

NUTRITION SCREENING IN OLD PEOPLE: Its Place in a Coherent Practice of Preventive Health Care

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KEY WORDS: prevention, screening, aging, intervention, evaluation

ABSTRACT

The central demographic reality of our times is the rapid aging of our society. Preventive nutritional and preventive health care of older people, therefore, are pressing issues that must be contended with. Several strategies for this are possible, including the broadcasting of general nutritional and health messages to the population, the inclusion of preventive nutrition and health as part of routine primary care, and nutrition screening: a process of self-identification by the older population in which they judge for themselves whether they are at nutritional risk and, if so, seek the care of professionals. This review focuses on some of the necessities for screening: sensitive, specific, and inexpensively applied screening devices; and explicit interventions that do not have major public health benefit for those who screen negative. Unfortunately, there is little evidence that screening is beneficial, nor have the benefits of this strategy been compared with its alternatives. Thus, the ethical imperative of screening has not been met: that because the activity is being promoted (it is not initiated by the public), its benefit must be conclusive.

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INTRODUCTION

American society is undergoing massive changes in demography, health status, and health care. Among these changes, three aspects in particular will have an enormous impact on the health care of our aging population: the rising cost of health care; the rapid increase in numbers and proportion of the elderly; and the remarkable decline in incidence of, and mortality from, heart disease. These changes make uncertain who will deliver health care—and what form it will take—in the twenty-first century.

America's struggle to restructure its health care system has not been smooth. The key goal during the first two years of the Clinton presidency was the financing of those not covered by health insurance. Now the issue is cost; the proportion of the gross national product that goes toward health care in the United States has risen steadily over the last decades and is already far higher than what other industrialized societies allot. The debate about containing costs is contentious. The concept of cost-benefit is not quite archaic, but cost containment (and profit making) are the central issues now. There has also been concern that cost containment will erode the quality of health care. Before, such issues as what services would be reimbursable and who would deliver them were in the forefront. Now the focus is on how much (or how little) service will be available from the health maintenance organizations that increasingly dominate American health care.

The increasing numbers and proportion of old people in the population will have a profound impact on every aspect of our society, from housing to work patterns to taxation, but nowhere more so than on health care. Between 1960

and 1990, the total US population grew by 39%, that portion over 64 years of age grew by 89%, and the portion over 84 years of age grew by 232% (10). There are currently 3.5 million people in the United States who are 85 years or older; one estimate of the number of people who will be over 65 years of age in the year 2020 is 64 million, or 22% of the total US population, of whom 8.8 million will be 85 years of age or older (58). Another estimate is that by the year 2040, the number of Americans over the age of 84 may be 24 million or more (10). This increase in the number of old people will change all aspects of health care; it also represents a marketing opportunity for those whose goods and services will be purchased by or for this expanding cohort.

Interrelated with these changes is the unprecedented decrease in the incidence and fatality from heart disease, the primary cause of mortality among adults in industrialized countries (73). Between 1972 and 1992, the death rate in the United States from coronary heart disease decreased by 49% and from stroke by 58% (65). The population is living longer, and rates of incidence of, and mortality from, heart disease have been decreasing. At the same time, levels of disability in the elderly are going down (69). All these issues are interlinked with nutrition in a complex and as yet poorly understood way. In an analysis of the NHANES I follow-up study (34), stretching from 1971 through 1987, the factors that were independently related to death and hospitalization from heart disease included exercise, body mass index, dietary riboflavin and iron, and serum magnesium, all in the expected direction. Thus, nutrition is associated intimately with the profound reduction in disability and death from heart disease [e.g. the substantial decline in serum cholesterol levels in US adults (51) increased life expectancy and decreased rates of disability].

Diet and Health was developed in the context of these massive changes. In its Executive Summary (23), the Committee on Diet and Health of the Food and Nutrition Board said that in order to improve population health through better diet, "there are two complementary approaches to reducing risk factors in the target population. The first, the public health or population-based approach, is aimed at the general population, and the second, the high-risk or individual-based approach, is aimed at individuals with defined risk profiles." They go on: "...it is usually not possible to make recommendations for individuals. On the other hand because the major chronic disease burden falls on the general population (approximately 70% of all deaths in the U.S. population are due to cardiovascular diseases and cancer), the most benefit is likely to be achieved by a public-health prevention strategy to shift the distribution of dietary risk factors and means of dietary recommendations to reduce chronic disease risk in the general population...Therefore, in the committee's judgment, an effective preventive strategy should be aimed at the general public and, where knowledge permits [emphasis added], it should be complemented

with recommendations for those at high risk.” This review aims to explore these issues.

I primarily address issues of nutrition screening and health in the community-dwelling elderly. Hospitalized or institutionalized patients present a different mix of problems. They are, on average, sicker, more disabled, and under more intense supervision and scrutiny by professional caregivers. With a “captive” population, health and nutritional intervention can be done systematically and intensively. (Some of the obstacles to understanding nutritional needs in the home-dwelling elderly are mirrored in work with the institutionalized, and I therefore refer to some work on nutrition in the care of the institutionalized elderly.)

