Original Article

Programme and policy issues related to promoting positive early nutritional influences to prevent obesity, diabetes and cardiovascular disease in later life: a developing countries view[1]

Noel W. Solomons MD
Center for Studies of Sensory Impairment, Aging and Metabolism (CeSSIAM), Guatemala City, Guatemala

Abstract

Public health policy differs from programme insofar as the former is the expression of goals at a higher decision-making level (international, regional, national or provincial) and the latter involves the execution of intervention measures at the community or individual level. It has recently become fashionable to speak of 'evidence-based' policy. There is now ample evidence to suggest that early nutritional influences on chronic disease risk in later life are contributing to the acceleration of the overall worldwide epidemic of obesity and non-transmissible diseases. In developing countries, in which 80% of the world's population resides, the opportunities for preventive policy must be balanced against needs, cost and effectiveness considerations and the intrinsic limitations of policy execution. Not everyone in the population is at risk of suffering from any given negative condition of interest, nor will everyone at risk benefit from any given intervention. Hence, decisions must be made between universal or targeted policies, seeking maximal cost-efficiency, but without sowing the seeds of either discrimination or stigmatization with a non-universal application of benefits. Moreover, although large segments of the covered population may benefit from a public health measure, it may produce adverse and harmful effects on another segment. It is ethically incumbent on policy makers to minimize unintended consequences of public health measures. With respect to the particular case of mothers, fetuses and infants and long-term health, only a limited number of processes are amenable to intervention measures that could be codified in policy and executed as programmes.

Keywords: policy, programmes, Barker hypothesis, nutrition, food guidelines, chronic diseases, developing countries, Guatemala.

Correspondence: Noel W. Solomons, CeSSIAM-IN-GUATEMALA, PO Box 02-5339, Section 3163/GUATEMALA, Miami, FL 33102-5339, USA. Tel.: +5022-473-3942; fax: +502 2473 3942; e-mail: cessiam@guate.net.gt

[1]Prepared for the Workshop on Early Nutritional Influences on Obesity, Diabetes and Cardiovascular Disease Risk in Later Life – The Evidence, Policy Implications and Research Priorities, Montreal, 7–9 June 2004.

There's many a slip twixt the cup and the lip.

Olde English Aphorism

Introduction

During the long period of human evolution, the hunter-gather lifestyle was the exclusive format for

social organization, and tribes and clans roamed their wild terrains in a search of sustenance from the terrestrial, aquatic, marine and atmospheric fauna and flora. Violent death from predation and accidents, intratribal conflict and intraclan succession combined with infections and complications of childbirth in limiting the average lifespan to less than 40 years.

Forty thousand years ago, humans domesticated some wild species as working dogs, dairy animals and beasts of burden (Simoons, 1978). While remaining nomadic, greater food security was introduced by having one's own herds. The pastoralist diet was distinct from that of the classical hunter-gatherer (Simoons, 1978; Cordain, 1999) with fresh and fermented milk and occasional meat, but foraged and hunted items were still included as reflected in the contemporary Masai in east Africa.

Some 10 000 years ago saw the advent of settled agriculture, with domestication of wild grasses to produce cereal crops such as wheat, rice and millet, and even later maize, barley and oats (Cordain, 1999), tuber crops of yams, cassava, potatoes and sweet potatoes. Dairy and non-grazing animals became agricultural livestock living in a confined area. Life was still very rigorous and activities vigorous, but populations were settled and more sedentary than their nomadic hunter and pastoralist peers. The nature of human diets changed from ample diversity (but often verging on scarcity) in Neolithic times, to monotonous fares (based on a dominant grain or tubers) on the advent of agriculture.

The Industrial Age, beginning three centuries ago, was a turning point in human demography (Fogel & Helmchen, 2002). Agricultural technology advances greatly reduced the percentage of the population that had to be based on the land in order to provide a food supply, freeing the rest of the population for other pursuits and for urban living. Over time, with mechanization and information technology, the physical effort to produce goods and services had been dramatically reduced. Nevertheless, median survival (life expectancy) still hovered around 40 years. It was only improvements in food and water sanitation, immunizations and antibiotics controlling child mortality that allowed the advancing average life expectancies and unprecedented individual longevities registered at the end of the 20th century.

In the meantime, a series of transitions have begun to occur, including epidemiological transition [in which infectious diseases receded and chronic diseases advanced as causes of morbidity and mortality (Manton, 1988)], and demographic transition [in which the median ages of societies increase because of extended longevity and reduced fertility (Manton, 1991)]. Popkin (1994) identified nutrition transition as the most recent in the series, and defined it as: 'The rapid shift in the structure of diet in low-income countries and in the coexisting problems of under- and over-nutrition'. In other papers in this issue the theory and empirical evidence on the operation of dietary, environmental and lifestyle exposures on pregnant and lactating women and on their respective fetuses and young infants in terms of increasing or decreasing risk of later-life non-transmissible diseases is discussed.

