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Nutrition Policies and Interventions for Chronic Disease Risk Reduction in International Settings: The INTERHEALTH Nutrition Initiative

Barbara Millen Posner, Dr.P.H., R.D., Paula A. Quatromoni, M.S., R.D., and Mary Franz, M.S., R.D.

The INTERHEALTH Programme

In every country in the world today, depending on its stage of epidemiologic transition,[1–4] noncommunicable diseases (NCDs) such as cardiovascular diseases, cancer, diabetes, and osteoporosis are either newly appearing, rapidly rising, or already established at high levels.[5] Based on the philosophy that these diseases have common, modifiable risk factors, the World Health Organization's Division of Noncommunicable Diseases (WHO NCD) initiated the global INTERHEALTH Programme in 1986.[6–13] INTERHEALTH is an international collaborative project in which participating nations work toward prevention and control of common risk factors for a group of NCDs using strategies that emphasize total community involvement, health promotion activities, behavioral interventions, and prevention and control activities implemented through existing primary health care systems and other community structures.[14] INTERHEALTH is led by the NCD Division of WHO in Geneva, Switzerland, in conjunction with a coordinating center at the National Public Health Institute in Helsinki, Finland. The INTERHEALTH Nutrition Initiative is directed by the Boston University Schools of Medicine and Public Health in conjunction with WHO and the INTERHEALTH Coordinating Center.

INTERHEALTH promotes an integrated approach to prevention and control of chronic disease[6,7] whereby activities concerning more than one disease are simultaneously coordinated. This approach is preferred to the design of "vertical" programs, which tend to be disease-specific and compete for scarce public health resources as well as the attention of mass media and other channels of public health education. With similar reasoning, INTERHEALTH advocates comprehensive population-based screening services, using standardized protocols, and is particularly concerned with establishing major initiatives emphasizing the promotion of healthy lifestyle behaviors that reduce NCD risk at the population level.

INTERHEALTH involves countries in all WHO regions: AMRO (Tanzania, Mauritius), PAHO (Chile, Cuba, United States [Stanford, Texas, and Florida]), EMRO (Cyprus), EURO (Finland, Malta, Lithuania, Moscow), SEARO (Thailand, Sri Lanka), and WPRO (China [Beijing and Tianjin], Australia, Japan). Each of these countries is committed to mounting activities and programs for NCD prevention and control, but the extent to which these activities have been implemented varies. For example, some countries have conducted screening activities to establish baseline data and monitor changes in population disease rates and risk factor levels. Others not only have carried out population-based risk factor screening but have developed national public health policies and nutrition policy statements to facilitate the design of relevant interventions for NCD risk reduction. Countries which have long-established high rates of NCDs have mounted population-based nutrition interventions and are currently evaluating the impact of such efforts on NCD risk factors and chronic disease morbidity and mortality.

INTERHEALTH collaborators have committed to evaluate many different risk factors, including smoking prevalence, alcohol consumption, drug use, obesity, nutritional behaviors and nutrient intake levels, physical activity level, systolic and di-

Dr. Posner is Assistant Director for Research, Boston University School of Medicine and Director, INTERHEALTH Nutrition Initiative, and with the Office of the Director and Department of Social and Behavioral Sciences, School of Public Health, School of Medicine, Boston University, Boston, MA. Ms. Quatromoni and Ms. Franz are with the Department of Social and Behavioral Sciences, School of Public Health, School of Medicine, Boston University, Boston, MA, USA.

astolic blood pressure, prevalence of hypertension, and serum total cholesterol levels. Standard methodologies are used to assess certain risk factors (such as smoking prevalence, body mass index [BMI], blood pressure, and serum cholesterol), whereas country-specific methods are relied upon for others.[15]

INTERHEALTH has attempted to standardize the approaches used for risk factor screening in order to facilitate the exchange of technologies worldwide and to allow international comparisons across project areas. The intervention strategies employed by INTERHEALTH collaborators for population-based NCD risk reduction are not standardized. Instead, countries are encouraged to use a common strategic and behavioral model based upon specific needs and/or available resources.[16] Specific intervention strategies are influenced by a country's cultural, environmental, social, and demographic factors. Intervention methods, innovative approaches, and technologies are shared among participating INTERHEALTH countries to foster and strengthen the international collaborative nature of the INTERHEALTH project.