Haddix et al (39) present a framework for addressing the issues under concern here in a systematized way. Preventive programs are amenable to orderly quantitative analysis, and preventive nutrition requires no less careful attention than the programs Haddix et al discuss.

NUTRITIONAL STATUS IN RELATIONSHIP TO OLD AGE

Changes in Nutritional Status with Age

There are many changes in physiologic function, nutritional status, and diet with aging (46, 79, 104). That said, it is by no means clear whether change is inherent to the aging process or whether it reflects changes in physical activity, diet, or musculoskeletal integrity, either because of chronic illness, disability, poor oral health, decline in chemosensory function, dementia, depression, loneliness, etc, or from disease processes themselves.

Nutritional Status of Old People Across the Developed Societies

Knowing the prevalence and causes of nutritional problems is essential for planning programs for preventive nutrition, including screening: The cost and benefit from the application of screening instruments, whatever their sensitivity and specificity, will vary in utility depending on the prevalence of the problems detected.

There are large differences in nutritional status across different populations of old people, even in the economically developed countries. The recently reported SENECA studies (14, 15) show extraordinary variability across 16 communities in 11 European countries in such indices as physical activity, body mass, serum lipid levels, amount and composition of fat and other food intake, etc. (The authors do not report whether these differences are associated with differential health outcome.)

The British nutrition survey of the elderly (16), a representative survey of 1879 men and women over the age of 65, found that only 27, or 1.4%, of the subjects could be labeled malnourished, usually because they were thin. Of the 15 subjects (0.7%) thought to be malnourished not secondary to concurrent disease, and thus suffering from primary malnutrition, six were judged to have "a failure adequately to cope," one woman was restricted in expenditure by her husband, and eight were found to have no clear social or medical reason for their condition. Of the 27, 4 were judged unable to masticate efficiently, a proportion not different from that of the sample as a whole. Given low frequency, the efficiency of population screening for malnutrition would have been very low.

This cohort was followed up seven years later (17). In this follow-up, 26 of 365 subjects were judged to be malnourished (7.1%). Five of these were postgastrectomy and therefore represented failures in follow-up care rather than examples of primary malnutrition. Six geographic areas were studied, and 18 of the 21 subjects who were malnourished (but not postgastrectomy) came from the same area. Thus, malnutrition that was not a result of postgastrointestinal surgery was very rare (3/243) in five of the six areas of the survey but common in one (15%). Social and other conditions that led to malnutrition in the aged were thus geographically highly focal: A policy of universal screening might have foundered without initial area estimates of the extent of poverty, availability of food, etc, in order to plan and implement programs where they were most needed.

Thorslund et al (108) applied some of the assessment parameters typically used in the nutritional evaluation of institutionalized subjects to 1206 randomly selected people between 65 and 80 years old living in their own home in one Swedish town. They defined 5% of the population as malnourished using a combination of their criteria. Although not statistically significant, the magnitude of difference [from a little over 3% of those under 65, to over 6% (among males, over 8%) for those 80 and over] was appreciable.

There were no federally sponsored national studies of the nutrition and health of people over 75 years of age prior to the current NHANES III study (72). We are thus at the beginning of a systematic study of nutritional status of the American elderly. In a recent small survey, Ryan et al (95) found lower-than-recommended intakes of energy and a series of micronutrients.

Roe (92) addressed the frequency of hunger in the US elderly. She referred to a study by the Food Research and Action Center done on a (nonrepresentative) sample of 3600 old people in 1984 and 1985 in the United States and noted that 35% ate fewer than three meals a day and 5.4% were without food for more than three days in a row during the month before the survey. Some 18.1% responded positively to the statement "I do not have enough money to buy the food I need,"

and 17.2% indicated that they were unable to shop for or prepare their own food. The meaning of these data, given the nonrepresentative sampling, is unclear, but these results are different from those of the British surveys. Roe had found that of the frail elderly she surveyed, 25% received fewer than seven hot meals a week, and 16% went one or more days a week without food. These issues are now being studied in a representative sample of the US elderly by the Bureau of the Census.

What is Malnutrition and How Does It Relate to Nutritional Screening?

The American Heritage Dictionary defines malnutrition as “poor nutrition because of insufficient or poorly balanced diet or because of defective digestion or defective utilization of foods” (1). This definition concerns foods and diet. Yet most of the systems for evaluating elderly nutritional status, at least of institutionalized subjects, do not include diet, because diet is probably a small contributor to their nutritional status as typically defined by anthropomorphic indices, serum albumin or other protein levels, hypocholesterolemia, lymphocyte counts, and energy assessed by decreased delayed cutaneous hypersensitivity. However, there is little evidence that low serum albumin levels reflect starvation or cachexia or that they can be reversed by diet. Keys et al (55) demonstrated that in starvation, the body pool of serum albumin did not decrease but rather was diluted by increased plasma volume. Munro et al (80) demonstrated that in a group of elderly volunteers in Boston, the average protein intake was high (well above the recommended daily allowance), and that although several plasma proteins (albumin, prealbumin, transferrin) decreased somewhat with age, protein intake was not correlated with plasma protein level nor with the muscle mass of the upper arm. Durnin & Fidanza (18) reviewed the serum proteins that might be satisfactory indices of protein turnover, but all were subject to a multiplicity of determinants, of which diet was minimally important. There has been endless confusion because various parameters have been labeled as indices of nutritional status, but they are all multiply determined, only reflect diet weakly or not at all, and typically have not been shown to be amenable to change by nutritional intervention.

