global project for developing countries based on an integrated programme approach (5, 13, 14), i.e. diseases with common risk factors should be approached using a common strategy of health promotion and provision of preventive health services. The outcome was the establishment of the WHO Inter-Health Programme, whose aim was to demonstrate how such integrated programmes could be implemented in populations in all regions of the world, at every stage of the demographic and epidemiological transition (15). The core of the programme consists of interventions aimed at modifying the levels of the major risk factors of CNCDs in the community through an integrated, community-oriented approach to health promotion and maintenance (5, 13, 14, 16, 17).

Materials and methods

Study design

Based on the recommendations contained in the core protocol, a quasi-experimental design was used, selecting intervention and reference populations (16, 17). The effects of intervention activities were assessed by examining changes in the status of risk factors in these two populations before and after the intervention. For this purpose, baseline and terminal cross-sectional prevalence surveys were employed.

Study population

The study population consisted of people living in an intervention (experimental) and in a reference (control) area, both of which fulfilled specially defined characteristics (18). This article covers 10 of the 12 Inter-Health countries.

Local study populations were selected randomly from entire populations using the MONICA Project recommendations (18). The sampling frame consisted of individuals of both sexes aged 35–64 years, ensuring that at least 200 people were represented in each 10-year age group. The characteristics of the study populations in the various participating countries are shown in Table 1.

Since this article primarily reports the status of risk factors in the Inter-Health countries, but does not evaluate the intervention activities, samples from intervention and reference populations, when available, were combined for the analysis. The size of samples range from 959 in Stanford, CA, USA, to

Table 1: Characteristics of the study populations, by programme area, year, and sex

Country	Centre	Period	Men (n)	Women (n)	Total	Response rate(%)
<i>Group 1</i>						
Finland	North Karelia, Kuopio	1982	2 123	2 230	4 353	87.1
Lithuanian SSR	Kaunas	1983–85	728	735	1 463	69.2
Malta	Malta	1985	630	672	1 302	64.3
Cyprus	Nicosia	1989–90	458	540	998	78.9
Russian SFSR	Moscow	1984–85	1 940	1 889	3 829	72.4
USA	Stanford	1979–80	435	524	959	68
<i>Group 2</i>						
Chile	Santiago	1987–88	185	336	521	87.2
China	Beijing	1989	2 723	3 046	5 769	89.2
China	Tianjing	1989	5 771	5 877	11 648	92
Mauritius	Port Louis	1987	1 402	1 562	2 964	86.2
United Republic of Tanzania	Morogoro, Kilimanjaro	1987–88	1 368	1 641	3 009	89

11 648 in Tianjing, China. The response rate varied from 64.3% in Malta to 92% in Tianjing, China (Table 1).

Data collection and survey methods

In the developed countries (Finland, Lithuanian SSR, Malta, Russian SFSR, and USA) the data were collected over the period 1979–85, but in Cyprus over the period 1989–90, while in the developing countries (Chile, China, Mauritius, and United Republic of Tanzania) the corresponding period was 1987–89. The following risk factors were covered: smoking, alcohol intake, blood pressure, serum lipids, obesity, physical inactivity, diet, and environmental risk factors. Information on educational level, occupation, socioeconomic status, vital statistics, social support, availability of health services and morbidity data were also collected. Criteria for survey procedures and techniques were based on those used in the WHO MONICA Project (18). Because this methodology has been extensively described previously, only a summary of the procedures used will be given here. Inter-Health's Coordinating Committee prepared manuals and guidelines with standardized criteria and methods to support activities (19). A standardized questionnaire was administered and standardized physical measurements and laboratory tests were carried out by appropriately trained field teams.

Smoking. A project-administered questionnaire (18) was used in all centres except Mauritius, where a self-administered questionnaire was used. Smoking was dichotomized (smokers and nonsmokers) as follows; daily or regular smokers were combined with occasional smokers (those who smoked at least one cigarette per week) and both were considered to be smokers; ex-smokers were combined with nonsmokers and taken to be nonsmokers. Data on the number of cigarettes smoked per day were also collected.

Obesity. Height and weight were measured according to the MONICA methodology (18). The cut-off point for obesity for both sexes was a body mass index (BMI) ≥ 30 .