Origins of non-transmissible diseases

'Paleohistorians' from the anthropological and archeological disciplines generally agree that the array of chronic degenerative diseases responsible for much of the morbidity and mortality in the world (Yach *et al*., 2004) were unknown among Stone-Age hunter-gatherers (Cordain, 1999; Milton, 2000; Cordain *et al*., 2005). The nature of the diet, the active lifestyles of the constant hunt, and short life expectancy all contributed to the absence of chronic degenerative diseases in prehistoric times. The change in the manner of obtaining food with the dawn of the Agricultural Age is one of the factors implicated in the development of chronic diseases. Contemporary affluent societies consume a selection of items of very recent evolution, including dairy foods, cereal grains, refined sugars and vegetable oils, salt, fatty domesticated meats and ethanol (Cordain *et al*., 2005). This has a number of potential health ramifications including low micronutrient density in association with a low dietary fibre content and high glycemic index of the diet. Macronutrient composition has dramatically altered, especially the fatty acid composition. Modern foods also have a high sodium/potassium ratio and lead to altered acid–base balance.

Sedentarism in the daily pursuits in urban settings is clearly a major contributory factor to non-communicable disease (Kyle *et al*., 2004; Manson *et al*., 2004), being responsible for a positive energy balance in which an individual gains excess body weight. Low levels of physical activity also lead to a lack of muscular conditioning both for locomotion (skeletal muscles) and cardiovascular health.

The definitions and semantics of reference

Those of us in the academic research community often use the public health terms 'policy' and 'programmes', perhaps without appreciating the nuances of the distinction. 'Policy' is defined as 'a high level overall plan embracing general goals and acceptable procedures, especially of a governmental body' (Merriam-Webster's Dictionary, 2004). Policies result from decisions made at the highest levels of state authorities, national governments or even transnational bodies such as the United Nations agencies, aimed at effecting desirable changes in a situation or in a behavioural pattern (or to stabilize and resist undesirable changes). 'Programme' is defined as 'a plan of procedure, especially toward a goal'. (Merriam-Webster's Dictionary, 2004). In public health, this usually refers to interventions at a community or individual consumer level (Solomons & Latham, 1994).

The origins of 'evidence' in evidence-based policy and programme

A watchword in the discussion of policy and programme is 'evidence-based' (Buekens *et al*., 2004). Where does the evidence come from? It should be generated by serious, competent and unbiased investigators who know how to evaluate the situation, frame the question, and produce valid findings. It is the academic wing of the public health community calling for applying research to testing the measures placed into policy (Haddad, 2003; Beukens *et al*., 2004). Other contributors have compiled the scientific evidence, often contradictory, to illustrate how a clearer understanding of the biological and epidemiological problems of early nutritional influences can be derived (Hediger, 2004; Joshi, 2004; Kuh, 2004; Eriksson, 2005; Faith & Kerns, 2005; Garrett & Ruel, 2005; Gluckman *et al*., 2005; Langley-Evans *et al*., 2005; Law, 2005; Sawaya *et al*., 2005; Stein *et al*., 2005).

In an ideal world, the role of research in fostering policy would be to determine the nature of health problems and whether proposed solutions might work, e.g. by uncovering associations through population surveys or case-control comparisons (Willett, 1998). With establishment of a plausible framework for causality within associations, intervention research is used to confirm these. This should ensure that interventions are examined in terms of their efficacy, usually within the format of randomized controlled trials (RTC) (Chalmers *et al*., 1972). One important criticism in evaluation of efficacy is the frequent failure to look for adverse effects of interventions alongside the positive benefits (Solomons, 1994; Solomons *et al*., 2003), either because the studies are not designed to collect the safety evidence or are not monitored for a long-enough period to see adverse consequences emerge.

A measure can be efficacious when administered under rigorously controlled conditions, but there is a need to assess whether the benefits are achievable within the routine public health system. This is the domain of effectiveness research (Habicht *et al*., 1999; Victora *et al*., 2004) which has been heralded as the most useful contribution that the academic community can make to public health (Beukens *et al*., 2004). Finally, the impact of research and the mobilization of evidence must be measured in the efficiency of the programmes. Efficiency relates to the cost of implementing and maintaining an efficacious and effective intervention programme (Gross & Solomons, 2003). An example of a policy leading to cost-effective programmes based on prior demonstration of biological efficacy and public programme effectiveness is that of vitamin A supplementation with high-dose capsules, in Ghana, Nepal and Zambia, documented in case studies by Houston (2003).

The investigative scientific community aspires to find practical outcomes that reflect in policy and incorporation into programmes. For the empirical researcher, the fundamentals of policy generation

and formation, and insertion into programmes constitute a complex labyrinth.

Evidence-based information and a sense of urgency is no guarantee that policy will ensue. This requires political will at both legislative and executive level. If a measure is particularly visible or palpable, a wide stakeholder consensus may be needed. Formulation of policy is also no guarantee that programmes will result. Issues of financing within national or local governments, and scarcity of other, non-monetary resources, as well as simply the well known bureaucratic inertia may prevent this. Finally, the establishment of programmes is no guarantee of the desired and expected effect. A programme may succumb to community resistance, uneven delivery, opposing and diluting factors intrinsic to the society or even false premises and flaws in the programme design.