However, dietary intervention may be of great benefit and needs further careful study. Larsson et al (61) randomly allocated 501 new geriatric patients either to an experimental group that received 400 kcal in addition to standard hospital diet or to a control group that received hospital diet alone. The nutritional status of both groups deteriorated from admission to week 26 of long-term care, but among those who were well nourished on admission, 8.3% of the group that received nutritional supplements became malnourished vs 21.1% of the control group. Mortality rates were significantly lower among those given nutritional support versus the control group (8.6% vs 18.6%, respectively).

The utility of risk assessment alone could be studied: A randomized trial of assigning a risk statement to the patient (without further explicit intervention) would be an analog of the studies on health risk appraisal (100, 107). Thus, the effect of informing people of their prognosis for morbidity and mortality from indices of nutritional status (see particularly 66) could be, but has not been, empirically tested to establish whether it delivers some benefit.

WHAT SHOULD BE THE CONTENT OF PREVENTIVE NUTRITION?

Current Schemes Detailing the Content of Health Maintenance in Primary Care

The lives of the majority of American old people intersect frequently with the health care system, and the strategy of including nutrition in their periodic health examination is attractive. Lee (64) reported that as of 1993, nearly 80% of American adults had had routine health checkups, over 60% had received some form of health counseling, and over 50% had had their cholesterol level checked in the past two years. There have been several specifications of good adult health maintenance and anticipatory care. Among them are the report of the Canadian Task Force on the Periodic Health Examination (11), a review by Kane et al on prevention in the elderly (52), a series of papers by Frame (27–30), and the Report of the US Preventive Services Task Force (90), which has published separately its recommendations for older adults (122, 123).

The latter suggest screening for tobacco use, alcohol abuse, obesity, total serum cholesterol in middle-aged men, and dental health, and when clinically indicated for diabetes, anemia, osteoporosis, dementia, and depression. They recommend counseling to maintain physical activity, low-dose aspirin therapy for men with risk factors for myocardial infarction, and estrogen therapy for women at high risk of osteoporosis.

Barriers to Changing Health Behaviors

Any preventive strategy must educate and counsel the public in order to help them modify their nutritional behavior in a healthy way. Simons-Morton et al (103) extensively reviewed controlled studies of patient education and counseling for preventive health behaviors and concluded that “(e)vidence for which approaches to patient education and counseling are most effective is sparse.” They write: “Physicians have been involved in patient education for smoking cessation, alcohol control, injury prevention, but not for other prevention areas” and that “(t)he involvement of physicians in nutrition, weight control and studies of addictive behaviors, therefore seem to deserve additional attention.” On the other hand, Pill et al (86) studying working-class women found that over a five-year recall period lifestyle counseling (smoking, alcohol,

and exercise) was remembered by 48% of patients, a higher frequency than was found in doctors' records, and that the majority of these women acted on the advice of their doctors.

In a study of Massachusetts primary care physicians, first conducted in 1981 and repeated in 1994 (113), the percentage who felt it was very important for the average adult to engage in exercise rose from 27% to only 37%, but the percentage who believed it was important to avoid foods high in saturated fats rose to 55%. The proportion that believed that excess calories should be avoided and that one should eat a balanced diet fell significantly. Although physicians reported feeling "very prepared" to counsel patients about smoking, alcohol use, and exercise, fewer than half felt very prepared to counsel patients about diet and several other behavioral factors, and only a small minority described themselves as "very successful" in helping patients change their behaviors. Preventive health, and especially nutritional counseling, is being given inconsistently and is clearly not a high priority. We may guess at several causes: ignorance on the part of the practitioner, belief that time spent on these activities confers less benefit than standard therapeutic practices do, changing and seemingly contradictory information received from the scientific community, and/or a belief that health behavior cannot be influenced. We need better to understand how to overcome these barriers.

NUTRITIONAL SCREENING

Screening is appropriate (a) where an important but relatively small proportion of the population is affected, (b) where those affected can be identified with some test that can be effectively applied by a screening program (i.e. Pap smears for cervical cancer or mammography for breast cancer), (c) where it leads to effective intervention, and (d) where considerable public health benefit is not sacrificed by not treating those at moderate, or even low, risk.

Definitions of Screening

In his book *Screening in Chronic Disease*, Morrison (76) gives the following as the primary definition of screening: "the examination of asymptomatic people in order to classify them as likely, or unlikely, to have the disease that is the object of screening. People who appear likely to have the disease are investigated further to arrive at a final diagnosis." He also says: "Screening may refer to the identification of people at high risk [emphasis added] of a disease, but who do not yet have it." Morrison also notes that the term screening is sometimes used to refer to a series of tests done on symptomatic patients for whom a diagnosis has not yet been established. "This type of screening is part of the practice of clinical medicine rather than public health or preventive medicine."

In this review, the term screening is used in its usual, or public health, sense for presymptomatic disease (secondary prevention), or for risk factors for disease or disability (primary prevention).