Blood pressure. Blood pressure was measured in all centres on the right arm, strictly following WHO recommendations (18). Two consecutive measurements were made to the nearest 2 mmHg (0.26 kPa) for both systolic and diastolic blood pressure. The means of both sets of measurements were used in the analysis. The prevalence of hypertension was assessed using WHO criteria: systolic blood pressure

(SBP) ≥ 160 mmHg (≥ 21.26 kPa) and/or diastolic blood pressure (DBP) ≥ 95 mmHg (≥ 12.7 kPa).

Serum lipids. Total serum cholesterol was the minimum obligatory parameter to be measured. The guidelines for processing samples followed the MONICA Project recommendations (18). Fresh blood samples were used for total cholesterol determinations at local sites. The samples were processed within 24 hours of being collected. Aliquots were also separated and sent to reference laboratories for external quality control.

Data processing and statistical analysis

The data were analysed at the Department of Community Health and General Practice, University of Kuopio, Finland, using the SPSS/PC+ statistical package. Absolute and relative frequency distributions of the variables selected for the analysis were obtained. Ages were adjusted using the new standard world population data (1).

Results

Reported here are the findings on smoking, blood pressure, total cholesterol, and obesity in the following countries: Chile, China, Cyprus, Finland, Lithuanian SSR, Malta, Mauritius, Russian SFSR, United Republic of Tanzania, and USA. The results for the two centres in China are given separately because of their large sample sizes and differences in stage of development.

In view of the different survey periods used in some of the countries, and to facilitate interpretation of results, countries were divided into the following groups:

- group 1: Cyprus, Finland, Lithuanian SSR, Malta, Russian SFSR, and USA; and
- group 2: Chile, China, Mauritius, and United Republic of Tanzania.

Smoking

The mean number of cigarettes smoked per day in group 1 countries ranged from 15 to 28 among men and from 9 to 20 among women. For group 2 countries only data from Chile were available, with the corresponding means being 14 for men and 8 for women. Medians were also calculated (Table 2).

The prevalence of smoking in group 1 countries did not show marked inter-country variation. In all these countries the rates were much higher for men than for women, except for USA where the rates

Table 2: Age-adjusted mean number of cigarettes smoked per day, by sex, in the two groups of Inter-Health countries

Country	No. smoked by men:		No. smoked by women:	
	Mean	Median	Mean	Median
<i>Group 1</i>				
Finland	20 (8.7) ^a	20	12 (6.3)	10
Lithuanian SSR	15 (6)	15	9 (6.8)	7
Malta	24 (14.8)	20	12 (11.9)	8
Cyprus	24 (14.6)	20	14 (10.4)	12
Russian SFSR	18 (7)	20	12 (6)	10
USA	28 (12.6)	30	20 (10.4)	20
<i>Group 2^b</i>				
Chile	14 (12.2)	12	8 (7.5)	6

^a Figures in parentheses are standard deviations.

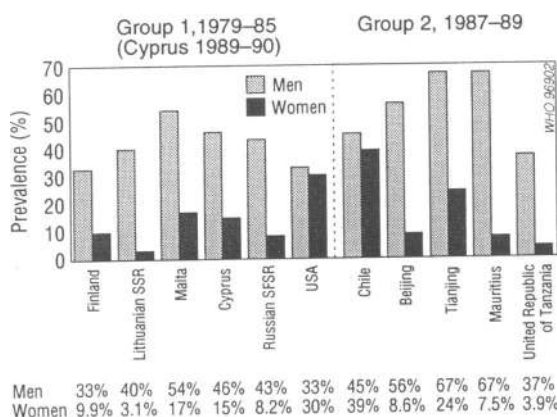
^b Only data for Chile were available.

were very similar for both sexes. In contrast, in group 2 countries, the pattern exhibited more marked sex-dependent differences mainly in China and Mauritius, where also the rates were much higher than in group 1 countries (Fig. 1).

Blood pressure

In group 1 countries the mean SBP distribution ranged from 145 mmHg (19.3 kPa) among men in Finland to 124 mmHg (16.5 kPa) for women in USA. In group 2 countries the mean SBPs were lower, ranging from 130 mmHg (17.3 kPa) for men in Mauritius and China to 122 mmHg (16.3 kPa) for women in Beijing, China (Table 3).

Fig. 1. Age-adjusted prevalence of smoking, by sex, among 35–64-year-olds in the two groups of Inter-Health countries.



The distribution for DBP was similar to that for SBP, with the lowest level in group 1 countries being consistently higher than the highest in group 2 countries (Table 3).