The INTERHEALTH Nutrition Initiative is an important component of the INTERHEALTH Programme. Its goals are fourfold: (1) to evaluate global trends in population food and nutrient intake central to chronic disease prevention; (2) to assess commonalities in international nutrition policies of relevance to NCD risk reduction; (3) to explore the characteristics of integrated, population-based lifestyle interventions for NCD prevention, particularly nutrition strategies; and (4) to evaluate the impact of community-based interventions on nutrition behaviors and population NCD risk, morbidity, and mortality. The Nutrition Initiative provides a unique opportunity to examine trends in diet and population health profiles, to collectively consider and share effective integrated nutritional strategies for NCD risk reduction, and to accelerate favorable global trends in NCD prevention and management.

For this report, members of the INTERHEALTH Nutrition Initiative collected information from participating nations regarding nutrition-related activities aimed at NCD prevention and control. As well, progress reports submitted by INTERHEALTH project directors, manuscripts in preparation, and published data were analyzed. Nutrition interventions for NCD risk reduction are highlighted in this review, with emphasis on diverse and innovative strategies that are used worldwide.

Nutrition Monitoring Activities in INTERHEALTH Countries

Surveys of individual dietary intake are an important means of obtaining information regarding population food and nutrient consumption. These surveys reflect the intake levels of individuals, in contrast with Food and Agriculture Organization (FAO) estimates of per capita food availability.[17] In addition to characterizing food consumption patterns and intake levels of macronutrients, surveys of individuals provide estimates of other nutrients important for the prevention and treatment of NCDs, such as cholesterol, sodium, polyunsaturated, monounsaturated, and saturated fats, fiber, calcium, β-carotene, and other key nutrients. Surveys also allow a closer look at various geographic, socioeconomic, or ethnic subgroups within populations. Surveillance activities provide information to facilitate the development of national nutrition policies and to identify priority areas for allocation of public health resources.

Twelve INTERHEALTH countries have undertaken population-based nutrition monitoring activities to survey individual food and nutrient intake levels (Table 1). Country-specific tables of food composition were used to derive estimates of nutrient intake. There appears to be consistency in the adoption of either the 24-hour recall or 3-day food record as the primary method for collection of dietary data within each project area. Dietary recall data were frequently supplemented with additional information from food habit surveys, food frequency questionnaires, or, in China, weighed records of salt use. Use of food models to aid with portion size estimation was also a common practice. The commitment to standard methodologies for dietary assessment facilitates ongoing surveillance of food and nutrient intake levels and also allows international comparisons of dietary patterns.

Nutrition Policies in INTERHEALTH Countries

Traditionally, national nutrition policies focused on trade, economics, and agriculture to guarantee the minimal nutritional requirements for the majority of people and for specific high-risk groups. As countries developed, NCD levels rose and the importance of diet as a key risk factor for a variety of chronic diseases became recognized. Through nutrition monitoring and risk factor surveillance activities, INTERHEALTH countries have identified high levels of NCD risk factors (including unfavorable dietary patterns), morbidity, and mortality. The result has been widespread development of national nutrition policies aimed at lowering population NCD risk.

Nine INTERHEALTH countries have developed national nutrition policies with fairly consistent population-based dietary recommendations to foster chronic disease risk reduction (Table 2). Nutrition

Table 1. Nutrition Monitoring Activities in INTERHEALTH Countries

INTERHEALTH Site	Dietary Assessment Method	Baseline Survey	Follow-up Survey
Australia	Food frequency questionnaire	1985	
China—Beijing	3 days of dietary recall with weighed salt use	1989	1991
—Tianjin			
Cuba	24-hour recall and food habit questionnaire	1990	
Cyprus	24-hour recall	1989	
Finland	3-day food records, food habit questionnaire	1972	1982
			1991
Japan	24-hour recall	1975–1977	
Lithuania	24-hour recall and food habit questionnaire	1983	1986
			1991
Malta	Food frequency and household budget survey	1984	1989–1990
Mauritius	24-hour recall, diet habit survey, food frequency, household inventory	1987	1992
Russia	24-hour recall and food frequency	1986	1990–1991
USA—Florida	Food frequency, food habit questionnaire	1992	
USA—Stanford	24-hour recall and food intake questionnaire	1978–1980	1980–1982
			1982–1984
			1984–1986
			1988–1990
USA—Texas	Food frequency	1985–1987	1991
			1994–1995
Tanzania	Food frequency and food habit survey	1992	

recommendations common to national policies encourage maintenance of appropriate body weight; decreased consumption of total fat, saturated fat, dietary cholesterol and sodium; increased ratio of polyunsaturated to saturated fat (P/S ratio) in the diet; increased consumption of fiber-rich foods and complex carbohydrates; and moderate alcohol intake.