Screening raises several ethical as well as practical problems. It alters the traditional doctor-patient relationship in ways that raise issues of ethics and trust. Traditionally, it is the patient, or client, who takes the initiative and requests help; the care giver responds to the best of his/her ability. With screening, it is not the client who initiates intervention but the health professions, invoking their knowledge and authority. Such interventions, however well motivated, consume time and resources; it is essential on several counts that the public can be assured to what extent they will be benefited by them. They require a higher level of certainty for implementation than do interventions in response to patient-initiated requests for symptomatic treatment.

Justifications for Screening

There are several prerequisites for a screening program (94).

1. Acceptable levels of sensitivity in the screening instrument (the ability to identify those with presymptomatic disease or risk factors for disease), specificity (the ability to classify correctly those without disease or risk factors), and relatively high predictive validity (the proportion of those screened positive who are truly positive). If the prevalence of the condition is very low, the population screen will yield relatively few cases compared with false positives and might prove to be cost or otherwise ineffective.
2. The availability of proven interventions.
3. Significantly greater benefit from the earlier intervention screening allows than from what would result from intervention at the time the subject seeks help because of the symptoms. Many therapies have proven no more effective in early use, sometimes because the lead time conferred by the screening test is too short.
4. Screening (i.e. selective identification) shown to be preferable to other strategies, such as universal application of an intervention.

Screening Versus Diagnosis

There is no fixed boundary between screening and diagnostic testing. Any nutritional status indicator can potentially be used for screening, with limitations imposed by the complexity, cost, and utility of the screen, by the prevalence of the problem being assessed and the potential benefit from intervention, and by the disadvantage that some benefit might accrue from intervention among those who screened negative.

The venue of screening influences what sorts of tests might be applicable. Screening tools for the home dwelling must of necessity be short, relatively inexpensive, and applicable to large numbers of subjects. Fixed equipment can be used for clinic or office-based periodic health examination. It is possible, for example, that noninvasive measurements of body composition such as ultrasound (12, 60) and infrared interactance (13) could be developed for mass use. Bioelectric impedance (68, 93, 102) could be used now. The use of biochemical screening tools is also far easier in the clinic setting than in the field.

Applying Data on Instrument Validation to Screening

Of necessity, some level of the screening test must be established below which the subject is not engaged in further assessment or intervention but above which subsequent action is taken.

The technology and terminology of screening (sensitivity, specificity, predictive value) follow from this need for classification. On the other hand, most published validation studies are not geared to assess accuracy of classification but rather to estimate the correlations, or shared variance, between several sets of measurements.

The data of Willett et al (120) allow an example of the way typical validation results could be structured for screening. They present enough information on one nutrient (calorie-adjusted cholesterol intake) to enable a judgement of whether individuals classified by their semiquantitative food-frequency questionnaire are similarly classified by their validating criterion, four (separated) weeks of diet records. Of the subjects in the highest quintile of cholesterol intake by diet record, 68% are correctly classified if the top two quintiles of the questionnaire are used as the cut-off level for screening, whereas the remaining third of those at highest risk are misclassified (a sensitivity of 0.68). Although the specificity of 0.89 was fairly high (92 of 103 subjects in the lowest four quintiles by diet record were classified in the lowest three quintiles by questionnaire), the predictive value was only 0.27 (only 27% of subjects classified as having high intake by questionnaire also had high intake by diet record). This level of misclassification may well be satisfactory for observational epidemiologic research, if causal relationships are robust, but it could be weak for population screening and intervention because the health care system would not only have to process a large number of people for whom intervention would presumably not be appropriate, it would also miss many who might profit from intervention.

The Likelihood of Those at High Risk Participating in Screening

Hart (44) proposed the "inverse care law": "The availability of good medical care tends to vary inversely with a need for it in the population served." This

reflects one of the central problems of screening: Those who might profit from it most are least likely to participate. Kleinman & Kopstein (56) found that women at highest risk for cervical cancer are least likely to have Pap tests. Kono et al (57) found similar results for stomach and uterine cancer screening in Japan. Comparable results were found in England by Nathoo (81). Waller et al (112) in the Oxford region of the United Kingdom concluded: "After five years of offering health checks opportunistically to men and in the context of cervical smear test to women, less than half of the eligible patients had attended, the likelihood of accepting an invitation to attend was inversely related to the patient's cardiovascular risk for all factors measured except age." Pill et al (85) compared a sample of 259 non-attenders with the 216 (out 1570) attenders at an offered health check at the doctor's office. The attenders were at considerably lower health risk and the authors concluded, "Offering cohorts of patients additional screening services is unlikely to be efficient or effective, since it is the low-risk people already known to the doctor who are most likely to attend. The onus lies on primary health care to provide services in a way which permits appropriate screening of the high-risk groups as they attend for other reasons." In contrast, Marsh & Channing (70) reported on a 15-month campaign by a primary health care practice in a severely deprived area in England to raise the uptake of preventive care of its patients. The authors were optimistic. They found that with "rigorous monitoring and organization general practitioners may improve the uptake of preventive health care by their more deprived patients." Their experience is important to the planning and implementation of preventive health care programs, and almost certainly to screening.