The age-adjusted prevalences of hypertension were very alike and high in the European countries in group 1 for both sexes, the highest level (38%) being for men in Finland and the lowest for women in USA (8.4%). Group 2 countries had lower levels, with the highest prevalence of hypertension (17%) being in Chile (Fig. 2).

Obesity

The distribution of mean BMI in group 1 countries was lowest (24.7) for women in USA and highest (29.9) for women in Lithuanian SSR. For group 2 countries the mean values ranged from 27.2 for women in Chile to 20.8 for men in the United Republic of Tanzania (Table 4).

The prevalence of obesity in all countries was higher for women than men. In group 1 this sex-dependent difference was greater in Lithuanian SSR, Malta, and Russian SFSR, and in Chile in group 2. The highest prevalence of obesity occurred in Lithuanian SSR (45%, for women), while the lowest was in the United Republic of Tanzania (0.6%, for men) (Fig. 3).

Total cholesterol

In group 1 countries the mean distribution of total cholesterol ranged from 6.4 mmol/l among men in Finland to 5.3 mmol/l among women in USA. Levels were lower in group 2 countries, ranging from 5.6 mmol/l among men in Mauritius to 4.1 mmol/l

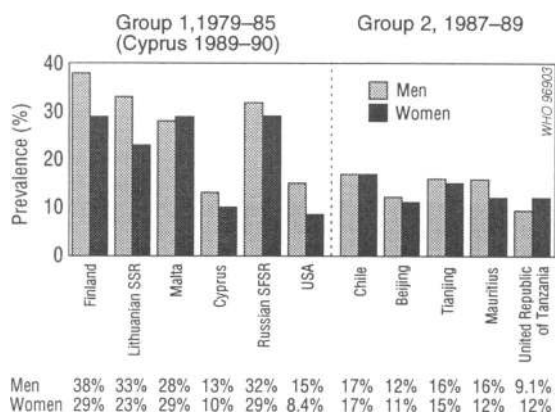
Table 3: Age-adjusted mean blood pressure, by sex, in the two groups of Inter-Health countries

Country	Men (mmHg): ^a		Women (mmHg): ^a	
	Mean ^a	Median ^a	Mean ^a	Median ^a
Group 1				
Finland	145 (19)/89 (12)	143/89	143 (21)/85 (11)	141/84
Lithuanian SSR	141 (20)/88 (11)	139/89	140 (23)/87 (11)	136/86
Malta	139 (17)/87 (10)	136/86	140 (20)/87 (10)	138/86
Cyprus	133 (15)/81 (10)	131/81	129 (18)/78 (11)	127/76
Russian SFSR	137 (22)/89 (13)	134/88	139 (26)/87 (13)	134/86
USA	128 (15)/83 (11)	127/82	124 (18)/78 (11)	121/78
Group 2				
Chile	129 (21)/82 (14)	126/80	127 (20)/80 (12)	122/80
China, Beijing	123 (20)/82 (11)	120/80	122 (21)/78 (12)	120/76
China, Tianjing	123 (18)/81 (12)	125/81	129 (24)/80 (12)	124/79
Mauritius	130 (20)/82 (12)	126/81	129 (22)/78 (12)	123/75
United Republic of Tanzania	126 (16)/79 (11)	125/79	125 (19)/79 (11)	122/78

^a Data shown are systolic/diastolic pressures.

^b Figures in parentheses are the standard deviations.

Fig. 2. Age-adjusted prevalence of hypertension, by sex, among 35–64-year-olds in the two groups of Inter-Health countries.



among men in the United Republic of Tanzania. The trends for the median values followed a similar pattern to this (Table 5).

The prevalence of hypercholesterolaemia (serum cholesterol ≥ 6.5 mmol/l) was higher among women in all countries, except USA, Finland, Cyprus, and Mauritius. The highest prevalence in group 1 countries was among women in Malta (50%) and the lowest among men in USA (19%). In group 2 countries the highest level was for women in Mauritius (26%) and the lowest for men in China (Fig. 4).