Generic issues of policy and programme

An interactive and iterative model of policy generation and formation

The Institute of Nutrition in Central America and Panama (INCAP), a Pan American Health Organization affiliate for the Central American Isthmus located in Guatemala City, has a multifaceted approach to understanding the formation of policy, specifically in the area of food and nutritional security. They see policy as an outline for creation of norms and plans for action at the highest decision-making levels, e.g. supranational, national or subnational. Policy generally begins with the definition of priorities and goals. This requires an interaction with an assessment of the situation related to the policy issue at hand. It also requires formation of a consensus among the authorities involved in placing their imprimatur and authority behind the policy outline. Continuing monitoring and evaluation of the situation over time is then needed as a feedback loop to the policy plan. Concurrently, after consensus is achieved, practical selection among options is required and will condition the steps of execution. Execution is tantamount to and transitional to the programme level.

Table 1. Basic postulates and assertions regarding policy and programmes for the public health in developing countries

1. The formulation of policy related to the health of the public is more difficult and sensitive than in other areas of the public domain.
2. These policy formulations are more difficult in settings in which the populations are of low income, low educational attainment, and geographic and ethnic diversity, such as in developing countries in the tropics.
3. The execution of effective intervention programmes is even more difficult than the formulation of the underlying policy.
4. Policy and programmes based on evidence are better than those not based on evidence.
5. The monitoring and evaluation of policy and programme impacts is most often left undone, and often with untoward consequences for the underlying goals and aspirations.

The programme is the actual action at the community level, responding to the demands of the policy decisions. Development is basically a microcosm at population level of the scheme outlined for policy, beginning with goals definition, at the level of the programme workers. Once again, this is guided by a contemporary analysis of the situation on the ground at each site and proceeds to the definition of specific action strategies within the local agency(ies), both of which must feedback to the local definition of goals. From the definition of action strategies comes the generation of operative strategies, and essential ongoing monitoring and evaluation of results (P. Palma, personal communication, 2004). Although this scheme seems complex, the theories behind interactive and iterative policy and programme formation are mature. Table 1 illustrates a number of projections.

Itemized requirements for 'a policy'

According to Caulfield (2004), a policy has a specific set of requirements. First, it needs an objective or goal, that is, what is to be achieved. The actions to be effected and the results to be achieved must be clearly distinguished. Then, a strategy or overall approach to achieving the end is needed. It needs a method of procedure that is operationalized with a plan (blueprint), management scheme and execution.

In developing a health policy, a critical element is to define the population sector currently at risk of

suffering the relevant health consequences, in terms of gender, age, physiological status, ethnicity or economic group. With respect to early life influences on later life nutrition, the dyad of the fetus and pregnant woman and the dyad of infant and mother are an obvious framework. Attempts have been made to define more particular characteristics of increasing risk within these groups. However, not all persons at risk of an adverse outcome will necessarily benefit by a certain centerpiece measure of a given policy (Ruel *et al*., 1996). The most efficient programmes would be those that reach, in a targeted manner, those individuals within the groups at highest risk who may benefit from intervention measure(s).

Choices, paradoxes and dilemmas of policy and programme

In this discussion, traditional aphorisms are fitting. 'There is no free-lunch' is a common saying which applies to both policy and programme. This is not only because there are expenses involved, however. Paradoxically, in terms of public policy interventions, it is possible to do both good and harm at the same time in the same population, and even in the same individual. The population may be heterogeneous in age, income, gender and many other ways. Just as medications may be curative, but fraught with side effects, measures applied at the population level can be a two-edged sword for the individual (Gross & Solomons, 2003; Solomons *et al*., 2003).

Vertical vs. horizontal policy initiatives

With respect to public health policy and programme initiatives, the qualifiers are the terms 'vertical' and 'horizontal'. Vertical initiatives imply that resources and agenda are mobilized alone, and are delivered in specific contexts. The distribution of vitamin A capsules (West *et al*., 1989) to alleviate endemic hypovitaminosis A, is an example of a vertical, one-issue initiative.

Horizontal initiatives can be seen as constructing a public health crossword puzzle with a series of interlocking pieces reinforcing one another to construct the basis for optimal population health. A synonym for horizontal is often 'integral' or 'integrated'. A maximally blended, horizontal policy, applicable to the present concern of early life influences, has been enunciated by Wahlqvist (2002, 2004) under the term 'eco-nutrition'. An eco-nutritional public health policy to achieve broad and simultaneous goals in nutritional well-being would promote community development through concurrent education programmes, health programmes, economic initiatives and environmental strategies.

Universal vs. targeted policy initiatives

A major dilemma in the formulation of policy is often that of enacting a universal measure, i.e. one that reaches and affects everyone in the jurisdiction, vs. a targeted measure, i.e. one that directed at a specific (eligible and more vulnerable or appropriate) subgroup of the population. An example of a universal policy would be a ban on the sale of alcoholic beverages. Everyone is prevented from buying ethanol, but only those with an interest in purchasing it are effectively constrained. For the remainder of the population, it is a directed issue, although collateral effects from affected individuals close to the non-imbiber may occur.

A classic example of a targeted project is that of the Women, Infants and Children (WIC) assistant programme run by the US Department of Agriculture. This is explicitly designed to provide food to women in greatest need of support, i.e. targeted exclusively at the poorest recent mothers with nutritional deficits or at nutritional risk by virtue of a poor diet.