Lave et al (63) studied screening among Medicare beneficiaries aged 65–79 in rural Pennsylvania, in a randomized controlled trial of physician-based services versus hospital-based practice. They found that over 90% of those who volunteered participated in follow-up screenings, but that only 45% of the eligible population attended at least one nutrition promotion session, 17% attended a smoking cessation program, and 58% received an influenza immunization (eligibility was determined by applying objective risk criteria). Although the response for nutrition counseling was much better among the better educated and more affluent, it rarely exceeded 50% of those at risk.

A Trial of Screening That Found Few New Cases

Holmen et al (45) screened for hypertension in one Norwegian county. The participation rate was high (88.1% of the 85,000 people living in the county), but of all the patients taking antihypertensive drugs after screening, 94% had been diagnosed before screening. Thus, only 406 new patients received drug treatment for hypertension out of the 75,000 screened (0.5%). (There was a slightly higher yield in those over age 60, particularly among men.) The

authors concluded that population screening for blood pressure was inefficient and what they called case finding, i.e. the inclusion of blood pressure measurement as part of the practice of primary health care represented a less intrusive and more cost-effective way of approaching early detection and control of hypertension.

Trials of Screening in Primary Health Care

There have been efforts to incorporate screening into the routine of primary health care, and several studies are of interest. Wrench & Irvine (125) screened 600 men aged 25–45 for smoking and exercise habits, weight, blood pressure, and family history of heart disease. Of these, 188 were identified as at-risk and 63% responded to an invitation to attend a special clinic. Of those, three quarters subsequently attended an annual review. There was minimal impact, but the number of subjects was small.

Sacks & Marsden (96) did a detailed study of the cost, in terms of both staff time and finances, of offering cardiovascular-oriented health screening for 2.5 years in a general practice. They reached 25% of the targeted population and, among the 1300 adults screened, found 65 new cases of hypertension (a very high yield) and 11 new cases of diabetes. The financial calculations were specific for the British National Health Service, but the net cost to the practice was £1.73 per patient per year.

The OXCHECK trial (47) has reported on its first screening phase; results of the outcome are not yet available. It found that the vast majority of subjects (78% of men, 68% of women), aged 35–64, needed specific advice or follow-up because of cigarette smoking, high-fat diet, being overweight, or having high cholesterol levels. In terms of care-giver work load, 13% of the subjects needed dietary advice only, 15% needed only follow-up of hyperlipidemia or hypertension, 9% needed advice on smoking, and 35% needed follow-up for a combination of risk factors. They found that stratifying those to be examined for cholesterol level by prior risk characteristics, particularly in men, was not preferable to testing the entire population. One of their conclusions was that “(t)he importance of the data presented is to emphasize that the real work in cardiovascular disease prevention is not in screening, but in providing and sustaining follow up. The major failing of health checks has been to confuse the process of screening with that of intervention and follow up. It is time that these two processes were separately identified so that it becomes clear to all concerned that identifying risk does not necessarily reduce it.”

Gibbins et al (36) screened all men between 28 and 60 years of age ($n = 687$) in one general practice in Wales. They stated, “We originally intended to intervene actively for all positive risk factors, but an analysis of the first 100 patients seen showed that over 80 would need recalling if this were done. We

therefore limited active secondary intervention to blood pressure and cholesterol concentration unless other disease (such as diabetes) was discovered." (They also assessed smoking, alcohol intake, exercise level, and diet.) Thus, their plans for screening broke down: Such a high proportion of those screened would have required further individual attention by their initial criteria that they judged that it would have overwhelmed their practice.

After intervention, they found no impact on serum cholesterol or systolic blood pressure, but they did find a highly significant decrease in diastolic hypertension. Although overall cholesterol levels rose slightly (the men were getting older), best results were obtained in men who said they had changed their diet, who were over 45 years old, or who had more than two visits for support and counsel. On the other hand, although there was no reduction in mean population cholesterol concentration, subjects reported reduction in dietary fat intake, and local food stores reported that there was "an eight-fold increase in sales of skim and semi-skim milk during the study period, increased sales of whole meal bread, and reduced sales of fatty meat, together with an increased health awareness of food purchases generally." Although these practitioners felt there was real benefit among those at highest risk, they were clearly disappointed; they concluded, "Population screening and intervention for cardiovascular risks is time consuming and expensive. For it to be cost effective, a reduction in risk for the general population must be shown. Unfortunately, we have not found any such reduction, and there is no published evidence from the United Kingdom to contradict our findings. Our results also suggest that it may be more worthwhile to find and treat those with established problems, rather than screening the population as a whole."

Fullard et al (31, 32) were more optimistic. A staff person called a facilitator was experimentally attached to three general practices, with the goal of involving patients in health screening. Over the course of the study, process measures changed: The recording in the medical chart of blood pressure, smoking habits, and weight was markedly increased. However, no data were presented on the health impact of this intervention. The results of Hahn (40) were also encouraging. Serum cholesterol was screened at the time of delivery of symptomatic care. Of the eligible population, 95% accepted cholesterol testing, and 114 of the 158 who screened high returned for follow-up, with a mean change over one year of -9.2% . Although not a controlled study, this was impressive.