Risk factor combinations

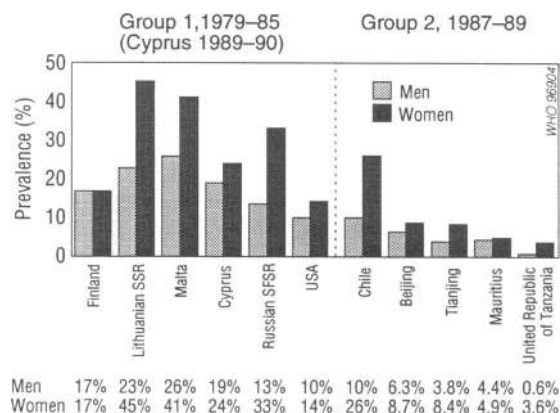
Different combinations of risk factors were found. In general group 1 countries had a higher prevalence of combinations of three and four risk factors than group 2 countries. Analysis of combinations of two

Table 4: Age-adjusted mean body mass index (BMI), by sex, in the two groups of Inter-Health countries

Country	Men (BMI):		Women (BMI):	
	Mean	Median	Mean	Median
Group 1				
Finland	26.8 (3.7) ^a	26.5	26.8 (4.8)	25.9
Lithuanian SSR	27.5 (3.6)	27.2	29.9 (5.2)	29.4
Malta	27.5 (4.4)	26.8	28.9 (5.8)	28.5
Cyprus	27.1 (3.7)	25.8	27.1 (5.3)	26.2
Russian SFSR	26 (3.6)	25.8	28.3 (5.1)	27.7
USA	25.9 (3.4)	25.8	24.7 (5.2)	23.5
Group 2				
Chile	25.3 (4.5)	24.7	27.2 (5.9)	25.8
China, Tianjing	23.8 (3.3)	23.6	24.4 (4)	24
Mauritius	23.3 (3.8)	23.2	24.9 (4.8)	24.4
United Republic of Tanzania	20.8 (2.7)	20.5	21.7 (3.6)	21.1

^a Figures in parentheses are standard deviations.

Fig. 3. Age-adjusted prevalence of obesity (body mass index ≥ 30), by sex, among 35–64-year-olds in the two groups of Inter-Health countries.



risk factors indicated that there were still differences between the two groups of countries but that they were less marked. The occurrence of one risk factor was more prevalent in group 2 countries, while in group 1 countries simultaneous occurrence of two risk factors was more prevalent (Fig. 5).

Discussion

Projections of the findings

Most information on lifestyle-related risk factors for cardiovascular diseases is available for develop-

ed countries (20–24). Developing countries have little experience in carrying out research on chronic diseases, because they have emerged only during the last 15 years as a real health problem in such countries.

The present article reports, for the first time, data on the risk factors for noncommunicable diseases in a group of both developed and developing countries. The results were obtained from surveys based on common, standardized methods of data collection and centralized analysis. The only other survey that has collected data on risk factors from a wide range of countries using a common protocol is the WHO MONICA Project (25), which did not include developing countries.

Based on the United Nations classification (26), all categories of countries were included in the study: developing countries of Latin America, Asia, Pacific region, and Africa; least developing countries; countries from Eastern Europe; and countries from developed market economies. The results of the study therefore provide data that have worldwide relevance as well as permitting inter-country comparisons at different stages of the epidemiological transition and predictions about the future developments in countries at early stages of the transition. Comparative analyses of changing epidemiological patterns are likely to become increasingly important for planning public health services.

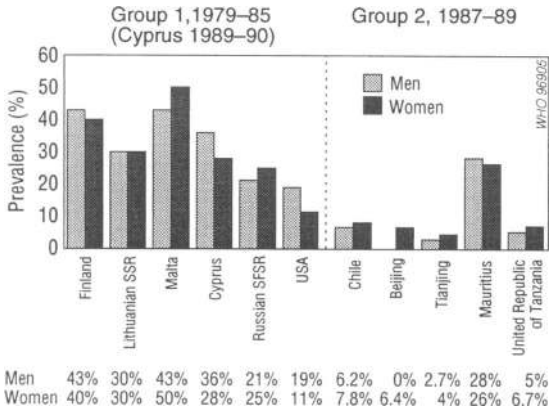
The disadvantage in this study, as is the case with most multinational surveys, is that although great efforts were made to employ standardized survey methods, there were variations in the approaches used in non-European and European countries because of their different social, cultural, and economic backgrounds. Also, the surveys were

Table 5: Age-adjusted mean serum total cholesterol, by sex, in the two groups of Inter-Health countries