There are pros and cons to approaches involving targeting a population of specific interest. For the funding authority, costs can be contained by restricting investment to a subsection of the population and a targeted policy can be tightly linked to 'risk' and to 'capacity to benefit'. On the negative side, however, is the fact that screening methods may neither be sensitive nor specific enough. Screening may not uncover all of the women who are suited for the intervention and may include large numbers who have nothing specific to gain (Caulfield, 2004). Another drawback is the contrast within a closed community between those receiving an intervention and those

not. If it is perceived as a valuable and attractive benefit, a sense of discrimination may result among those excluded. On the other hand, if women are 'singled out' because they have a socially unpleasant condition, such as seropositivity for HIV, there could be stigmatization of those included (Caulfield, 2004).

Obviously, for improving long-term health from fetal life and infancy initiatives affecting fertile-age or pregnant women, as part of the general population or directed specifically to them, are required to be both universal and targeted, whilst minimizing adverse effects characteristic of each intervention.

Standard issue vs. creative approaches

Policy tends to be more conservative and conformist than creative. It seeks a 'fashionable' scenario often following the leadership of international or bilateral agencies. Parsimonious 'magic bullet' solutions are advocated to give the greatest impact for the funds invested and national governments are brought on board to adopt the agency consensus. Packages of programmes are designed and generalized that are aimed at instituting the 'correct' policy.

What may be needed, however, is not a 'standard' policy framework, but rather a creative and locally adapted scenario, based on biological and epidemiological findings relevant to the local ethnic, ecological and environmental characteristics. National governments must also be brought on board and consequences interpreted in terms of local risk. Such a policy would produce nuanced programmes, adapted to the settings, drawing upon the local cultural heritages. Wahlqvist (2002, 2004) has summarized the basic tenets of such a particularized and adaptive approach for nutrition policy in terms of 'eco-nutrition'.

Barriers to the policy transition to respond to nutrition transition

The 'nutrition transition' formulation of Popkin (Popkin, 1994; Caballero & Popkin, 2002) requires policy and programme to address overnutrition, as well as deficiencies. Since World War II, there has been a virtual policy lock on undernutrition, micronutrient deficiency states and food insecurity (SCN, 2004). Because the ethos of public health is to combat the state of 'having too little' and because the perception of chronic disease risk is that of 'having too much', shifting from the cause of the poor to the (perceived) cause of the 'rich' might present an ideological barrier.

It is difficult for policy-makers and programme-workers to fathom that present problems derive from a paradox. We are currently suffering the health consequences of an epidemic of sedentarism (Kyle *et al*., 2004; Manson *et al*., 2004) in a mechanized and informatics world resulting from the desire to create 'labor-saving' devices to liberate us from the drudgery of manual work and household maintenance. Achievement of this goal leaves society with lower tolerance for its energy intake together with reduced muscular and cardiovascular conditioning. The flight from drudgery has brought us a host of sedentarism-related problems.

A similar paradox faces public health professionals reflecting on the flight from famine, hunger and household food insecurity, which afflicted preindustrial societies. It may be difficult to justify attention to 'calorie control' to policy agencies and health workers accustomed over decades to combating the consequences of food scarcity. In the case of developing countries, 'emergence from food insecurity' may lead to a 'plenitude is beautiful' attitude. In a cultural sense, overweight may be seen as the confirmation of the 'Promised Land', of the 'liberation' to calorie sufficiency, were it not for the severe adverse effects on health that it brings.

Food trade norms and commercialization of foods in a free market system work against the individual ability to achieve energy balance intake within a high-quality diet. External forces open markets and opportunities that could work to the detriment of population health. These include the commercialization of crop seeds, agricultural commodities (wheat, soy, corn, vegetable oil), as well as the franchising of fast-food restaurants around the world (SCN, 2004) and a global market, which allows both bulk produce and finished ready-to-serve products to travel freely disrupting conservationist efforts to keep traditional cuisines and food habits intact.

From 'energy supply' to the 'quality of the diet' and 'healthful dietary pattern'

Behaviours that will produce a more nourishing fetal environment and improved infant nutrient supply must be harmonized with other guidelines and recommendations for maternal nutrition. The focus has moved from food security (energy and protein availability and accessibility) to adequate micronutrient density and bioavailability (to combat endemic nutritional anemias, iodine deficiency disorders and hypovitaminosis A), and on to healthful dietary patterns (i.e. that minimize risks of metabolic syndrome and malignancies).

A final barrier to policy transition derives from our traditional use of the wrong indicators for population nutritional status. An example is the traditional use of 'weight for age', referenced to international standards. The counting of underweight has been used as an index of undernutrition in a population, without noticing a central paradox. Because populations are severely stunted, an individual may (at the same time) be 'underweight' compared to a US peer and 'overweight' in relation to desirable body composition for height (Trowbridge *et al*., 1980). In part, this index, which only requires weight and age, was used out of a reluctance to invest effort in getting a valid measure of length or height. Assessment and monitoring becomes more laborious when stature measures must be gathered, but the body mass index references must be adopted and (ideally) more refined measures of body composition must be employed, even with the requirement for more training, effort and costs. Transition to the dual concern of both under- and overnutrition requires that policy analysis and programme evaluation use newer and better fundamented diagnostic tools.

The targets of evidence-based policy and programmes

With respect to early life nutrition, possibilities exist for modifying behaviour, the maternal diet, breastfeeding practices, and infant feeding and caring practices. These factors could all effect attainment of size in early life, although infant growth per se, with its genetic component, cannot be totally determined. Evidence from public health research can help determine the most beneficial programmatic actions.