Screening to Lower Morbidity and Mortality of Heart Disease

Attempts have been made to use screening in primary care. There are many published studies of intervention at the work site (3, 35, 124). All have involved the randomization of volunteers, as have the Multiple Risk Factor Intervention Trials (48, 78) and the Diet and Reinfarction Trials (9). There is

little doubt that these trials have demonstrated the marked effectiveness of screening and intervention in lowering cardiovascular disease incidence and mortality. However, these were studies of volunteers, and their results are difficult to generalize. Some population-based interventions included those in Finnmark county in Norway (109) and the intervention among all women in the Swedish community of Strömstad (6, 7). The Finnmark study was notable in that it used dual approaches, with health messages to the population and treatment and counsel for high-risk individuals. Over the course of three years, cholesterol levels became lower not only in those who were at high risk, but in their household members as well. There was minimal impact from the recommendation to follow up high blood pressure, but cigarette consumption decreased 12% among males and 4% among females, with an estimated improvement of risk factors such that the authors expected a 20% decrease in myocardial infarction rates. In the Strömstad study, 86% of women between the ages of 45 and 64 participated in a screening program. Of these, 528 were identified as having at least one risk factor for coronary disease, but only 30% of the nonsmokers with risk factors and 5% of the smokers accepted an invitation into an intensive three-month follow-up intervention. Those who participated did well, with a significant decrease in body weight, waist and hip circumference, and diastolic blood pressure. The greatest impact on weight was among the minority of participants in the program who improved their exercise habits. Thus, this study demonstrated that those who participated in such an intervention did well, but a saddeningly small number of them chose to do so.

Screening for Food Insecurity

There has been an increase in concern over the issues of hunger and food security in the elderly over the last decade (8, 54, 88a). Many sets of questionnaire items have been developed to detect food insecurity. Olson et al (83) compared the results of five sets of such items from an in-depth questionnaire completed by 24 poor, old people, rural whites as well as urban blacks. One of the items was the Nutrition Screening Initiative (NSI) item, "I don't always have enough money to buy the food I need." (The NSI is described in detail below.) In these 24 subjects, half of whom were food secure and half of whom were not, sensitivity and specificity of the five sets of items ranged between 50% and 90%. The NSI item functioned reasonably well, classifying 9 of the 12 food-insecure individuals and 8 of the 12 food-secure individuals correctly. On the other hand, this was a very small study, and far more work needs to be done on this issue before any of the sets of items can be confidently used in efforts to identify those who need help, let alone what and how much help that should be. Thus, although food security is clearly an important issue, we have neither

a confident mechanism to identify those who are food insecure nor studies on effective responses.

Other Multidimensional Nutrition Screening Instruments for the Elderly

MINI NUTRITIONAL ASSESSMENT The mini nutritional assessment is another format for the application of nutritional screening by professionals (37, 38) and is similar to the NSI level II screen. It includes 18 items and assigns points on nutritional adequacy based on the body mass index, mid-arm circumference, calf circumference, recent weight loss, some historical items, some items assessing activities of daily living, and dietary assessment, including some self-assessment on the part of the elderly individual. It requires a professional to complete and is specifically intended for the frail elderly. It is most appropriate for those who are at some stage of dependency. Validation was against clinical status, “78% (90 subjects of 115) were classified correctly” (38), but sensitivity and specificity of the exam were not presented and it has not yet been tested whether the application of the this screening device confers benefit.

Future Directions for Research and Implementation of Dietary Screening in the Elderly

It is theoretically possible to develop a self-administered, machine-readable, food-frequency questionnaire to assess habitual dietary intake, which could be validated by use of repeated weighed diet records, or recalls, or by other detailed quantitative dietary methods. The greatest drawback to this approach is its limited applicability among those with cognitive or sensory impairment, or among the disabled.

Another approach would be to develop a few sentinel dietary questions: They could be foods or key food groups and might include indices of food security. Yet another approach would be to first define the set of dietary interventions of proven utility for which screening might be the entree, and to develop specific food-frequency and adjunctive questions aimed at finding those individuals who might profit most from the specific intervention. For example, we might try to assess the adequacy of calcium and vitamin D intake among women from pubescence through senility, or the fat content and composition of the diet, or the intake of key micronutrients.

In some cases it is likely to be more effective to develop non-dietary screens for dietary interventions. Thus, dietary (and exercise) intervention might follow screening for body fat distribution and amount or abnormality in cholesterol level. In some trials, serum cholesterol screening has worked; knowledge of high serum cholesterol levels alone can be highly motivating (78).

ALTERNATIVE APPROACHES TO SCREENING TO IMPROVE PUBLIC HEALTH: PUBLIC HEALTH MEASURES FOR THE POPULATION AT LARGE

Self-screening is adequate in many situations, e.g. any individual can judge whether he/she is smoking or not exercising. The modification of the public's awareness of cholesterol awareness, with reduction of saturated and total fat, is likely the result of this process (101). If very large numbers of individuals screen positive for a given condition, the health care system might not be prepared to cope; if too few screen positive, many people who might benefit from interventions could be neglected.

