THE USE OF FOOD STAMPS TO PURCHASE VITAMIN AND MINERAL SUPPLEMENTS

Food and Nutrition Service
U.S. Department of Agriculture

September 1999

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Acknowledgments

While the Food and Nutrition Service of the U.S. Department of Agriculture (USDA) had overall responsibility for this report, it includes the contributions of many individuals from a variety of organizations. Contributors gave generously of their time and expertise.

The primary authors of each chapter are identified in the Table of Contents. Major contributions were made by the USDA's Food and Nutrition Service, Economic Research Service, Center for Nutrition Policy and Promotion, and Agricultural Research Service. Special recognition also goes to two organizations who provided consulting services to the USDA. The Life Sciences Research Office, with funding from the Economic Research Service, convened an expert panel to review and summarize research pertinent to the potential value of dietary supplements. Iowa State University's Center for Agricultural and Rural Development, under subcontract to Mathematica Policy Research, analyzed usual nutrient intakes, calculated supplement use patterns and estimated likely impacts on food expenditures.

Many individuals and organizations improved the quality of the report through their editorial assistance and technical review. Sincere appreciation goes to the:

Centers for Disease Control and Prevention

Agricultural Research Service:
- Alanna Moshfegh
- Katherine Sykes
- Katherine Tippett

Center for Nutrition Policy and Promotion
- Peter Basiotis
- Carol Kramer-LeBlanc

Economic Research Service
- Elizabeth Frazao
- David Smallwood

Food and Nutrition Service
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- Alice Lockett
- Judy Love
- Pat McKinney
- Elaine McLaughlin
- Anne Sherriff

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THE USE OF FOOD STAMPS TO PURCHASE VITAMIN AND MINERAL SUPPLEMENTS

Executive Summary

Interest, research, and expenditures on dietary supplements are growing very fast. Americans spent $8.2 billion in 1995 for vitamins, minerals, herbs and botanicals, and sports nutrition products. About half of all Americans reported at least some use of vitamins and minerals in response to recent surveys.

Compared to the general population, low-income persons are less likely to report any use of vitamins or minerals, use of more than one vitamin or mineral product, or use of supplements composed of a single nutrient. Within the low-income population, the percentages are smaller for food stamp recipients.

Some point to the Food Stamp Program's authorizing legislation which prohibits using benefits to buy dietary supplements as a serious impediment to using them. They are calling for a Program change in this area in order to create more equitable treatment of food stamp recipients and to improve their health.

Those who support current rules point out that the Program's mission, as well as the nation's official dietary guidance focus on food as the source of nutrients and other substances necessary for good health. They also acknowledge the potential trade-offs associated with redirecting some food stamp benefits to purchase supplements.

In 1996, the Personal Responsibility and Work Opportunity Reconciliation Act (Public Law, 104-93) directed the Secretary of Agriculture to conduct a study, in consultation with the National Academy of Sciences and the Centers for Disease Control and Prevention, on the use of food stamps to purchase dietary supplements. The general goal of the study is to examine existing data that bear on a diverse set of pertinent issues.

Adequacy of Nutrient Intakes among Low-income Populations in the United States

USDA monitors the food and nutrient intakes of Americans through the Agricultural Research Service's Continuing Survey of Food Intakes by Individuals (CSFII). The most recent available data (1994-96) were analyzed to estimate usual vitamin and mineral intakes of Americans. Nutrient intake data from the 1988-94 National Health and Nutrition Examination Survey were also examined for comparison purposes.

The most striking result is that vitamin and mineral intakes from food differ little across income levels. Some nutrient gaps occur, but the pattern of usual intakes above and below the relevant Recommended Dietary Allowances is quite similar for high and low-income persons – that is for households with incomes above and below 130 percent of poverty.

Within the low-income population, food stamp recipients have better nutrient profiles than their non-recipient counterparts. For some nutrients, median intakes for food stamp recipients even exceed the comparable average for higher income persons.

Belonging to a particular age and sex group is related to diet quality. Children's intakes are higher than those of the general population for all nutrients. In contrast, females of child-bearing age, pregnant and lactating females, as well as elderly men and women have intakes below recommended levels for more nutrients than the population as a whole. Within subgroups, income is a factor but its influence varies by subgroup and nutrient.

Potential Value of Nutritional Supplements in Meeting Nutrient Gaps and Impacts of Nutritional Improvements on Health Status and Health Care Costs

There is virtual scientific consensus that dietary patterns and nutrient intakes can dramatically affect health, as well as agreement on the general characteristics of a healthful diet. However, the links between diet and chronic, degenerative diseases are complex, and current research is less than definitive. Although there is research support for greater supplement use in some circumstances, there are also indications that the relative effectiveness of improved diet, fortified food, and supplement use varies across nutrients in question and population subgroups.

Scientific knowledge is particularly limited when it comes to understanding:

- how some of the non-nutrient components of food (like fiber and phytochemicals) reduce the risks of disease;
- what differences exist in the bio-availability of nutrients in food compared to supplements;
- what represents deficient and excessive intake levels for different nutrients and groups of people; and
- what are the key interaction effects for different combinations of nutrients.

Even less is known about the comparative health care impacts of these alternative approaches to nutrition improvement among U.S. citizens. The studies that estimate potential savings for a single type of intervention or across two approaches typically are subject to serious methodological criticism.

Dietary Supplement Use Patterns and Expenditures among Low-income Populations in the United States

Data from national surveys show that between 41 and 48 percent of the general U.S. population reported at least some vitamin and mineral use. Higher-income persons were consistently more likely than low-income persons to report supplement use. Among low-income persons, Food Stamp Program participants are less likely than non-participants to use dietary supplements.

Information on household supplement *purchase* patterns is much more limited. Data from the national Consumer Expenditure Survey suggest that purchases are relatively infrequent. Only a small percentage of households reported buying vitamins or minerals within the two-week reporting period. Given the fact that supplements typically are sold in quantities providing a two or three month supply, the findings are not surprising. The average amount of vitamin and mineral purchases during the two-week diary period was in the $8 to $11 range.

Costs of Commercially Available Vitamin and Mineral Supplements

There is substantially more information available on the average costs of nonprescription vitamins and minerals, at least for some retail environments. Using market data collected by A.C. Nielsen from supermarkets and drug stores (which together represent 70% of total U.S. vitamin and mineral sales by mass merchandisers), per tablet prices were estimated for a variety of products.

Price variability across nutrient type, brand and retail category was observed, but the average per tablet costs typically fell below 10 cents. This information can be used to estimate the daily, monthly or annual costs of various combinations of dietary supplements. For example, on average, it costs a household consisting of a mother and two young children slightly more than 17 cents per day for them each to take a generic-label multi-vitamin with minerals.

Impact of Using Food Stamps to Purchase Vitamin and Mineral Supplements on Food Expenditures

Analyses of survey data offer a look at the relationship between supplement use and food expenditures but cannot establish the effect of a policy change on recipient behavior. The observed relationships are modest in magnitude and vary across different household types.

A related question – to what extent are food stamp households now constrained from buying vitamins and minerals – can be addressed more directly. In general, the Food Stamp Program benefit structure expects households with income to be responsible for a portion of their food costs. Since there are no restrictions on how a household spends its own food money, these dollars could be used without restriction to purchase vitamins and minerals. Nationally, about 77 percent of participating households have sufficient income so that benefits are reduced to an amount less than the maximum allotment. These households have some minimum amount of cash income that could be used to buy vitamin and mineral supplements.

The Consumer Expenditure Survey shows that a somewhat smaller, 62, percent of food stamp households reported actually spending more than their allotments on food. Thus, overall a majority of food stamp households currently have cash resources for food which could be used for vitamin and mineral supplements.

Projections of the impact of a Food Stamp Program policy change on food expenditures are made for a number of different, but realistic scenarios. They are based on the premise that allowing vitamin and mineral purchases with food stamps *without* increasing total household resources is unlikely to lead to greater supplement and food expenditures. The results of this analysis indicate impacts on food expenditures that range from a $0.00 to $0.94 reduction in food purchases per food stamp household per month.

These estimates, however, assume relatively small proportions of food stamp households actually respond to the policy change by reducing food expenditures, and the impact on them is averaged across all food stamp households. Among households who actually redirect some benefits from food to supplements, the dollar impact would be larger. The family of three who consumes multi-vitamins each day could be expected to spend $5.20 a month on supplements.

Economic Impact of Using Food Stamps to Purchase Vitamin and Mineral Supplements on Agricultural Commodities

The alternative estimates of policy impacts on household food expenditures, just described, were converted into changes in farm receipts. This was done using the impact estimates of a policy change on food expenditures, national survey data on the distribution of food dollars across different food groups, and average 1996-97 values of the farm share of the retail dollar as calculated by the Economic Research Service, USDA. Impacts of a Food Stamp Program policy change concerning dietary supplements are projected to reduce annual farm receipts from $5-19 million. In the context of overall farm receipts, the estimated impacts represent less than a fraction of one percent of the total.

Administrative Implications for the Food Stamp Program of Using Benefits to Purchase Vitamin and Mineral Supplements

While not quantified, a change in Food Stamp Program policy regarding dietary supplements also affects Program administration. Among the most immediate requirements is the need to define which dietary supplements are eligible for purchase with food stamp benefits. With thousands of products currently on the market, the criteria for defining eligible supplements need to be clear to manufacturers, food retailers and recipients. There will be some additional challenge to the Food and Nutrition Service to monitor and enforce compliance.

In addition, the introduction of dietary supplements as food stamp eligible items raises questions of whether or not the existing food model remains adequate for defining a healthful diet; estimating associated food costs (i.e., the Thrifty Food Plan); and determining food stamp benefit amounts. In any case, a policy change to allow the purchase of supplements adds some additional requirements for the Program's educational efforts. It will become important to provide food stamp recipients with guidance on how to use information in the market place to make supplement purchases that meet their individual needs and represent good value.

CHAPTER 1

INTRODUCTION

Scientific evidence concerning the link between nutrition and health, including the role of dietary supplements, is still evolving. Nevertheless, a large number of Americans already consume supplements and spend billions of dollars each year on vitamins and minerals. Food stamp recipients are, however, less likely to use dietary supplements than the general population. One view is that this difference in supplement use is a result of the Food Stamp Program's authorizing legislation which prohibits using benefits to buy dietary supplements. Recently, the Congress directed the U.S. Department of Agriculture (USDA) to look into this matter. Specifically, the Food and Nutrition Service, in collaboration with other USDA, federal, and academic organizations examined the implications of extant research findings for a variety of policy-relevant questions.

Background

While there is an established link between nutrition and health, our knowledge about the specific nature of that relationship continues to evolve. Existing Federal guidance is based on the view is that, by and large, individual nutrient needs can be met through a diet that balances a variety of foods (USDA, 1992 and USDA/DHHS, 1995). A healthful diet not only provides essential vitamins and minerals but supplies many other substances which contribute to well-being and disease prevention. Since the critical connections between specific food components and health are still uncertain in many instances, Federal guidance continues to emphasize a balanced diet that incorporates a wide range of foods.

Interest in dietary supplements is keen, however. Americans spent $8.2 billion in 1995 for vitamins, minerals, herbs and botanicals, and sports nutrition products; more than half of this amount went to buy vitamin and mineral supplements (Commission on Dietary Supplement Labels, 1997). In response to a national survey conducted during 1994-1996 (i.e., the Continuing Survey of Food Intakes by Individuals), 48 percent of Americans reported some use of vitamins and minerals during the preceding year (USDA, 1998).

Patterns of supplement use vary, however, across population subgroups. Low-income persons are less likely to report consumption. Among food stamp recipients, just 31 percent reported some vitamin and mineral use in the previous year (USDA, 1998).

Differences in supplement use may be explained by a variety of factors. Knowledge, habit, motivation, and economic resources are some of the potential influences. Food stamp recipients face an additional constraint; benefits can only be used to the purchase eligible items – i.e., products that are primarily used as a food or to prepare food, or seeds and plants to produce food in home gardens. While hundreds of thousands of food products are eligible items, food stamp benefits may not be used to purchase vitamin and mineral supplements.

During the last decade, there have been periodic public discussions concerning a change to this particular Food Stamp Program policy. Strong views have been expressed with regard to both the potential advantages and disadvantages. Proponents of change typically argue on the basis of potential improvements to health status and more equitable and fair treatment of food stamp recipients. Arguments against change point to evolving scientific information about the health benefits of supplements, the potential trade-offs associated with redirecting some food stamp benefits to supplement purchase, and matters of administrative feasibility.

Study Objectives and Scope

In 1996, the Personal Responsibility and Work Opportunity Reconciliation Act (P.L. 104-93, see Appendix A) called for the Secretary of Agriculture to conduct a study, in consultation with outside experts, on the use of food stamps to purchase dietary supplements. The U.S. Department of Agriculture (USDA) was directed to examine scientific findings as they bear on a broad set of policy-relevant matters. They include the:

- adequacy of nutrient intakes among low-income populations in the United States (U.S.), including vulnerable subgroups, such as females of child-bearing age, pregnant and lactating females, elderly men and women;
- potential value of nutritional supplements in filling nutrient gaps that may exist in the overall U.S. population or in vulnerable subgroups;
- impact of nutritional improvements (from supplementation, fortified foods, or more healthful food choices) on health status and health care costs;
- purchase patterns among low-income populations with regard to vitamins and minerals;
- costs of commercially available vitamin and mineral supplements;
- impacts of using food stamps to purchase vitamins and minerals on food purchases; and
- economic impacts of using food stamps to purchase vitamins and minerals on the production of agricultural commodities.

USDA clarified the study scope, during an initial consultation with Congressional staff, to focus on vitamins and minerals rather than on the full range of dietary supplements. Consequently, this report excludes consideration of herbals and botanicals, amino acids, sports nutrition products, protein supplements, as well as liquid and powder vitamin tonics.

Study objectives are addressed through analyses of several existing national data sets. In some instances, these extant data offer less precision than desired. However, neither the time nor dollar resources available were sufficient to conduct any new information collection.

To the degree that extant data permit, analyses of nutrient intakes and the potential impact of nutritional improvements are reported for the general population, as well as several subgroups. In addition to considering the vulnerable subgroups identified by Congress, the report examines nutrient intakes for children.

Key Project Contributors

This report is a collaborative effort involving the active participation of several USDA agencies. The Food and Nutrition Service coordinated individual contributions from the Agricultural Research Service, Center for Nutrition Policy and Promotion, and Economic Research Service. As specified in the legislation, both the National Academy of Sciences and the Centers for Disease Control were invited to actively participate in the project. That invitation included, but was not limited to, an opportunity to review the draft report. Finally, consulting services were obtained from two organizations. The Life Sciences Research Office convened an expert panel to review and summarize scientific research pertinent to the potential value of nutritional supplements. Staff from the Iowa State University Center for Agricultural and Rural Development analyzed nutrient intakes among various population subgroups and estimated the likely impact of a change in Food Stamp Program (FSP) supplement policy on food expenditures.

Report Organization

The remainder of this report is organized around the Congressionally-specified objectives. There is a separate chapter for each objective, plus an additional chapter that addresses applicable matters of Food Stamp Program administration. To maximize the reader friendliness of this report, we have included, in its main body, only those data and analysis details that are needed to support the narrative. For those with interest, additional data and methodological notes are provided in the report appendices.

CHAPTER 2

THE ADEQUACY OF VITAMIN AND MINERAL INTAKES AMONG LOW-INCOME AMERICANS

To monitor the food and nutrient intakes of Americans, USDA conducts the Continuing Survey of Food Intakes by Individuals (CSFII). This survey collects information on the daily dietary intakes of a nationally representative sample of Americans. The most recent CSFII data available for analysis were collected during 1994-96. These data were analyzed to estimate the usual vitamin and mineral intakes of Americans, with particular attention to the vulnerable subgroups identified in the legislative language. Usual intakes were compared to the dietary standards established by the National Academy of Sciences (NAS) and now under revision.

The most striking result is that vitamin and mineral intakes among Americans differ little across income levels. The pattern of median nutrient intakes above and below the relevant RDA is quite similar for higher and lower income persons. This similarity does not imply total adequacy for either income category. For several nutrients, one-fourth of both high and low income respondents reported intakes that fall substantially below the RDAs.

Within the low-income population, food stamp participants have better nutrient profiles than their non-participating counterparts. For some nutrients, median intakes for food stamp recipients exceed the comparable average for higher income persons.

Belonging to a particular age and sex group is related to diet quality. Children's intakes exceed those of the general population for all nutrients. In contrast, females of child-bearing age, pregnant and lactating females, as well as elderly men and women have intakes below recommended levels for more nutrients than the population as a whole. While income is a factor, its influence varies by subgroup and nutrient.

Comparable nutrient intake data from the most recent available waves (1988-94) of the National Health and Nutrition Examination Survey are also presented. While the specific numbers vary across the two data sets, the general intake patterns across subgroups and nutrients are similar.

Current Dietary Standards

Since 1941, the Food and Nutrition Board (FNB) of the NAS has established dietary recommendations for vitamins, minerals and other essential nutrients. Until recently, these standards were known as Recommended Dietary Allowances or RDAs. The RDAs are calculated by estimating the nutrient level needed to prevent deficiency in a given age-sex group and then adding a safety margin that allows for individual variation in nutrient need and bio-availability. This approach results in recommendations that are intended to meet the nutritional needs of most healthy members in each age-sex group. It also means that one cannot assume automatically that deficiencies exist for any individual with intakes below the RDAs. The last complete edition of RDAs was published ten years ago (FNB, 1989).

Recent advances in nutrition knowledge prompted the Food and Nutrition Board to re-evaluate the RDAs and to pursue a different approach to dietary recommendations. The new standards, known as Dietary Reference Intakes or DRIs, differ from the earlier RDAs in several ways. First, the underlying definition of nutrient adequacy shifted from a focus on specific nutrient deficiencies to a broader consideration of links between diet and chronic, degenerative diseases. The RDAs reflect intake levels needed to avoid or treat conditions associated with nutrient-specific deficiencies. In contrast, the DRIs reflect current knowledge of the relationships between nutrients and the risk of future health problems. For example, a new indicator of calcium adequacy was chosen – maximal calcium retention – because of its association with reducing the likelihood of osteoporosis in later life (Institute of Medicine, FNB, 1998)

While the RDAs involve a single value for each nutrient, every DRI is a set of standard values that are used for different purposes (FNB, 1998). Specifically, the DRI for each nutrient will eventually include an:

> *Estimated Average Requirement (EAR)* which is the nutrient intake value estimated to meet the needs of 50 percent of persons in a given age-sex group;
>
> *Recommended Dietary Allowance (RDA)* which is the daily intake level sufficient to meet the needs of almost all healthy persons in a particular age-sex group; and
>
> *Tolerable Upper Limit (TUL)* which is the maximum intake level unlikely to pose health risks.

These three standards require a substantial amount of information on subgroup needs which is not currently available for all key nutrients. When current knowledge is considered insufficient to establish an EAR and RDA, an alternative standard, an *Adequate Intake (AI)* is used instead. The AI represents intake levels that appear to be adequate based on current scientific data and may be used to formulate tentative intake goals, as is now the case for calcium.

A third difference involves the procedures for updating nutrient recommendations. In the past, the RDAs for all essential nutrients were updated at the same time. The DRIs, in contrast, are being established over several years. To date, some DRI values have been issued for biotin, calcium, choline, phosphorus, magnesium, fluoride, folate, niacin, pantothenic acid, riboflavin, thiamin, vitamins B_6, B_{12}, and D. The 1989 RDAs continue to serve as the dietary standards for the remaining nutrients.

The dietary standards serve multiple purposes. They include: 1) planning diets to meet the nutrition needs of individuals, and 2) assessing the dietary adequacy of population groups. With respect to individual dietary planning, the RDAs incorporate a safety factor, and planners can be reasonably sure that the recommended diet will meet the needs of almost every individual. The Thrifty Food Plan, which provides guidance on how a nutritious diet can be obtained within the food stamp allotment, relies on the RDAs and Dietary Guidelines (USDA and DHHS, 1995).

However, use of the RDAs for assessing the adequacy of intakes among population groups is more challenging. While the FNB (Institute of Medicine, FNB, 1998) recommends that the EAR values be used in conjunction with distribution data to assess the extent of population and subgroup deficiencies, these values are not yet available for many nutrients.

Because neither the new RDAs nor EARs have been established for all essential nutrients, the analysis in this chapter uses the 1989 RDAs as the criteria for assessing population intakes. That approach avoids the problem of inappropriately mixing standards with different meanings. However, for those nutrients which have revised RDAs, population intakes have been calculated. The results of this additional analysis are presented in Appendix C (see Table C.2).

Again, nutrient intakes below the RDAs do not necessarily mean a physiological deficiency exists. However, a large proportion of persons with intakes below the RDA level suggests the need for improvement. Consequently, information on the distribution of usual intakes for population subgroups is provided here to indicate the likely need for intervention.

Methods

Data Sources. The primary results presented in this chapter are based on the USDA's 1994-96 CSFII. This survey, conducted by the Department's Agricultural Research Service (ARS), is designed to obtain nationally representative data on the food and nutrient intakes of non-institutionalized persons residing in U.S. households. Persons living in group quarters or institutions, those residing on military installations, and the homeless were excluded. The CSFII sample design included oversampling low-income individuals to yield a nationally representative sample of the low-income population. For the purposes of this analysis, low-income persons are defined as those who come from households with gross incomes for the previous calendar year that were at or below 130 percent of the Federal poverty level. Individuals were defined as Food Stamp Program participants if any member of their household was authorized to receive benefits at the time of the interview.

In each of the three survey years, respondents of all ages were asked to provide information on food intakes for two non-consecutive days. These data were collected through in-person, 24-hour recall interviews. For the analysis reported in this chapter, only respondents who provided both days of food consumption data were included. Breast-fed children were excluded.

The final data set includes 15,170 individuals which represents a survey response rate of 76.1 percent. Table C.1 in Appendix C provides unweighted counts for each population subgroup designated in the Congressional mandate to be of particular interest.

Sample data are weighted to adjust for differential rates of sample selection and non-response, as well as to calibrate the sample to control for effects related to survey design, such as day of week or interview sequence (Chu, Nowverl and Goldman, 1998). Unless otherwise noted, these survey weights are used, so the results can be considered generalizable to the American population.

Targeted Vitamins and Minerals. Eleven vitamins and minerals are the focus of this analysis. The selected nutrients meet two criteria. They are considered to be of current or potential public health concern (FASEB, 1995) [1]and it is possible to estimate individual intake of these nutrients from CSFII data. The selected nutrients are:

calcium
folate
iron
magnesium
phosphorus
vitamin A
vitamin B_6
vitaminB_{12}
vitamin C
vitamin E
zinc

Estimation of Nutrient Intakes. Food intake data collected in the 1994-96 CSFII were converted to nutrient intake estimates using the Survey Nutrient Database developed by the ARS (USDA, 1998). For the analysis reported here, the CSFII estimates were then converted to usual intake estimates using a statistical approach developed by Iowa State University (Guenther et al., 1997; Nusser et al., 1996). This approach involves several data adjustments to address survey effects, such as within-individual variation, distributions of intakes that don't meet the statistical assumption of normality, and heterogeneous variances. The adjustments made to the data are similar to those recommended by the National Research Council (1986).[2]

It is important to note that researchers believe dietary intakes are commonly underreported. Respondents may underreport as much as 20-25 percent, and the bias may vary by personal characteristics (Riddick, 1996; Scholler, 1990). While the 1994-96 CSFII incorporated improved methods to collect dietary data, the possibility of underreporting cannot be ruled out. No statistical method has yet been developed to adjust for this bias. Furthermore, the nutrients consumed through supplement use are not reflected in the intake values. Consequently, the nutrient intake estimates reported should be considered *lower boundaries*.

Replication of the Analyses. In order to assess the reliability of CSFII results, the same analyses were repeated with a second nationally representative data set. These data come from the most recent waves (1988-1994) of the National Health and Nutrition Examination Survey (NHANES III) (DHHS, 1996).

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[1] Note that a public health issue regarding a particular nutrient may be more complex than a simple deficiency. For example, there is some public concern that high phosphorus and protein intakes may exacerbate calcium losses in some circumstances.

[2] For a more detailed description of the procedures used to estimate usual nutrient intakes, see pages 4-5 of Appendix E.

Nutrient intake estimates based on NHANES III were also developed from 24-hour food recall data using the Iowa State University adjustment method. However, some key differences between the NHANES and CSFII data sets exist. An important distinction is that most NHANES III respondents reported one day of consumption information; that is, just 5.6 percent provided data for two days (see Table C.3). While there are established methods for combining one and two day recalls, it is not known precisely how this and other differences in the data sets affect comparability. We do know that for NHANES III data the estimated adjustments for within-individual variance are based on a relatively small number of observations.

Given this difference, the comparison of usual intakes estimated for NHANES III respondents versus CSFII respondents focuses on *median* nutrient intakes. The median is the percent of each RDA that divides the distribution of individual intakes in half. For example, if the median intake for vitamin E is 86 percent, one knows that half of the respondents have usual intakes above 86 percent of the RDA and half fall below. Unlike the typical average score, medians are less likely to be skewed by any extreme individual values. The distribution of nutrient intakes at other percentiles is provided for HNANES data, however, in Appendix Table C.4.

Results

CSFII Findings. Table 2.1 presents the distribution of usual nutrient intakes for the general population and subgroups of interest[3] – specifically, the percentage of 1989 RDAs consumed by persons at different percentiles in the intake distribution. For example, among all respondents, those with calcium intakes at the lowest five percent (5^{th} percentile) of the distribution consume 39 percent of the recommended level of that nutrient. With respect to iron consumption among FSP participants, persons at the midpoint of the intake distribution (the 50^{th} percentile) consume 120 percent of the RDA.

General Population Patterns For the population as a whole, median intakes met the RDAs for all nutrients examined, except calcium, magnesium, vitamin E and zinc. For these nutrients, median intakes ranged between 81 and 93 percent of the 1989 standards. Note that the new RDAs established by the NAS for some nutrients are higher. Specifically, the median intake of folate among all respondents, falls below the revised (1998 DRI) recommended level (see Table C.2). With the subsequent folic acid fortification of grain products, there is some evidence that intakes are now higher, however (Lewis et al., 1999).

Comparison Across Income Groups When usual intakes of higher- and low-income individuals are compared, the median intakes of calcium, magnesium, vitamin E and zinc by both groups fall below the 1989 RDAs. Low-income persons also have median intakes of vitamins A and B_6 which fall slightly below recommended standards – i.e., at 96 percent and 99 percent of the RDAs, respectively. In general, the differences between higher and lower income groups in median intakes for this subset of nutrients are small.

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[3] See Chapter 1 for a description of the subgroups targeted in the Congressional mandate for this study.

The percentage of individuals with usual intakes not meeting the 1989 RDAs also is similar across income groups (see Table 2.2). Differences between higher- and low-income groups of more than five percent occur only for calcium, iron, phosphorus, and vitamin A. For these four nutrients, six to eight percent more low-income persons have usual intakes below the recommendations. While all of these differences are statistically significant and, thus, may be considered reliable, their meaningfulness with respect to health and well-being is less clear.

Food Stamp Participation Differences between food stamp recipients and low-income non-FSP participants are generally larger and occur for more nutrients. As Table 2.2 indicates, the percentage of FSP participants who do not meet the RDAs is smaller for all but one nutrient, and the difference is usually greater than five percent. Looking again at the 50^{th} percentile in Table 2.1, the usual intakes of food stamp recipients exceed those of non-recipients for every nutrient. The difference between these groups, with respect to percent of RDA consumed, exceeds five percent for a majority of the nutrients examined.

Within the low-income population, nutrient gaps are most prominent for calcium, vitamin E and zinc. Median intakes for both FSP participants and non-participants fall below the RDAs on these three nutrients with usual intake ranging from 77 percent to 87 percent of the recommended values (Table 2.1). The median intakes for non-FSP participants, however, also fall below the RDAs for magnesium, vitamin A and vitamin B_6.