Country	Men (mmol/l):		Women (mmol/l):	
	Mean	Median	Mean	Median
<i>Group 1</i>				
Finland	6.4 (1.2) ^a	6.2	6.3 (1.3)	6.1
Lithuanian SSR	6.1 (1.2)	6	6.2 (1.2)	6
Malta	6.2 (1.3)	6.1	6.4 (1.5)	6.3
Cyprus	6 (1.4)	6	5.7 (1.4)	5.6
Russian SFSR	5.6 (1.1)	5.6	5.8 (1.3)	5.6
USA	5.5 (1.1)	5.3	5.3 (1.1)	5.1
<i>Group 2</i>				
Chile	5 (1.1)	5	5.1 (1.2)	5
China, Tianjing	4.6 (0.9)	4.5	4.6 (1)	4.5
Mauritius	5.6 (1.7)	5.6	5.5 (1.1)	5.4
United Republic of Tanzania	4.1 (1.3)	4	4.3 (1.6)	4.3

^a Figures in parentheses are standard deviations.

Fig. 4. Age-adjusted prevalence of hypercholesterolaemia (serum cholesterol ≥ 6.5 mmol/l), by sex, among 35–64-year-olds in the two groups of Inter-Health countries.



carried out at different times in the two groups of countries. This could produce bias in intergroup comparisons arising from any secular changes in risk factor trends in the various populations. This was reduced to a certain extent, since the group 1 countries are at an advanced stage of the transition, characterized by a slow rate of change in the incidence of their chronic and noncommunicable diseases (2).

The results show as expected, that the highest prevalences for all the risk factors assessed were in developed countries, except for smoking, which was much higher among men in Mauritius and China. Examination of sex-specific differences in both groups indicates that smoking was a risk factor for men and obesity for women. Interestingly, the prevalences of risk factors in the USA were similar to those observed in developing countries.

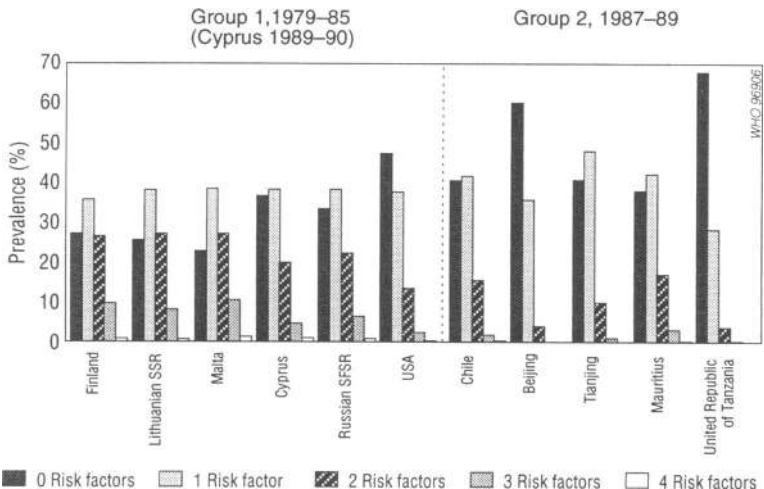
The prevalence of hypertension in developed countries was more than twice that in developing countries. A similar trend was observed for the prevalence of hypercholesterolaemia.

Analysis of the simultaneous occurrence of more than one risk factor indicates that occurrence of two or more risk factors was high among both sexes in Finland, Lithuanian SSR, Malta, slightly less in the Russian SFSR and USA, with similar levels in Chile and Mauritius. The lowest rate of simultaneous occurrence of risk factors was in China and the United Republic of Tanzania.

Simultaneous occurrence of risk factors and their synergistic effect on the risk of developing cardiovascular disease have been documented in several studies (27–29). On the basis of our results, specific combinations in definite target subgroups in the populations can be recognized that will require particular preventive interventions.

The results of the study are important also because they support the rationality of the multi-

Fig. 5. Prevalence of various numbers of risk factors among 35–64-year-olds in the two groups of Inter-Health countries (no data on cholesterol levels or body mass index were available for Beijing).



factorial approach to community-based prevention programmes.

Possibilities for action

The findings indicate that countries with low mortality rates from CNCDs have a clear and unique opportunity of taking preventative action. While the epidemiological transition is in progress, the set of lifestyle-related risk factors studied here is influencing future disease patterns. In developing countries at an intermediate stage of the transition, the rates for mortality from chronic and noncommunicable diseases are moderately high compared with those in countries with well-developed market economies. In countries such as Chile, China, and United Republic of Tanzania, it is reasonable to assume that there is an underlying potential for disease that has not yet been expressed as mortality. The key risk factors in the natural history of chronic and noncommunicable diseases are smoking, obesity, high blood pressure, and hypercholesterolaemia. Thus, it is only a matter of time until developing countries experience the same high mortality rates for such diseases that industrialized countries with well-established market economies had 30 years ago.