INTERHEALTH countries are at various stages in nutrition policy development. The United States (1977), Australia (1979), and China (1982) were the first to publish general dietary goals to promote population nutritional health. Later, Japan (1983), Malta (1986), Finland (1987), Lithuania (1987), and the United States (1984–1989) established nutrition policies and dietary guidelines specifically aimed at NCD prevention. More recently, Cyprus (1992) and Mauritius (1992) set nutrition goals for population food and nutrient intake patterns to be achieved in the next 5–8 years. The other INTERHEALTH countries are considering the development of national nutrition policies.

Nutrition policies in INTERHEALTH nations have been issued by government agencies, national heart and cancer associations, and special advisory groups. Expert panels have been created to advise governments on matters of nutrition policy. For example, a National Committee on Nutrition was formed in Cyprus to study local issues related to food and nutrition, conduct nutrition monitoring, set nutrition goals, evaluate nutrition policies, and implement campaigns to promote proper nutrition.[25] In addition to setting dietary goals, governments are striving to promote more healthful food supplies by working with trade organizations, agricultural and fisheries departments, and food industries.

The consideration of national nutrition policies for NCD prevention and control is a challenge in any country but particularly those in which the epidemiological transition is beginning or progressing more slowly. Activities to prevent the rise of chronic, noncommunicable diseases may compete with infectious disease control programs for extremely limited health resources. Indeed, the use of relatively inexpensive population-based preventive measures may be the only feasible means of arresting the spread of NCDs in developing countries where health care resources are scarce or nonexistent.[26] Here, national health and nutrition policies and programs will have to consider the population's changing disease profiles. Nutrition goals must emphasize the availability of a safe and adequate food supply, as well as the promotion of dietary practices to reduce NCD morbidity and mortality, particularly in higher risk populations of all ages. In Tanzania, rates of NCDs are low and infectious disease rates and famine or undernutrition in certain populations may still be high. "Primordial" prevention appears

Table 2. Nutrition Policy Recommendations in INTERHEALTH Countries

Recommendation	Australia	China	Cyprus	Finland
Maintain appropriate body weight	Yes	40 kcal/kg	NC	Yes
Reduce total fat (% kcal)	33%	25–30%	<30%	<30%
Reduce saturated fat (% kcal)	P:S 1.0	NC	NC	<10%
Increase polyunsaturated fat (% kcal)	P:S 1.0	NC	NC	P:S > 0.5
Limit cholesterol (mg/day)	Restrict	NC	NC	Reduce
Limit simple sugars	<12% of energy	NC	NC	NC
Increase complex carbohydrates (% kcal from CHO)	Eat enough	60%	55%	NC
Increase fiber	To 30 g/day	NC	NC	NC
Restrict salt	To 100 mmol/day	<10 g/day	<5 g/day	<5 g/day
Moderate alcohol intake	<5% of energy	NC	NC	Moderate
Other recommendations	Variety; water fluoridation; year 2000 targets; food labeling; focus on high risk groups		Limit protein to 12% of energy	Exercise; food labeling
Data source	National Research Council[18]	Dietary report[19]	Dietary report[20]	WHO report[21]

relevant here, as NCD morbidity is low but risk factors are beginning to emerge. Efforts in Tanzania must emphasize the development of policies and programs to ensure food security and stability, and the implementation of strategies to encourage the population to maintain its traditional diet (lower in fat, higher in complex carbohydrate and vegetable protein).

Nutrition Interventions in INTERHEALTH Countries

Fourteen INTERHEALTH countries have implemented nutrition intervention programs for NCD risk reduction. INTERHEALTH strategies incorporate behavioral approaches which directly help individuals modify lifestyle behaviors as well as mass-media approaches which attempt to influence population behavior through television, radio, and print media campaigns.[16] Nutrition interventions in INTERHEALTH countries have been directed at various populations of children, adolescents, and adults, with intervention activities focused at macro levels (food supply and mass media), intermediate levels (community, worksite, school, and health professions), and micro levels (family and individual) (Table 3).

A variety of strategies have been developed in each INTERHEALTH country, yet a number of approaches are common among the nutrition intervention programs. Macro-level interventions (Table 4) include efforts to increase the availability and desirability of nutritious foods. Reducing the price of whole wheat flour and vegetable oils, lowering the duty on imported fruits, and increasing the tax on alcohol are a few examples of ways to influence a nation's food supply and affect population food consumption patterns. As well, mass media is a strategy used by many INTERHEALTH countries as a means of promoting health and nutrition messages, and to increase public awareness of the importance

Table 2. Extended.