One of the best known of the population or area efforts that has not employed screening was the North Karelia project in Finland (88,98). North Karelia is a large, mainly rural area in eastern Finland, which had a population in 1980 of around 180,000 inhabitants. An intensive effort, through public and professional education, was made to lower the high rates of mortality and morbidity from cardiovascular disease by lowering rates of cigarette smoking, serum cholesterol, and blood pressure in the total population. The project has been successful, with major reductions in population rates of smoking, serum cholesterol (particularly among men), and blood pressure and, as of 1983, twice the decrease in incidence and mortality rates from coronary heart disease compared with national rates.

Yamori & Horie (126) described a population-based intervention in Japan that included general health education, with a substudy to reduce dietary salt and increase vegetables and protein in the diet of institutionalized old people. At the same time, extensive health education, home nursing visits, and educational TV programs were introduced into the total population of 750,000. Blood pressure decreased markedly in the group who received a low-salt diet, and stroke mortality decreased far more rapidly in the test prefecture than in the rest of Japan, especially among women.

The work of Larsson et al (61) was referred to earlier. Müller et al (77) did a randomized trial of 10 days of preoperative parenteral nutrition prior to surgery for gastrointestinal carcinoma. The treated group gained 1.98 kg, whereas controls lost 1.04 kg, with significant impact on some, but not all, serum proteins, an improvement in skin test reactivity (no statistical test was presented), and improved clinical outcome: significant decreases in mortality, and fewer major complications. However, these investigators decided on the basis of past experience not to screen; rather they randomized all preoperative patients if they did not have total obstruction of the gut. They stated, "Patients with normal nutritional status were included because a survey of 187 patients operated on during 1976 and 1977 for gastrointestinal cancer showed no differences in

complications and mortality rate between those with normal nutritional status and those who are malnourished.”¹ Screening was thus of no use, either because of the low sensitivity and specificity of their screening process or because those at moderate risk also benefited. Forse & Shizgal (26) found, in hospitalized surgical patients, “that these seven anthropometric and biochemical parameters are valid measures of the nutritional state for epidemiologic surveys. However, due to their low sensitivity and specificity, they are of little value in assessing an individual patient’s nutritional status.”

THE NUTRITION SCREENING INITIATIVE IN CONTEXT

The NSI aims to increase awareness of the importance of nutrition among the elderly and their care providers through a series of checklists, documents, and guidelines, both for the general public and for health professionals (19, 24, 25). The NSI has generated an impressive amount of activity (2, 4, 20–23, 33, 41–43, 53, 59, 67, 74, 75, 82, 84, 89, 91, 97, 99, 105, 110, 111, 114–119, 121). It has carried its concerns for nutrition and aging into the federal appropriations process, with the result that the National Institute of Aging has shifted some of its nutrition budget to directly address nutrition screening as a component of care for the aged. The NSI is funded by a major multinational pharmaceutical, nutritional supplement, and infant formula corporation; is managed and coordinated by a Washington, DC, public relations firm; and is sponsored by three professional organizations, two of which (the American Dietetic Association and the American Academy of Family Practice) have a major stake in who will provide care for the elderly and what services will be reimbursable. These realities do not mean that the NSI cannot have, and is not having, an important beneficial effect; it means only that the NSI is embedded in American society and the complex way in which we define our policies and allocate our resources. As such, it deserves careful and searching scrutiny.

Whatever the origins, sponsorship, and motives behind its introduction, the NSI has proposed specific strategies for improving the nutritional, and thereby the health, status of the American elderly. It promotes screening, including self-screening by old people and screening by geriatric professionals, as the central components of these strategies. While it also advocates some alternative strategies to achieve the same goal, such as population education, screening is its central strategy. However, it has not addressed the technical requirements that must be fulfilled before screening can be justified.

¹This information would not have been accessible had not the investigators gone on to perform and publish their randomized trial. While we can only make judgements on the basis of articles that get published, there is a strong publication bias for positive results, and negative findings tend to get buried. The authors’ aside underscores the need for complete data from all trials performed, especially those that produce negative results.

The NSI has created and strongly promoted its series of screens. They include one screen intended for the public (DETERMINE) and the level II screen for professionals (25). Although our primary focus has been on the level I screen for the general public (DETERMINE), the comments are also applicable to the level II screen for nutrition professionals. The DETERMINE screen includes 10 items, each of which is weighted with a numerical score. The items include having an illness or condition that changes the kind or amount of food eaten; eating fewer than two meals a day; eating few fruits or vegetables or milk products; having three or more drinks of beer, liquor, or wine almost every day; having tooth or mouth problems that make it hard to eat; not always having enough money to buy the food needed; eating alone most of the time; taking three or more prescribed or over-the-counter drugs a day; gaining or losing 10 lb unintentionally in the last six months; and not always being able to shop, cook, or feed oneself. The subject with a low score is advised to recheck the score in six months. For subjects with a moderate score the form states: "You are at moderate nutritional risk. See what can be done to improve your eating habits and life style. The Office on Aging Senior Nutrition Program senior citizen's center or health department can help. Recheck your nutritional score in three months." At the level of six points or higher (out of a possible 21) the form states, "YOU ARE AT HIGH NUTRITIONAL RISK. Bring this checklist the next time you see your doctor, dietitian or other qualified health or social service professional. Talk with them about any problems you may have. Ask for help to improve your nutritional health." The guidelines to the professional to respond to the DETERMINE score are vague. (There is also a checklist entitled "Determine Your Oral Health," mental health screening alerts, a medication-use checklist, and a nutrition counseling checklist). The level II screen—which requires measurement of height, weight, mid-arm circumference, triceps skin fold, serum albumin, and cholesterol and has questions about drug use, eating habits, living environment, and functional status—prompts the use of the Folstein mini-mental evaluation and either the Beck depression inventory or the geriatric depression scale.