Other Subgroups Table 2.1 also provides intake data for important population subgroups, specifically children, non-pregnant females of child-bearing age and the elderly, by income. Note that median intakes for all these subgroups fall below the RDAs for calcium, vitamin E and zinc, and all but the children fall below the RDA for magnesium. This pattern replicates the one observed for the general population. However, median intakes for the elderly and/or females of child-bearing age also fall below the recommended levels for iron, vitamin A and vitamin B_6. In addition, the intake levels at the 50^{th} percentile are typically lower for females of child-bearing age and the elderly than those for the general population. Children, in contrast, have median intakes that are consistently higher than those estimated for all respondents.

Another view of subgroup patterns is provided in Table 2.2 – the percent of individuals with usual intakes below 100 percent of the RDAs. Most distinguishable is the pattern for children. They typically have the lowest percentage of individuals with intakes below the RDAs when compared to other subgroups or the general population. The only exception occurs with phosphorus, where about five percent more children than the general population do not meet the RDA.

Looking within major subgroups, there are some differences by income. They are larger and occur more frequently for elderly males and females than for children or females of child-bearing age. Table 2.1 indicates the median intakes for elderly males and females from higher income households are more than five percent closer to the relevant RDA for all nutrients. The pattern is less distinct for females between 12 and 50 years. For this subgroup, higher income is associated with better median intakes but the differences between income categories are generally small.

Income appears to make the least difference for children. For those nutrients where median intakes are below the RDAs, higher- and low-income children are within one to three percentage points of each other. Among the remaining nutrients, children in both income categories exceed the RDAs.

Table 2.1 also provides information for pregnant and lactating females – although these subgroup sample sizes are too small to report intakes by income level. The most striking observation is the apparent vulnerability of pregnant females with respect to folate and iron. Even at the 75^{th} and 95^{th} percentiles, intakes fall below the RDAs. Since a relatively large percentage of people in this subgroup reported using dietary supplements (see Chapter 4), it is difficult to get a precise sense of the actual risk.

NHANES III Findings. Table 2.3 shows median nutrient intakes, expressed as a percent of the 1989 RDAs, that are based on the NHANES III data. The general patterns are similar to those reported for the CSFII. Among all respondents, median intakes meet the 1989 RDAs except for calcium, magnesium, vitamin E and zinc. The only difference between surveys is that at 94 percent, the median intake for vitamin B_6 among NHANES respondents also falls just below the RDA.

With respect to higher and low-income groups, both look similar to the general population. However, among NHANES respondents, persons from higher income households have median intakes that fall below the RDAs for an additional three vitamins – A, B_6 and E. This is in contrast to the CSFII survey where it was only low-income persons whose median intakes fell below the RDAs for vitamins A and B_6.

Comparisons between food stamp participants and low-income nonparticipants again show that median intakes for recipients are greater for most nutrients. Among NHANES III respondents the percentage differences between these subgroups is generally smaller than for similar comparisons among CSFII subgroups.

Discussion and Conclusions

The most striking result of this analysis is that vitamin and mineral intakes among Americans differ little across income levels. For both higher- and low-income groups, median intakes are well above the RDA for folate, iron, phosphorus, vitamin B_{12}, and vitamin C. Median intakes fall below 100 percent of the RDA for calcium, magnesium, vitamin E and zinc among both groups. While the median intakes of vitamins A and B_6 among lower income individuals also fall below the recommended standards, the gaps are very small.

Similarities across income groups do not imply nutrient intakes are adequate across the board. For calcium, magnesium, vitamin A,, vitamin B6, vitamin E and zinc, 25 percent of both income categories reported usual dietary intakes that fall substantially (20-40 percent) below the RDAs.

Information from food stamp recipients indicates they have a better nutrient profile than the rest of the low-income population. Consequently, median intakes for benefit recipients compare even more favorably than low-income non-recipients to those of higher-income persons. Specifically, median intakes of food stamp recipients fall below the RDAs for only three nutrients – calcium, vitamin E, and zinc. Among this nutrient subset, the median intake of zinc was greater for FSP participants than for higher income persons.

Membership in particular age-sex groups does appear to be associated with diet quality. Children's intakes exceed those of the general population for all nutrients. However, the vitamin and mineral intakes of other potentially vulnerable groups -- nonpregnant females of child-bearing age, pregnant and lactating females, as well as elderly men and women -- have intakes below recommended levels for more nutrients than the population as a whole.

Both biological and economic factors appear to influence dietary intakes, but their role varies across subgroups. Among children, median intakes of calcium, vitamin E, and zinc are below the pertinent RDAs, regardless of income. Furthermore, the actual differences in median intakes for these nutrients are very small between income groups and not consistently in the same direction. Among females of child-bearing age from both income categories, median intakes fall below recommended values for the same seven nutrients. In some instances – for calcium, magnesium, and vitamin A—there is more than a five percent difference in the median intakes across income subgroups. Being elderly is associated with median intakes below the RDA for five nutrients -- calcium, magnesium vitamins B_6 and E and zinc -- irrespective of income. For a sixth nutrient, vitamin A, low-income elderly also have median intakes a bit below the RDA. In general, the median intake values for all six nutrients are uniformly and measurably smaller for low-income elderly.

Table 2.1

Usual Nutrient Intakes (as Percentages of the 1989 RDAs) at Selected Percentiles, by Demographic Characteristics -- CSFII

	Calcium					Folate				
	Percentile					Percentile				
Group	5th	25th	**50th**	75th	95th	5th	25th	**50th**	75th	95th
All Respondents	39	64	**87**	114	168	57	100	**145**	210	359
All Higher Income	41	65	**88**	115	167	59	101	**144**	207	347
All Low Income	35	59	**81**	110	165	53	98	**150**	227	398
Low Income:										
FSP Participants	34	59	**84**	116	179	53	104	**163**	249	430
Non-Participants	36	59	**80**	105	152	55	97	**143**	211	366
Higher Income:										
Children ⌠ 18 yrs.	45	71	**94**	121	168	92	156	**222**	311	485
Females 12-50 yrs.	37	56	**73**	94	129	62	93	**121**	157	225
Females >65 yrs.	35	55	**73**	94	133	62	95	**124**	160	227
Males > 65 yrs.	47	71	**92**	118	165	63	99	**133**	177	263
Low Income										
Children ⌠ 18 yrs.	43	69	**91**	117	165	93	160	**230**	325	513
Females 12-50 yrs.	28	46	**62**	81	116	53	83	**109**	144	209
Females >65 yrs.	31	49	**65**	84	117	52	79	**104**	135	198
Males > 65 yrs.	35	54	**72**	95	138	48	79	**109**	148	224
All Income:										
Pregnant Females	44	61	**75**	90	167	34	46	**56**	68	89
Lactating Females	48	65	**78**	94	121	54	84	**113**	152	234

SOURCE: 1994-96 Continuing Survey of Food Intakes by Individuals

Table 2.1

(Continued)

Usual Nutrient Intakes (as Percentages of the 1989 RDAs) at Selected Percentiles, by Demographic Characteristics -- CSFII

	Iron					Magnesium				
	Percentile					Percentile				
Group	5th	25th	**50th**	75th	95th	5th	25th	**50th**	75th	95th
All Respondents	58	93	**125**	170	265	44	69	**93**	124	194
All Higher Income	60	94	**128**	172	265	45	70	**93**	122	188
All Low Income	53	85	**117**	161	255	39	66	**94**	132	219
Low Income:										
FSP Participants	51	86	**120**	166	264	39	69	**100**	145	241
Non-Participants	54	86	**116**	155	240	40	65	**90**	123	198
Higher Income:										
Children ⌠ 18 yrs.	65	96	**124**	162	238	53	89	**126**	174	263
Females 12-50 yrs.	49	68	**84**	105	143	48	66	**81**	97	126
Females >65 yrs.	69	97	**122**	151	207	47	67	**83**	101	135
Males > 65 yrs.	84	122	**157**	203	296	47	66	**82**	100	133
Low Income										
Children ⌠ 18 yrs.	62	93	**120**	156	231	55	92	**131**	182	279
Females 12-50 yrs.	44	62	**79**	100	139	40	58	**73**	89	118
Females >65 yrs.	54	81	**105**	135	190	41	56	**69**	83	106
Males > 65 yrs.	69	103	**134**	173	250	36	52	**66**	82	113
All Income:										
Pregnant Females	20	32	**42**	53	71	27	47	**65**	84	116
Lactating Females	54	82	**108**	144	219	54	70	**85**	103	138

SOURCE: 1994-96 Continuing Survey of Food Intakes by Individuals

Table 2.1
(Continued)

Usual Nutrient Intakes (as Percentages of the 1989 RDAs) at Selected Percentiles, by Demographic Characteristics -- CSFII

	Phosphorus					Vitamin A				
	Percentile					Percentile				
Group	5th	25th	**50th**	75th	95th	5th	25th	**50th**	75th	95th
All Respondents	72	106	**135**	170	236	41	72	**104**	149	263
All Higher Income	74	108	**138**	172	237	43	74	**106**	151	256
All Low Income	66	98	**126**	160	225	36	64	**96**	145	282
Low Income:										
FSP Participants	64	98	**129**	165	238	37	68	**101**	155	308
Non-Participants	68	99	**124**	155	212	35	62	**92**	138	259
Higher Income:										
Children ⌠ 18 yrs.	70	99	**123**	150	198	54	90	**125**	170	263
Females 12-50 yrs.	67	94	**116**	140	182	43	70	**98**	136	218
Females >65 yrs.	69	96	**119**	144	186	60	91	**124**	170	273
Males > 65 yrs.	90	125	**152**	183	233	47	79	**113**	164	288
Low Income										
Children ⌠ 18 yrs.	72	100	**122**	148	193	50	82	**117**	168	300
Females 12-50 yrs.	54	81	**104**	129	174	32	56	**82**	120	214
Females >65 yrs.	61	84	**101**	120	155	35	62	**90**	135	255
Males > 65 yrs.	70	100	**126**	157	210	31	60	**94**	145	276
All Income:										
Pregnant Females	67	87	**101**	115	137	66	96	**123**	157	222
Lactating Females	71	94	**112**	132	165	43	68	**95**	131	205

SOURCE: 1994-96 Continuing Survey of Food Intakes by Individuals

Table 2.1
(Continued)

Usual Nutrient Intakes (as Percentages of the 1989 RDAs) at Selected Percentiles, by Demographic Characteristics -- CSFII

	Vitamin B_6					Vitamin B_{12}				
	Percentile					Percentile				
Group	5th	25th	**50th**	75th	95th	5th	25th	**50th**	75th	95th
All Respondents	53	79	**102**	129	179	89	158	**228**	332	758
All Higher Income	55	80	**102**	128	177	91	158	**224**	326	658
All Low Income	48	75	**99**	129	183	86	161	**239**	373	946
Low Income:										
FSP Participants	49	78	**104**	135	191	92	180	**275**	483	931
Non-Participants	49	74	**97**	124	175	86	150	**215**	319	669
Higher Income:										
Children ⌠ 18 yrs.	68	95	**118**	145	195	122	204	**281**	381	595
Females 12-50 yrs.	53	75	**93**	114	153	91	134	**176**	238	395
Females >65 yrs.	53	76	**95**	117	154	85	131	**181**	266	552
Males > 65 yrs.	50	75	**96**	121	168	101	160	**223**	327	706
Low Income										
Children ⌠ 18 yrs.	64	92	**116**	145	198	144	230	**312**	436	868
Females 12-50 yrs.	47	70	**89**	111	150	83	126	**165**	223	410
Females >65 yrs.	39	59	**77**	99	138	55	91	**131**	195	382
Males > 65 yrs.	36	56	**75**	99	142	93	146	**206**	305	600
All Income:										
Pregnant Females	45	60	**72**	86	107	135	173	**203**	234	284
Lactating Females	48	73	**94**	118	158	89	131	**167**	209	280

SOURCE: 1994-96 Continuing Survey of Food Intakes by Individuals

Table 2.1
(Continued)

Usual Nutrient Intakes (as Percentages of the 1989 RDAs) at Selected Percentiles, by Demographic Characteristics -- CSFII

	Vitamin C					Vitamin E				
	Percentile					Percentile				
Group	5th	25th	**50th**	75th	95th	5th	25th	**50th**	75th	95th
All Respondents	50	100	**156**	232	390	43	65	**86**	114	179
All Higher Income	50	100	**155**	230	386	45	67	**87**	115	179
All Low Income	50	101	**158**	238	404	39	61	**81**	110	170
Low Income:										
FSP Participants	55	110	**170**	252	405	38	62	**85**	115	184
Non-Participants	47	96	**151**	230	402	40	60	**79**	104	158
Higher Income:										
Children ≤ 18 yrs.	72	131	**192**	273	430	45	66	**87**	117	183
Females 12-50 yrs.	47	87	**132**	193	319	49	68	**86**	108	155
Females >65 yrs.	48	101	**153**	215	323	41	62	**81**	105	160
Males > 65 yrs.	46	100	**158**	234	382	40	60	**80**	107	172
Low Income										
Children ≤ 18 yrs.	78	139	**200**	280	427	44	66	**88**	118	186
Females 12-50 yrs.	49	90	**131**	188	303	48	66	**82**	100	131
Females >65 yrs.	40	80	**122**	177	286	32	46	**60**	78	117
Males > 65 yrs.	30	70	**114**	176	299	27	44	**59**	78	118
All Income:										
Pregnant Females	56	109	**167**	249	423	51	66	**79**	93	117
Lactating Females	37	78	**125**	194	350	47	61	**74**	90	119

SOURCE: 1994-96 Continuing Survey of Food Intakes by Individuals

Table 2.1
(Continued)

Usual Nutrient Intakes (as Percentages of the 1989 RDAs) at Selected Percentiles, by Demographic Characteristics -- CSFII

	Zinc				
	Percentile				
Group	5^{th}	25^{th}	**50^{th}**	75^{th}	95^{th}
All Respondents	46	65	**81**	102	144
All Higher Income	47	65	**81**	101	142
All Low Income	43	63	**81**	103	147
Low Income:					
FSP Participants	44	66	**87**	111	160
Non-Participants	43	61	**77**	97	136
Higher Income:					
Children ≤ 18 yrs.	51	70	**87**	108	148
Females 12-50 yrs.	47	62	**76**	93	124
Females >65 yrs.	43	57	**69**	83	108
Males > 65 yrs.	41	58	**73**	92	132
Low Income					
Children ≤ 18 yrs.	51	71	**88**	109	125
Females 12-50 yrs.	43	59	**74**	92	125
Females >65 yrs.	33	46	**58**	72	101
Males > 65 yrs.	35	49	**61**	76	105
All Income:					
Pregnant Females	36	52	**65**	80	104
Lactating Females	37	50	**60**	72	93

SOURCE: 1994-96 Continuing Survey of Food Intakes by Individuals

Table 2.2

Percentage of Individuals with Usual Intakes Below 100% of 1989 RDAs, by Demographic Characteristics -- CSFII

	Calcium	Folate	Iron	Magnesium	Phosphorus	Vitamin A
Group						
All Respondents	63	25	31	57	20	47
All Higher Income	62	25	29	58	19	46
All Low Income	68	26	37	55	27	53
Low Income:						
FSP Participants	64	23	36	50	27	49
Non-Participants	71	27	37	59	26	56
Higher Income:						
Children ⌠ 18 yrs.	56	7	29	32	26	32
Females 12-50 yrs.	81	31	70	78	31	52
Females > 65 yrs.	80	29	28	74	29	32
Males > 65 yrs.	59	26	12	75	9	41
Low Income:						
Children ⌠ 18 yrs.	60	7	31	30	25	38
Females 12-50 yrs.	89	42	75	85	46	69
Females > 65 yrs.	88	46	45	92	49	57
Males > 65 yrs.	79	43	23	90	25	54
All Income:						
Pregnant Females	86	98	100	88	48	29
Lactating Females	81	39	42	71	34	55

SOURCE: 1994-96 Continuing Survey of Food Intakes by Individuals

Table 2.2
(Continued)

Percentage of Individuals with Usual Intakes Below 100% of 1989 RDAs, by Demographic Characteristics -- CSFII

	Vitamin B_6	Vitamin B_{12}	Vitamin C	Vitamin E	Zinc
Group					
All Respondents	48	7	25	64	73
All Higher Income	48	7	25	63	74
All Low Income	51	8	24	68	72
Low Income:					
FSP Participants	44	6	21	64	65
Non-Participants	53	8	27	72	78
Higher Income:					
Children ≤ 18 yrs.	30	2	13	63	67
Females 12-50 yrs.	59	8	32	67	82
Females > 65 yrs.	57	10	24	71	91
Males > 65 yrs.	55	5	25	70	82
Low Income:					
Children ≤ 18 yrs.	33	1	11	62	66
Females 12-50 yrs.	45	3	23	82	78
Females > 65 yrs.	76	31	37	90	95
Males > 65 yrs.	76	7	42	89	93
All Income:					
Pregnant Females	91	0	21	84	93
Lactating Females	57	9	37	85	97

SOURCE: 1994-96 Continuing Survey of Food Intakes by Individuals

Table 2.3

Usual Nutrient Intakes (as Percentages of the 1989 RDAs) at the 50th Percentile, by Demographic Characteristics -- NHANES

	Calcium	Folate	Iron	Magnesium	Phosphorus	Vitamin A
Group						
All Respondents	88	144	115	86	128	100
All Higher Income	89	139	115	83	128	97
All Low Income	86	164	116	97	127	111
Low Income:						
FSP Participants	89	189	114	108	129	130
Non-Participants	85	149	116	90	126	100
Higher Income:						
Children ⌠ 18 yrs.	83	237	119	134	119	129
Females 12-50 yrs.	84	133	87	84	121	110
Females > 65 yrs.	100	135	133	89	143	103
Males > 65 yrs.	94	113	127	66	136	80
Low Income:						
Children ⌠ 18 yrs.	84	257	120	148	124	139
Females 12-50 yrs.	81	140	88	85	117	101
Females > 65 yrs.	98	132	132	85	141	101
Males > 65 yrs.	95	113	133	67	141	69

SOURCE: 1988-94 Third National Health and Nutrition Examination Survey

Table 2.3
(Continued)

Usual Nutrient Intakes (as Percentages of the 1989 RDAs) at the 50th Percentile, by Demographic Characteristics -- NHANES

Group	Vitamin B_6	Vitamin B_{12}	Vitamin C	Vitamin E	Zinc
All Respondents	94	217	178	91	74
All Higher Income	92	209	176	88	73
All Low Income	101	242	186	100	79
Low Income:					
FSP Participants	106	275	191	98	81
Non-Participants	99	226	182	103	77
Higher Income:					
Children ⌠ 18 yrs.	119	293	222	103	88
Females 12-50 yrs.	99	191	162	97	79
Females > 65 yrs.	102	210	189	101	80
Males > 65 yrs.	76	182	164	76	59
Low Income:					
Children ⌠ 18 yrs.	126	317	220	112	89
Females 12-50 yrs.	99	219	172	109	80
Females > 65 yrs.	100	213	170	97	79
Males > 65 yrs.	74	186	151	77	63

SOURCE: 1988-94 Third National Health and Nutrition Examination Survey

CHAPTER 3

POTENTIAL VALUE OF VITAMIN AND MINERAL SUPPLEMENTS TO MEET NUTRIENT GAPS AND IMPROVE HEALTH STATUS AMONG LOW-INCOME INDIVIDUALS

This chapter reviews existing research relevant to how dietary supplements, improved diet and fortified foods meet nutrient needs and enhance health. Specifically, the chapter summarizes a report prepared for the United States Department of Agriculture by the Life Sciences Research Office (LSRO). The report is based on discussions of, and materials evaluated by an ad-hoc expert panel convened by LSRO. Panel members included professionals whose expertise covers nutrition research, clinical nutrition, nutrition education, public health, as well as agricultural and medical economics. The full report, a list of expert panel members, detailed description of procedures, and panel recommendations, are provided in Appendices D-G.

There is essentially scientific consensus that dietary patterns and nutrient intakes can dramatically affect health, as well as agreement on the general characteristics of a healthful diet. However, the links between diet and chronic degenerative diseases are more complex. Current research is less definitive on this matter than is our state of knowledge about the relationships between individual vitamins and minerals and deficiency diseases.

Further, the relative effectiveness of different approaches to reducing nutrition-related health problems is likely to vary with the nutrient in question and the affected population group. Improving dietary patterns, using nutritional supplements, and fortifying commonly consumed foods each has advantages and disadvantages, and the net results depend on the particular circumstances. There is even less research on the relative impacts of these alternatives for health care – that is, the costs to intervene and the costs of treatment avoided.

Research in this area does provide some support for greater supplement use. At the same time, there are uncertain gains and potential issues associated with a one-size-fits-all change in the Food Stamp Program to make dietary supplements an eligible food item.

Scientific Foundation for the Relationship between Nutrition and Health

There is virtually unanimous scientific agreement that dietary patterns and nutrient intakes can profoundly affect overall health and substantially influence a person's risks of developing numerous chronic, degenerative diseases (Cannon, 1992; National Research Council, 1989b). Poor-quality diets and physical inactivity are estimated to account for at least 300,000 deaths in the United States each year, 14 percent of all deaths (McGinnis and Foege, 1993). Poor eating habits were estimated to cost this country at least $71 billion per year due to premature deaths and medical-care costs (Frazao, 1999). In the late 1980s, the Surgeon General of the United States (United States Department of Health and Human Services, [DHHS], 1988) and the National Research Council (1989a) summarized the scientific data about diet and health relationships. Recent reviews on selected diet/health topics have been published by the American Heart Association (1996) and the World Cancer Research Fund and American Institute for Cancer Research (1997), as well as in major nutrition journals such as the *Annual Review of Nutrition* (e.g., Halliwell, 1996; Kurzer and Xu, 1997; and Naylor and Patterson, 1996). Policy documents such as the various editions of *Dietary Guidelines for Americans* (United States Department of Agriculture [USDA] and DHHS, 1980, 1985, 1990, and 1995) and *Healthy People 2000* (DHHS, 1991) provide dietary guidance and targets to achieve based on the scientific findings.

The Surgeon General's nutrition report stated: "For the two out of three adult Americans who do not smoke and do not drink excessively, one personal choice seems to influence long-term health prospects more than any other: what we eat" (DHHS, 1988). This statement attests to the importance of nutrition but notes that other factors affect health. Among the non-modifiable factors are genetic endowment, gender and age. In addition, low socioeconomic status is associated with poor health and adverse health outcomes, operating through behavioral and environmental factors such as substance abuse, poor nutrition, inadequate social networks, and reduced access to health care (Haan et al., 1987; Lantz et al., 1998; Lynch et al., 1997).

In the first half of this century, human nutrition research was focused primarily on vitamins and minerals and their role in the prevention and correction of nutrient deficiencies (National Research Council, 1989b). Since World War II, human nutrition research has investigated the role of diet in the prevention and treatment of a variety of chronic, degenerative diseases, such as cardiovascular disease, cancer, stroke, and diabetes (National Research Council, 1989b). This body of research shows that dietary patterns closely linked to health and reduced risk of disease are relatively low in total fat (especially saturated fat), sodium, and added sugars; high in complex carbohydrates; and moderate in protein.

However, the links between diet and chronic-disease risk are more complex than the links between individual micro-nutrients and deficiency diseases. Chronic diseases have numerous etiologies, and the extent to which dietary patterns or consumption of specific nutrients may contribute for any given individual is difficult to assess. Furthermore, many of the more recently observed connections between diet and disease focus on over-consumption of macro-nutrients, like sodium, sugar and fat, rather than the intake of micro-nutrients which make up vitamin and mineral supplements.

Advances in molecular biology and genetic engineering have led to the identification and characterization of genes associated with many nutrition-related chronic diseases (Bowers and Allred, 1995). Some nutrients are known to influence the transcription and translation of gene products. The presence of a defective gene, for example, may increase an individual's risk of a disease, but dietary measures may reduce or increase that risk. Aberrant genes may affect nutritional needs as well. There is evidence that women with variants of the vitamin D receptor gene have reduced bone density and reduced calcium-absorption efficiency when calcium intakes are low (Dawson-Hughes et al., 1995; Krall et al., 1995). Iron-containing supplements could be harmful to individuals with a genetic predisposition to iron storage and hemochromatosis (Fairbanks, 1994; Herbert, 1992).

Defining Nutritional Adequacy

The traditional focus of nutritional adequacy on the prevention of nutrient deficiencies is being expanded by research which suggests that higher intakes of certain nutrients may provide additional health benefits. For example, in one controlled study, elderly men and women with calcium and vitamin D intakes at approximately Recommended Dietary Allowance (RDA) levels who also received supplements of these nutrients had a moderate reduction in bone loss compared to subjects receiving the same diet and a placebo supplement (Dawson-Hughes et al., 1997). Some studies have shown that intakes of vitamin E beyond the RDA and beyond amounts that can be obtained from reasonable diets may increase protection from oxidative stresses that appear to be related to heart disease, cancer and other diseases of aging (Heinonen et al., 1998; Meydani et al., 1997; Rimm et al., 1993; Stephens et al., 1996). Other studies do not show vitamin E supplements to be of benefit (Kushi et al., 1996; The Parkinson Study Group, 1993; Priem et al., 1997).

An adequate intake for a nutrient is somewhere between the extremes of deficient and excessive intakes. At either end of this continuum, negative biochemical, physiological, or clinical consequences can occur. But there is great uncertainty about when these end points are reached with any one nutrient for any given individual. Nutrient recommendations (i.e., RDAs and Dietary Reference Intakes [DRI]) reflect the best judgments of experts about the levels of nutrient intakes that are associated with minimal risk of inadequacy or toxicity (Institute of Medicine, Food and Nutrition Board, 1997, 1998; National Research Council, 1989a).

Nutritional supplements and appropriately fortified foods, in addition to improved diets, have been recommended to people who are at risk of nutrient deficiencies. These include individuals with medical conditions that raise nutrient needs, older people and others with little exposure to sunlight (vitamin D), pregnant women (iron), and people eating low-energy diets (National Research Council, 1989a; USDA and DHHS, 1995). An expanding database of research studies has provided some support for the greater use of nutritional supplements. For example, the Food and Nutrition Board (FNB) recently recommended that women capable of becoming pregnant consume the DRI for folate from fortified foods and/or supplements in addition to the folate they obtain from a varied diet to reduce the risk of neural tube defects (NTDs) in their infants (Institute of Medicine, Food and Nutrition Board, 1998). Similarly, because 10-30% of older adults have lost the ability to absorb sufficient amounts of naturally occurring vitamin B_{12} from food, the FNB recommended that these people meet most of the DRI for this nutrient from supplements and/or fortified foods (Institute of Medicine, Food and Nutrition Board, 1998). The FNB's primary indicator of adequacy for calcium – maximal bone retention – results in DRIs that many people will have difficulty meeting without the use of calcium-fortified foods or supplements (Institute of Medicine, Food and Nutrition Board, 1997).

At the same time, varied diets based on the DRIs and RDAs should meet the nutrient needs of most people. Foods also supply biologically active phytochemicals, fiber, and other non-nutrient substances that are associated with reduced risks of chronic diseases (Decker, 1995; Nestle, 1997). For example, strong correlations are found between fruit and vegetable consumption and reduced risks of cancer, a connection not well explained by any nutrient (such as vitamin C) or phytochemical (such as individual carotenoids) in these foods (Block et al., 1992; Food and Drug

Administration [FDA], 1993a; Ross, 1991; Sauberlich, 1991). Given the uncertainty in many instances of the critical substances in foods associated with health and disease prevention, dietary guidance to consumers should continue to place primary emphasis on a balanced diet that incorporates a variety of foods.