Maternal (gestational) diet

What a mother eats during pregnancy involves options. Selection of foods can be determined by local customs adopted by the mother, preference of the larger family circle and household economics. How available or accessible are the necessary healthy, nutritious foods? Pre-pregnancy weight and intragestational weight gain are major determinants of birthweight (Worthington-Roberts, 1985; Vobecky, 1986), and would seem to be susceptible to dietary intervention. The quality of the diet has also been cited as a determinant factor in birth (Susser, 1991). The health of the mother, specifically her sense of well-being, which might affect her appetite and willingness to consume a nutritious diet, is also important (Coad *et al*., 2002). Interventions with specific micronutrients in pharmaceutical preparations, such as iron (Rasmussen, 2001), zinc (Osendarp *et al*., 2003) or multiple micronutrients (Christian *et al*., 2003), have shown variable impact on fetal growth, fetal survival and birthweight.

Breastfeeding practices

Breastfeeding practices involve standards. Associations of health professionals have made specific recommendations and guidelines for the exclusivity and duration of breast feeding in infants (Anon, 1982; WHO, 2002). However, the quantity of milk consumed by the baby can be governed by demand and supply. Maintaining the health and care of the baby favours a vigorous appetite and hearty milk intake. Mothers' health and nutrition, correspondingly, permits maximal production and response to the sucking demands of their offspring. Measures to maintain optimal health in both parties can be part of policy.

Infant feeding and caring practices

Infant feeding throughout the weaning period to the full introduction of complementary foods also

involves discretionary options, which are subject to overall guidelines and standards (SCN, 2003). Again, the infant's health status can affect appetite and intake, and measures to conserve good health favour good nutrition and infant care, in terms of stimulation and hygiene, are also important (Engle *et al*., 2000). Maternal and grandmaternal beliefs, based on local or tribal customs regarding food selection, timing and amount, may determine intake; and even if good guidelines are accepted by the carers, household economics in terms of income and demand on resources will ultimately determine a family's ability to achieve best feeding practice.

Notes of cautions in policy transition

Policy transition is, by concept and definition, a new and meta-stable adventure. It can move actions into recommended practice – but through largely uncharted waters. Policy makers and monitors must search for any adverse consequences and adapt the policies and programme to mitigate these effects. An example of an emerging policy that has to balance its beneficial and detrimental features is the promotion of increased consumption of fruits, vegetables or both. Five to nine servings a day are recommended by the US Food Pyramid (Davis *et al*., 2001) and by other dietary guidance documents (WCRF, 1997), and usually called the 'Five-a-Day' recommendation, based on the minimal serving in the Food Pyramid (Anderson, 2000). Vast recent literature supports the notion that increasing consumption of fruits and vegetables, so that at least five servings are eaten, is a promising intervention to reduce risk of obesity and many non-transmissible diseases (Feldman, 2001; Joffe & Robertson, 2001; Joshipura *et al*., 2001).

A fruit and vegetable-rich diet may contribute beneficial outcomes because of its rich water content, dilution of total meal calories and rich content of certain micronutrients such as vitamin C, vitamin K, potassium, magnesium and folates, However, vegetables and fruits are poor in certain micronutrients and by substituting for foods of animal, cereal, tuber and legume origin may variously reduce the density of vitamin B12, vitamin D, bioavailable vitamin A, calcium, iron, zinc and selenium in the meal.

This caution in promoting fruit and vegetables must be exercised for the three groups of interest to 'early life nutritional influences'. The growth of children below 2 years of age can be compromised by restriction of energy, calcium, vitamin D and trace elements; adequate intakes of these nutrients must be guaranteed. For preschool children and juvenile girls, the aim is to break the cycle of small mothers with small pelvises inclined to giving birth to small offspring; hence, adequate energy and protein densities for maximal linear growth are needed for this group. For nursing women, energy-adequate and micronutrient-dense diets are needed to support lactation, and ensure simultaneous protection of milk quality and the maternal nutritional state.

Multisectorial communication

The Eco-nutritional mandate of Wahlqvist (2002, 2004) justifies the need for wide and deep biological questions. Rational health policy and effective programmes require both multisectorial consultation and communication, covering a wide network, if policies are to be effectively carried out. Given the complexity of early influences on later-life health, not only Ministries of Health but also those of Agriculture, Trade and Commerce, Education, Culture/Recreation, Environment, and even Finance must be involved. Outside government, private industry financiers, importers, agro-industrialists and retailers, together with consumer advocates, religious institutions, community groups and universities must be enlisted into any campaign surrounding preventive health.

Conclusions

The undeniable evidence that non-transmissible diseases are on the rise in developing countries, and are replacing infectious diseases as the leading causes of morbidity and mortality (Murray & Lopez, 1994; Yach *et al*., 2004), is not comforting news for international or local health officials. Aborting a pandemic of chronic disease is now a priority of the United Nations' agencies (WHO, 2003a, 2003b). The evidence presented at the workshop contributes to clar-

ifying the impact of early life nutritional influences on the genesis of non-transmissible diseases in later adult life, and having a transparent evidence-base guiding public health is clearly superior to any alternative approach.