Japan	Lithuania	Malta	Mauritius	United States
Yes	NC	NC	NC	Yes
20–25%	<35%	30%	≤30%	≤30%
Yes	<15%	10%	<⅓ total fat intake	<10% individuals; 7–8% population
Use vegetable and fish oils	P:S = 0.5	P:S ≥ 0.5–1.0	NC	<10% individuals; 7% population
NC	<100 mg/1000 Kcal	<100 mg/1000 kcal	NC	<300 mg/day
NC	<10%	<10%	<10%	Yes
NC	>40%	>45%	NC	≥55%
				≥5 daily servings of vegetables and fruit; ≥6 daily servings of bread/ cereal/legumes
NC	>30 g/day	>30 g/day	≥30 g/day	Yes
<10 g/day	5 g/day	<5–8 g/day	≤7 g/day	≤6 g/day Goal: 4.5 g/day
NC	NC	≤2 units/day	NC	For those who drink, limit to <2 drinks/ day
Varied diet; at least 30 foods daily; home cooking; pleasant eating environment		Protein 12–15%; fluoridate water; eat fish and poultry; use lowfat dairy; eat vegetables, fruits & grains		Drink fluoridated water; moderate protein intake; avoid dietary supplements in excess of the RDA; eat a variety of foods
National Research Council[18]	Baubiniene et al.[22]	Bellizzi et al.[23]	Uusitalo et al.[24]	National Research Council[18]

of lowering NCD risk and the benefits of a healthy lifestyle.

Intermediate-level intervention strategies (Table 5) are most common among INTERHEALTH countries. Community-based strategies range from marketing activities through local grocers to promote the use of fresh produce and fiber-rich foods, to incorporation of NCD control programs into primary health care systems. Integrated programs, such as "Eat To Your Heart's Content" in Malta[23] and "Salud" in the United States (San Antonio, Texas),[27] require the cooperation of many individuals, groups, and organizations. Volunteers, community organizations, religious groups, social groups, specific associations such as the local heart and cancer associations, community government leaders, educational institutions, local media, community businesses, and area medical groups are all important partners that enhance intervention efforts. Specialized training for health workers, public health nurses, and family physicians in nutrition and chronic disease prevention is a common feature of INTERHEALTH nutrition intervention programs.

While worksite nutrition and health promotion programs are effective means of targeting adults, school-based strategies are an innovative way of changing nutrition practices and risk factor levels among children and adolescents. In addition to modifications to foods served in school lunch programs, a wide range of nutrition education and food activities have been incorporated into the school environment. As well, peer leadership programs have been used to facilitate positive behavior change and development of skills for social pressure resistance and decision making.

Micro-level interventions (Table 6) focus on families and individuals. Family-based strategies have been designed to target dietary habits of parents only or parents and children together. Both approaches to dietary modification were equally effective at lowering serum cholesterol levels among children in Finland.[28] In China, weekly diet menus

Table 3. Nutrition Intervention Activities in INTERHEALTH Countries

INTERHEALTH Site	Macro Level		Intermediate Level				Micro Level	
	Food Supply	Mass Media	Community-based	Worksite-based	School-based	Health Professions	Family-based	Individualized Strategies
Australia			●					
Chile		●						●
China	●	●	●	●	●	●		
Cuba	●	●	●			●	●	●
Cyprus		●			●	●	●	
Finland	●	●	●	●	●	●		
Japan[a]							●	●
Lithuania	●	●	●		●	●		
Malta	●	●	●		●		●	●
Mauritius	●	●	●		●			
Russia		●		●	●	●		●
Sri Lanka	●			●	●	●		
Tanzania			●		●	●		●
Thailand						●		
USA—Florida			●			●		●
USA—Stanford	●	●	●	●	●			
USA—Texas	●	●	●			●	●	●

[a] At present, no intervention activities are underway in Japan.

were distributed to families to facilitate dietary behavior changes.[29] Individualized interventions rely on structured networks for referral, treatment, and follow-up of high risk individuals. Development of patient education materials for NCD risk reduction and disease management has also been an important activity among INTERHEALTH countries. Publication of guidelines to enhance the management of diabetes mellitus has been a priority in Tanzania[30] and Mauritius.