It is also important to address the concept of balance among nutrients when discussing nutritional adequacy. Nutrients are often studied in isolation because the data are easier to interpret than when studying them in combination. However, in the human body, nutrients interact; the amount consumed of one can affect the requirement for another. Calcium is crucial to bone health, for example, but other nutrients such as phosphorus and vitamin D – as well as lifestyle factors such as not smoking, being physically active, and limiting alcohol consumption – favorably affect both calcium and bone metabolism (National Research Council, 1989b).

Nutrient intakes are best evaluated in the context of total health. Yet because of narrowly focused research, which typically considers only one or a small number of positive outcomes, the existence of countervailing risks often may not be readily evident. For example, beginning in the 1960s, the nutrition community viewed the achievement of genetic potential for height as one important measure of adequate nutrition for children (Joint FAO/WHO/UNO Expert Consultation, 1985). However, maximizing height is biologically associated with earlier age of menarche in girls, and early menarche has come to be recognized as a strong and consistent risk factor for breast cancer in later life (Kelsey and Bernstein, 1996; Li et al., 1997). This is but one example of the tradeoffs that are known to exist across a wide range of health and environmental issues (Graham and Wiener, 1995) and require a broader perspective in risk analysis.

Meeting Nutrient Needs, Improving Health Status, and Reducing Nutrition-Related Health Problems

Meeting Nutrient Needs. There are three general approaches to meeting nutrient needs: 1) improved diets, 2) food fortification, and 3) nutritional supplements. Each approach has both advantages and disadvantages that depend on the nutrient in question and the affected population group. For example, common foods have been fortified with folic acid to increase the intakes of this nutrient among women in their child-bearing years and thereby reduce the incidence of NTDs among newborns. But this approach may expose some elderly people to excess folic acid such that it masks the development of pernicious anemia until irreversible neurological degeneration occurs (FDA, 1993b). An approach often works best when the individuals to be affected are able to learn about the benefits and risks and understand what types of behavior changes are recommended.

Improving Dietary Patterns Eating a diet as described in the Food Guide Pyramid should raise intakes of nutrients (generally to recommended levels) as well as other important food constituents. There are virtually no disadvantages to this approach, except perhaps for those living in poverty who may find it difficult to purchase more vegetables, fruits and whole-grain products. To afford these foods, they would need to buy the less costly products in each food group and limit their purchase of foods with minimal nutritional value (Kaufman et al., 1997).

Fortunately, America's food supply is extremely diverse and reasonably priced, and high-quality nutrition information is readily available from multiple sources. Most Americans can obtain a nutritionally adequate diet irrespective of income if they desire to do so and have the necessary education, skills and environmental supports (such as kitchen appliances and nearby supermarkets) (Kaufman et al., 1997; Weinberg and Epstein, 1996). Various sectors of society – including government, the private sector, health-care professionals and educators – should assume more responsibility in facilitating the adoption of healthier diets by more Americans (Thomas, 1991).

Nutritional Supplements Nutritional supplements can help individuals increase their intakes of nutrients that are often not consumed in adequate amounts (e.g, iron, calcium and folic acid) or may not be absorbed well enough from food (e.g., vitamin B_{12}). Among those who may benefit from nutritional supplements are women with heavy menstrual bleeding (iron), pregnant and lactating women (iron, folic acid and calcium), vegetarians (vitamin B_{12}), people with very low energy intakes, and people with certain disease or taking certain medications that alter nutrient requirements (National Research Council, 1989b). Nutritional supplements may even provide benefits to people with apparently adequate diets (Chandra, 1992; Dickinson, 1998; Russell, 1997). However, there has not been a systematic effort to determine the wide range of potential positive and negative outcomes of the use of nutritional supplements among various population groups.

There are risks to indiscriminate supplementation with nutrients at levels substantially above recommended intakes. Excessive intakes of vitamin A, for example, can injure the liver and produce birth defects (Hathcock, 1997; Rothman et al., 1995). Examples of toxicity are rare, but there is the possibility of imbalances since some nutrients can affect the absorption, excretion or availability of others. Excess zinc, for example, can adversely affect copper status (Festa et al., 1985; Fischer et al., 1984; and Sandstr m, 1995). Since the bio-availability of a nutrient in supplement form may differ from its bio-availabity in foods, depending on the formulation of the supplement and chemical form of the nutrient (Carr and Shangraw, 1987; Cuskelly et al., 1996; Institute of Medicine, FNB, 1998), it is not yet known if the thresholds for risk are consistently the same for food and supplement forms. Despite the potential for nutrient imbalances, evidence of widespread occurrence is both difficult to obtain and not well substantiated by clinical or epidemiological data.

A recent study suggests the possibility that some supplement takers might make dietary changes that compromise rather than improve their nutritional status (Pelletier and Kendall, 1997). This research challenges the generalization from earlier studies that dietary supplement users tend to have better diets compared to nonusers (Koplan et al., 1986; Looker et al., 1988), raising doubts about accurately predicting the consequences of supplement use for different groups. People take nutritional supplements for different reasons; some take them as part of an overall healthy lifestyle while others take them to compensate for an unhealthy diet and lifestyle.

Fortified Foods Fortified foods have contributed to reducing nutrient-deficiency diseases throughout the world. Iodized salt, milk with added vitamin D, and grain products enriched with several B vitamins and iron are examples of products in the United States that are fortified. Enriched grains now have folic acid added (FDA, 1996), and this fortification initiative appears to meet the folate needs of nearly all Americans (Lewis et al., 1999). The United States FDA has issued voluntary guidelines to food manufacturers and processors to discourage the random or indiscriminate fortification of foods (Miller and Stephenson, 1987).

Fortification has had clear benefits (DHHS, 1988; Mertz, 1997). However, the nutritional contribution of some of these interventions may have been exaggerated (Gussow and Akabas, 1993; Mertz, 1997), at least in part because overall dietary patterns have been improving (Institute of Medicine, FNB, 1994). Commonly-eaten fortified foods also expose much of the population to the added nutrient even though they are not part of the target population.

Fortification programs are most successful when they are initiated to combat specific nutritional problems in specific populations and when the foods chosen as vehicles for the added nutrient are carefully selected (Miller and Stephenson, 1987). An important consideration in the design of fortification programs is the bioavailability of the added nutrient and the nutrient's effect on the taste, color, odor and palatability of the fortified foods (Mertz, 1997).

Consumer Behavior Most Americans do not eat as well as they should (Enns, et al., 1997; Frazao, 1999; Guthrie, 1998; Kennedy et al., 1995) despite their growing knowledge of diet-disease connections (Institute of Medicine, FNB, 1991) and the availability of an abundant and health-promoting food supply (Institute of Medicine, FNB, 1994). Dietary patterns are profoundly affected by metabolic, sensory, cognitive, cultural, religious and economic factors; habit and taste (particularly the preference for sweet and fatty foods) are especially important determinants of food preferences (Institute of Medicine, FNB, 1994). Taking nutritional supplements and eating fortified foods are obvious options to increase nutrient intakes short of improving dietary patterns, but consumers who choose these approaches without sufficient education about the merits and limitations could ingest excess amounts of some nutrients and insufficient amounts of others. Some people may use supplements to compensate for a diet and lifestyle they perceive to be unhealthful (Pelletier and Kendall, 1997).

Knowledge about health does not necessarily lead to health-promoting behaviors. To change behavior, knowledge has to be motivational or persuasive in some way. This is the approach to providing knowledge that marketers and advertisers use. The provision of "how to" knowledge, which nutrition education has typically emphasized (e.g., how to modify a recipe to lower its fat content) can be important, but generally only when motivation has already become instilled (Contento et al., 1995). A basic principle of change is that individuals will embark on a behavior if they think it will lead to a desirable outcome.

Lachance (1994) contends that because education has not worked well enough to improve dietary patterns in this country, additional approaches to dietary improvement that include supplements and fortified foods are needed. However, nutrition education by the government and institutions of learning cannot compete effectively with advertising by the food and dietary-supplement industries that far outspend government and other, more neutral, providers of information (Nestle, 1993).

Costs and Benefits of Alternative Approaches to Meeting Nutrient Needs. While there are analytic tools and research guidance for assessing the multiple benefits and risks of different interventions and their effects on health status and health-care costs (e.g., Gold et al., 1996; Haddix et al., 1996; and Petitti, 1994), no research on the comparative impact of improved diets, fortified foods and nutritional supplements for United States citizens was identified. One study estimated the relative costs of these three approaches to combat vitamin A deficiency in Guatemala (Phillips et al., 1996). The analysis, which used existing data, found that sugar fortification was the least costly approach, allowing each high-risk person to receive adequate vitamin A, followed by a supplement distribution program. Promoting home food production combined with nutrition education was the most expensive approach.

There are numerous studies that estimate the potential savings in health-care costs of single approaches or that compare the relative merits of two approaches using data from people living in the United States (e.g., Hornberger, 1998; Kelly et al., 1996; Romano et al., 1995; and Torgerson and Kanis, 1995). However, each study's conclusions can be seriously critiqued on the basis of the methodologies employed and assumptions made. For example, a recent cost-benefit analysis provided an estimate of the potential economic benefits of nutritional supplements in reducing health-care costs due to hospitalization for birth defects, low-birth-weight premature births, and coronary heart disease (Bendich et al., 1997). The authors based their estimates on a carefully selected set of studies, all of which demonstrated major health benefits with supplementation. Since several of these studies were based on specific subgroups in the population, they cannot be generalized to the entire United States population.

In theory, the additional economic productivity that would result from knowledge and attitude change leading to better dietary patterns would be greater than what would result from simply consuming nutritional supplements and/or fortified foods. The problem is in estimating the health effects of educational campaigns to encourage better diets.

Economic analyses could be useful in determining the value of allowing food stamp recipients to use their food stamps to purchase nutrition supplements compared to other approaches to raise nutrient intakes. However, it would be extremely difficult to conduct good studies in practice. In the case of allowing nutritional supplements to be purchased with food stamps, many debatable assumptions would need to be made, such as which supplements could be purchased, who would buy them, how dietary patterns might change as a result, and what the tradeoffs are. For example, some Program participants might maintain their food budgets while others would decrease their food purchases by at least the cost of the supplements. There is very little empirical basis on which to quantify the monetary and health-care consequences of these assumptions and tradeoffs in order to perform a credible analysis.

Conclusions and Recommendations

In addition to the preceding critique of the scientific literature, the expert panel convened by the Life Sciences Research Office (LSRO) provided a detailed set of conclusions and research recommendations. They are presented as part of the complete paper submitted by LSRO in Appendix D. The conclusions are summarized below:

The Current Food Stamp Program Does Provide Low-Income Persons with Access to a Balanced Diet

Based on its review of micronutrient-intake data from the 1994-95 Continuing Survey of Food Intakes by Individuals, the expert panel found no unique micronutrient intake problems among the FSP participants. The panel concluded that the current Food Stamp Program has apparently achieved the goal of ensuring basic social equity in access to food, irrespective of income. Further, the use of nutritional supplements to achieve this goal is not scientifically supported by nutrient intake data reviewed by the panel.

Food Stamp Program Coverage for Nutritional Supplements Would Be an Uncertain Benefit to Recipients as a Whole

While the expert panel recognized that nutritional supplements can be useful to some people, it was unaware of research which indicates those persons who might benefit more from nutritional supplements are the ones who would use them. In addition, the expert panel was unaware of any scientific evidence that the ability to purchase supplements with food stamps would benefit participants as a group. This uncertainty is all the greater because of our current inability to predict the impact of supplement purchases on dietary patterns among food stamp households.

Changing Food Stamp Program Policy to Allow the Purchase of Nutritional Supplements Would Raise Additional Issues.

The primary concern was that without more definitive research and general knowledge about the way in which supplements versus diet are useful in reducing the occurrence or progression of chronic diseases, there is ample opportunity for FSP participants to make inappropriate supplement purchases. These circumstances introduce some risk of toxicity and nutrient imbalance which call for responsible education and regulatory efforts.

CHAPTER 4

HOUSEHOLD PATTERNS OF VITAMIN AND MINERAL SUPPLEMENT USE AND PURCHASE

National surveys provide some information on the purchase and, more often, the use of vitamin and mineral supplements across different demographic subgroups. These data indicate at least some vitamin and mineral use among 41-48 percent of the U.S. population. The income distinctions in dietary supplement use are sharper and more consistent, however, than those observed in Chapter 2 for nutrient intakes. Higher income persons are more likely to report some use of vitamins and minerals, use of supplements composed of a single vitamin or mineral, and use of more than one supplement product. Among low-income respondents, food stamp recipients are less likely to report using vitamin and mineral supplements.

Information on household supplement expenditures is more limited. The available data suggest that purchases are relatively infrequent − only a small percentage of households bought vitamin or mineral supplements within a two-week reporting period. Given the fact that dietary supplements typically are sold in quantities of 60 or more tablets, the observed purchase frequencies are not surprising. The average purchase is in the $8-11 range but is somewhat larger and more varied for higher versus low-income households.

Background

Research on dietary supplement consumption has focused primarily on use (Read et al.; 1996 Slesinski et al., 1995; Sobal and Marquart, 1994; Bender et al., 1992; Park et al., 1991; Subar and Block, 1990; Block et al., 1988; Looker et al., 1988; Koplan et al., 1986; and Stewart et al., 1985). This chapter provides a summary of information collected from recent waves of two national surveys – the 1994-1996 Continuing Survey of Food Intake by Individuals (CSFII) and the 1988-94 Third Nationwide Health and Nutrition Examination Survey (NHANES III). The 1994 Consumer Expenditure Survey (CES) data on household patterns of dietary supplement use and expenditures are also reported.

Methods

Measuring Supplement Use. While both CSFII and NHANES include questions about supplement use, there are some differences in approach. The 1994-96 CSFII asked all respondents to indicate how often, if at all, they take any vitamin supplement in pill or liquid form "every day or almost every day," "every so often," " or not at all." Individuals who indicated any vitamin consumption were then asked about the type of supplement used and the frequency of use. The survey does not distinguish between physician- and self-prescribed supplement use. Table C.5 (see Appendix C) provides unweighted counts of the number of CSFII respondents reporting any supplement intake and the number reporting use by specific supplement categories.

In contrast, supplement users among NHANES respondents are defined as all those who report taking any specific vitamin or mineral in the past month. The survey explicitly includes *both* prescription and nonprescription supplements. Unweighted counts by supplement type are provided in Appendix Table C.6.

The data presented in this chapter from CSFII and NHANES are weighted to adjust for differential rates of sample selection and non-response, as well as to control for effects associated with survey design. With these weights, results can be generalized to the U.S. population.

Measuring Supplement Expenditures. The CES is conducted annually by the Bureau of the Census for the Bureau of Labor Statistics (BLS) to obtain information on U.S. expenditure patterns. The sample consists of a nationally representative set of consumer units that may be:

- all members of a household who are related by blood, marriage, adoption or other legal arrangements;

- two or more people living together who pool their incomes to make joint expenditure decisions; or

- a person living alone or sharing a household with others or living as a roomer in a private home or lodging house or in permanent living quarters in a hotel or motel, but who is financially independent.

In addition to responding to the standard expenditure survey, a national sample of consumer units, representing the civilian and non-institutionalized population, is asked to keep detailed expenditure diaries. Consumer units produce two diaries, with each one covering seven days in a consecutive two-week period. Each diary is considered an independent observation by BLS.

The most recent data on supplement purchases, available for this study, come from the 1994 diaries (U.S. Department of Labor, 1997). The two diaries from each responding unit were linked together because people are not likely to purchase dietary supplements on a weekly basis.

This initial sample consisted of approximately 5,000 consumer units. Only units providing complete income data and those containing a single household were included. Single household units were chosen to eliminate ambiguity about which household purchased supplements during the data collection period.

All low-income households were included in the final sample, along with a random sample of non low-income units. Low-income households are defined as those having before-tax income in the year that they were surveyed less than or equal to 130 percent of the poverty threshold for the relevant unit size. This is the gross-income definition used to determine food stamp eligibility. Higher-income households are those with a before-tax income above 130 percent of the poverty threshold for their respective household size. This selection process resulted in a final sample of 833 low-income and 833 higher-income households.

Within this sample, dietary supplement purchasers were identified through a two-step process. First, the survey public use tapes were examined to identify consumer units who reported making over-the-counter drug purchases during the two weeks in which expenditure diaries were kept; this purchase category includes vitamin and mineral supplements. There are 521 households who reported such expenditures. Because information on dietary supplement purchases requires looking at the actual diaries, the second step involved extracting relevant information.

Respondents choose how to record their purchases, and their approaches varied considerably. Vitamin and mineral purchases were recorded by type, brand name, or sometimes very generally as "vitamin or mineral." The analysis did not break out purchases by type of vitamin or mineral because these data cannot be categorized uniformly across all respondents.

The purchase of other dietary supplements, such as amino acids or botanical products, was treated as "other food" expenditures by BLS. Few households reported buying these supplements, and almost none of them were in the final sample of 1,666 households. Consequently, expenditure patterns for such products were not examined in this analysis. The terms "dietary supplements" and "vitamins and minerals" are used interchangeably for the remainder of this chapter.

Results and Discussion

Overall Use of Vitamin and Mineral Supplements. Overall, 47.5 percent of respondents to the CSFII reported some vitamin use at the time of the survey (see Table 4.1). This figure is close to other survey estimates and a Congressional statement in the Dietary Supplement and Health Education Act of 1994, which indicate almost 50 percent of Americans regularly use supplements. Fewer low-income than higher-income individuals use supplements: about 38 versus almost 50 percent. This pattern is repeated across income comparisons of different age-sex subgroups, although the size of the difference varies. Among low-income respondents, those who participate in the Food Stamp Program (FSP) are less likely than non-participants to use supplements – about 31 versus 42 percent.

Substantial percentages of pregnant and lactating females reported at least some supplement use; however, small subgroup samples of these CSFII respondents do not permit a reliable break-out by income. A recent study conducted by the Food and Nutrition Service provides some indication. At least among the low-income pregnant women participating in the Supplemental Food Program for Women, Infants, and Children (WIC), 74.6 percent reported using prenatal vitamins (USDA, 1998).

There are consistently smaller percentages of supplement users among NHANES respondents (Table 4.1). This is most likely due to the different type of question used to assess supplement consumption. The NHANES asks respondents about their actual behavior in the past month versus the CSFII survey which asks a question about more general behavior. Nevertheless, response patterns within income categories are similar across the two surveys.

Table 4.2 describes frequency of vitamin and mineral supplement use for all respondents, as well as by age and FSP participation. Almost one-third of all respondents reported regular use of dietary supplements – i.e., taking vitamins "every day or almost every day." Another 15 percent reported some use – taking vitamins "every so often." Among supplement users, the ratio of reporting regular use to some use is similar for all individuals and Food Stamp Program participants. That is, about twice as many persons in each category reported taking vitamins every day or almost every day compared to the percent who reported taking them less often.

Consumption of Different Supplement Types. Data on individual use of specific vitamin and mineral types are presented in Tables 4.3 and 4.4. The percentages for any group of supplement users will add to more than 100 across all product types because some individuals consume from more than one category.

Multivitamins with and without minerals were the most commonly reported types of products used. Among single vitamin and single mineral products, vitamin C and calcium were, respectively, the most popular choices.

For both higher- and low-income supplement users, multi-vitamins are again the most frequently consumed products. Larger percentages of higher-income supplement users reported consumption of single vitamins, particularly vitamins C and E. With respect to single mineral products, there is more similarity across income groups.

Comparisons between food stamp recipients and low-income non-recipients show some differences in types of supplements used. FSP participants were less likely to use single vitamin and mineral products – with the exception of iron products. For example, only 5.9 percent of food stamp supplement users responding to the CSFII reported taking vitamin C compared to 19.1 percent of low-income non-recipients (second page of Table 4.3). Similarly, about 10 percent of food stamp supplement consumers responding to the NHANES reported using a single vitamin during the last month versus more than 25 percent of low-income non-recipients (Table 4.4). For both surveys, the differences between these two subgroups in their use of single mineral products are generally smaller.

Use by supplement type is also reported for the vulnerable subgroups identified in the Congressional request for this study (see Table 4.3 and 4.4). Among the observations that stand out is the greater popularity of at least some single vitamins and minerals among the elderly. Men and women over 65 years, regardless of income, are more likely to have taken vitamin E. A larger proportion of elderly females also reported consuming calcium.

Use of Multiple Supplement Products. Most supplement users, 70.5 percent, reported consuming only one product (see Table 4.5). Of the remaining users, the percentage generally declines with the number of products consumed. Low-income individuals were less likely than higher-income respondents to use multiple products. Food stamp recipients were the least likely to consume multiple supplements products. Using more than five products is most likely to occur among higher-income individuals, but even among this group, it is an infrequent occurrence.

Expenditures on Vitamins and Minerals. As stated earlier, the analysis of supplement purchases is based on comparing all low-income households to a random sample of higher-income households from the Consumer Expenditure Survey. Select demographic characteristics of households by income level are described in Table C.7 (see Appendix C).

Only 30 of all the low-income households reported vitamin and/or mineral purchases in their two-week expenditure diaries, and only 51 of the higher-income households reported such purchases: 3.6 percent and 6.1 percent of the low- and higher-income samples, respectively.

These numbers may seem unusually low given the percentage of respondents to the CSFII survey and NHANES who report supplement use. However, vitamins and minerals are typically sold in large quantities, e.g., containers with 60 or more pills. If the typical purchase equals a two or three month supply for regular supplement users, the purchase frequency observed in the CES diaries is closer to the expected level. That is, households typically consume supplement products over several weeks; thus, relatively few would need to replenish their supply during any specific two-week period.

Average expenditures range from about $8 to $11, and there is no statistically significant difference between low- and higher-income households (see Table 4.6). However, the absence of a statistically significant difference may be a function of the small sample sizes and large household variation in expenditures. The average supplement expense for higher-income households during the two-week diary period is $2.18 *more* than for low-income households. The range of supplement expenditures is also twice as large for higher-income households.

Table 4.1

Individuals' Use of Vitamin and Mineral Supplements by Demographic Characteristics

	Any Vitamin/Mineral Use (CSFII)	Specific Vitamin or Mineral Use Reported for Past Month (NHANES)
All Respondents	47.5%	40.7%
All Higher Income	49.8	43.4
All Low Income	37.5	31.0
Low Income:		
Food Stamp Program Participants	31.2	28.9
Non-Participants	42.1	32.5
Higher Income:		
All Children ≤ 18 yrs.	43.5	44.5
Non-Pregnant Females 12-50 yrs.	54.0	44.0
Females > 65 yrs.	58.6	54.3
Males > 65 yrs.	53.2	41.1
Low Income:		
All Children ≤ 18 yrs.	35.3	32.0
Non-Pregnant Females 12-50 yrs.	36.7	24.8
Females > 65 yrs.	50.9	46.4
Males > 65 yrs.	39.9	33.6
All Income:		
Pregnant Females	86.6	na
Lactating Females	70.1	na

SOURCES: 1994-96 Continuing Survey of Food Intakes by Individuals and 1988-94 National Health and Nutrition Examination Survey

NOTES: Respondents in both surveys were defined as low-income if their household's annual income was less than or equal to 130 percent of the poverty level.

CSFII and NHANES respondents were defined, respectively, as Food Stamp Program participants if anyone in their household was authorized to receive benefits or did receive benefits at the time of the survey.

Table 4.2

Percentage of Individuals Using Vitamin and Mineral Supplements, by Frequency of Use and Selected Demographic Characteristics

	Percent of Individuals Who Reported		
	Regular Use	Some Use	No Use
All Individuals	**31.0**	**14.9**	**54.1**
All Children ≤ 18 yrs.	25.3	15.6	59.1
All Adults ≥ 19 yrs.	33.2	14.7	52.1
Food Stamp Program Participants	**20.3**	**11.7**	**68.0**
Children ≤ 18 yrs.	19.0	10.4	70.6
Adults ≥ 19 yrs.	21.3	12.8	65.9

SOURCE: 1994-96 Continuing Survey of Food Intakes by Individuals

NOTE: The slight inconsistencies between Tables 4.1 and 4.2 in percent of respondents who reported any supplement use is due to the fact that the data come from responses to two different questions in the CSFII.

Table 4.3

Individuals' Use of Different Supplement Types, by Demographic Characteristics – CSFII

	Multi-Vitamin	Multi-Vitamin and Mineral(s)	Iron *or* Vitamin C and Iron Combination	Calcium	Folic Acid	Magnesium
All Individuals	43.9%	35.4%	9.4%	9.7%	0.9 %	0.6%
All Higher Income	43.9	35.5	9.3	10.5	1.0	0.6
All Low Income	44.1	35.0	9.9	5.7	0.5	0.3
Low Income:						
Food Stamp Program Participants	45.6	38.1	10.2	2.4	0.0	0.1
Non-Participants	43.3	33.3	9.7	7.1	0.7	0.3
Higher Income:						
All Children ⌠ 18 yrs.	51.3	36.9	6.3	3.9	0.2	0.2
Non-Pregnant Females 12-50 yrs.	39.5	39.7	12.2	12.9	1.2	1.0
Females > 65 yrs.	42.1	27.5	6.3	22.9	1.6	0.9
Males > 65 yrs.	40.7	30.4	8.0	9.8	1.3	0.3
Low Income:						
All Children ⌠ 18 yrs.	52.0	35.2	8.6	1.0	0.0	0.0
Non-Pregnant Females 12-50 yrs.	39.9	36.5	14.1	6.1	0.8	0.2
Females > 65 yrs.	33.4	30.9	7.3	14.4	0.7	0.0
Males > 65 yrs.	36.6	33.0	9.3	6.2	1.0	2.2
All Income:						
Pregnant Females	27.6	70.4	12.3	6.8	0.0	2.1
Lactating Females	43.7	55.4	8.3	9.6	0.0	0.0

SOURCE: 1994-96 Continuing Survey of Food Intakes by Individuals

NOTE: Percentages of use by type represent the number of respondents who reported taking a particular supplement divided by the number of respondents who took any supplement.

Table 4.3
(continued)

Individuals' Use of Different Supplement Types,
by Household Demographics -- CSFII

	Phosphorus	Vitamin A	Vitamin B	Vitamin C	Vitamin E	Zinc	Other
All Individuals	0.1%	3.2%	8.3%	19.5%	12.2%	3.1%	7.6%
All Higher Income	0.1	3.4	8.5	20.4	13.1	3.3	8.2
All Low Income	0.0	2.5	7.7	14.5	7.5	2.2	4.5
Low Income:							
Food Stamp Program Participants	0.0	0.6	2.7	5.9	4.0	1.0	2.4
Non-Participants	0.0	3.5	10.3	19.1	9.3	2.8	5.6
Higher Income:							
Children ⌠ 18 yrs.	0.2	0.2	1.2	9.6	0.8	0.2	3.5
Non-Pregnant Females 12-50 yrs.	0.0	3.8	9.5	20.6	11.1	2.9	8.7
Females > 65 yrs.	0.0	3.9	11.8	25.5	22.1	3.4	9.4
Males > 65 yrs.	0.2	4.8	13.1	26.8	27.6	7.8	10.2
Low Income:							
Children ⌠ 18 yrs.	0.0	1.0	0.0	5.2	0.4	0.7	1.1
Non-Pregnant Females 12-50 yrs.	0.0	2.0	9.0	15.0	8.4	2.2	5.3
Females > 65 yrs.	0.0	7.3	6.1	10.2	25.2	4.3	5.2
Males > 65 yrs.	0.0	9.3	5.9	6.0	16.4	5.3	6.9
All Income:							
Pregnant Females	0.0	2.9	3.7	6.3	2.9	5.0	9.0
Lactating Females	0.0	0.0	4.6	15.9	2.2	0.0	4.5

SOURCE: 1994-96 Continuing Survey of Food Intakes by Individuals

NOTE: No further specification of vitamin B products.