Policy and programmes begin with the definition of goals. How far up or down the chain one focuses this definition, the more concrete and objectifiable can be the programmatic attempts at execution. In the area of tobacco use, for example, one could focus on the top of the chain by 'eliminating the activity of smoking' itself, or further down the cascade to the 'reduction of smoking-related lung cancer'. This paper discusses something quite specific, 'Early Nutritional Influences on Obesity, Diabetes and Cardiovascular Disease Risk', and the context of the policy and programme aspect is for 'developing countries'. We may actually gain more from analysing the nature of such a challenge than mobilizing any serious attempt to address it. There is no monolithic 'developing world'. The 80% of the world that lives with major degrees of poverty and deprivation is governed within systems which differ enormously in the tendencies or abilities to generate and execute policy and programmes. Moreover, with respect to the risk of non-transmissible diseases in later life, the relative determination by early life nutritional influences is likely to differ widely. For the same array of factors, susceptibility to benefiting from the application of specific changes of nutritional behaviour is also likely to have its imponderables. This should not make us nihilistic with respect to remedial action, but 'cautiously realistic' about the limits of effectiveness and impact thorough public health efforts.

Seven guiding considerations are outlined in Table 2. These distill the tentative dos and don'ts that emerge at the interface of the evidence of pathogenesis in early life and mobilization of efforts to redress this at a more generic perspective. The proceedings of this workshop, in fact, initiate the sequence as the distillation of evidence from the meeting provides a concentrated resource to begin the reeducation and sensitization of the policy decision-making community as outlined as the first step in Table 2. Since such a step cannot be by-passed in the march toward policy and programme transition to alleviate non-transmissible disease risk in developing countries, these discussions should be widely disseminated – especially among governmental officials in low-income societies, this building the bridge of consciousness that leads to rationale policy development in the areas of concern.

Table 2. Tentative suggestions and guidelines for the policy and programme transition to alleviating non-transmissible disease risk

1. (Re)educate and sensitize the leadership and authorities at all policy levels (international, national, regional) with the evidence-base for a concern for non-transmissible disease epidemics and the role of early life nutritional strategies to blunt the risks of later-life chronic diseases. Must be done in harmony with (not as counterpoint to) the established concerns for food insecurity and micronutrient malnutrition.

2. Move from the exclusive 'Ministry-of-Health obsession' to a broader, multisectoral coalition strategy that includes the governmental sectors of Agriculture, Trade and Commerce, Economy, Finances, Education and Culture and Recreation as well as the stakeholders in the private sector and civil society.

3. Avoid the temptation for 'magic bullets' and 'one-size-fits-all' universal solutions promulgated by the international (multilateral and bilateral) agencies and interests, and locally individualize the formulas for changes in policies and programme efforts toward reducing chronic disease in later life.

4. Prioritize the most inexpensive-to-mount and/or the most cost- effective programmes initially in order to avoid 'Sticker Shock' for the constrained operating budgets of developing countries.

5. Exercise careful deliberations regarding the policy choices between universal, mass interventions (with the adverse consequences of creating entitlements for individuals neither at risk nor in the line of benefits) vs. selectively targeted interventions (with their dual drawbacks of stigmatization and perception of discrimination).

6. Continue to emphasize (and at the same time redirect) the education and empowerment of women in developing countries as the most proximal lever for effecting beneficial practices and attitudes in the home. This is preconditioned by campaigns to bring women to full literacy and scholastic parity with men, and assuring their economic rights within the household.

7. All that is simple is not safe. Emphasize and integrate a concern for 'safety testing' of interventions in both the short-term of efficacy trials and in long-term monitoring. The same measures may have benefits and risks all in the same, but with different time-courses, with the benefits emerging early and the adverse effects manifesting later.

References

Anderson A.S. (2000) How to implement dietary changes to prevent the development of metabolic syndrome. *British Journal of Nutrition*, **83**(Suppl. 1), 41–45.

Anon. (1982) Promotion of breast feeding: recommendations of the Councils of the Society for Pediatric Research (SPR) and American Pediatric Society (APS), and of the American Academy of Pediatrics (AAP). *Pediatric Research*, **16**(4 Part 1), 264–265.

Buekens P., Keusch G., Belizán J. & Bhutta Z.A. (2004) Evidence-based global health. (Editorial). *JAMA*, **291**, 2639–2641.

Caballero B. & Popkin B.M. (eds) (2002) *The Nutrition Transition: Diet and Disease in the Developing World*. Academic Press: London.

Caulfield L. (2004) Methodological challenges in performing targeting. Presented in the Symposium on Challenges in Targeting Nutrition Programmes. Experimental Biology 2004, Washington DC April 2004. 285.

Chalmers T.C., Block J.B. & Lee S. (1972) Controlled studies in clinical cancer research. *New England Journal of Medicine*, **287**, 75–78.

Christian P., West K.P. Jr, Khatry S.K., Leclerq S.C., Pradhan E.K., Katz J. *et al.* (2003) Effect of maternal micronutrient supplementation on fetal loss and infant mortality: a cluster-randomized trial in Nepal. *American Journal of Clinical Nutrition*, **78**, 1194–1202.

Coad J., Al-Rasasi B. & Morgan J. (2002) Nutrient insult in early pregnancy. *Proceedings of the Nutrition Society*, **61**, 51–59.