Posner et al (87) gave the NSI DETERMINE checklist in a telephone interview to 749 old people who had a 24-hr dietary recall and had answered several other health questions one year previously. The relationship between the checklist and an index of poor nutrient intake derived from the 24-hr recall and the subject's own perception of poor health status was weak.

Jensen and his colleagues (5, 49, 50) have initiated an evaluation of a modified version of a combined NSI levels I and II screens among Medicare-eligible rural elderly in Pennsylvania. They aim to include over 5000 subjects and to compare the screen with other information on ability to predict disability and functional status. Their first report indicated that height tended to be overestimated and

weight tended to be underestimated and that a recent 4.5-kg weight gain was reported by 7% of males and 11% of females (they did not report on weight loss). This study promises to be invaluable for evaluating the sensitivity and specificity of the NSI items.

The weights of the DETERMINE scores are arbitrary, as are the cut-off points that are prompts for further attention. We lack data on the sensitivity and specificity of this instrument in relationship to any specific indices of health or nutritional status. There is no information on the internal consistency of the items. The interventions suggested are nonspecific, and there is no evidence for their efficacy. Given its wide and unsystematic use, it may be too late to judge the public health impact of the NSI screens. While the NSI clearly has captured the imagination of the nutrition professions, it has not gone through the kind of careful and systematic evaluation that should be in place prior to the introduction of therapeutic or preventive strategies (e.g. for medications, vaccines, or medical devices).

CONCLUSION

Our society is engaged in the task of improving the nutritional and health status of our oldest and some of our most vulnerable and neediest citizens. Nutrition screening is among a variety of strategies that are available to do this. It is likely to be maximally efficient to link such efforts to ongoing health care. Barriers remain to improving the public health by screening: These include the lack of validated screening techniques, and the paucity of well-documented interventions for the elderly. Also, to prevent some problems in old age, action must be taken much earlier in life.

Nutritional screening has been promoted enthusiastically in advance of data sufficient to justify its widespread application to American health care. Action before justification by reasonable evaluation is not a rare occurrence. Stamler (106), reviewing the state of research on nutrition and disease prevention, stated that the research base reveals "over and over again, bewildering inconsistency of results from a score or more of studies, almost certainly resulting from inadequate methodology..." He went on to say that "(n)utrition research is in this double bind because it is not part of present-day 'big science'. In terms of 'big science' (e.g. the genome project, the space station, and the Super Conducting Super Collider) budgeted in the billions, research on the role of nutrition and causation of modern mass diseases is outside in the cold, looking in, like a poor relation... This is the fact. Unfortunately, it is a fact not frankly faced and forcefully addressed at the policy making level in our country, not even by the nutrition research community." Mayes et al (71) found 56 different health issues with contradictory results in case-control research studies. The inadequacy of

our data base has not prevented the nutrition community from responding to the public clamor for programs and answers; we have been willing to assert that we have solutions when our knowledge is contradictory or incomplete. Might not our society be better off if we were honest with policy makers and the public and let them know that although almost all their questions can probably be answered, it will require time, resources, and attention far greater than have yet been available?

A SUGGESTED WAY FORWARD

The following are some steps that might be taken to achieve a rational policy for preventive nutrition for the American elderly.

- 1 Institute a program for preventive nutrition, given current knowledge. (a) Attempt to find consensus on nutritional causation of disease and disability. To bring order to the issue of preventive nutrition for the elderly, and to nutrition screening in particular, a first goal might be to reach reasonable agreement about which conditions are caused, or affected, by nutrition. These would be conditions in which it has been reasonably demonstrated that nutritional intervention has been effective, either to avoid, reverse, or ameliorate risk factors or disease and disability. Examples are the treatment of high blood pressure to prevent stroke and the lowering of cholesterol to prevent coronary heart disease. (b) Implement practical prevention strategies. Having defined the conditions for which intervention is justified, we are faced with a series of operational questions. When in the life cycle it is best to intervene? How should the intervention be distributed? To the entire population or only to those at high risk? Is this best done via preventive health care or through the work site or self-screening? (c) Find methods for consensus. Though it is unclear how to initiate a process for finding consensus, the NIH Consensus Conferences and the US Preventive Services Task Force could serve as models. Other organizations, such as the Institute of Medicine or professional societies, could collaborate. The broader the representation, the greater the credibility, and the more defensible—and less open to charges of special pleading—the results.
- 2 Continue with new research. Following Stamler's comments, an integral need is to define gaps in knowledge to help steer the research agenda, both at local and national levels. An extended knowledge base for prevention is needed, including estimation of the benefits of early intervention and definition of the strategies needed for applying knowledge to. Thus, while moving ahead as best as possible with the current knowledge base, we need to be aggressive to enrich it.

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