Table 4.4

Individuals' Use of Different Supplement Types, by Demographic Characteristics – NHANES

	Multi-Vitamin	Vitamin and Mineral Combination	Multi-Mineral	Single Vitamin	Single Mineral	Other
Group						
All Respondents	35.5%	46.2%	3.6%	28.4%	19.5%	10.2%
All Higher Income	36.0	47.1	3.9	30.1	19.4	10.5
All Low Income	33.1	41.9	2.0	20.1	20.2	8.6
Low Income:						
FSP Participants	36.0	42.3	1.4	10.5	19.9	8.0
Non-Participants	31.3	41.7	2.3	25.7	20.4	9.0
Higher Income:						
All Children ≤ 18 yrs.	50.6	33.7	5.1	13.8	12.5	7.9
Non-Pregnant Females 12-50 yrs.	34.2	51.4	3.8	32.4	19.8	10.8
Females > 65 yrs.	25.9	47.0	4.6	40.6	42.3	11.4
Males > 65 yrs.	26.8	50.2	2.7	38.3	27.7	12.8
Low Income:						
All Children ≤ 18 yrs.	43.9	35.1	2.2	10.4	13.8	8.8
Non-Pregnant Females 12-50 yrs.	26.1	47.0	2.6	23.5	21.9	7.6
Females > 65 yrs.	20.0	41.3	0.4	31.5	38.8	7.9
Males > 65 yrs.	18.6	38.0	0.8	43.0	34.9	15.8

SOURCE: 1988-94 NHANES

NOTE: Percentages of use by type represent the number of respondents who reported consuming from a particular supplement category divided by the number of persons who took any of seventeen supplement types.

Table 4.5

Number of Different Supplement Products Among Those Reporting Any Use, by Demographic Characteristics

				Low Income:	
	All Supplement Users	Higher Income	Low Income	FSP Participants	Non FSP-Participants
Number of Supplement Products					
1	70.5%	69.2%	77.8%	86.2%	73.3%
2	15.0	15.3	13.3	11.2	14.4
3	6.2	6.6	3.8	1.6	4.9
4	3.2	3.2	2.7	0.4	4.0
5	1.9	2.0	1.0	0.1	1.6
>5	3.3	3.6	1.4	0.6	1.9

SOURCE: 1994-96 Continuing Survey of Food Intakes by Individuals

NOTE: FSP = Food Stamp Program

Table 4.6

Household Vitamin and Mineral Supplement Expenditures Over A Two-week Period, by Income

	Higher Income Households n=833	Low Income Households n=833
Households with Vitamin/Mineral Expenditure	6.1% n = 51	3.6% n = 30
Mean Expenditure among Households with Expense	$10.76	$8.58
Expenditure Range for Households with Expense	$0.10-$75.00	$0.99-$35.90

SOURCE: 1994 Consumer Expenditure Survey

NOTE: Among the 30 low-income households who reported buying vitamin and mineral supplements during two-week diary period, only 9 households reported getting food stamp benefits in the past month.

CHAPTER 5

RETAIL COST OF VITAMIN AND MINERAL PRODUCTS

In contrast to the limited information available on individual household expenditures for vitamin and mineral supplements, there are substantially more data on average costs of nonprescription vitamins and minerals, at least in key retail environments. Such information is particularly useful in projecting the likely costs of alternative purchase choices.

The chapter begins with a brief examination of total vitamin and mineral sales in the U.S. which reached almost $5 billion in 1995. Per tablet prices for select vitamins and minerals are estimated using market data collected by A.C. Nielsen from supermarkets and drug stores. Together, these sales represent about 70 percent of the total U.S. vitamin and mineral sales by mass merchandisers. There is some variability in price across different nutrients, brands, and store types, but the average <u>per tablet</u> costs typically fall below 10 cents. With this data source, it is possible to estimate the price of the most popular supplement combinations.

Total Sales of Vitamin and Mineral Supplements

Since 1947, *Supermarket Business* has conducted an annual market survey designed to estimate total retail sales, as well as sales in supermarkets for over 700 product categories including nonprescription vitamin and mineral supplements. This survey provides a measure of the size of the market for these products. However, the estimates of total retail sales provided by this survey are likely to underestimate sales of products, such as vitamins and minerals, because they fail to include mail-order sales or to adequately reflect the increasing sales of dietary supplements through outlets other than mass marketing channels.

For 1996, *Supermarket Business* estimated sales from retail outlets of "Vitamins and Tonics", a category used to capture the sales of vitamin and mineral supplements, totaled $2.93 billion. Estimates provided by other industry sources suggest that when a more complete account is taken of sales through natural product stores and other outlets, total sales of vitamin and mineral supplements may be considerably higher. For example, the Commission on Dietary Supplement Labels (1997) cites one industry estimate of $4.8 billion in U.S. sales of vitamins and minerals for 1995.

Sales of Vitamin and Mineral Supplements in Key Retail Outlets

Food stamp recipients can only redeem their benefits at authorized food stores, however, and they typically use a majority (almost 80 percent of the dollar value of benefits) in supermarkets. So, examining vitamin and mineral prices in such outlets is particularly relevant for the purposes of this report.

A.C. Nielsen collects the pertinent data from uniform product or bar code scanning systems in both supermarkets and drug stores. Data are collected from a nationally representative sample of 3,000 large food and 470 large drug stores. Food stores in the sample must have at least $2 million in annual sales, and drug stores must have at least $1 million in annual sales. The sample data are used to project national estimates of the quantity and dollar sales for all food and drug stores with annual sales that meet or exceed the thresholds described. According to Nielsen calculations, supermarkets account for slightly more than 30 percent of the total sales of vitamin and mineral supplements, while drug stores account for approximately 40 percent of the market share.

For this report, data on selected nonprescription vitamins, minerals and multivitamin combinations, including children's chewable vitamins, are used. Explicitly excluded from the analysis was consideration of other categories of dietary supplements, such as, herbals and botanicals, amino acids, sports nutrition products, protein supplements, liquid and powder vitamin tonics, as well as complete nutritional products which are intended to replace normal meals.

The Neilsen data also include information on the product attributes of each vitamin and mineral item. This information includes: the type of vitamin, mineral or multivitamin (e.g. vitamin A, vitamin A with D); the product form (e.g. tablet, capsule); the strength (where appropriate); the number of tablets per product item; and the brand name and manufacturer.

Data on sales volume are measured in terms of product movement. Since the number of tablets contained in the product item is recorded, it is possible to calculate the total number of tablets of each vitamin, mineral or combination product sold.

Approach to Measuring Consumer Costs

The cost of a particular vitamin and mineral supplement depends on a number of factors. Since vitamins and minerals are formulated to be taken one unit at a time, a convenient and intuitive measure of a product's cost is its price per tablet. However, even for the same vitamin or mineral product the price per tablet will vary. For example, a vitamin tablet of greater potency will generally cost more. A lower per tablet price typically occurs when more tablets are bought, and a quantity discount is offered. Many other factors contribute to price variation per tablet. These include where the vitamin or mineral supplement is bought (e.g. supermarket, drug store); the form of the vitamin (e.g. tablet, capsule); the source of the nutrient (e.g., oyster shell calcium, calcium carbonate); and whether it is a national or private label brand.

The complexity of the market and the variety of choices available means that there is no single price or cost of, say, a calcium tablet. To characterize an overall per tablet cost of a specific vitamin or mineral supplement it is necessary to develop a simple measure that can reflect the various costs paid by the individual consumers.

Prices paid by consumers for vitamin and mineral supplements are estimated from Nielsen scanner data from the period of September 1996 to September 1997. Two simplifying steps were taken to measure the cost of these products to consumers. The first helps to specify the cost of a particular supplement. The second simplifying step was taken to specify the cost of a tablet representing the combination of products in a supplement category .

The cost of a particular vitamin and/or mineral supplement is defined, here, as the average price paid per tablet. This price reflects all product versions sold over-the-counter and captures the price-related aspects of consumer decisions regarding product form, nutrient source, etc. It is obtained by dividing total dollar sales of a particular product type by the total number of tablets sold. As such, this price does not represent the price of any particular version of the product that is actually sold but reflects the typical or "representative" cost of the vitamin and mineral supplements to consumers

The second simplifying step was taken to specify the average cost of a combination of different individual vitamin and mineral supplement types that make up a broader category, e.g., single vitamin. In this case, the cost of various combinations also can be measured in terms of the price of a "typical" tablet.

Consider the supplement category of single vitamins – a category composed of seven individual vitamin types (see Table 5.1). The "typical" single vitamin tablet consists of a combination of the seven types of individual vitamin products that form this category. Each individual vitamin type is represented in the average tablet by its share of the total number of individual vitamin tablets sold. The overall quantity shares of each single vitamin type in the general category of single vitamins are shown in Table C.8 (see Appendix C). The average vitamin tablet does not correspond to any actual vitamin tablet available in the market. Instead, it represents the combination of single vitamins purchased by users. As indicated in Table C.8, the typical single vitamin tablet consists largely of vitamin C.

The cost of a typical single vitamin tablet is equal to the weighted average of the individual vitamin tablet prices. Weights reflect the quantity shares of the individual vitamins in the category. This price measures how much it costs, on a per tablet basis, to purchase the combination of single nutrient vitamins actually bought by consumers. It equals the price paid, on average, for a single nutrient tablet defined by the quantity shares. By construction, the cost of the typical vitamin tablet when multiplied by the total number of vitamin tablets bought equals total expenditure on vitamins.

A similar measure for the cost of an "typical" single mineral tablet can be calculated. The composition of such a tablet is given by the quantity shares in Table C.8 (see Appendix C). This table illustrates that the average single mineral tablet is made up of mostly calcium and calcium with vitamin D.

Prices of Vitamin and Mineral Supplements

Table 5.1 reports the average price per tablet for the individual vitamins and minerals that have been identified to be of current or potential public health concern (FASEB, 1995). Phosphorus is excluded because of the exceedingly small sales of this mineral as a single-nutrient product. *Average prices for these single-nutrient products ranged from 1.4 cents to 11.5 cents per tablet.*

Table 5.2 reports the average price per tablet for multivitamin products, with and without minerals, for both adults and children. Prices for some popular adult combinations are also included in Table 5.2 for comparison purposes. *For adult products, the average multi-vitamin per tablet prices ranged from 2.3 cents to 17.9 cents* with the vitamin B combinations accounting for the higher priced tablets. *Prices for children's multiple vitamins showed less variability; average per tablet prices ranged from 4 cents to 10.4 cents.*

National Brand versus Private Label and Generic Brands

The comparison of the average price of national brands to those of the private label/generic brands provides one perspective for explaining the range of prices consumers encounter. Overall, the average price per tablet of the national brands can be expected to exceed the average price per tablet of the private label/generic brands, even though the per tablet price of a specific national brand may be less than the average per tablet price of the corresponding private label/generic brands.

The data in Tables 5.1 and 5.2 indicate that for the supplement types examined, the national brand product was consistently more expensive than its private label/generic counterpart. The size of the difference ranged from 0.4 to 12.2 cents with most national brands costing 2-4 cents more, on average, per tablet. A comparison of national brand to private label/generic supplement prices in supermarkets indicates a similar pattern of differences (see Table 5.3).

One apparent anomaly in these data is that the average price per tablet of a multivitamin with iron was less than the average price of a multivitamin tablet without minerals (see Table 5.2). Adding iron should increase the per tablet price providing the combination tablet has the same potency as the multivitamin without iron. Since no information on the potency of these multivitamin products is available, it is not possible to determine whether or not potency differences explain the price anomaly.

Drug Store and Supermarket Prices

As Tables 5.1 and 5.2 indicate, the average price per tablet of vitamin and mineral supplements in drug stores and supermarkets are similar. This would be expected for retail businesses in a competitive market structure. In general, the average price per tablet of single-nutrient vitamins and multivitamins for adults is slightly less expensive in the drug stores. The average single mineral for adults and for children's multivitamins are, in contrast, a bit less expensive in supermarkets.

Price differences between store types are, at least in part, a result of different proportions of national brands being sold. For example, the largest absolute price differences between supermarkets and drug stores occur for iron and magnesium. Although not evident from the tabled data, both these minerals are associated with large proportions of the more expensive national brands being sold in drug stores.

The breakout of quantity shares by type of business across supplement types is reported in Table C.9 (see Appendix C). Drug stores accounted for 60-67 percent of the adult supplements sold by both supermarkets and drug stores. In contrast, supermarkets accounted for 65 percent of children's multivitamins.

Cost of Vitamin and Mineral Supplements to FSP Recipients Redeeming Food Stamps

Estimates of what it would cost FSP recipients to buy vitamin and mineral supplements are shown in Table 5.3. These estimates indicate the average prices paid per tablet for different vitamin and mineral products in supermarkets. It is assumed that FSP recipients will purchase their vitamin and mineral supplements in supermarkets where they can currently redeem their food stamp benefits.[4] The analysis also assumes that the quantity shares used to calculate average prices are the same for food stamp recipients as those reported for all supermarket shoppers (as in Table C.10).

The data in Table 5.3 can be used to estimate what FSP recipients would pay for various combinations of supplements. For example, the combined cost of a private label/generic multivitamin tablet without minerals (3.5 cents) and a national brand tablet of calcium with vitamin D (8.5 cents) is 12 cents per day. Alternatively, a family of one adult and two young children buying generic multi-vitamin with minerals from a supermarket would spend 17.1 cents (4.5 cents + (2 x 6.3 cents)) each day Given meaningful data about the frequency of vitamin and mineral use, it is possible to estimate monthly or annual costs for this and other supplement combinations.

[4] FNS observes that an increasing number of discount stores, such as Kmart and Walmart, are participating in the Food Stamp Program. There is no available information, however, on the extent to which recipients either currently are buying or under a Program policy change would buy dietary supplements in these stores.

Table 5.1

Average Price Paid Per Tablet for Selected Single Vitamins and Minerals, by Store and Brand Types – A.C. Nielsen

	Average Price	Super-Market	Drug Store	National Brands	Private Label Generic
Single Vitamins					
A	$0.034	$0.031	$0.035	$0.035	$0.030
A/D	.035	.039	.033	.041	.027
B_6	.046	.043	.048	.056	.038
E	.061	.068	.058	.077	.052
C					
Tablets	.038	.041	.036	.047	.032
Chewable	.055	.054	.057	.074	.041
Folacin	.016	.016	.016	.018	.014
Overall Single Vitamins	**0.047**	**0.051**	**0.046**	**0.059**	**0.040**
Single Minerals					
Calcium	$0.059	$0.055	$0.061	$0.078	$0.039
Calcium/D	.063	.063	.062	0.086	0.038
Iron	.069	.054	.075	.115	.034
Magnesium	.049	.035	.056	.061	.028
Zinc	.045	.041	.047	.057	.031
Overall Single Minerals	**0.060**	**0.055**	**0.062**	**0.083**	**0.036**

SOURCE: A.C. Nielsen (weeks ending 9/21/96 through 9/13/97)

Table 5.2

Average Price Paid Per Multiple Vitamin Tablet, by Store and Brand Types – A.C. Nielsen

	Average Price	Super-Market	Drug Store	National Brands	Private Label Generic
Product Type					
Adult Multiple Vitamins:					
w/o minerals	$0.048	$0.053	$0.046	$0.071	$0.033
w/ Iron:	.025	.028	.024	.039	.023
w/ Iron and Calcium:	.058	.058	.058	.075	.052
w/ Iron, Calcium and Zinc:	.054	.054	.054	.069	.048
w/ Minerals:	.070	.071	.070	.081	.045
Adult Multiple Vitamins Overall:	**0.062**	**0.064**	**0.061**	**0.079**	**0.038**
Adult B Complex Vitamins					
B-50	.059	.079	.048	.092	.047
High Potency w/ C	.120	.078	.132	.179	.057
Regular w/ C	.058	.051	.063	.072	.046
Children's Multiple Vitamins					
w/o Minerals	.075	.075	.075	.099	.040
w/ Extra C:	.080	.080	.081	.099	.045
w/ Iron:	.068	.066	.072	.096	.040
w/ Minerals:	.093	.092	.094	.104	.083
Children's Multiple Vitamins Overall:	**0.077**	**0.076**	**0.078**	**0.100**	**0.044**

SOURCE: A.C. Nielsen (weeks ending 9/21/96 through 9/13/97)

NOTES: Multivitamin are defined as any product that contains, at a minimum, Vitamins A, B, C, and/or D.

A multivitamin is defined as a high potency product if at least two-thirds of vitamins present contain 100 percent or more of applicable RDA.

Table 5.3

Estimated Average Cost Per Tablet of Vitamin and Mineral Products, by Brand Type in Supermarkets -- A.C. Nielsen

Product Type	Private Label/ Generic	National Brand	Average
Average Adult Single Vitamins	$0.043	$0.063	$0.051
A	.028	.037	.031
A/D	.030	.042	.039
B_6	.033	.055	.043
E	.059	.084	.068
C			
Tablets	.035	.052	.041
Chewable	.039	.075	.054
Folacin	.013	.018	.016
Average Adult Single Minerals	.035	.076	.055
Calcium	.036	.077	.055
Calcium/D	.038	.085	.063
Iron	.027	.087	.054
Magnesium	.025	.042	.035
Zinc	.029	.054	.041
Adult Multiple Vitamins			
w/o Minerals	.035	.074	.053
w/ Minerals	.045	.081	.071
Children's Multiple Vitamins			
w/o Minerals	.038	.101	.075
w/ Minerals	.063	.104	.092

SOURCE: A.C. Nielsen (weeks ending 9/21/96 through 9/13/97)

NOTES: Average costs use appropriate quantity shares as weights.

Prices for multiple vitamins without minerals exclude all multi-vitamin and mineral combinations listed in Table 5.2.

CHAPTER 6

IMPACT OF SUPPLEMENT PURCHASES ON FOOD STAMP RECIPIENT FOOD EXPENDITURES

Will changing Food Stamp Program (FSP) policy to allow the purchase of vitamins and minerals affect recipients' food expenditures? Existing data do not provide a definitive answer but suggest than any change in food expenditures is likely to be small.

Analyses of survey data offer a look at the relationship between food and supplement expenditures but cannot establish the effect of a policy change on recipient behavior. The observed relationships are modest in magnitude and direction varies across different household types.

We also pose a different question: to what extent are food stamp households now constrained from buying vitamins and minerals? Administrative data show that a large percentage of food stamp households receive less than the maximum allotment and are expected to use some of their cash resources for food. Similarly, the Consumer Expenditure Survey indicates a majority of recipients spend more than their benefit on food. Such patterns suggest that most households currently have resources which could be used for vitamin and mineral purchases.

Data limitations make it difficult to quantify the effects of a policy change on food expenditures. The chapter concludes with a range of hypothetical illustrations of the potential effect of a FSP policy change. They are based on a set of plausible, but untested assumptions. These illustrations suggest that monthly reductions in food expenditures may be small, ranging from zero to less than a dollar per food stamp household. However, the impact for an individual household which actually uses food resources to buy supplements may be considerably greater.

Background

The key question addressed in this chapter is whether or not a Food Stamp Program policy change that allows recipients to buy vitamin and mineral supplements with their benefits will affect their food expenditures. One possibility is that households might reduce their benefit expenditures on food to free up resources to purchase vitamins and minerals. Alternatively, changing Program policy without any increase in total household resources may have no measurable affect on the average dollar value of food expenditures. In the absence of research which measures how food stamp households actually respond to a change in Program policy regarding vitamins and minerals, reasonable conjecture is the only option available to address this question.

Data Sources

In this chapter, we use Food Stamp Program administrative data and recent national survey data. Administrative data come from the Food Stamp Quality Control System (USDA, 1998) and provide information for a nationally representative sample of food stamp households.

The Consumer Expenditure Survey (CES) data set, analyzed here, includes 833 low-income households and 833 non low-income households (the latter being a random subsample of the full CES sample). Among the 1,666 units in the analysis sample, 250 food stamp households reported benefit receipt during the last month. Monthly food expenditures are *grocery* expenditures for food and non-alcoholic beverages. The amount is calculated from detailed diaries that were kept for two weeks by each consumer unit in the sample. CNPP/USDA augmented the diary information available for public use with data on vitamin and mineral purchases that were extracted from the actual diaries. However, the total number of households who reported buying vitamin and mineral supplements within the two-week observation period is very small (81 in total; see Appendix Table C.11 for details).

The 1994-96 Continuing Survey of Food Intakes by Individuals (CSFII) includes almost 4,000 low-income households. Designation as a food stamp household means that someone in the unit was authorized to receive benefits at the time of the survey. Respondents reported the dollar amount spent at grocery stores for their household and their individual pattern of vitamin and mineral supplement use. More details about the CSFII and CES are provided in Chapters 2 and 4, respectively.

Are Average Food Expenditures Related to Supplement Purchase or Use?

We cannot assess directly whether or not a Program policy change on vitamin and mineral supplements will affect how much food stamp households spend on food. But we have used available data to compare food expenditures of those who buy or use vitamin and mineral supplements. The patterns observed are only suggestive, however, and fall short of assessing policy impacts.

We used data from the CES to compare average food expenditures of households who purchase vitamins and minerals to food expenditures of those who did not. As indicated by Table 6.1, none of the differences are statistically significant nor is there consistency in the direction of differences. The very small sample of food stamp households who purchased supplements (n = 9) precludes a comparison for this group.

Larger sample sizes for the CSFII data set supported more detailed examination of the relationship between food expenditure amount and supplement use. The results (see Table C.12), again, indicate no strong nor entirely uniform pattern. For example, among food stamp households overall, there is a modest positive relationship between the amount of supplement use and amount of food expenditures. This relationship may simply reflect individual preferences which a policy change may not even affect. In contrast, the relationship between amount of supplement use and amount of food expenditures is negative among food stamp households with children. Food stamp households with supplement users and children had lower food expenditures than non-users. Both relationships were statistically significant.

Does Current Policy Constrain Recipient Supplement Purchases?

Since existing data don't answer the policy impact question, we pose a different but relevant question – does current policy limit food stamp household purchases of vitamins and minerals?

Once a household is certified as eligible for food stamps, the monthly allotment amount depends on their net monthly income, the benefit reduction rate, and maximum benefit for the corresponding household size and location. The maximum benefit is based on the cost of the Thrifty Food Plan, a low-cost, nutritious model diet, and then adjusted for household size and residence (in or outside the contiguous United States). More specifically, a household's benefit amount is computed by subtracting 30 percent of its net income (the benefit reduction rate) from the pertinent maximum benefit. The benefit reduction rate represents that portion of a household's net income that is expected to be spent on food. A household with zero net income receives the maximum food stamp benefit.

In 1997, 77 percent of all food stamp households received less than the maximum allotment (USDA, 1998). In general, a majority of food stamp households can be expected to have some food resources that could be used to buy vitamins and minerals. This provides a floor for estimating the number of food stamp households who currently have cash food resources that could be used to purchase vitamin and mineral supplements if they choose.[5]

Another approach is to identify the proportion of food stamp households whose reported food expenditures actually exceed their food stamp benefits. Data from the 1994 CES show that food stamp households, overall, spend almost three time the amount of their benefits on food purchases. A majority (62%)of these households reported spending more than the amount of their benefit on food (U.S. Department of Labor, 1997).[6] These data also suggest that, under

[5] Alternatively, one might argue that only food stamp households who have no **gross** income are absolutely without cash resources that could be spent on vitamins and minerals. These households represent only about 10 percent of all FSP households.

[6] It is important to note, however, that these findings are subject to error. Specifically, in the CES, food stamp benefit amounts are defined in terms of what households reported receiving during the past month. Food expenditures were obtained for two consecutive weeks and then multiplied by 4.3/2 to project monthly grocery purchases. We know, however, that benefit expenditures for food are not evenly distributed throughout the month but are concentrated in the week immediately after food stamp issuance (USDA, 1997; Wilde and Ranney, 1998). Consequently, the CES approach to calculating food stamp households' monthly food expenditures results in estimates with an indeterminate amount and direction of error.

This may explain the surprising percentage of households (38%) who reported monthly food expenditures equal to or less than their food stamp benefit. If the 38% was a valid number, we would expect that a large amount of the total benefit value would be subject to trafficking (that is, traded for cash). In fact, the most recent empirical estimate of the food stamp trafficking rate is just 3.8% (USDA,1995).

existing Program rules, a large majority of food stamp households have cash resources **currently spent on food which** could be used to purchase vitamins and minerals.

Estimating the Likely Impact of Changing FSP Policy on Food Expenditures

Although a precise estimate is not possible, we use the available data to illustrate how changes in FSP policy might affect household supplement purchases and food expenditures. While the specific assumptions of this sensitivity testing may be plausible, the results are hypothetical.

The estimated monthly vitamin and mineral expenditures per household who uses supplements may be calculated generally as:

daily tablet use x tablet price x 30.4 days.

Daily Supplement Use. The CSFII collects data on the frequency of supplement use for individual respondents. We use this information to estimate daily consumption of vitamin and mineral tablets for households. Estimates of daily household vitamin and mineral supplement use, along with the relevant adult and child proportions, are shown in Table 6.2 The average number of tablets consumed each day by FSP households who reported any supplement use is 1.02 compared to a daily average of 1.21 tablets consumed by all households.

These calculations may overestimate or underestimate actual impacts somewhat given some of the data constraints and consequent need to make assumptions. For example, the estimation process assumes that households who reported "some" vitamin and mineral use are consuming supplements, on average, one out of every three days. There is no way to know how accurate this assumption is. In contrast, no individual household member is treated as consuming more than one supplement product per day although in reality some may. Further, household use estimates are based on the average number of persons in each household responding to the survey which is smaller than the actual average household size. That is, the survey sample includes multiple but not all household members. Household estimates of daily vitamin and mineral use are consequently different than those that occur in actual practice which contributes to the hypothetical nature of estimated effects on food expenditures.

Supplement Prices. Estimates are based on the A.C. Nielsen supermarket survey data described in Chapter 5. Specifically, estimates represent the weighted average price of adult multi-vitamins with and without minerals for the adult portion of household use and the weighted average price of children's multi-vitamins with and without minerals for the child portion of household use. Prices were calculated separately for private label/generic brands, national brands and the combination of both (see Table 6.3).

Policy Impact Estimates. Projected impacts on average food expenditures due to a change in FSP supplement policy are provided in Table 6.5. The average monthly food expenditure (far left hand column) is the one reported by all food stamp households on the CES. Four levels of monthly food expenditure changes are presented, ranging from zero to a reduction of 94 cents.

The assumptions underlying the estimates are summarized here:

No Impact In this scenario, one assumes that even with a policy change, recipients will not purchase dietary supplements with their food stamp benefits. This perspective is consistent with the weak and variable evidence concerning a relationship between dietary supplement use and food expenditures for low-income households. It also reflects the inherent logic in concluding that food stamp households are unlikely to shift benefit use from food to dietary supplements in the absence of increased resources.

Low Impact In this scenario, food stamp households whose food expenditures are currently equal to or less than their benefits (38 percent of all recipient households) are presumed to be constrained in their purchases by the terms of the food stamp benefit. That is, their food purchases are made entirely with food stamp benefits which cannot be used for buying vitamins or minerals. With a policy change, at least some of these households might choose to use their benefits for dietary supplements.

We assume that half of these food stamp households would purchase supplements with their benefits, that household supplement consumption would be the same as estimated for food stamp households who currently report vitamin and mineral use, 1.02 tablets per day, and that the price per tablet reflects the average cost of private-label/generic adult and children's multi-vitamins with and without minerals from supermarkets weighted by the adult and children's household share (see Table 6.4). The arithmetic calculation is thus:

(.5 x .38) (1.02 tablets per day x 4.34 cents per tablet) (30.4 days) = $0.26 per household per month.