Cordain L. (1999) Cereal grains. Humanity's two-edged sword. In: *Evolutionary Aspects of Nutrition and Health: Diet, Exercise, Genetics, and Chronic Disease* (ed. A.R. Simopoulos), pp 19–73. S Karger AG: Basel.

Cordain L., Eaton S.B., Sebastian A., Mann N., Lindberg S., Watkins B.A. *et al.* (2005) Origins and evolution of the western diet: Health implications for the 21st century. *American Journal of Clinical Nutrition*, **81**, 341–354.

Davis C.A., Britten P. & Myers E.F. (2001) Past, present, and future of the Food Guide Pyramid. *Journal of the American Dietetic Association*, **101**, 881–885.

Engle P.L., Bentley M. & Pelto G. (2000) The role of care in nutrition programmes: current research and a research agenda. *Proceedings of the Nutrition Society*, **59**, 25–35.

Eriksson J.G. (2005) Early growth and adult health outcomes – lessons learned from the Helsinki Birth Cohort Study. *Maternal and Child Nutrition*, **1**, 149–154.

Faith M.S. & Kerns J. (2005) Infant and child feeding practices and childhood overweight: the role of restriction. *Maternal and Child Nutrition*, **1**, 164–168.

Feldman E.B. (2001) Fruits and vegetables and the risk of stroke. *Nutrition Reviews*, **59**(1 Part 1), 24–27.

Fogel R.W. & Helmchen L.A. (2002) Economic and technological development and their relationships to body size and productivity. In: *The Nutrition Transition: Diet and Disease in the Developing World* (eds B. Caballero & B.M. Popkin), pp 9–24. Academic Press: London.

Garrett J. & Ruel M.T. (2005) The coexistence of child undernutrition and maternal overweight. Prevalence, hypotheses, and programme and policy implications. *Maternal and Child Nutrition*, **1**, 185–196.

Gluckman P.D., Hanson M.A. & Pinal C. (2005) The developmental origins of adult disease. *Maternal and Child Nutrition*, **1**, 130–141.

Gross R. & Solomons N.W. (2003) Research needs in micronutrient deficiencies. *Food and Nutrition Bulletin*, **24**, S42–S53.

Habicht J.P., Victora C.G. & Vaughan J.P. (1999) Evaluation designs for adequacy, plausibility and probability of public health programme performance and impact. *International Journal of Epidemiology*, **28**, 10–18.

Haddad L. (2003) *What Can Food Policy Do to Redirect the Diet Transition?* FCND Discussion Paper No. 165. Washington, DC. International Food Policy Research Institute: Washington, DC.

Hediger M.L. (2004) Breastfeeding and the risk of chronic disease. International Workshop on Early Nutrition: Influences on. Obesity Diabetes and Cardiovascular Disease Risk, Montreal, 6–9 June 2004, Final Programme, 2004: 15.

Houston R. (2003) *Why They Work: An Analysis of Three Successful Public Health Interventions – Vitamin A supplementation programs in Ghana, Nepal and Zambia*. The MOST Project/US AID: Rosslyn, VA.

Joffe M. & Robertson A. (2001) The potential contribution of increased vegetable and fruit consumption to health gain in the European Union. *Public Health Nutrition*, **4**, 893–901.

Joshi N. (2004) Maternal nutrition and cardiovasacular risk in the offspring. Pune Maternal Nutrition Study. International Workshop on Early Nutrition: Influences on Obesity Diabetes and Cardiovascular Disease Risk. Montreal, 6–9 June 2004, Final Programme, 2004: 14.

Joshipura K.J., Hu F.B., Manson J.E., Stampfer M.J., Rimm E.B., Speizer F.E. *et al.* (2001) The effect of fruit and vegetable intake on risk for coronary heart disease. *Annals of International Medicine*, **134**, 1106–1114.

Kuh D. (2004) Integrating the early nutritional influences into a life course approach. International Workshop on Early Nutrition: Influences on Obesity Diabetes and Cardiovascular Disease Risk, Montreal, 6–9 June 2004. Final Programme, 2004: 12.

Kyle U.G., Morabia A., Schutz Y. & Pichard C. (2004) Sedentarism affects body fat mass index and fat-free mass index in adults aged 18–98 years. *Nutrition*, **20**, 255–260.

Langley-Evans S.C., Bellinger L. & McMullen S. (2005) Animal models of programming. Early life influences on appetite and feeding behavior. *Maternal and Child Nutrition*, **1**, 142–148.

Law C. (2005) Early growth and chronic disease: a public health overview. *Maternal and Child Nutrition*, **1**, 169–176.

Manson J.E., Skerrett P.J., Greenland P. & VanItallie T.B. (2004) The escalating pandemics of obesity and sedentary lifestyle. A call to action for clinicians. *Archives of International Medicine*, **164**, 249–258.

Manton K.G. (1988) The global impact of noncommunicable diseases: estimates and projections. *World Health Statistics Quarterly*, **41**, 255–266.

Manton K.G. (1991) The dynamics of population aging: demography and policy analysis. *Milbank Quarterly*, **69**, 309–338.

Merriam-Webster's Dictionary. (2004). Merriam-Webster Inc.: Springfield, MA.

Milton K. (2000) Hunter-gatherer diets – a different perspective (Editorial). *American Journal of Clinical Nutrition*, **71**, 665–667.

Murray C.D.L. & Lopez A.D. (1994) *Global Comparative Assessment in the Health Sector*. World Health Organization: Geneva.