Our findings as well as those drawn from other studies indicate the following:

- the risk factors are not specific for one CNCD, but are involved in the natural history of several such diseases;
- the risk factors are interactive not only additively but also multiplicatively when they are present simultaneously;
- risk factor interventions are associated with decreases in mortality not only from those diseases that the interventions are directed towards but also from other diseases or conditions, thus improving general community mortality levels (30, 31); and
- common behavioural and physiological risk factors related to CNCDs are already present at young ages (32).

The need to convert these findings into action to improve health and reduce the burden of CNCDs through community-based, integrated prevention programmes has been reported previously (33, 34).

It has been recommended that changes in habits, behaviour and lifestyles of populations be promoted through multifactorial activities, including different risk factors intercepted simultaneously. Such interventions should involve family and community participation and incorporate health

promotion components that stimulate personal responsibility in health care.

Conclusions

The major risk factors that are associated epidemiologically with CNCDs, and which have been considered only to be a problem in industrialized countries, have also emerged in developing countries.

At present the situation in developing countries is moderate compared with that exhibited by industrialized countries in the past, providing a clear option for primary prevention of CNCDs, particularly cardiovascular diseases.

Developing countries should take an example from developed countries and be encouraged to set up their own intervention programmes based on their own assessments of their health situations. Here, developing countries can learn from errors and successes made by developed countries; developing countries should take advantage of this experience.

Clearly, the only rational way to tackle the problem is through preventive activities, which should be aimed at promoting healthy lifestyles and healthy environments. The experience gained in carrying out those recommendations in some developing countries should be shared with other developing countries that have not yet established intervention programmes. This survey also shows that the MONICA Project methodology can be usefully applied in developing countries to collect data on chronic diseases. The Inter-Health project is a model and an option to face the challenge presented by such diseases.

Résumé

Distribution et prévalence des principaux facteurs de risque de maladies non transmissibles dans divers pays: le Programme INTERSANTÉ de l'OMS

Le Programme INTERSANTÉ a été lancé en 1986 par l'OMS avec la collaboration de l'Institut national de santé publique d'Helsinki (Finlande) pour prévenir et combattre les maladies chroniques non transmissibles de l'adulte. Des programmes d'action ont été organisés en partant du principe que la plupart des maladies chroniques non transmissibles partagent les mêmes facteurs de risque et qu'il est possible d'agir sur celles qui sont liées aux modes de vie au moyen d'interventions efficaces

faisant appel à des stratégies multifactorielles basées sur la participation communautaire et les modifications des comportements, mises en œuvre au niveau des soins de santé primaires. Douze pays couvrant l'ensemble des Régions de l'OMS participent au Programme.

Une étude quasi expérimentale a été conçue aux fins d'évaluation. Une enquête de base a été réalisée dans les 12 pays selon un protocole commun utilisant les critères et méthodes du Projet MONICA. Au total, 38 957 hommes et femmes de 35 à 64 ans ont été inclus dans l'analyse actuelle qui porte sur les pays suivants du Programme INTERSANTÉ: Chili, Chine, Chypre, Etats-Unis d'Amérique, Finlande, RSS de Lituanie, Malte, Maurice, République-Unie de Tanzanie et RSFS de Russie. Outre l'analyse réalisée individuellement par les pays, une analyse centralisée a été effectuée à l'Institut national finlandais de santé publique et au Département de santé communautaire de l'Université de Kuopio (Finlande). Cet article donne les valeurs moyennes de la tension artérielle, de l'indice de Quételet (BMI) et du cholestérol total (dans le sérum), ainsi que les taux de prévalence du tabagisme, de l'hypertension, de l'obésité et de l'hypercholestérolémie.

Les résultats indiquent que la prévalence des principaux facteurs de risque est très variable, surtout entre pays développés et en développement. Les taux les plus faibles s'observent en République-Unie de Tanzanie. Le tabagisme est maintenant un problème dans l'ensemble des pays en développement, de même que l'hypercholestérolémie et l'hypertension artérielle. Ces résultats, ajoutés à la fréquence élevée de deux ou plusieurs facteurs de risque simultanés, même dans les pays en développement, montrent qu'il est urgent d'organiser des programmes efficaces basés sur une approche multifactorielle pour faire face à la charge croissante des maladies chroniques non transmissibles.

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