Medium Impact In this scenario, we assume that the same proportion of food stamp households (.5 x .38) would choose to purchase vitamin and/or mineral supplements with their benefits under a policy change. However, household supplement consumption would be as frequent as estimated for all households who currently report supplement use, 1.21 tablets per day. We also assume that the price per tablet reflects the cost of multi-vitamins (both private-label/generic and national brands) from supermarkets weighted by the adult and children's household share (see Table 6.4). The computation is:

(.5 x .38) (1.21 tablets per day x 7.38 cents per tablet) (30.4 days) = $0.52 per household per month.

High Impact Finally, we assume that a majority of constrained food stamp households would choose to purchase vitamin and mineral supplements. Average daily consumption would remain at 1.21 tablets, but the average price per tablet is based on assuming households would choose national brand multi-vitamins from supermarkets weighted by the adult and children's household share (see Table 6.4). The calculation is:

(.75 x .38) (1.21 tablets per day x 8.98 cents per tablet) (30.4 days) = $0.94 per household per month .

Looking across the different scenarios in Table 6.5, the impact of a supplement policy change per food stamp household ranges from zero to a monthly reduction of 94 cents in food expenditures.

Another View The impacts just discussed are averaged across all food stamp households, regardless of whether or not they have modified their behavior in response to the policy change. If, however, we look at potential impacts for the individual household who responds to the new policy by shifting benefit use from food to supplements, the effect may be greater. Recall, the hypothetical family from Chapter 5 consisting of a mother and two young children. If this household began using benefits to buy a generic multi-vitamin with minerals for daily use, their food expenditures would be reduced by $5.20 per month.

Summary and Limitations of Data

Available information limits our ability to explain and quantify the relationship between supplement use and food expenditures, generally and in response to a policy change. But, given the relatively widespread use of supplements and the relatively large share of FSP households who spend more than their benefits on food, it is unlikely that a policy change would lead to large shifts in current food expenditures across the board. Impacts for any one family may, however, be considerably larger.

Table 6.1

Average Expenditures for Food at Home among Households Who Bought and Did Not Buy Vitamin and Mineral Supplements

	Average Monthly Expenditures for Food at Home :	
	Those Who Bought Supplements	Those Who Did Not Buy Supplements
High-income Households	$280.85 (*147.79*) n = 51	$242.55 (*181.69*) n = 782
Low-income Households	**$191.13** ***(116.25)*** **n = 30**	**$193.21** ***(186.12)*** **n = 803**
All Households	247.62 (143.01) n = 81	217.55 (185.54) n = 1585

SOURCE: 1994 Consumer Expenditure Survey

NOTE: Numbers in parentheses are standard deviations.

Table 6.2

Estimated Number of Dietary Supplement Tablets Used per Day by Household

	Estimated Daily Supplement Use For:	
	All Households	User Households
All Households	**0.72**	**1.21**
Adult Proportion	0.40	0.67
Child Proportion	0.32	0.54
Food Stamp Households	**0.46**	**1.02**
Adult Proportion	0.13	0.28
Child Proportion	0.34	0.74

SOURCE: 1994-96 Continuing Survey of Food Intakes by Individuals

NOTE: Estimated daily use is based on the relative frequency of vitamin and mineral use indicated by household members responding to the survey.

Table 6.3

Calculation of Weighted Price of Supplements from Supermarkets

	Private Label/Generic		Average		National Brand	
	Price	Share	Price	Share	Price	Share
Adult:						
Multivitamins w/o Minerals	$0.035	0.303	$0.053	0.184	$0.074	0.125
Multivitamins w/ Minerals	$0.045	0.697	$0.071	0.816	$0.081	0.875
Average Price	**$0.042**		**$0.068**		**$0.080**	
Children:						
Multivitamins w/o Minerals	$0.038	0.744	$0.075	0.643	$0.101	0.597
Multivitamins w/ Minerals	$0.063	0.256	$0.092	0.357	$0.104	0.403
Average Price	**$0.044**		**$0.081**		**$0.102**	

SOURCE: A. C. Nielsen

Table 6.4

Calculation Details for Single Tablet Prices Used in Impact Analysis

	Supplement Brand		
If Average Household Use Per Day	Private Label / Generic	Combined / Average	National
1.02 Tablets	(.28/1.02 X $0.042) + (.74/1.02 X $0.044) $0.0434		
1.21 Tablets		(.67/1.21 X $0.068) + (.54/1.21 X $0.081) $0.0738	(.67/1.21 X $0.080) + (.54/1.21 X $0.102) $0.0898

Table 6.5

Impact of Policy Change on Household Food Expenditures

	Average Monthly Expenditure for All FSP Households	Impact of FSP Policy Change on Food Expenditures			
	Expenses	**No Impact**	**Low Impact**	**Medium Impact**	**High Impact**
Total Expenditure for Food at Home	$224.06	$0.00	-$0.26	-$0.52	-$0.94

SOURCE: 1994 Consumer Expenditure Survey

NOTE: See text for definition of impact categories.

CHAPTER 7

THE IMPACT ON FARM RECEIPTS OF USING FOOD STAMPS TO PURCHASE VITAMINS AND MINERALS

To the extent that a Food Stamp Program policy change allowing the use of food stamps to purchase vitamin and mineral supplements affects food expenditures, agricultural production is also affected. Impacts on farm receipts are projected for the low, medium and high impact scenarios identified in Chapter 6. That is, we convert the estimated changes in retail food expenditures by recipients into changes in farm receipts. This is done by allocating total food expenditure impacts across different food groups and applying values of the farm share of the retail dollar as calculated by the Economic Research Service, USDA. Average farm value shares for 1996-97 were used in the conversion process. Based on these calculations, impacts of the Food Stamp Program policy change are expected to reduce annual farm receipts from about $5-19 million. When considered in the context of overall farm receipts the estimated impacts represent a very small fraction of the total.

Farm Value Share

The farm value share is the proportion of retail grocery store sales received by farmers. The Economic Research Service, U.S. Department of Agriculture (USDA), compiles and publishes farm value shares for an overall market basket of U.S. farm-originated foods and for ten food groups. During 1996-1997, the overall farm value share of foods in the market basket was equal to 24.1 percent of the retail price.

The farm value shares is calculated from average retail food prices and farm values of agricultural commodities. Retail prices come from prices collected by the Bureau of Labor Statistics, U.S. Department of Labor and from proprietary scanner data. Farm values are calculated from average prices received by farmers which are published by the National Agricultural Statistics Service, USDA and spot prices reported by *Market News* which are published by the Agricultural Marketing Service, USDA.[7]

In order to calculate the farm value share, it is necessary to estimate the quantity of a farm product that must be purchased from a farmer to sell a unit of the product at retail. This quantity, the farm product equivalent, is larger than the quantity sold at retail because part of the farm product is removed in processing or is lost from waste and spoilage in marketing. For example, an average of 2.4 pounds of live choice steer is required to sell one pound of choice beef in retail food stores. In the case of beef, the value of the hide, tallow, and other byproducts must also be deducted from the gross farm value in order to obtain the price of a raw farm commodity that must be purchased from the farmer in order to sell a pound of beef at retail.

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[7] A spot price is the price quoted for immediate delivery. This is in contrast to a future price that represents the price quoted for delivery at some specified future date.

Farm value shares for nine food groups and an overall average are presented in Table 7.1. Farm value shares vary widely among the food groups. Generally, farm value share decreases as the degree of processing increases. For example, foods derived from animal products tend to have higher farm value than those derived from crops because farm inputs are greater for animal products than for crops. Other factors influencing the farm value share include the cost of transportation and the degree to which a product is perishable. These factors help explain why the farm value shares for fruits and vegetables are relatively low.

Impact on Farm Receipts from Changing Food Stamp Program Policy to Allow Vitamin and Mineral Supplement Purchases

The estimated impacts on farm receipts of allowing food stamp recipients to use their benefits to purchase vitamin and mineral supplements are reported in Table 7.2. These estimates were calculated for the low, medium and high impact scenarios using the estimated reductions in total food expenditures presented in Table 6.5. For each scenario, the total monthly reduction per household food expenditure was multiplied by the percentage of the total expenditure associated with each of nine food groups (see Table C.13). The results estimate the reduction in food group retail sales per household, assuming that the Food Stamp Program policy change does not affect the mix of foods recipients buy. The monthly reductions in per household food expenditures for each food group were then multiplied by the total number of food stamp households. Average monthly participation in the Food Stamp Program was assumed to be 9.5 million households[8]. This step provides the expected monthly impact on total retail expenditures of nine food groups for the low, medium, and high impact scenarios. These monthly estimates of the reduction in total retail food sales were multiplied by twelve to produce annual amounts. The resulting annual reduction in retail sales of each food group was then multiplied by the corresponding average farm value share for 1996-1997, given in Table 7.1, to obtain the corresponding reduction in farm receipts.

For example, consider the policy effect on annual farm receipts associated with fresh vegetables under the medium impact scenario. For the individual household, the monthly reduction in fresh vegetables is:

> $0.52 (the total food expenditure reduction) x 0.047 (the market basket share associated with fresh vegetables) = $0.0244.

The total reduction in annual retail sales of fresh vegetables is:

> $0.0244 per household x 9.5 million households x 12 months = $2.786 million.

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8 Average monthly enrollment in the FSP during 1997 was 9,461 million households.

This amount was then multiplied by the 1996-97 average farm value share for fresh vegetables to obtain an estimated reduction in annual farm receipts:

> $2.786 million x 0.205 (the average farm value share for fresh vegetables) = $0.571 million.

Estimates of the annual dollar reduction in farm receipts for each food group that are associated with the low, medium, and high impact scenarios are presented in the top half of Table 7.2.

The percentage reduction in the farm receipts for each impact scenario are reported in the lower half of the same table. These numbers were obtained for each food groups by calculating the annual reduction in retail sales as a percentage of the appropriate U.S. retail sales figure. Assuming that the policy change has no effect on the farm value shares, these entries measure the percent reduction in farm receipts. Estimates of total U.S. retail sales for the individual food groups were obtained from the Personal Consumption Expenditure accounts compiled by the Bureau of Economic Analysis (BEA).[9] Average expenditures for 1996-1997 were used.

Summary

Given a range of effects that is defined by the low and high impact scenarios, the decision to allow food stamps to be used to purchase vitamin and mineral supplements can be expected to reduce annual farm receipts by between $5.31 to $19.18 million each year. The largest decreases are associated with meat, dairy and poultry products. These dollar reductions are, however, a small fraction of total farm receipts. Over the range defined by the low and high impact scenarios, the policy change is estimated to reduce overall annual farm receipts between eight-one thousandths (.008) to three-one hundredths (.03) of one percent.

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9 BEA data consists of food purchased for off-premise consumption and corresponds to the retail grocery sales that is used in measuring the farm value share. Unpublished underlying detail data from Table 2.6U were used.

Table 7.1

Farm Value Share (Percentages) of Retail Prices for Selected Food Groups, 1996-1997

Food Groups	1996	1997	Average
Meat Products	36.3	35.5	35.9
Poultry	44.3	41.2	42.8
Eggs	51.9	45.6	48.8
Dairy Products	36.2	32.3	34.3
Fats and Oils	21.5	20.8	21.2
Fresh Fruits	19.7	17.7	18.7
Fresh Vegetables	20.3	20.7	20.5
Processed Fruits and Vegetables	20.0	18.6	19.3
Bakery and Cereal Products	8.8	7.4	8.1
Average	**24.9**	**23.3**	**24.1**

SOURCE: Economic Research Service, USDA

NOTES: Farm value shares are not available for two categories – Fish and Seafood Products and Miscellaneous Foods.

The Dairy Products category includes butter. The Fats and Oils category includes peanut butter. The Fresh Vegetables category includes potatoes.

Table 7.2

Reduction in Farm Receipts for Alternative Assumptions on the Impact of FSP Policy Changes on Food Expenditures

	Scenario		
Food Group	Low	Medium	High
	Millions of Dollars		
Meat Products	$1.861	$3.722	$6.728
Poultry	0.832	1.665	3.009
Eggs	0.217	0.433	0.784
Dairy Products	1.018	2.036	3.681
Fats and Oils	0.187	0.375	0.678
Fresh Fruits	0.231	0.461	0.834
Fresh Vegetables	0.286	0.571	1.032
Processed Fruits and Vegetables	0.335	0.669	1.210
Bakery and Cereal Products	0.339	0.678	1.226
Total Dollars	**$5.306**	**$10.612**	**$19.182**
	Percentages		
Meat Products	0.0084	0.0169	0.0305
Poultry	.0092	.0183	.0331
Eggs	.0148	.0296	.0534
Dairy Products	.0085	.0170	.0307
Fats and Oils	.0080	.0160	.0290
Fresh Fruits	.0086	.0171	.0311
Fresh Vegetables	.0070	.0141	.0254
Processed Fruits and Vegetables	.0059	.0118	.0212
Bakery and Cereal Products	.0066	.0131	.0237
Total Percentages	**0.0077**	**0.0154**	**0.0279**

CHAPTER 8

ADMINISTRATIVE IMPLICATIONS FOR THE FOOD STAMP PROGRAM OF USING BENEFITS TO PURCHASE VITAMIN AND MINERAL SUPPLEMENTS

Changing Food Stamp Program policy to permit the purchase of vitamins and minerals with food stamp benefits will have impacts that go beyond those considered so far. They include a variety of implications for Program administration. Specifically, a policy change will require a clear definition of what constitutes an eligible supplement, reconsideration of the Thrifty Food Plan, expanding the focus of nutrition education, and review of the authorization criteria that determine store eligibility to participate. Each of these issues is discussed here.

Defining Which Dietary Supplements Are Eligible Food Stamp Items

Dietary supplements share some defining features (DSHEA, 1994). They are:

intended for ingestion,

intended to supplement one's diet rather than serving as a stand-alone item in a meal or diet, and

labeled as a dietary supplement.

Current law, however, is quite broad in terms of the kinds and number of products which fit this definition. Dietary supplements may include vitamins, minerals, herbs or other botanicals, amino acids, and any combination of the preceding or other substances intended to increase total dietary intake (DSHEA, 1994).

The legislative mandate (PRWORA, 1996) for this report focuses on vitamins and minerals. However, both the dietary supplement industry and consumers are likely to have strong opinions about which products should become eligible food stamp items. Since use of amino acids and botanicals has increased substantially (Roe et al., 1997), it is reasonable to expect interest in including such products in any supplement policy change for the Food Stamp Program (FSP).

This situation raises the question of what criteria will determine supplement eligibility. The alternatives range from making all dietary supplements eligible to selecting only those with specific pharmacological composition or to choosing those that provide scientifically established physiological benefits.

Limiting eligibility to vitamin and mineral supplementation may be a straight forward policy decision, but implementation of such a decision is not. Many dietary supplements contain ingredient combinations require further guidance to determine when an item is primarily a vitamin or mineral.

Ultimately, the question of product eligibility has implications for food store procedures and staff. Any selection criteria will require a simple method for identifying eligible products. To the extent that retailers participating in the FSP also operate bar code or uniform product code scanning systems this is manageable. Stores without scanner systems will face more challenge distinguishing eligible from ineligible supplements in a consistent and efficient manner.

The bottom line is that a change in FSP policy on supplement purchases opens the door to debate on what to include and exclude. With the number of products on the market now in the thousands and growing, the decision rule on eligible supplements needs to be clear for manufacturers, food retailers and recipients.

Implications for the Thrifty Food Plan and Food Stamp Benefits

The amount of food stamp allotments is based on the costs of a nutritionally adequate food model that varies by household size and is adjusted annually to reflect changes in retail food costs. Inclusion of dietary supplements logically leads to a new dietary model in which adequate intake is defined in terms of food *and* supplement purchases, and benefit allotments reflect appropriate market place costs. The major challenge, here, is that the current state of scientific knowledge does not clearly indicate to what extent nutrients and the other components of food can be replaced by the ingredients in supplements.

Alternatively, the choice may be to retain the food model in its current form without any changes. This seems reasonable given the relatively small daily cost of a multi-vitamin, for example. There are, however, some wrinkles in this approach. For recipient subgroups whose nutrient interests, needs and/or health risks lead to consuming multiple supplement products, large doses or costly supplement ingredients, the current benefit structure will be inadequate.

Even if eligible supplements are limited to multivitamin products, there may be a budgeting challenge for recipients. Such products, typically, are purchased in large quantities at a price that makes it more difficult for recipients to manage their food dollars from month to month.

Potential Impacts for Recipient Nutrition Education

Nutrition education directed to food stamp recipients currently focuses on the purchase, preparation and consumption of a combination of foods that are consistent with messages in the Federal Government's Food Guide Pyramid and Dietary Guidelines. A change in FSP policy to allow the use of benefits to buy dietary supplements will add some complexity to the Program's educational efforts. Attention to choosing an appropriate combination of supplements and food will be needed, along with some guidance on how to use information in the market place to make supplement purchases that meet individual needs and represent good value.

Nutrition education has been challenging, historically, given the multiple sources of influence on individual choices. The much larger resources associated with commercial advertising versus educational efforts make the goal of creating adequately-informed and motivated consumers particularly difficult. To some extent, the stringent rules for food labeling and health claims assist consumers in making appropriate choices. In contrast, the 1994 Dietary Supplement, Health and Education Act provides more latitude with respect to the availability and use of product claims for supplements. This environment adds to the challenge of ensuring that supplement consumers are able to knowledgeably assess the choices available.

Implications for Store Participation in the Food Stamp Program

Current law (P.L. 103-225) defines the eligibility for FSP participation among food retail stores as those establishments or house-to-house trade routes that sell food for home preparation and consumption and either 1) offer for sale on a continuous basis a variety of foods in each of the four staple food categories[10] with perishable foods in at least two of the categories; or 2) have more than 50 percent of total gross sales in staple food. Approximately 170,000 food retailers are authorized to redeem food stamp benefits. While this set of businesses includes a wide variety of food retailer types, a large majority (almost 80 percent) of the dollar value of food stamp benefits are spent in supermarkets.

Such businesses typically sell at least some dietary supplements, so it is conceivable to change Program policy concerning the purchase of supplements with benefits without making any changes to FSP eligibility criteria for stores. This would require, however, that vitamins and minerals be deemed explicitly as accessory foods; otherwise, the number and types of stores that meet FSP eligibility requirements would increase significantly . It is more likely that a change in supplement eligibility will lead to strong expressions of interest to broaden the criteria for store eligibility. Note that two industry sources, Supermarket Business (1997) and A.C. Neilsen (1997) recently reported that only about one-third of vitamin and mineral sales take place in supermarkets. Furthermore, as reported in Chapter 5, the average price for some products is less expensive in drug stores compared to supermarkets.

There are significant implications should the debate ultimately lead to redefining the criteria for store eligibility so that other business types (e.g., drug stores, natural product stores, personal product trade routes) are permitted to redeem food stamp benefits. Expanding the pool of potentially eligible stores would result in sizable additional costs associated with store authorization, equipping stores for electronic food stamp transactions, and monitoring store performance. It is also likely that adding stores whose products include only a small proportion of eligible items will increase the frequency of Program violations (USDA, 1995).

[10] Variety of foods is generally accepted to mean no fewer than three different types in each category. Staple food categories mean (1) meat, poultry or fish; (2) bread or cereal; (3) vegetables or fruits; and (4) dairy products (excluding accessory food items).

Redefining the Food and Nutrition Service Mission and Relationship with the Agricultural Community

The Food Stamp Act (1977) states:

> "Congress hereby finds that the limited food purchasing power of low-income households contributes to hunger and malnutrition among members of such households. Congress further finds that increased utilization of food in establishing and maintaining adequate national levels of nutrition will promote the distribution in a beneficial manner of the Nation's agricultural abundance and will strengthen the Nation's agricultural economy...."

It is clear that a policy change in the USDA's largest program to allow the purchase of supplements with food stamp benefits broadens our mission and creates new industry ties. That is, our focus will encompass more individual health risks and goals, and our stakeholders will include the pharmaceutical industry. Such changes are neither good nor bad but they raise a question of whether public and political support for the FSP will be affected.

APPENDIX A

PUBLIC LAW 104-93

SEC. 855. STUDY OF THE USE OF FOOD STAMPS TO PURCHASE VITAMINS AND MINERALS.

(a) IN GENERAL. – The Secretary of Agriculture, in consultation with the National Academy of Sciences and the Center for Disease Control and Prevention, shall conduct a study on the use of food stamps provided under the Food Stamp Act of 1977 (7 U.S.C. 2011 et seq.) to purchase vitamins and minerals.

(b) ANALYSIS. – The study shall include–

(1) an analysis of scientific findings on the efficacy of and need for vitamins and minerals, including–

(A) the adequacy of vitamins and mineral intakes in low-income populations, as shown by research and surveys conducted prior to the study; and

(B) the potential value of nutritional supplements in filling nutrient gaps that may exist in the United States population as a whole or in vulnerable subgroups in the population;

(2) the impact of nutritional improvements (including vitamin or mineral supplementation) on the health status and health care costs of women of childbearing age, pregnant or lactating women, and the elderly;

(3) the cost of commercially available vitamin and mineral supplements;

(4) the purchasing habits of low-income populations with regard to vitamins and minerals;

(5) the impact of using food stamps to purchase vitamins and minerals on the food purchases of low-income households; and

(6) the economic impact on the production of agricultural commodities of using food stamps to purchase vitamins and minerals.

(e) REPORT. – Not later than December 15, 1998, the Secretary shall report the results of the study to the Committee on Agriculture of the House of Representatives and the Committee on Agriculture, Nutrition, and Forestry of the Senate.

APPENDIX B

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REFERENCES

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APPENDIX C

ADDITIONAL TABLES

Table C.1

1994-96 CSFII Data Set, Unweighted Counts

	Sample Size, Unweighted
Group	
All Respondents	15,170
All High Income	11,225
All Low Income	3,945
Low Income:	
FSP Participants	1,593
Non-Participants	2,352
Higher Income:	
Children </= 18 yrs.	458
Non-Pregnant Females 12-50 yrs.	1,846
Females > 65 yrs.	737
Males > 65 yrs.	866
Low Income:	
Children </= 18 yrs.	174
Non-Pregnant Females 12-50 yrs.	634
Females > 65 yrs.	312
Males > 65 yrs.	225
All Income:	
Pregnant Females	70
Lactating Females	41

SOURCE: 1994-96 Continuing Survey of Food Intakes by Individuals, 2 day reporters; breastfed infants excluded.

Table C.2

Usual Nutrient Intakes (as Percentages of the 1997/98 RDAs) at Selected Percentiles, by Demographic Characteristics -- CSFII

	Folate					Magnesium				
Group	5th	25th	**50th**	75th	95th	5th	25th	**50th**	75th	95th
All Respondents	28	48	**67**	93	150	37	60	**82**	112	185
All Higher Income	29	48	**67**	93	147	39	61	**81**	110	178
All Low Income	26	46	**67**	97	157	33	59	**84**	122	217
Low Income:										
FSP Participants	26	48	**71**	103	164	33	62	**91**	137	240
Non-Participants	27	46	**65**	92	149	34	57	**80**	113	193
Higher Income:										
Children </= 18 yrs.	42	67	**92**	123	184	48	84	**121**	170	262
Females 12-50 yrs.	28	42	**55**	71	102	42	58	**72**	87	114
Females >65 yrs.	28	43	**56**	72	102	41	58	**72**	89	118
Males > 65 yrs.	31	49	**67**	89	132	39	55	**68**	84	111
Low Income										
Children </= 18 yrs.	41	67	**93**	126	189	50	86	**126**	181	284
Females 12-50 yrs.	24	37	**49**	65	94	36	52	**65**	80	107
Females >65 yrs.	23	35	**47**	61	89	36	49	**60**	73	93
Males > 65 yrs.	24	40	**55**	74	112	30	44	**55**	68	94
All Income:										
Pregnant Females	22	30	**378**	46	59	24	43	**59**	77	106
Lactating Females	25	39	**53**	71	109	61	79	**96**	117	155

SOURCE: 1994-96 Continuing Survey of Food Intakes by Individuals

NOTE: This table includes intake information for those nutrients of potential health concern (FASEB, 1995) that currently have revised RDAs (Institute of Medicine, FNB, 1997 and 1998)

Table C.2
(Continued)

Usual Nutrient Intakes (as Percentages of the 1997/98 RDAs) at Selected Percentiles, by Demographic Characteristics -- CSFII

	Phosphorus					Vitamin B_6				
Group	5th	25th	**50th**	75th	95th	5th	25th	**50th**	75th	95th
All Respondents	80	124	**163**	210	302	60	101	**139**	191	299
All Higher Income	82	126	**164**	210	297	62	102	**139**	188	290
All Low Income	72	116	**157**	210	316	53	97	**141**	203	330
Low Income:										
FSP Participants	71	117	**161**	219	334	55	105	**155**	223	357
Non-Participants	74	117	**154**	202	299	53	93	**134**	187	302
Higher Income:										
Children </= 18 yrs.	64	105	**146**	200	300	96	150	**199**	259	371
Females 12-50 yrs.	76	109	**136**	166	218	65	92	**115**	142	192
Females >65 yrs.	78	110	**136**	165	212	56	81	**101**	124	164
Males > 65 yrs.	103	143	**174**	209	266	59	88	**113**	142	198
Low Income										
Children </= 18 yrs.	68	110	**155**	213	323	93	149	**200**	264	395
Females 12-50 yrs.	62	96	**125**	157	214	58	87	**111**	138	187
Females >65 yrs.	70	96	**115**	137	177	41	63	**82**	106	148
Males > 65 yrs.	79	114	**144**	179	240	42	66	**88**	116	168
All Income:										
Pregnant Females	110	114	**170**	196	236	52	70	**84**	99	124
Lactating Females	122	160	**191**	226	283	50	77	**99**	124	166

SOURCE: 1994-96 Continuing Survey of Food Intakes by Individuals

Table C.2
(Continued)

Usual Nutrient Intakes (as Percentages of the 1997/98 RDAs) at Selected Percentiles, by Demographic Characteristics -- CSFII

	Vitamin B_{12}				
Group	5th	25th	**50th**	75th	95th
All Respondents	76	134	**194**	285	645
All Higher Income	77	134	**191**	275	559
All Low Income	74	137	**203**	314	740
Low Income:					
FSP Participants	80	156	**234**	405	833
Non-Participants	73	128	**183**	270	562
Higher Income:					
Children </= 18 yrs.	114	186	**251**	334	502
Females 12-50 yrs.	76	112	**148**	202	399
Females >65 yrs.	70	109	**151**	222	460
Males > 65 yrs.	84	133	**185**	273	589
Low Income					
Children </= 18 yrs.	134	206	**273**	372	712
Females 12-50 yrs.	70	106	**141**	190	349
Females >65 yrs.	46	76	**109**	162	319
Males > 65 yrs.	77	121	**172**	254	500
All Income:					
Pregnant Females	114	146	**171**	198	240
Lactating Females	83	122	**156**	194	260

SOURCE: 1994-96 Continuing Survey of Food Intakes by Individuals

Table C.3

1988-94 NHANES III Data Set

Unweighted Counts by Number of Recall Days

	Sample Size, Unweighted 1 Day	Sample Size, Unweighted 2 Days
Group		
All Respondents	28,700	1,599
All Higher Income	18,082	1,008
All Low Income	10,618	591
Low Income:		
FSP Participants	4,930	265
Non-Participants	5,688	326
Higher Income:		
Children </= 18 yrs.	7,121	420
Females 12-50 yrs.	3,865	207
Females > 65 yrs.	1,313	66
Males > 65 yrs.	1,374	73
Low Income:		
Children </= 18 yrs.	5,824	320
Females 12-50 yrs.	2,182	130
Females > 65 yrs.	625	42
Males > 65 yrs.	482	27
All Income:		
Pregnant Females	264	11

SOURCE: 1988-94 Third National Health and Nutrition Examination Survey

Table C.4

Usual Nutrient Intakes (as Percentages of the 1989 RDAs) at Selected Percentiles, by Demographic Characteristics – NHANES III

	Calcium					Folate				
Group	5th	25th	**50th**	75th	95th	5th	25th	**50th**	75th	95th
All Respondents	40	65	**88**	118	175	53	95	**144**	223	449
All Higher Income	40	65	**89**	119	176	52	92	**139**	213	431
All Low Income	39	64	**86**	116	172	56	104	**164**	259	518
Low Income:										
FSP Participants	45	68	**89**	114	160	65	121	**189**	298	583
Non-Participants	36	61	**85**	116	178	53	96	**149**	233	465
Higher Income:										
Children </= 18 yrs.	37	60	**83**	111	167	83	155	**237**	371	720
Females 12-50 yrs.	38	62	**84**	112	167	67	101	**133**	177	269
Females >65 yrs.	47	74	**100**	132	198	80	110	**135**	166	221
Males > 65 yrs.	44	70	**94**	124	178	56	86	**113**	150	223
Low Income										
Children </= 18 yrs.	35	60	**84**	115	180	87	167	**257**	396	757
Females 12-50 yrs.	43	63	**81**	102	140	76	109	**140**	181	254
Females >65 yrs.	63	82	**98**	115	145	79	108	**132**	160	212
Males > 65 yrs.	52	75	**95**	119	163	61	88	**113**	146	208

SOURCE: 1988-94 Third National Health and Nutrition Examination Survey

NOTE: Excludes individuals with missing value or nutrient intake.