Osendarp S.J., West C.E., Black R.E. & Maternal Zinc Supplementation Study Group. (2003) The need for maternal zinc supplementation in developing countries: an unresolved issue. *Journal of Nutrition*, **133**, 817S–827S.

Popkin B.M. (1994) The nutrition transition in low-income countries: an emerging crisis. *Nutrition Reviews*, **52**, 285–298.

Rasmussen K.M. (2001) Is these a causal relationship between iron deficiency or iron deficiency anaemia and weight at birth, length of gestation and perinatal mortality? *Journal of Nutrition*, **121**, 590S–603S.

Ruel M.T., Habicht J.P., Rasmussen K.M. & Martorell R. (1996) Screening for nutrition interventions: the risk or the differential-benefit approach? *American Journal of Clinical Nutrition*, **63**, 671–677.

Sawaya A.L., Sesso R., de Menezes Toledo Florencio T.M., Fernades M.T. & Martins P.A. (2005) Association between chronic undernutrition and hypertension. *Maternal and Child Nutrition*, **1**, 155–163.

Simoons F.J. (1978) The geographic hypothesis and lactose malabsorption. A weighing of the evidence. *American Journal of Digestive Diseases*, **23**, 963–980.

Solomons N.W. (1994) Biological, ecological and social origins of trace elements deficiencies in developing countries. In: *Nutrition in a Sustainable Environment. Proceedings of the XV International Congress on Nutrition* (eds M.L. Wahlqvist, A.S. Truswell, R. Smith & P.J. Nestel), pp 299–302. Gordon-Smith: London.

Solomons N.S. & Latham M.L. (1994) Symposium on clinical nutrition in developing countries: toward the application of contemporary concepts and technology. Introduction. *Journal of Nutrition*, **124**(Suppl. 8), 1447S–1448S.

Solomons N.W., Orozco M. & Schümann K. (2003) Safety and security considerations of micronutrient interventions: Fitting in red palm oil. In: *Proceedings of the PIPOC 2003 International Palm Oil Congress – Food Technology and Nutrition Conference* (ed. K. Sundram), pp 83–96. Malaysian Palm Oil Board: Kuala Lumpur.

Standing Committee on Nutrition, United Nations System. (2003) Meeting the challenge to improve complementary feeding. *SCN News*, **27**, 1–82.

Standing Committee on Nutrition, United Nations System (2004) *Nutrition for Improved Development Outcomes*. 5th Report on the World Nutrition Situation. SCN: Geneva.

Stein A.D., Thompson A.M. & Waters A. (2005) Childhood growth and chronic disease: evidence from countries undergoing the nutrition transition. *Maternal and Child Nutrition*, **1**, 177–184.

Susser M. (1991) Maternal weight gain, infant birth weight, and diet: causal sequences. *American Journal of Clinical Nutrition*, **53**, 1384–1396.

Trowbridge F.L., Newton L., Huong A., Staehling N. & Valverde V. (1980) Evaluation of nutrition surveillance indicators. *Bulletin of the Pan American Health Organization*, **14**, 238–243.

Victora C., Habicht J.P. & Bryce J. (2004) Evidence-based public health. Moving beyond randomized trials. *American Journal of Public Health*, **94**, 400–405.

Vobecky J.S. (1986) Nutritional aspects of preconceptional period as related to pregnancy and early infancy. *Progress in Food and Nutritional Science*, **10**, 205–236.

Wahlqvist M.L. (2002) Chronic disease prevention: a life-cycle approach which takes account of the environmental impact and opportunities of food, nutrition and public health policies – the rationale for an eco-nutritional disease nomenclature. *Asia Pacific Journal of Clinical Nutrition*, **11**(Suppl.), S759–S762.

Wahlqvist M.L. (2004) Nutrition and prevention of chronic disease: a unifying eco-nutritional strategy. *Nutrition Metabolism and Cardiovascular Diseases*, **14**, 1–5.

West K.P. Jr, Howard G.R. & Sommer A. (1989) Vitamin A and infection: public health implications. *Annual Reviews of Nutrition*, **9**, 63–86.

Willett W.C. (1998) *Nutritional Epidemiology*. Oxford Press: London.

World Cancer Research Fund (1997) *Food, Nutrition and Prevention of Cancer. A Global Perspective*. American Institute for Cancer Research: Washington, DC.

World Health Organization. (2002) *The Optimal Duration of Exclusive Breastfeeding*. Report of an Expert Consultation. WHO: Geneva.

World Health Organization. (2003a) *Integrated Prevention of Noncommunicable Disease. Draft Global Strategy on Diet, Physical Activity and Health.* Document EB113/44. WHO: Geneva.

World Health Organization. (2003b) *Report of the Joint WHO/FAO Expert Consultation on Diet, Nutrition and Prevention of Chronic Diseases.* WHO Technical Report Series 916. WHO: Geneva.

Worthington-Roberts B. (1985) The role of nutrition in pregnancy course and outcome. *Journal of Environmental Pathology Toxicology and Oncology*, **5**, 1–80.

Yach D., Hawkes C., Gould C.L. & Hofman K.J. (2004) The global burden of chronic diseases: Overcoming impediments to prevention and control (Special Communication). *JAMA*, **291**, 2616–2622.