While research has shown that nutrition interventions improve population dietary patterns and risk factor profiles,[28,31–35] the long-term impact of these strategies on population eating behaviors is uncertain. In the North Karelia project (Finland), significant reductions in intake levels of saturated fat from milk and fat spreads were achieved between 1972 and 1987 as a result of community-based nutrition intervention efforts.[31,32] Changes in dietary fat consumption and serum cholesterol levels were more pronounced in North Karelia than in the reference community during the first 5 years of the intervention period.[31,33] During the first 5 years of the project, net reductions in dietary fat use in the intervention community versus the reference area were significant only among men and disappeared over the 10-year study period. However, net reductions in saturated fat intake were statistically significant among both men and women in the intervention area at years 5 and 10.[32]

Table 4. Macro-Level Nutrition Interventions

Food supply	• Agricultural policies • Food importation regulation • Price and tax legislation • Partnerships with food industries • Collaborations with food distributors • Increased marketing of desirable foods • Food labeling policies • Identification of alternatives to staples (i.e., coconut oil) • Monitoring and evaluation of trends in food/alcohol sales
Mass-media	• Newspaper articles on nutrition and chronic disease topics • Weekly radio programs • Television programs targeted toward specific age groups • Dissemination of print media regarding nutrition and NCDs • Widespread promotion of healthy eating messages

Table 5. Intermediate-Level Nutrition Interventions

Community-based	• Population risk factor screening
	• Health fairs
	• Nutrition services added to local health clinics
	• Specialized NCD clinics formed at local health centers
	• Increased availability of exercise facilities
	• Supermarket nutrition education programs
	• Small group programs and lectures
	• Cooking demonstrations
	• Partnerships with local restaurants and grocers
	• Specific community challenge programs
	• Health and nutrition training for community leaders
	• Programs targeted at specific ethnic groups
	• Local advertisements and public service announcements
	• Cookbooks containing fat-modified ethnic recipes
Worksite-based	• Worksite health promotion and nutrition programs
	• Cafeteria programs to promote nutritious food choices
	• Educational seminars
	• Risk factor screening
School-based	• Modification of school food service
	• Health and nutrition training for teachers
	• Nutrition education curricula
	• Food preparation activities in the classroom
	• Annual risk factor screening and health education
	• Nutrition counseling for high risk students
	• Parent involvement in nutrition and health projects
	• Peer leadership training with role modelling activities
	• Healthy child program in pre-schools
	• Nutrition lectures in university courses
Health professions	• Training and education for health professionals
	• Health promotion workshops and conferences
	• Monthly newsletters promoting preventive nutrition

More recently, investigators from the Stanford Five-City Project (United States) reported an inability to detect any significant, lasting nutritional effects of their educational intervention program after 10 years of follow-up.[35] Thus, significant changes in nutrition were difficult to achieve through mass media and population-based efforts alone. INTERHEALTH investigators increasingly recognize that sustained changes in population nutrition behaviors will require ongoing efforts and broader intervention strategies, which target the differences in population ethnicity, dietary patterns, and environmental determinants of risk factor behaviors.

Conclusions

It is evident that NCD risk and risk factor profiles are of global concern and deserve widespread attention. Risk factors for noncommunicable diseases are high or rising in all INTERHEALTH nations. Research has shown that dietary patterns and NCD risk factors may be favorably influenced by comprehensive nutrition intervention strategies. Further

Table 6. Micro-Level Nutrition Interventions

Family-based	• Dietary modifications targeted at parents and children
	• Healthy diet and baby care programs for new mothers
	• Parent involvement in school-based interventions
	• Home visits to monitor/promote nutrition behavior change
	• Distribution of nutrition education materials to families
Individual-based	• Referral networks for high risk individuals
	• Provision of nutrition counseling services
	• Follow-up programs to monitor high risk individuals
	• Development of effective patient education materials

development and implementation of national nutrition policies for chronic disease risk reduction should remain a priority for INTERHEALTH countries in the coming years. Ongoing nutrition monitoring of population dietary patterns and evaluation of intervention activities are crucial to determine whether established nutritional goals are being met and to identify target areas for future intervention programs. Participation in the INTERHEALTH Programme will surely enhance the efforts of individual countries to promote improved health and nutritional status of populations worldwide.

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INTERHEALTH Steering Committee Members: A. McAlister, University of Texas Health Sciences Center, Houston, Texas, USA; A. Nissinen, Univeristy of Kuopio, Finland; X. Berrios, Departamento de Salud Publica, Escuela de Medicina de la Universidad Catolica, Santiago, Chile; K. G. M. M. Alberti, University of Newcastle-upon-Tyne, United Kingdom; H. Gareeboo, Ministry of Health, Mauritius; and N. Khaltaev, Division of Noncommunicable Diseases and Health Technology, World Health Organization, Geneva.

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