Table C.4
(Continued)

Usual Nutrient Intakes (as Percentages of the 1989 RDAs) at Selected Percentiles, by Demographic Characteristics – NHANES III

	Iron					Magnesium				
Group	5th	25th	**50th**	75th	95th	5th	25th	**50th**	75th	95th
All Respondents	58	88	**115**	153	233	34	59	**86**	129	264
All Higher Income	58	88	**115**	153	235	34	58	**83**	124	248
All Low Income	58	88	**116**	152	228	36	64	**97**	151	315
Low Income:										
FSP Participants	56	86	**114**	151	226	38	70	**108**	177	366
Non-Participants	61	90	**116**	152	226	35	61	**90**	136	271
Higher Income:										
Children </= 18 yrs.	64	92	**119**	155	231	45	84	**134**	218	434
Females 12-50 yrs.	46	67	**87**	113	171	42	64	**84**	108	153
Females >65 yrs.	88	113	**133**	158	203	58	75	**89**	104	131
Males > 65 yrs.	64	97	**127**	168	254	33	50	**66**	85	124
Low Income										
Children </= 18 yrs.	61	91	**120**	157	240	45	91	**148**	240	463
Females 12-50 yrs.	46	68	**88**	115	172	45	66	**85**	107	148
Females >65 yrs.	85	110	**132**	156	199	61	75	**85**	96	114
Males > 65 yrs.	110	123	**133**	145	163	43	56	**67**	81	107

SOURCE: 1988-94 Third National Health and Nutrition Examination Survey

Table C.4
(Continued)

Usual Nutrient Intakes (as Percentages of the 1989 RDAs) at Selected Percentiles, by Demographic Characteristics – NHANES III

	Phosphorus					Vitamin A				
Group	5th	25th	**50th**	75th	95th	5th	25th	**50th**	75th	95th
All Respondents	62	97	**128**	168	248	41	70	**100**	148	278
All Higher Income	62	97	**128**	168	249	39	67	**97**	141	259
All Low Income	62	96	**127**	167	246	45	77	**111**	168	355
Low Income:										
FSP Participants	64	98	**129**	168	244	53	88	**130**	208	406
Non-Participants	61	95	**126**	166	246	42	71	**102**	149	280
Higher Income:										
Children </= 18 yrs.	55	87	**119**	161	254	56	92	**129**	184	321
Females 12-50 yrs.	59	91	**121**	160	237	63	87	**110**	142	211
Females >65 yrs.	83	115	**143**	177	238	53	79	**103**	134	199
Males > 65 yrs.	72	106	**136**	172	237	35	58	**80**	111	179
Low Income										
Children </= 18 yrs.	56	91	**124**	168	263	59	97	**139**	219	516
Females 12-50 yrs.	60	91	**117**	149	209	51	76	**101**	138	232
Females >65 yrs.	93	120	**141**	164	203	52	77	**101**	132	195
Males > 65 yrs.	90	118	**141**	169	222	32	50	**69**	94	152

SOURCE: NHANES III 1988-94

Table C.4
(Continued)

Usual Nutrient Intakes (as Percentages of the 1989 RDAs) at Selected Percentiles, by Demographic Characteristics – NHANES III

	Vitamin B_6					Vitamin B_{12}				
Group	5^{th}	25^{th}	**50^{th}**	75^{th}	95^{th}	5^{th}	25^{th}	**50^{th}**	75^{th}	95^{th}
All Respondents	40	68	**94**	131	221	83	148	**217**	331	741
All Higher Income	39	66	**92**	129	215	80	143	**209**	316	682
All Low Income	44	73	**101**	142	237	93	166	**242**	381	918
Low Income:										
FSP Participants	45	75	**106**	149	253	103	183	**275**	444	1,018
Non-Participants	44	72	**99**	135	226	91	158	**226**	337	712
Higher Income:										
Children </= 18 yrs.	51	85	**119**	170	300	95	187	**293**	468	1,057
Females 12-50 yrs.	48	75	**99**	128	191	85	139	**191**	268	571
Females >65 yrs.	65	85	**102**	122	155	178	196	**210**	224	248
Males > 65 yrs.	40	59	**76**	98	139	87	137	**182**	241	365
Low Income										
Children </= 18 yrs.	54	90	**126**	179	311	109	207	**317**	531	1,386
Females 12-50 yrs.	52	76	**99**	128	182	167	195	**219**	247	301
Females >65 yrs.	69	86	**100**	116	142	122	169	**213**	267	366
Males > 65 yrs.	41	58	**74**	95	135	99	143	**186**	246	374

SOURCE: 1988-94 Third National Health and Nutrition Examination Survey

Table C.4
(Continued)

Usual Nutrient Intakes (as Percentages of the 1989 RDAs) at Selected Percentiles, by Demographic Characteristics – NHANES III

	Vitamin C					Vitamin E				
Group	5th	25th	**50th**	75th	95th	5th	25th	**50th**	75th	95th
All Respondents	73	126	**178**	247	382	42	66	**91**	127	215
All Higher Income	69	122	**176**	247	388	40	64	**88**	123	214
All Low Income	82	135	**186**	249	374	49	75	**100**	137	223
Low Income:										
FSP Participants	86	140	**192**	256	379	43	71	**98**	139	242
Non-Participants	80	132	**182**	244	370	56	80	**103**	133	201
Higher Income:										
Children </= 18 yrs.	94	160	**222**	299	446	47	74	**103**	145	253
Females 12-50 yrs.	61	112	**162**	228	355	55	77	**97**	126	193
Females >65 yrs.	116	156	**189**	230	301	70	87	**101**	117	145
Males > 65 yrs.	59	110	**164**	239	387	39	58	**76**	100	150
Low Income										
Children </= 18 yrs.	99	162	**220**	293	434	53	82	**112**	158	277
Females 12-50 yrs.	80	128	**172**	227	325	66	89	**109**	133	179
Females >65 yrs.	88	131	**170**	215	294	57	78	**97**	120	163
Males > 65 yrs.	79	117	**151**	194	272	61	70	**77**	84	97

SOURCE: 1988-94 Third National Health and Nutrition Examination Survey

Table C.4
(Continued)

Usual Nutrient Intakes (as Percentages of the 1989 RDAs) at Selected Percentiles, by Demographic Characteristics --- NHANES III

	Zinc				
Group	5th	25th	**50th**	75th	95th
All Respondents	37	56	**73**	99	157
All Higher Income	36	55	**73**	98	157
All Low Income	41	60	**79**	104	157
Low Income:					
FSP Participants	41	61	**81**	109	166
Non-Participants	42	61	**78**	100	154
Higher Income:					
Children </= 18 yrs.	44	67	**88**	116	179
Females 12-50 yrs.	44	63	**79**	101	146
Females >65 yrs.	49	65	**80**	98	133
Males > 65 yrs.	30	45	**59**	78	118
Low Income					
Children </= 18 yrs.	44	66	**89**	119	190
Females 12-50 yrs.	46	64	**80**	100	140
Females >65 yrs.	56	69	**79**	91	111
Males > 65 yrs.	42	53	**63**	77	108

SOURCE: 1988-94 Third National Health and Nutrition Examination Survey

Table C.5

Dietary Supplement Use by Individuals -- CSFII[a]
Unweighted Counts

Supplement Frequency or Type	Number of Persons Reporting Use 2-Day Data Set n=15,170
Any Vitamin or Mineral Use	7,130
Multivitamin	3,133
Multivitamin and Mineral	2,559
Iron and Vitamin C Combination	409
Any Single Vitamin	2,171
Specific Single Vitamin or Mineral	
Calcium	653
Folacin	52
Iron	221
Magnesium	40
Phosphorus	5
Vitamin A	210
Vitamin B (not further specified)	540
Vitamin C	1,286
Vitamin E	846
Zinc	40
Other Single Vitamin or Mineral	695
Fish Oil	233
Fiber	514

SOURCE: 1994-96 Continuing Survey of Food Intakes by Individuals

[a] The count for the multi-vitamin category includes those who answered “yes” to the question, “Do you usually take a multi-vitamin?” The count for the single vitamin and mineral category includes those who answered “yes” to the question, “Do you usually take single vitamins or mineral?” For those reporting single vitamin or supplement use, counts are broken out by specific type.

Table C.6

Dietary Supplement Use by Individuals -- NHANES III
Unweighted Counts

	Number of Persons Reporting Use in Past Month 1 and 2 day data sets n=29,228
Any Use of Vitamins or Minerals	9,815
Yes to Use of One or More Specific Product Type	10,653
Multivitamin	4,146
Vitamin-Mineral Combination	4,391
Multimineral	331
Single Vitamin	2,146
Single Mineral	2,027
Other	1,077

SOURCE: 1988-1994 Third National Health and Nutrition Examination Survey

Table C.7

Selected Characteristics for Households by Income -- CES

	Higher Income Households n=833	Low Income Households n=833
Annual Gross Income*	$45,560	$8,780
Weekly Food Expense*	$87	$54
Household Size	2.6	2.6
Age of Household Head:*		
Less than 30 yrs.	14%	21%
30-59 yrs.	62	42
60 yrs. or More	24	37
Education of Household Head:*		
Less than High School Degree	13%	41%
Completed High School	31	29
More than High School Degree	56	30
Race of Household Head:*		
Non-White	11%	23%
White	89	77
Household Configuration:*		
Husband & Wife w/ Children	33%	20%
Husband & Wife w/o Children	23	9
Single Parent w/ Children	5	17
Single Person	24	36
Other	15	18
Food Stamp Receipt:*		
Yes	2%[a]	31%[b]
No	98	69

SOURCE: 1994 Consumer Expenditure Survey

*Statistically significant differences at $p \leq .05$; *t* and *chi-square* statistics used as appropriate.

Table C.8

[a] Because household circumstances may fluctuate over the course of a year it is understandable that a small percentage of household reporting incomes > 130 percent of poverty also report having received food stamp benefits sometime during the past year.

[b] The finding that only 31percent of low income household reported receiving food stamp benefits sometime during the past year is an anomaly, but one that has been observed previously with CES data. It may be that some households have underreported income and been inaccurately classified.

Expenditure and Quantity Shares for Selected Vitamins and Minerals in Supermarkets and Drug Stores Combined, by Brand Types – A.C. Nielsen

	Expenditure Share		Quantity Share	
Adult Single Vitamins		.415		.488
A	0.15		.022	
A/D	.005		.006	
B_6	.030		.031	
E	.499		.388	
C				
Tablet	.369		.465	
Chewable	.073		.063	
Folacin	.009		.026	
Adult Single Minerals		.205		.189
Calcium	.284		.288	
Calcium/D	.408		.390	
Iron	.181		.156	
Magnesium	.034		.041	
Zinc	.093		.125	
Adult Multvitamins		.349		.298
w/o Minerals	.165		.222	
w/ Minerals	.863		.778	
Children's Multivitamins		.033		.023
w/o Minerals	.609		.659	
w/ Minerals	.391		.341	

SOURCE: A.C. Nielsen (weeks ending 9/21/96 through 9/13/97); Tables 5.1 and 5.2

Table C.9

Quantity Share for Selected Vitamins and Minerals, by Store and Brand Types – A.C. Nielsen

	Super-Market	Drug Store	National Brands	Private Label Generic
Adult Single Vitamins				
A	0.38	0.62	0.41	0.59
A/D	.36	.64	.60	.40
B_6	.39	.61	.45	.55
E	.30	.70	.38	.62
C				
Tablets	.36	.64	.37	.63
Chewable	.52	.48	.42	.58
Folacin	.31	.69	.54	.46
Single Vitamins Overall	**0.35**	**0.65**	**0.38**	**0.62**
Adult Single Minerals				
Calcium	0.34	0.66	0.50	0.50
Calcium/D	.33	.67	.51	.49
Iron	.27	.73	.44	.56
Magnesium	.33	.67	.65	.35
Zinc	.37	.63	.51	.49
Single Mineral Overall	**0.33**	**0.67**	**0.50**	**0.50**
Adult Multivitamins				
w/o Minerals	0.33	0.67	0.40	0.60
w/ Minerals	.42	.58	.70	.30
Multivitamins Overall	**0.40**	**0.60**	**0.64**	**0.36**
Children's Multivitamins				
w/o Minerals	0.64	0.36	0.59	0.41
w/ Minerals	.68	.32	.49	.51
Children's Multivitamins Overall	**0.65**	**0.35**	**0.63**	**0.37**

SOURCE: A.C. Nielsen (weeks ending 9/21/96 through 9/13/97)

Table C.10

Expenditure and Quantity Shares for Select Vitamins and Minerals in Supermarkets, by Brand Types – A.C. Nielsen

		Quantity Share		
	Expenditure Share Overall	National Brands	Private Label/ Generic	Overall
Adult Single Vitamins	.404	.357	.574	.464
A	.014	.022	.025	.024
A/D	.005	.013	.002	.006
B_6	.029	.039	.032	.035
E	.454	.331	.342	.338
C				
Tablets	.392	.461	.495	.482
Chewable	.099	.100	.090	.094
Folacin	.007	.035	.014	.022
Adult Single Minerals	.161	.164	.178	.171
Calcium	.296	.261	.330	.297
Calcium/D	.447	.426	.360	.392
Iron	.125	.117	.139	.128
Magnesium	.026	.051	.030	.040
Zinc	.106	.147	.139	.143
Adult Multvitamins	.379	.429	.219	.325
w/o Minerals	.143	.125	.303	.184
w/ Minerals	.857	.875	.697	.816
Children's Multivitamins	.056	.050	.030	.040
w/o Minerals	.596	.597	.744	.643
w/ Minerals	.404	.403	.256	.357

SOURCE: A.C. Nielsen (weeks ending 9/21/96 through 9/13/97); Tables 5.1, 5.2 and 5.3

Table C.11

Percentage of Households Who Reported Vitamin and Mineral Purchases, by Income and Food Stamp Program Status

Groups	Those Who Bought Supplements		Those Who Did Not Buy Supplements	
	Number	Percent	Number	Percent
Higher Income Households	51	6.1	782	93.9
All Low-income Households	30	3.6	803	96.4
Low-income Households Receiving Food Stamps	9	3.6	241	96.4
Low-income Households Not Receiving Food Stamps	72	5.1	1344	94.9
All Households	**81**	**4.9**	**1585**	**95.1**

SOURCE: 1994 Consumer Expenditure Survey

Table C.12

Estimated Effect of Household Dietary Supplement Use on Food Expenditures

	All Households	Higher-Income Households	Low-Income Households	**Food Stamps Households**
Intercept	4.58*	4.56*	4.60*	**4.41***
Supplement Amount Used	.071*	.055*	.093*	**.157***
Households Size	.174*	.177*	.171*	**.129***
Children Present	.167*	.122*	.287*	**.513***
Age of Household Head	.001*	.002*	-.001	**.002**
Income	.075*	.070*	.070*	**.079***
Supplement by Children Present	-.080*	-.058	-.110*	**-.168***

SOURCE: 1994-96 Continuing Survey of Food Intakes by Individuals

NOTE: Asterisk (*) indicates statistically significant regression coefficients with $p \leq .05$.

Table C.13

Impact of FSP Policy Change on Household Food Expenditures by Food Category

Expenditure Category	Average Monthly Expenditure for All FSP Households		Impact of FSP Policy Change on Food Expenditures			
	Expenses	**Share**	**No Impact**	**Low Impact**	**Medium Impact**	**High Impact**
Number of Food Stamp Households	250					
Bakery and Cereal Products	$31.64	14.12%	$0.00	-$0.04	-$0.09	-$0.13
Meat Products	$39.18	17.49%	$0.00	-$0.04	-$0.09	-$0.16
Poultry	$14.71	6.57%	$0.00	-$0.02	-$0.03	-$0.06
Fish and Seafood	$8.55	3.82%	$0.00	-$0.01	-$0.02	-$0.04
Eggs	$3.35	1.50%	$0.00	-$0.00	-$0.01	-$0.01
Dairy Products	$22.48	10.03%	$0.00	-$0.03	-$0.05	-$0.09
Fresh Fruits	$9.33	4.16%	$0.00	-$0.01	-$0.02	-$0.04
Fresh Vegetables	$10.54	4.70%	$0.00	-$0.01	-$0.02	-$0.04
Processed Fruits and Vegetables	$13.11	5.85%	$0.00	-$0.01	-$0.03	-$0.06
Fats and Oils	$6.70	2.99%	$0.00	-$0.01	-$0.02	-$0.03
Other Foods	$64.47	28.77%	$0.00	-$0.08	-$0.15	-$0.27
Total Food at Home	**$224.06**	**100.00%**	**$0.00**	**-$0.26**	**-$0.52**	**-$0.94**

SOURCE: 1994 Consumer Expenditure Survey

NOTE: See Chapter 6 for definition of impact categories

APPENDIX D

REPORT PREPARED BY LIFE SCIENCES RESEARCH OFFICE

POTENTIAL VALUE OF VITAMIN AND MINERAL SUPPLEMENTS TO MEET NUTRIENT GAPS AMONG LOW-INCOME INDIVIDUALS

POTENTIAL VALUE OF VITAMIN AND MINERAL SUPPLEMENTS TO MEET NUTRIENT GAPS AMONG LOW-INCOME INDIVIDUALS

Life Sciences Research Office

OVERVIEW

In the Personal Responsibility and Work Opportunity Reconciliation Act of 1996, Congress specified that the Secretary of Agriculture, consulting with appropriate outside experts, conduct a study on the use of food stamps to purchase nutritional (i.e., vitamin and mineral) supplements. Presently, Food Stamp Program (FSP) participants can only purchase food products and seeds for gardening with their stamps. USDA sought the assistance of the Life Sciences Research Office (LSRO) in identifying and assessing the quality of available research regarding:

> "(1) the potential value of vitamin and mineral supplements in filling nutrient gaps, and (2) the comparative impact of vitamin and mineral supplements, improved diets, and the intake of fortified foods on health status and health care costs."

LSRO was asked to review and evaluate current knowledge and scientific opinion on these two aspects of USDA's study. To carry out this charge, LSRO assembled an eight-member ad-hoc Expert Panel and held a two-day meeting. The discussions from that meeting formed the basis of this report; additional sources were literature collected by staff and the Expert Panel and relevant materials submitted by interested individuals and organizations in response to an invitation for public comment.

The Expert Panel concluded that any of the three general approaches to meeting nutrient needs – improved diets, fortified foods, and nutritional supplements – could help reduce or eliminate nutrient gaps and possibly improve health. However, health status is only partly related to diet and nutritional supplement use, and their effects vary among individuals and by disease or medical problem. The Expert Panel did not identify any research on the comparative impact of improved diets, fortified foods, and nutritional supplements on health status and health-care costs among U.S. citizens. However, numerous studies have included estimates of the potential savings in U.S. health-care costs of single approaches, and others have compared the relative merits of two approaches.

The Expert Panel reviewed micronutrient-intake data from a nationally representative survey conducted by USDA in 1994-1995 (see Guthrie, 1998 in Appendix E). It found that, for the ten vitamins and minerals examined, intakes of FSP participants were usually equal to or greater than the nutrient intakes of individuals with incomes higher than 130 percent of the poverty line. These data suggest that the current FSP has achieved the goal of ensuring basic social equity in access to food irrespective of income. Consequently, a recommendation to use nutritional supplements to achieve this goal is not supportable scientifically. While nutritional supplements can be useful to some people, the Expert Panel was unaware of any scientific evidence that supplements would benefit FSP participants as a group.

The Expert Panel concluded that research is needed to assess how permitting FSP participants to purchase nutritional supplements with food stamps would affect their health-related behaviors and overall health. The Expert Panel made the following recommendations:

- Compare the food-consumption patterns of FSP participants, low-income nonparticipants, and higher-income individuals against the recommendations of the Food Guide Pyramid issued by USDA. Because similar nutrient intakes do not necessarily reflect similar food-consumption patterns, and because adequate micronutrient intakes may not be sufficient to minimize the risks of chronic disease, a full evaluation of nutritional adequacy requires data on both nutrient and food intakes.

- Understand why consumers take supplements, how they choose which products to take, and how their dietary behaviors may be affected by the practice.

- Compare the cost-effectiveness of the use of nutritional supplements by FSP participants against the approaches of improved diets and food fortification.

- Study whether supplemental nutrients, singly or in combination – as opposed to foods or diets – are useful in reducing the occurrence or progression of chronic disease.

If there were to be a change in the FSP to allow participants to purchase supplements with food stamps prior to the requisite studies, the Expert Panel recommended the following:

- Consider limiting the approved products to nutritional supplements rather than all dietary supplements.

- Consider further limiting the nutritional supplements allowed to multiple vitamin-mineral products that do not exceed the nutrient recommendations of the Food and Nutrition Board (FNB) of the Institute of Medicine, National Academy of Sciences. Most members of the Expert Panel supported this recommendation to reduce the risks of toxicity and nutrient imbalances from nutritional supplement use. However, one member recommended that single-nutrient supplements might also be available for purchase with food stamps at potencies that do not exceed the nutrient recommendations of the FNB.

- Initiate educational efforts to guide FSP participants to appropriate products, and inform them how to use nutritional supplements and fortified foods to avoid excessive nutrient intakes.

In the judgment of the Expert Panel, any discussion over possible coverage for nutritional supplements in the FSP should include an examination of the nutritional goals of all federal food-assistance and health programs. This recommendation is based on the Expert Panel's awareness that low-income individuals often participate in multiple programs (some of which provide nutritional supplements), knowledge that these federal assistance programs help to improve public health, and recognition that the definition and assessment of nutritional adequacy are evolving.

A nutritionally adequate diet is commonly viewed as one that meets approximately 100 percent of nutrient allowances as established by the FNB and includes the recommended number of servings from each food group in the Food Guide Pyramid. The achievement of nutritional adequacy may include the use of nutritional supplements when needed. But the use of high doses of nutritional supplements as preventive or therapeutic agents for chronic diseases that occur with age has been viewed as an unrelated issue. This traditional view of nutritional adequacy may need to be reconsidered on the basis of recent and future research, including the ongoing efforts of the FNB to develop nutrient recommendations that take into account the prevention of chronic degenerative disease as a criterion of adequacy. The Expert Panel believes that any definition of nutritional adequacy will need to include both a food and a nutrient component, because food contains many biologically important compounds and our knowledge of them is as yet incomplete.

Any changes in how nutritional adequacy might be defined in the future would have implications for the nutritional standards of food-assistance programs. Therefore, perhaps the time to revisit the nutrition-related goals of the FSP and related programs is when the FNB completes its process of issuing new guidelines for nutrient intakes (i.e., Dietary Reference Intakes or DRIs) and makes more detailed recommendations as to how these guidelines should be met.

I. INTRODUCTION

A. Background

On August 22, 1996, the Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (also known as the Welfare Reform Act) became Public Law 104-193 (U.S. Congress, 1996[1]). Section 855 of this law specified that the Secretary of Agriculture, consulting with appropriate outside experts, would conduct a study on the use of food stamps to purchase nutritional supplements [2] . Presently, Food Stamp Program (FSP) participants can only purchase food products and seeds for gardening with their stamps. Public Law 104-193 mandated that the U.S. Department of Agriculture (USDA) study be completed and presented to Congress by December 15, 1998 and include the following components:

> "(1) an analysis of scientific findings on the efficacy of and need for vitamins and minerals, including–
>
> (A) the adequacy of vitamin and mineral intakes in low-income populations, as shown by research and surveys conducted prior to the study; and
>
> (B) the potential value of nutritional supplements in filling nutrient gaps that may exist in the United States population as a whole or in vulnerable subgroups in the population;
>
> (2) the impact of nutritional improvements (including vitamin or mineral supplementation) on the health status and health care costs of women of childbearing age, pregnant or lactating women, and the elderly;
>
> (3) the cost of commercially available vitamin and mineral supplements;
>
> (4) the purchasing habits of low-income populations with regard to vitamins and minerals;
>
> (5) the impact of using food stamps to purchase vitamins and minerals on the food purchases of low-income households; and

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1 Full reference for all citations in this report are provided in Appendix B under Chapter 3.

2 Dietary supplements are defined by law as products "intended to supplement the diet that bears or contains one or more of the following dietary ingredients: (A) a vitamin; (B) a mineral; (C) an herb or other botanical; (D) an amino acid; (E) a dietary supplement used by man to supplement the diet by increasing the total dietary intake; or (F) a concentrate, metabolite, constituent, extract, or combination of any ingredient described in clause (A), (B), (C), (D), or (E)" (U.S. Congress, 1994). They are products labeled as dietary supplements and are not represented for use as a conventional food or sole item of a meal or the diet. This report uses the more restrictive term "nutritional supplement" to refer to products containing only or primarily vitamins and/or minerals.

(6) the economic impact on the production of agricultural commodities of using food stamps to purchase vitamins and minerals."

B. Objectives and Focus

To help prepare its Congressionally-mandated report, USDA sought the assistance of the Life Sciences Research Office (LSRO) in identifying and assessing the quality of available research regarding:

(1) the potential value of vitamin and mineral supplements in filling nutrient gaps, and

(2) the comparative impact of vitamin and mineral supplements, improved diets, and the intake of fortified foods on health status and health care costs.

LSRO was asked to prepare a concise and documented report that reviewed and evaluated current knowledge and scientific opinion on these two aspects of USDA's study.

The issue of whether or not FSP participants should be allowed to use their food stamps to purchase nutritional supplements has generated both substantial support and opposition. A variety of non-profit organizations, dietary supplement companies, trade associations, professional societies, and individual scientists and public-health experts have commented on this controversial topic. A wide range of views were expressed at a Congressional hearing on a proposed bill that would have allowed nutritional supplements to be purchased with food stamps (U.S. Congress, 1995).

In considering how vitamin and mineral supplements, better diets, and fortified foods may help individuals achieve nutritional adequacy and perhaps improve health status and lower health-care costs, LSRO studied subgroups likely to be receiving food stamps, such as low-income children, women of childbearing age, pregnant and lactating women, and the elderly. USDA and LSRO agreed to define *nutritional adequacy* as meeting: (1) approximately 100% of nutrient allowances (e.g., Recommended Dietary Allowances [RDAs]) as established by the Food and Nutrition Board (FNB) (Institute of Medicine, 1997, 1998; National Research Council, 1989a), and (2) the recommended number of servings from the five groups in the Food Guide Pyramid developed by USDA (1992).

C. Technical Approach

LSRO assembled an ad-hoc Expert Panel of eight members with expertise in nutrition research, clinical nutrition, nutrition education, public health, and agricultural and medical economics (see Appendix F). LSRO staff met with USDA representatives to identify the specific topics to be covered so that this LSRO report would address the needs of USDA with its larger study on food stamps and nutritional supplements. USDA provided LSRO with information about the FSP and two draft background papers: (1) an assessment of the adequacy of vitamin and mineral intakes of low-income Americans (Guthrie, 1998), and (2) a report on the economic costs of poor eating patterns in the United States (Frazao, 1998) (see Appendix E).

LSRO collected relevant scientific literature and sent an announcement to interested parties requesting additional data comparing vitamin-mineral supplements, eating an overall better diet, and/or eating specific fortified foods to help individuals achieve nutritional adequacy, improve health or health status, and affect health-care costs for individuals, groups, or this country in general (see Appendix G). Comparative data were also requested on consumer attitudes, behaviors, and preferences for increasing the vitamin-mineral content of diets by these three approaches. Approximately 75 announcements were mailed, primarily to individuals and organizations presenting oral testimony to the Commission on Dietary Supplement Labels (1997). The announcement appeared in *ASNS Notes*, the newsletter for members of the American Society for Nutritional Sciences; it was also placed on the Food and Nutrition Specialists email listserv, reaching its hundreds of subscribers. A summary of the announcement was published in *Food Chemical News*, *Food Labeling and Nutrition News*, and *The Tan Sheet*. Seven responses were received (see Appendix G).

The Expert Panel met on March 19-20, 1998 at the LSRO offices in Bethesda, MD. This report was prepared by staff based on deliberations of the Expert Panel and an analysis of relevant literature. Expert Panel members had the opportunity to review each draft of the report.

II. NUTRITION AND HEALTH

There is virtually unanimous scientific agreement that dietary patterns and nutrient intakes can profoundly affect overall health and substantially influence a person's risks of developing numerous chronic, degenerative diseases (Cannon, 1992; National Research Council, 1989b). Poor-quality diets and physical inactivity are estimated to account for at least 300,000 deaths in the United States each year, 14 percent of all deaths (McGinnis and Foege, 1993). Poor eating habits were estimated to cost this country at least $71 billion/year due to premature deaths and medical-care costs (Frazao, 1998). In the late 1980s, the Surgeon General of the United States (U.S. Department of Health and Human Services [DHHS], 1988) and the National Research Council (1989a) summarized the scientific data about diet and health relationships. Recent reviews on selected diet/health topics have been published by the American Heart Association (1996) and the World Cancer Research Fund and American Institute for Cancer Research (1997) and in major nutrition journals such as *Annual Review of Nutrition* (see, for example, Halliwell, 1996; Kurzer and Xu, 1997; and Naylor and Paterson, 1996). Policy documents such as the various editions of *Dietary Guidelines for Americans* (U.S. Department of Agriculture [USDA] and DHHS, 1980, 1985, 1990, 1995) and *Healthy People 2000* (DHHS, 1991) provide dietary guidance and targets to achieve based on the scientific findings.

The Surgeon General's nutrition report stated: "For the two out of three adult Americans who do not smoke and do not drink excessively, one personal choice seems to influence long-term health prospects more than any other: what we eat" (DHHS, 1988). This statement attests to the importance of nutrition but notes that other factors affect health. Among them are genetic endowment, gender, and age as non-modifiable factors and physical activity, hygiene, stress, substance abuse, and dietary patterns as modifiable ones. In addition, low socioeconomic status is associated with poor health and adverse health outcomes, operating through behavioral and environmental factors such as substance abuse, poor nutrition, inadequate social networks, and reduced access to health care (Haan et al., 1987; Lantz et al., 1998; Lynch et al., 1997).

In the first half of this century, human nutrition research was focused primarily on vitamins and minerals and their role in the prevention and correction of nutrient deficiencies (National Research Council, 1989b). Inadequate intakes of nutrients can lead to deficiency diseases if not corrected. For example, anemia due to iron deficiency is common worldwide among children and menstruating and pregnant women (Centers for Disease Control and Prevention [CDC], 1998; Looker et al., 1997; Walker, 1998). Goiter and mental retardation related to iodine deficiency have been and continue to be public-health problems in some parts of the world, although fortification of table salt with iodine has helped to reduce their incidence (Alnwick, 1998; Clugston and Hetzel, 1994; Solomons, 1998).

Since World War II, human nutrition research has investigated the role of diet in the prevention and treatment of a variety of chronic, degenerative diseases such as cardiovascular disease, cancer, stroke, and diabetes (National Research Council, 1989b). Research shows that dietary patterns closely linked to health and reduced risk of disease are relatively low in total fat (especially saturated fat), sodium, and added sugars; high in complex carbohydrates; and moderate in protein. However, the links between diet and chronic-disease risk are more complex than the links between individual nutrients and deficiency diseases. Chronic diseases have numerous etiologies, and the extent to which dietary patterns or consumption of specific nutrients may contribute for any given individual is difficult to assess.

Advances in molecular biology and genetic engineering have led to the identification and characterization of genes associated with many nutrition-related chronic diseases (Bowers and Allred, 1995). Some nutrients are known to influence the transcription and translation of gene products. The presence of a defective gene, for example, may increase an individual's risk of a disease, but dietary measures may reduce that risk. Aberrant genes may affect nutritional needs as well. There is evidence that women with variants of the vitamin D receptor gene have reduced bone density and reduced calcium-absorption efficiency when calcium intakes are low (Dawson-Hughes et al., 1995; Krall et al., 1995). Iron-containing supplements could be harmful to individuals with a genetic predisposition to iron storage and hemochromatosis (Fairbanks, 1994; Herbert, 1992).

Dietary guidelines internationally advise people to eat more grains, vegetables, and fruits; to choose lower-fat meat and dairy products; to eat a wide variety of foods; to balance energy intake with expenditure; and to drink alcohol moderately if at all (Cannon, 1992; National Research Council, 1989b; World Cancer Research Fund and American Institute for Cancer Research, 1997). Varied diets based on these guidelines should meet the nutrient needs of most people. Foods also supply biologically active phytochemicals, fiber, and other non-nutrient substances that are associated with reduced risks of chronic diseases (Decker, 1995; Nestle, 1997). For example, strong correlations are found between fruit and vegetable consumption and reduced risks of cancer, a connection not well explained by any nutrient (such as vitamin C) or phytochemical (such as individual carotenoids) in these foods (Block et al., 1992; Food and Drug Administration [FDA], 1993a; Ross, 1991; Sauberlich, 1991). Given the uncertainty in many instances of the critical substances in foods associated with health and disease prevention, dietary guidance to consumers should continue to place primary emphasis on a balanced diet that incorporates a variety of foods.

A. Defining Nutritional Adequacy

In the current (4th) edition of *Dietary Guidelines for Americans* (USDA and DHHS, 1995), nutritionally adequate "healthful" diets are defined as those containing "the amounts of essential nutrients and calories needed to prevent nutritional deficiencies and excesses" and that "provide the right balance of carbohydrate, fat, and protein to reduce risks for chronic diseases, and are part of a full and productive lifestyle. Such diets are obtained from a variety of foods that are available, affordable, and enjoyable." The report also states: "To make sure you get all of the nutrients and other substances needed for health, choose the recommended number of daily servings from each of the five major food groups displayed in the Food Guide Pyramid" (USDA and DHHS, 1995).

The Food Guide Pyramid serves as the standard for evaluating nutritional adequacy in terms of foods and dietary patterns (USDA, 1992). The RDAs are used as the standards of vitamin and mineral adequacy for groups of healthy people and, in common practice, for individuals (Food and Nutrition Board, Institute of Medicine [National Research Council], 1997, 1998; National Research Council, 1989a). RDAs have been defined as "levels of intake of essential nutrients that, on the basis of scientific knowledge, are judged...to be adequate to meet the known nutrient needs of practically all healthy persons" (National Research Council, 1989a). RDAs are "safe and adequate, but not necessarily the highest or lowest figures that the data might justify." They incorporate safety factors and "exceed the actual requirements of most individuals." The FNB has begun to issue new guidelines for nutrient intakes, termed Dietary Reference Intakes (DRIs) (Food and Nutrition Board, 1997, 1998). DRIs expand on the RDAs by placing greater emphasis on health promotion and disease prevention[3] .

The traditional focus of nutritional adequacy on the prevention of nutrient deficiencies is being expanded by research which suggests that higher intakes of certain nutrients may provide additional health benefits. For example, in one controlled study, elderly men and women with calcium and vitamin D intakes at approximately RDA levels who also received supplements of these nutrients had a moderate reduction in bone loss compared to subjects receiving the same diet and a placebo supplement (Dawson-Hughes et al., 1997). Some studies have shown that intakes of vitamin E beyond the RDA and what can be obtained from reasonable diets may increase protection from oxidative stresses that appear to be related to heart disease, cancer, and other diseases of aging (Heinonen et al., 1998; Meydani et al., 1997; Rimm et al., 1993; Stephens et al., 1996). In a randomized, controlled study, 96 middle class, independently living, and

[3] To date, DRIs have been issued for calcium, phosphorus, magnesium, vitamin D, fluoride, thiamin, riboflavin, niacin, vitamin B6, folate, vitamin B12, pantothenic acid, biotin, and choline. DRIs for the remaining micronutrients, macronutrients, electrolytes, and selected other substances in food are expected over the next several years (Food and Nutrition Board, 1997, 1998).

apparently healthy elderly individuals were given either a placebo or dietary supplement containing most nutrients in modest amounts (except for vitamin E and ß-carotene in larger amounts) for 12 months. Those taking supplements experienced statistically significant improvements in several immunological parameters and had less than half as many days of infection-related illness as those taking placebos (Chandra, 1992). Other studies do not show vitamin E supplements to be of benefit (Kushi et al., 1996; The Parkinson Study Group, 1993; Priemé et al., 1997).

An adequate intake for a nutrient is somewhere between the extremes of deficient and excessive intakes. At either end of this continuum, negative biochemical, physiological, or clinical consequences can occur. There are risks to health when nutrient intakes are too low or too high. But there is great uncertainty about when these points are reached with any one nutrient for any given individual. Nutrient recommendations (i.e., RDAs and DRIs) reflect the best judgments of experts about the levels of nutrient intakes that are associated with minimal risk of inadequacy or toxicity (National Research Council, 1997, 1998; National Research Council, 1989a).

Nutritional supplements and appropriately fortified foods, in addition to improved diets, have been recommended to people who are at risk of nutrient deficiencies. These include individuals with medical conditions that raise nutrient needs, older people and others with little exposure to sunlight (vitamin D), pregnant women (iron), and people eating low-energy diets (National Research Council, 1989a; USDA and DHHS, 1995). An expanding database of research studies has provided some support for the greater use of nutritional supplements. For example, the FNB recently recommended that women capable of becoming pregnant consume the DRI for folate from fortified foods and/or supplements in addition to the folate they obtain from a varied diet to reduce the risk of neural tube defects (NTDs) in their infants (National Research Council, 1998). Similarly, because 10-30 percent of older adults have lost the ability to absorb sufficient amounts of naturally occurring vitamin B_{12} from food, the FNB recommended that these people meet most of the DRI for this nutrient from supplements and/or fortified foods (National Research Council, 1998). The FNB's primary indicator of adequacy for calcium – maximal bone retention – results in DRIs that many people will have difficulty meeting without the use of calcium-fortified foods or supplements (National Research Council, 1997).

It is important to address the concept of balance among nutrients when discussing nutritional adequacy. Nutrients are often studied in isolation because the data are easier to interpret than when studying them in combination. However, in the body, nutrients interact; the amount consumed of one can affect the requirement for another. Calcium is crucial to bone health, for example, but other nutrients such as phosphorus and vitamin D – as well as lifestyle factors such as not smoking, being physically active, and limiting alcohol consumption – favorably affect both calcium and bone metabolism (National Research Council, 1989).

Nutrient intakes are best evaluated in the context of total health. Yet because of narrowly focused research agendas, which typically consider only one or a small number of positive outcomes, the existence of countervailing risks often may not be readily evident. For example, beginning in the 1960s the nutrition community viewed the achievement of genetic potential for height as one important measure of adequate nutrition for children (Joint FAO/WHO/UNU

Expert Consultation, 1985). However, maximizing height is biologically associated with earlier age of menarche in girls, and early menarche has come to be recognized as a strong and consistent risk factor for breast cancer in later life (Kelsey and Bernstein, 1996; Li et al., 1997). This is but one example of tradeoffs that are known to exist across a wide range of health and environmental issues (Graham and Wiener, 1995) and require a broader perspective in risk analysis. Other examples include: (1) the relationship between supplemental beta-carotene and lung cancer among heavy smokers (Albanes et al., 1996; The Alpha-Tocopherol, Beta Carotene Cancer Prevention Study Group, 1994; Omenn et al., 1996); (2) the potential masking of vitamin B_{12} deficiency due to high intakes of folate (FDA, 1993b); and (3) the potential for iron overload in the genetically susceptible due to high intakes of iron (Herbert, 1992). These examples highlight the inadequacy of our current base of scientific knowledge which is biased in favor of single-nutrient and single-outcome relationships.

In summary, the concept of nutritional adequacy is an evolving one. A nutritionally adequate diet is commonly viewed as one that meets approximately 100 percent of nutrient allowances as established by the FNB and includes the recommended number of servings from each food group in the Food Guide Pyramid. The achievement of nutritional adequacy may include the use of nutritional supplements when needed. But the use of high doses of nutritional supplements as preventive or therapeutic agents for chronic diseases that occur with age has been viewed as an unrelated issue. This traditional view of nutritional adequacy may need to be reconsidered on the basis of recent and future research, including the ongoing efforts of the FNB to develop nutrient recommendations that take into account the prevention of chronic degenerative diseases. The Expert Panel believes that any definition of nutritional adequacy will need to include both a food and a nutrient component, because food contains many biologically important compounds and our knowledge of them is as yet incomplete. Any changes in how nutritional adequacy might be defined in the future would have implications for the nutritional standards of food assistance programs such as the FSP.

B. Nutritional Status of FSP Participants

The FSP serves almost 19 million individuals, primarily women, children, and the elderly. Food stamp allotments are based on the Thrifty Food Plan, which was developed on the basis of American eating patterns and the RDAs (Cleveland and Kerr, 1988; Ohls and Beebout, 1993; USDA, 1983). The Thrifty Food Plan is used to estimate the resources needed for low-income households to meet nutritional needs with a food-based diet.

Guthrie (1998) analyzed vitamin and mineral intakes from food among low-income Americans based on data from the 1994-1995 Continuing Survey of Food Intakes by Individuals (CSFII)[4] . For the ten nutrients examined, the percentages of the RDAs or DRIs consumed by FSP participants were often equal to or greater than those consumed by individuals with incomes higher than 130 percent of the poverty line. This finding is consistent with USDA analyses of data over the past decade (USDA, 1995).

[4] The ten nutrients examined were vitamin A, vitamin B_6, vitamin C, vitamin, folate, calcium, iron, phosphorus, magnesium, and zinc. These nutrients are considered to be of current or potential public-health concern.

In examining the data presented by Guthrie (1998), the Expert Panel observed that:

- Usual intakes of nutrients below 100% of the RDAs were more common among low-income people than higher-income people. However, in the low-income category, FSP participants consumed more nutrients from food compared to nonparticipants. This suggests the FSP participants consumed more food (data on energy intakes were not provided), more foods of high nutrient density, and/or fewer foods of low-nutrient density.

- FSP participants had nutrient intakes that were approximately equal to or greater than intakes of higher-income individuals. This observation tended to hold true except at the 5th and sometimes 25th percentiles for vitamin A, vitamin E, calcium, and phosphorus. Iron intakes were also slightly lower for FSP participants than higher-income individuals at all percentiles reported, but the majority of people in both groups had intakes greater than 100% of the RDAs.

- Dietary intakes of all nutrients were below recommended levels for some people in both the low - and high -income groups and in vulnerable groups such as the elderly (e.g., vitamin B_6) and women of childbearing age (e.g., iron). Because recommended intakes of nutrients include a wide margin of safety and are not the best standard against which to assess the nutrient intakes of groups, intakes below those levels are not necessarily suggestive of inadequacy (National Research Council, 1989a; Yates et al., 1998). Furthermore, actual nutrient intakes may have been higher since food energy intakes tend to be underreported by about 20 percent in dietary surveys (Black et al., 1993; Mertz et al., 1991; Schoeller, 1990). Nevertheless, as Guthrie (1998) notes, the existence of large numbers of individuals with intakes below the RDAs suggests the need for further initiatives to improve dietary patterns among the affected groups. Further evidence of inadequate nutrient intakes comes from the Third National Health and Nutrition Examination Survey (Alaimo et al., 1998). Approximately 9 - 12 million Americans lived in families that reported sometimes or often not having enough food to eat, primarily related to their poverty status.

- For all nutrients except for iron, the 75th and 95th percentiles of intake were actually higher for FSP participants than for those with higher incomes. The implications of this interesting finding requires further investigation.

- Overall, 46 percent of the population surveyed reported using nutritional supplements. Fewer low-income than higher-income individuals took nutritional supplements – 36.3 percent vs. 49.1 percent, respectively. However, among low-income households, 30 percent of FSP participants used nutritional supplements whereas 41.5 percent of nonparticipants used them.

The Expert Panel did not have data to compare the dietary patterns of Americans with low incomes (both FSP participants and nonparticipants) to those with higher incomes. However, a full evaluation of nutritional adequacy requires data on the intakes of both nutrients and foods. It would be very useful to compare the food intakes of these groups in relation to the recommended numbers of servings from each group in the Food Guide Pyramid because similar micronutrient intakes do not necessarily translate into equivalent food intakes. The 1989-1991 CSFII survey reported lower consumption of fruits and vegetables among individuals whose incomes were <131 percent of the poverty index compared to people with higher incomes (LSRO, 1995). Data from the Nationwide Food Consumption Survey of 1987-88 also show that low income affects how much people spend on food and what they buy (Lutz et al., 1995). Compared to households at all incomes, low-income households consumed (by weight) 10 percent fewer dairy products per capita, 3 percent more red meat, 14 percent more eggs, 31 percent fewer beverages (especially soft drinks), 12 percent more sugars and sweets, 21 percent fewer fresh fruits, and 13 percent fewer fresh vegetables (other than potatoes). Low-income households used about 11 percent more canned produce and 25 percent less frozen produce than did households overall. Households with financial constraints tended to buy lower-priced foods in all categories.

In summary, micronutrient intakes of FSP participants are similar to those of higher-income Americans and greater than those of low-income individuals who do not participate in the FSP, according to data provided to LSRO by USDA. The Expert Panel concluded that the available data suggest that micronutrient gaps are similar among FSP participants and individuals with incomes higher than 130 percent of the poverty line.

III. MEETING NUTRIENT NEEDS, IMPROVING HEALTH STATUS, AND REDUCING NUTRITION-RELATED HEALTH PROBLEMS

A. Meeting Nutrient Needs

There are three general approaches to meeting nutrient needs (i.e., closing nutrient gaps), improving health status, and reducing nutrition-related health problems: (1) improved diets, (2) fortified foods, and (3) nutritional supplements. Each approach will help reduce or eliminate nutrient gaps but not necessarily improve health status and reduce nutrition-related health problems. As explained previously, these latter two outcomes are only partly related to diet and nutritional supplement use.

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), which has a demonstrated record of improving pregnancy outcomes (Owen and Owen, 1997), utilizes each of these approaches by providing pregnant women with nutritious supplemental foods (including fortified cereals) and nutrition education and linking participants to prenatal care (where they commonly receive prenatal nutritional supplements). Current initiatives to increase folic acid intakes among women capable of becoming pregnant also involve each approach.

1. Approaches

Each approach to meeting nutrient needs has both advantages and disadvantages (i.e., tradeoffs) that depend on the nutrient in question and the affected population group. For example, common foods can be fortified with folic acid to increase the intakes of this nutrient among women in their child-bearing years and thereby reduce the incidence of NTDs among newborns. But this approach may expose some elderly people to excess folic acid such that it masks the development of pernicious anemia until irreversible neurological degeneration occurs (FDA, 1993b). An approach often works best when the individuals to be affected are able to learn about the benefits and risks and understand what types of behavior changes are recommended.

a. Improving Dietary Patterns

Eating a diet as described in the Food Guide Pyramid should raise intakes of nutrients (generally to recommended levels) and other important food constituents. There are virtually no disadvantages to this approach, except perhaps for those living in poverty who may find it difficult to purchase more vegetables, fruits, and whole-grain products. To afford these foods, they would need to buy the less costly products in each food group and limit the purchase of foods of minimal nutritional value (Kaufman et al., 1997). Fortunately, America's food supply is extremely diverse and reasonably priced, and high-quality nutrition information is readily available from multiple sources. Most Americans can obtain a nutritionally adequate diet irrespective of income if they desire to do so and have the necessary education, skills, and environmental supports (such as kitchen appliances and nearby supermarkets) (Kaufman et al., 1997; Weinberg and Epstein, 1996). Various sectors of society – including governments, the private sector, health-care professionals, and educators – should assume more responsibility in facilitating the adoption of healthier diets by more Americans (Thomas, 1991).

b. Nutritional Supplements

The use of supplements is widespread in this country (Commission on Dietary Supplement Labels, 1997). Nutritional supplements can help individuals increase their intakes of nutrients that are often not consumed in adequate amounts (e.g., iron, calcium, and folic acid) or may not be absorbed well enough from food (e.g., vitamin B_{12}). Among those who may benefit from nutritional supplements are women with heavy menstrual bleeding (iron), pregnant and lactating women (iron, folic acid, and calcium), vegetarians (vitamin B_{12}), people with very low energy intakes, and people with certain diseases or taking certain medications that alter nutrient requirements (National Research Council, 1989b). Nutritional supplements may even provide benefits to people with apparently adequate diets (Chandra, 1992; Dickinson, 1998; Russell, 1997). However, there has not been a systematic effort to determine the wide range of potential positive and negative outcomes of the use of nutritional supplements among various population groups.

There are risks to indiscriminate supplementation with nutrients at levels substantially above recommended intakes. Excessive intakes of vitamin A, for example, can injure the liver and produce birth defects (Hathcock, 1997; Rothman et al., 1995). Frank examples of toxicity are rare, but there is the possibility of imbalances since some nutrients can affect the absorption, excretion, or availability of others. For example, excess zinc can adversely affect copper status (Festa et al., 1985; Fischer et al., 1984; Sandström, 1995), and calcium supplements may interfere with iron and zinc absorption (Allen and Wood, 1994; Cook et al., 1991; Hallberg et al., 1991; National Research Council, 1989a). Large doses of one form of vitamin E ("-tocopherol, found primarily in supplements) can displace another form (-tocopherol, found primarily in food) in the tissues, possibly resulting in decreased antioxidant protection from certain free radicals (Christen et al., 1997). The bioavailability of a nutrient in supplement form may be different from its bioavailability in foods, depending on the formulation of the supplement and chemical form of the nutrient (Carr and Shangraw, 1987; Cuskelly et al., 1996; National Research Council, 1998). However, evidence of widespread occurrence of nutrient imbalances is both difficult to obtain and not well substantiated by clinical or epidemiological data.

A recent cross-sectional study suggests the possibility that some supplement takers might make dietary changes that compromise rather than improve their nutritional status (Pelletier and Kendall, 1997). This study challenges the generalization from earlier studies that nutritional supplement users tend to have better diets compared to nonusers (Dickinson, 1998; Koplan et al., 1986; Looker et al., 1988), raising doubts about accurately predicting the consequences of supplement use for different groups. People take nutritional supplements for different reasons; some take them as part of an overall healthy lifestyle while others take them to compensate for an unhealthy diet and lifestyle.

c. Fortified Foods

Fortified foods have made many positive contributions to reducing nutrient-deficiency diseases throughout the world. Iodized salt, milk with added vitamin D, and grain products enriched with several B vitamins and iron are examples of products in the United States that are fortified. Enriched grains now have folic acid added (FDA, 1996). The U.S. Food and Drug Administration has issued voluntary guidelines to food manufacturers and processors to discourage the random or indiscriminate fortification of foods (Miller and Stephenson, 1987).

Fortification has had clear benefits (DHHS, 1988; Mertz, 1997). However, the nutritional contributions of some of these interventions may have been exaggerated (Gussow and Akabas, 1993; Mertz, 1997), partly because overall dietary patterns have been improving (National Research Council, 1994). Commonly-eaten fortified foods expose much of the population to the added nutrient even though they may be targeted to raise intakes only in certain population groups. Fortification programs are most successful when they are initiated to combat specific nutritional problems in specific populations and when the foods chosen as vehicles for the added nutrient are carefully selected (Miller and Stephenson, 1987). An important consideration in the design of fortification programs is the bioavailability of the added nutrient and the nutrient's effect on the taste, color, odor, and palatability of the fortified foods (Mertz, 1997).

2. <u>Consumer behavior</u>

Most Americans do not eat as well as they should (Enns et al., 1997; Frazao, 1998; Guthrie, 1998; Kennedy et al., 1995) despite their growing knowledge of diet-disease connections (National Research Council, 1991) and the availability of an abundant and health-promoting food supply (National Research Council, 1994). Dietary patterns are profoundly affected by metabolic, sensory, cognitive, cultural, religious, and economic factors; habit and taste (particularly the preference for sweet and fatty foods) are especially important determinants of food preferences (Institute of Medicine, 1994). Taking nutritional supplements and eating fortified foods are obvious options to increase nutrient intakes short of improving dietary patterns, but consumers who choose these approaches without sufficient education about the merits and limitations could ingest excess amounts of some nutrients and insufficient amounts of others. Some people may use supplements to compensate for a diet and lifestyle they perceive to be unhealthful (Pelletier and Kendall, 1997).

Knowledge about health does not necessarily lead to health-promoting behaviors. The knowledge-attitudes-behavior model posits that knowledge can change attitudes which can in turn change behavior (Contento et al., 1995; National Research Council, 1991; Petty et al., 1997). To change attitudes, knowledge has to be motivational or persuasive in some way. This is the approach to providing knowledge that marketers and advertisers use. The provision of "how to" knowledge, which nutrition education has typically emphasized (e.g., how much vitamin C there is in a food or how to modify a recipe to lower its fat content), can be important, but generally only when motivation has already somehow become instilled (Contento et al., 1995). A basic principle of change is that individuals will embark on a behavior if they think it will lead to a desirable outcome. People are likely to be motivated when they realize the benefits of a behavior. Alternatively, approaches to motivate behavior based on fear need to be carefully selected. While a small amount of fear can serve as a cue to action, overemphasis on the negative consequences of a learner's behavior can create paralysis and denial in the individual and inhibit change (Hale and Dillard, 1995; Job, 1988).

Health claims on food labels are one approach to nutrition education by the federal government that has influenced consumer food-selection behavior (The Keystone Center, 1996). The federal government regulates both health claims and the "Nutrition Facts" label on food products. On nutrition-supplement labels, the "Supplement Facts" panel must provide nutrition information, and "structure/function" claims (that describe the role of a nutrient or dietary ingredient intended to affect the structure or function of humans) must be truthful, scientifically valid, and not misleading (Commission on Dietary Supplement Labels, 1997).

Lachance (1994) contends that because education has not worked well enough to improve dietary patterns in this country, additional approaches to dietary improvement that include supplements and fortified foods are needed. However, nutrition education by the government and institutions of learning cannot compete effectively with advertising by the food and dietary-supplement industries that far outspend government and other, more neutral providers of information (Nestle, 1993). The implications of this disparity are potentially serious because 43 percent of adult FSP participants have less than a high-school degree (Stavrianos, 1997), and some participants and population groups are hard to reach with health-related information. These facts raise important questions about the abilities of some FSP participants to critically evaluate the advertising and promotional messages intended to induce the purchase of nutritional supplements and fortified foods.

B. Costs/Benefits of Approaches to Meet Nutrient Needs and Reduce Health-Care Costs

Potential frameworks exist for balancing the multiple benefits and risks of interventions and their effects on health status and health-care costs. Decision analysis, cost-effectiveness analysis, and cost-benefit analysis are the analytical tools for this activity; quantitative values are placed on the potential outcomes to determine the benefits, risks, and the tradeoffs of each intervention of interest. (Gold et al., 1996; Haddix et al., 1996; and Petitti, 1994 provide instruction in the use of these analytical tools.)

The Expert Panel did not identify any research on the comparative impact of improved diets, fortified foods, and nutritional supplements on health status and health-care costs among U.S. citizens. One study estimated the relative costs of these three approaches to combat vitamin A deficiency in Guatemala (Phillips et al., 1996). The analysis, which used secondary sources of data, found that sugar fortification was the least costly approach, allowing each high-risk person to receive adequate vitamin A, followed by a supplement distribution program. Promoting home food production combined with nutrition education was the most expensive approach.

There are numerous studies that estimate the potential savings in health-care costs of single approaches or that compare the relative merits of two approaches using data from people living in the United States (see, for example, Hornberger, 1998; Kelly et al., 1996; Romano et al., 1995; Torgerson and Kanis, 1995). However, each study's conclusions can be critiqued on the basis of the methodologies employed and assumptions made. For example, a recent cost-benefit analysis provided an estimate of the potential economic benefits of nutritional supplements in reducing health-care costs due to hospitalization for birth defects, low-birth-weight premature births, and coronary heart disease (Bendich et al., 1997). However, the authors based their estimates on a carefully selected set of studies, all of which demonstrated major health benefits with supplementation. Several of these studies were based on specific subpopulations and cannot be generalized to the entire U.S. population.

In theory, the additional economic productivity that would result from knowledge and attitude change leading to better dietary patterns would be greater than what would result from simply taking nutritional supplements and/or consuming fortified foods. The problem is in estimating the health effects of educational campaigns to encourage better diets.

Economic analyses could be useful in determining the value of allowing FSP participants to use their food stamps to purchase nutritional supplements compared to other approaches to raise nutrient intakes. However, it would be extremely difficult to conduct good studies in practice. In the case of allowing nutritional supplements to be purchased with food stamps, many debatable assumptions would need to be made, such as which supplements could be purchased, who would buy them, how dietary patterns might change as a result, and what the tradeoffs are. For example, some FSP participants might maintain their food budgets while others would decrease their food purchases by at least the cost of the nutritional supplement. Both groups would probably make some food-product substitutions. There is very little empirical basis on which to quantify the monetary and health-care consequences of these assumptions and tradeoffs in order to perform a credible analysis.

IV. CONCLUSIONS AND RECOMMENDATIONS

LSRO was asked by USDA to review and evaluate current knowledge and scientific opinion on (1) the potential value of nutritional supplements in filling nutrient gaps, and (2) the comparative impact of nutritional supplements, improved diets, and fortified foods on health status and health-care costs. The following conclusions and recommendations are based largely on the collective knowledge and expertise of the Expert Panel assembled by LSRO and secondarily on the limited data available from scientific studies.

CONCLUSION 1: NUTRIENT INTAKES OF FSP PARTICIPANTS ARE COMPARABLE TO INTAKES OF HIGHER-INCOME AMERICANS

One original goal of the FSP was to help ensure basic social equity with regard to access to food in the United States (Ohls and Beebout, 1993). Using food stamps, low-income people would be able to eat a balanced diet, the standard traditionally enjoyed by people who can afford to buy the foods they desire. The Expert Panel reviewed micronutrient-intake data from the 1994-1995 CSFII and found that, for the ten vitamins and minerals examined, FSP participants generally consumed a similar or greater percentage of the RDA or DRI than individuals with incomes higher than 130 percent of the poverty line. The data further showed that FSP participants were less likely to use nutritional supplements than low-income nonparticipants and higher-income individuals.

The Expert Panel found no unique micronutrient-intake problems among the FSP participants. The current FSP has apparently achieved the goal of ensuring basic social equity in access to food irrespective of income. Consequently, the use of nutritional supplements to achieve this goal is not supportable scientifically based on data provided to the Expert Panel.

Recommendations

Compare the food-consumption patterns of FSP participants, low-income nonparticipants, and higher-income individuals against the Food Guide Pyramid recommendations. Because similar nutrient intakes do not necessarily reflect similar food-consumption patterns, and because adequate micronutrient intakes may not be sufficient to minimize the risks of chronic disease, a full evaluation of nutritional adequacy requires data on both nutrient and food intakes.

Examine the nutritional goals of all federal food-assistance and health programs as part of any discussion over possible coverage for nutritional supplements in the FSP. This recommendation is based on the Expert Panel's (1) awareness that low-income individuals often participate in multiple programs (some of which provide nutritional supplements), (2) knowledge that these federal assistance programs help to improve public health, and (3) recognition that the definition and assessment of nutritional adequacy are evolving. Perhaps the time to revisit the nutrition-related goals of the FSP and related programs is when the FNB completes its process of issuing new guidelines for nutrient intakes (i.e., DRIs) and provides more detailed advice on how these guidelines should be met.

CONCLUSION 2: COVERAGE FOR NUTRITIONAL SUPPLEMENTS IN THE FSP WOULD BE OF UNCERTAIN BENEFIT TO FSP PARTICIPANTS AS A GROUP

Most nutrition professionals agree that improved diets are the best way to meet nutrient needs whenever possible because food supplies nutrients and other constituents important to health that may not be present or bioavailable in supplements (DHHS, 1988; Hunt, 1996; National Research Council, 1989a). Dietary guidelines to reduce the risks of chronic disease emphasize improvements in dietary patterns (e.g., consuming less saturated and total fat and more fruits, vegetables, and whole-grain products). Intakes of nutrients typically consumed in insufficient amounts by Americans will increase when more diets are based on the recommendations of the Food Guide Pyramid and the *Dietary Guidelines for Americans*. However, most low-income people, like most people in the United States, do not eat diets that meet both nutrient and food-group recommendations. Nutritional supplements and/or fortified foods can help individuals increase their intakes of nutrients that are often not consumed in adequate amounts from foods (e.g., iron, calcium, and folic acid) or may not be absorbed well enough from the foods that naturally contain them (e.g., vitamin B_{12} in the elderly).

The Expert Panel recognized that nutritional supplements can be useful to some people. However, it was unaware of any data to suggest that persons who might benefit most from nutritional supplements would use them. In addition, there is no empirically based behavioral model to predict the impact on dietary patterns of FSP participants should they be allowed to purchase nutritional supplements with food stamps. Finally, the Expert Panel was unaware of any scientific evidence that the ability to purchase nutritional supplements in the FSP would benefit participants as a group.

Recommendation

More research is needed to:

> **Understand why consumers in different demographic subgroups, as well as those with different states of health and interests in personal health, take supplements.** The need for such research is evidenced by the conclusions of the Commission on Dietary Supplement Labels (1997) and others (FDA, 1998; Levy and Schucker, 1987).
>
> **Learn how consumers choose which supplements to take and how their dietary habits may be affected by such practices.**
>
> **Determine whether supplemental nutrients, singly or in combination—as opposed to foods or diets – are useful in reducing the occurrence or progression of chronic diseases.**
>
> **Compare the cost-effectiveness of the use of nutritional supplements against the approaches of improved diets and food fortification.**

This research will be of benefit to the entire U.S. population, but especially to specific subsets of the population such as FSP participants. Only when more data are available from this research will it be possible to assess how changes in the FSP to allow the purchase of nutritional supplements with food stamps would affect participants' health-related behaviors and overall health.

CONCLUSION 3: ALLOWING FSP PARTICIPANTS TO PURCHASE NUTRITIONAL SUPPLEMENTS WITH FOOD STAMPS WOULD RAISE ADDITIONAL ISSUES

There is some support in Congress for a change in the FSP to allow participants to purchase nutritional supplements with their food stamps (U.S. Congress, 1995). This report was prepared for USDA, which was ordered by Congress to study the advantages and disadvantages of such a proposed change. Recently, the Council for Responsible Nutrition, a trade association representing manufacturers of dietary supplements, called on USDA to "withdraw its outdated guidance that currently prohibits the use of Food Stamps for the purchase of nutritional supplements" (Dickinson, 1998). However, the Expert Panel was concerned that some FSP participants might select inappropriate supplements if they were permitted to use food stamps to purchase any available product.

Recommendations

If supplements were allowed to be purchased with food stamps prior to the requisite studies, the Expert Panel recommended the following:

Consider limiting the approved products to nutritional supplements rather than all dietary supplements. Such a limitation is implied by the language in the Personal Responsibility and Work Opportunity Reconciliation Act of 1996.

Consider further limiting the nutritional supplements allowed to multiple vitamin-mineral products that do not exceed the nutrient recommendations of the FNB. Most members of the Expert Panel supported this recommendation to reduce the risks of toxicity and nutrient imbalances from nutritional supplement use[5] . However, one Expert Panel member recommended that single-nutrient supplements might also be available for purchase with food stamps at potencies that do not exceed the nutrient recommendations of the FNB. This member felt that women with a history of heavy menstrual bleeding, for example, could safely self-prescribe an iron supplement supplying the RDA for this nutrient.

Initiate educational efforts to guide FSP participants to appropriate products, and inform them how to use nutritional supplements and fortified foods to avoid excessive nutrient intakes. The Expert Panel emphasized that all private educational efforts should fully support the government's goal of providing clear, understandable, and unbiased information about nutritional supplements and emphasize food-based approaches to meeting nutrient needs.

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[5] One Expert Panel member specifically recommended that USDA might identify a list of approved formulations and/or multivitamin-mineral products of moderate potency.

Limiting the types of nutritional supplements allowed might create the impression among some FSP participants that the government endorses the use of particular products. To combat this potential misimpression, special educational or regulatory initiatives might be necessary[6] .

[6] One Expert Panel member suggested that additional regulations might be developed to prohibit the labeling of these nutritional supplements with phrases such as "Approved by USDA" or "Approved for FSP participants." This member noted that such a prohibition would be consistent with social equity (discussed in Conclusion 1).

APPENDIX E

BACKGROUND INFORMATION PROVIDED TO LSRO EXPERT PANEL

An Assessment of the Adequacy of Vitamin and Mineral Intakes of Low-Income Americans

Joanne F. Guthrie, Ph.D., M.P.H. and RD[1]

INTRODUCTION

The U.S. Department of Agriculture (USDA) has been asked by Congress to assess the adequacy of vitamin and mineral intakes of low-income Americans. This is one part of an overall project to examine the potential of vitamin-mineral supplements for improving the dietary status of low-income Americans. To monitor the food and nutrient intakes of Americans, USDA conducts the Continuing Survey of Food Intakes by Individuals (CSFII), which collects information on the dally dietary intakes of a nationally representative sample of Americans. The most recent CSFII data available for analysis were collected in 1994-95. In this paper, these data are used, first, to assess the vitamin and mineral intakes of Americans, with, special reference to the, low-income population and to several population subgroups identified in the Congressional language and, second, to compare estimated usual intakes to current dietary recommendations established by the National Academy of Sciences.

Current Dietary Recommendations

Since 1941, the Food and Nutrition Board (FNB) of the National Academy of Sciences (NAS) has established dietary recommendations for vitamins, minerals, and other essential nutrients. Until recently, those recommendations were known as the recommended Dietary Allowances or RDAs. They were calculated by estimating the nutrient level needed to prevent deficiency in a given age-sex group and then adding a safety margin that allowed for individual variation in nutrient absorption and nutrient need, so that the RDAs would meet the nutritional needs of practically all the entire healthy population. The last complete edition of RDAs was published in 1989 (FNB, 1989). Since then, the growth in nutrition knowledge has prompted re-evaluation of the RDAs, and led the FNB to develop a new approach to dietary recommendations. Now known as Dietary Reference Intakes or DRIs, the new recommendations differ from the older RDAs in several regards.

In the first, and perhaps most basic regard, they differ conceptually from the older RDAs in their definition of adequacy. In considering nutrient needs, current knowledge of the role of nutrients in reduction of disease risk was considered, rather than only the prevention of nutrient deficiencies (FNB, 1997). For example to estimate the new DRIs for calcium, a new indicator of adequacy was chosen - maximal calcium retention- because of its association with reduction of risk of osteoporosis in later life (FNB, 1997).

Second, while the RDA is a single number, the new DRIs are a set of reference values that can be used for a wide range of purposes. including the planning and assessment of diets for healthy

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[1] The author prepared this paper while on the staff, as a nutritionist, of the U.S. Department of Agriculture's Center for Nutrition Policy and Promotion. She is currently a staff member of the Center for Food Safety and Applied Nutrition, Food and Drug Administration.

populations (FNB, 1997). The DRIs include the following: a) the Estimated Average Requirement or EAR, which is the nutrient intake value estimated to meet the needs of *50* percent of individuals in a given age-sex group; b) the Recommended Dietary Allowance or RDA, the daily dietary intake level sufficient to meet the needs of practically all (97-98 percent) of the individuals in the given age-sex group; and c) the Tolerable Upper Limit or TUL, the maximum intake level unlikely to pose health risks. These three values require a considerable level of information on nutrient needs. If information is not considered sufficient to calculate an EAR and an RDA, a value called an Adequate Intake or AI is used instead. It represents intakes that appear to be adequate for that nutrient, based on current experimental or observational data. According to the FNB, "AI may be used to formulate tentative goals for group intakes." In the absence of firmer recommendations, this is probably necessary for nutrition planning; although the preliminary nature of the AI should be kept in mind.

Finally, the FNB has changed its procedures on updating dietary recommendations. Previously, the RDAs for all known essential nutrients were all updated at the same time. The DRIs are being issued gradually. To date, DRIs have been issued for calcium, phosphorus, magnesium, vitamin D, and fluoride. For other nutrients, the 1989 RDAs are still the most current dietary recommendations available.

Given this limitation, this paper uses the 1989 RDAs as the criteria for assessing dietary intakes of most nutrients and uses the new DRI values for calcium, magnesium, and phosphorus (vitamin D and fluoride were not assessed because national data on dietary intakes of these nutrients are not available; in addition both are obtained to a great extent from non-food sources). Although this is less than ideal, it represents the- intent to use the most up-to-date information available on vitamin and mineral recommendations.

One particular issue with the new DRIs for calcium, magnesium, and phosphorus, is which among the set of reference values provided is most suitable to use? For calcium, the FNB considered -available data too preliminary to develop an EAR and an RDA, and therefore has provided an AI instead. [2] This value was used-in this study. For magnesium and phosphorus, the RDA was used.

It is important when interpreting the results of this study to keep in mind that the RDAs serve numerous purposes (FNB, 1997). Purposes that are relevant to this project include a) planning diets that can be reasonably certain to meet the nutritional needs of individuals, and b) assessing the adequacy of dietary intakes of population groups. When planning diets for individuals, the NAS recommends using the RDA level of a nutrient as the Criterion. This is because the safety factor incorporated into the RDAs mean that planners can be reasonably sure the recommended diet will meet the needs of virtually the entire population. This diet planning approach has been used in the Food Stamp Program. The Thrifty Food Plan, which provides guidance on how a nutritious diet can be obtained at the Food Stamp allotment level, uses the RDAs as its dietary standards for intakes of essential vitamin and minerals.

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[2] TUL figures are available for calcium, magnesium, and phosphorus, but because our focus is adequacy, not excess, they were not considered as possible assessment criteria.

However, use of the RDAs for assessment of the adequacy of dietary intakes of populations is more problematic. Because of the safety margins incorporated into the RDAs, nutrient intakes below the RDAs do not necessarily mean that intakes are below requirements or that physiological nutrient deficiencies necessarily exist. In its recent report, the FNB recommends that the EAR for a nutrient be used in conjunction with information on the distribution of usual intakes of that nutrient to assess the likely extent of deficiency in the population (FNB, 1997). Currently, however, the FNB has only published EARs for a small number of nutrients. It was decided that because this approach could not be applied to the majority of nutrients at this time, it was better to use the RDA as a consistent assessment criterion in this paper. Therefore, it must be kept in mind that intakes below the RDA are not necessarily deficient. Nor is there a cut-off level of the RDAs that is generally accepted as an indicator of deficiency. However, the existence of large numbers of individuals in a population group with intakes below RDA levels may indicate a need for dietary improvement activities to be directed to that group.

Federal Dietary Guidance Policy in Relationship to Vitamin-Mineral Supplement Use

The Dietary Guidelines for Americans, jointly issued by the U.S. Department of Agriculture (USDA) and the Department of Health and Human Services (DHHS), are the official statement of Federal dietary guidance policy (USDA/DHHS, 1995). The Guidelines recommend eating a variety of foods as the primary strategy for obtaining essential nutrients. However, they also address the role of dietary supplements. The statement of the Dietary Guidelines for Americans on vitamin, mineral, and fiber supplements is as follows:

> "Supplements of vitamins, minerals, or fiber also may help to meet special nutritional needs. However, supplements do not supply all of the nutrients and other substances present in foods that are important to health. Supplements of some nutrients taken regularly in large amounts are harmful. Daily vitamin and mineral supplements at or below the Recommended Dietary Allowances are considered safe, but are usually not needed by people who eat the variety of foods depicted in the Food Guide Pyramid.
>
> Sometimes supplements are needed to meet specific nutrient requirements. For example, older people and others with little exposure to sunlight may need a vitamin D supplement. Women of childbearing age may reduce the risk of certain birth defects by consuming folate-rich foods or folic acid supplements. Iron supplements are recommended for pregnant women. However, because foods contain many nutrients and other substances that promote health, the use of supplements cannot substitute for proper food choices." (USDA/DHHS, 1995)

METHODS

Data Source

The data source for this study is the USDA's 1994 and 1995 CSFII. This survey, conducted by USDA's Agricultural Research Service (ARS) Food Surveys Research Group, was designed to obtain nationally representative data on the food and nutrient intakes of noninstitutionalized persons residing in households in the United States. Persons living in group quarters or institutions, those residing on military installations, and the homeless were excluded. The 1994 and 1995 CSFII oversampled low-income persons to produces a nationally representative sample of such individuals. For purposes of this analysis, low-income respondents are defined as those who come from households with gross incomes for the previous year at or below 130 percent of the Federal poverty threshold, an income level that generally qualifies households for participation in the Food Stamp Program (FSP).

Up to two nonconsecutive days of food consumption data were obtained from survey respondents, using the 24-hour recall method. Food consumption data were converted to nutrient intake information using information on the nutrient content of foods supplied by USDA's ARS Nutrient Data Research Group. Respondents were also queried on their use of vitamin-mineral supplements; however, nutrient intake from supplements was not quantified. Therefore nutrient estimates reported in this paper represent intake from food only.

Individuals who did not provide both days of food consumption data were not included in the data set used for this study; breastfed children were also excluded. With these exclusions, the final data set had a sample size of 10,289 individuals. This represents a survey response rate of 76.1 percent (Wilson et al., 1997). ARS has provided survey weights for the 2-day sample that adjust for differential rates of sample selection and nonresponse and calibrate the sample to match population characteristics that are correlated with eating behavior (Wilson et al., 1997). Unless otherwise noted, these survey weights are used in the analyses presented in this paper, so that results can be considered generalizable to the American population.

Vitamin and Minerals to Be Examined

The focus of this paper is on intakes of vitamins and minerals considered to be of current or potential public health concern. Based on expert opinion, we define these as including calcium, iron, vitamins A, E, C, B_6, and folate, and the minerals phosphorus, magnesium, and zinc. Nutrient intakes will be reported as a percent of RDA. This measure is used because it gives nonexperts a quick way of determining relationship of intake to recommendations, and it adjusts for demographic differences in population groups - e.g. low-income population will have more women and children than higher-income population, which affects both intake and recommendations.

Statistical Methods

As mentioned previously, the 1994 and 1995 CSFII collected two nonconsecutive days of dietary intake information. Because there is considerable day-to-day variation in the nutrient intakes of most individuals, it has long been recognized that the distribution of 2-day dietary intake data is wider than the distribution of usual intakes (FNB, 1997). Statistical adjustments have been developed that yield better estimates of the distribution of usual intakes. This paper will present distributions of usual intakes adjusted by a method developed by Iowa State University in cooperation with the USDA (Guenther et al., 1997) to provide a better estimate of usual intake. This method also was used by the FNB in the recent DRI report. Data tables will present the 5^{th}, 25^{th}, 50^{th}, 75^{th}, and 95^{th} percentiles of intake for population groups of interest. These groups include the following: a) total population (all-income), b) higher- and lower-income (130% of poverty as cut-off for lower-income), c) FSP Participants and lower-income non-FSP

Participants, and d) vulnerable low-income subgroups, as defined in the Congressional request, that is, women who are of childbearing age, pregnant or lactating, and the elderly.

Another problem with dietary intake data is that the occurrence of underreporting of intake appears to be common. Dietary intake data may be underreported by as much as 20-25 percent, and underreporting may vary depending on personal characteristics (Riddick, 1996). The 1994 and 1995 CSFII feature the use of an improved dietary data collection methodology designed to elicit more information from respondents. However, the possibility of underreporting of dietary data cannot be ruled out, in which case nutrient estimates presented in this paper might be considered lower boundaries of nutrient intakes. No statistical method has been developed to adjust for underreporting.

Supplement Usage

Usage of vitamin-mineral supplements also is examined. As part of the CSFII, respondents were queried on their usage of vitamin-mineral supplements. Possible responses were: a) every day or almost every day, b) every so often, c) not at all, d) don't know. For this study, vitamin-mineral supplement users are defined as those who responded that they took supplements every day or almost every day or every so often. Prevalence of supplement use by population subgroup is computed using USDA-provided survey weights in order to yield population-representative results.

Those reporting vitamin-mineral supplement use were further queried on the types of supplements they used. Supplement categories respondents were asked about are listed in Table 1, along with unweighted counts of respondents reporting their use. As Table 1 indicates, some supplements were consumed by few or no respondents. Others were quite popular. Frequency of use of selected supplements, chosen on the basis of their popularity and/or potential public health significance is computed using USDA-provided survey weights. Information on the use of multiple supplements is also provided.

RESULTS

Sample Characteristics

The final data set used in this study consisted of l0,289 individuals. In order to assess the ability of the data set to provide representative information on the key population subgroups identified in-the Congressional request, unweighted sample sizes for each subgroup are provided in Table 2. As the table indicates, sample sizes for pregnant and lactating women are quite small. If an attempt is made to subdivide these groups by income, the sample sizes are even smaller, especially for low-income pregnant and lactating women. Therefore, distributions of nutrient intakes were not examined for pregnant and lactating women by income (even without a breakdown by income, these sample sizes were so small that special assistance was needed from the Iowa State University Department of Statistics to develop usual intake estimates for these groups).

Distributions of Usual Nutrient Intakes

Table 3 provides distributions of usual nutrient intakes for the population subgroups of interest. The percentages of individuals in each population subgroup whose usual intakes are estimated to fall below recommendations are shown in Table 4.

For the population as a whole, median intakes met recommendations for all nutrients examined except vitamin E, calcium, magnesium and zinc. Calcium and zinc were the nutrients for which the highest percentage of all individuals- 73 percent had usual intakes that did not meet recommendations (it should be remembered that the new AI values for calcium established by the NAS are higher than previous recommendations for most age-sex groups). Between 60-70 percent of individuals had usual intakes of magnesium, and vitamin E below recommendations.

When usual intakes of higher- and-lower-income individuals were compared, median intakes of vitamin E, calcium, magnesium, and zinc of both groups failed to meet recommendations. The median intake of vitamin A-of the lower-income group also fell slightly below recommendations, at 98 percent of the RDA. There were few large differences in median intakes of these nutrients. Only median intakes of Vitamin E by more than 5 percent of recommendations. Lower-income individuals had usual intakes of vitamin E that were lower by 6 percent of recommendations. The percentage of individuals with usual intakes meeting recommendations also was similar across income groups with differences of more than 5 percent only for vitamin A, iron, and magnesium. For vitamin A, 51 percent of lower-income individuals failed to meet recommendations, compared to 43 percent of higher-income individuals, and for iron, 36 percent of low-income individuals failed to meet recommendations, compared to 29 percent of higher individuals. For magnesium, 63 percent of lower-income individuals failed to meet recommendations, compared to 69 percent of higher-income individuals.

There were more differences in median usual nutrient intakes between FSP participants and low-income individuals that did not participate in the FSP. Both groups had median intakes of vitamin E, calcium, magnesium, and zinc that fell below recommendations, but non-FSP participants also had median usual intakes of Vitamins A and B_6 that failed to meet recommendations. The two groups' median usual intakes of all these nutrients differed by more than 5 percent of recommendations. Differences in the percentages of individuals whose usual intakes met recommendations were also larger than in the groups compared by income, with a greater percentage of FSP participants meeting recommendations for all nutrients examined.

When usual vitamin and mineral intakes of females of childbearing age and the elderly were examined by income, all had median intakes of vitamin E, calcium, magnesium, and zinc that were below recommendations, as had the general population. In addition, there were other nutrients for which median intakes were below recommendations for each of the subgroups examined. In some cases, low intakes appeared to be associated with age-sex group. Median intakes were below recommendations for females of childbearing years in both income groups. Median vitamin B_6 takes were below recommendations for females 19-50 and elderly males and females, whether low-income or high. Median vitamin A and phosphorus intakes were below recommendations for females 12-18 years whether low-income or high.

There were some differences by income. Lower income females 19-50 years had median intakes of vitamin A that were below recommendations, whereas higher-income females did not. Females 12-18 years in the lower income group had median intakes of vitamin B_6 that were below recommendations, whereas higher-income females in this age group did not. Median usual vitamin A intakes were below recommendations for low-income females 19-50 years and elderly females, whereas they were not for the higher-income comparison groups.

When the diets of pregnant and lactating women of all incomes were examined, median intakes were below recommendations for both groups for vitamin E, magnesium, iron, and zinc. Interestingly, they were the only groups examined for which median intakes were not below the Al for calcium (this may be related to the fact that the calcium Ms for pregnant and lactating women 19-50 are 1,000 milligrams, whereas the 1989 calcium RDAs for these groups were 1,200 milligrams). Pregnant women also had median intakes of vitamin B_6 and folate that were below recommendations, and lactating women had median intakes of vitamin A that were below recommendations.

Prevalence of Supplement Use

Overall, 46 percent of the population report using supplements (Table 5). These results are reasonably consistent with those obtained by other surveys, and with Congress' statement in the Dietary Supplement and Health Education Act of 1994 that almost 50 percent of Americans regularly use supplements (Commission on Dietary Supplement Labels, 1997). Fewer low-income than higher-income individuals use supplements - 36.3 percent, compared to 49.1 percent. Of low-income households, those who participate in the FSP are less likely than non-participants to use supplements- 30 percent compared to 41.5 percent.

Types of Supplements Used

Multivitamins were the most commonly reported type of supplement used, with 22 percent of the total population reporting their use. Multivitamin-mineral combinations were slightly less popular; their use was reported by 15 percent of the population. Five percent reporting using either an iron-vitamin C combination or an iron supplement.

Vitamin C was the most popular single supplement consumed, with 9 percent of the total population reporting its use. Vitamin E was the second most popular single supplement, followed by calcium and vitamin B.

When type of supplements used by higher-income and lower-income individuals was compared, higher-income individuals were more likely to use all types of supplements, but the relative popularity of the various supplement types was similar across incomes. When supplement usage by low-income individuals who did or did not participate in the FSP was compared, however, there were some differences in the relative popularity of various supplement types. Food Stamp Participants, despite being less likely to use supplements overall, were equally likely to consume multivitamin-mineral combination supplements. The two groups were also similar in their usage of iron-vitamin C combination or iron supplements. Food Stamp Participants were less likely to use single nutrient supplements than low-income non-FSP participants. For example, only 1.5 percent of FSP participants took vitamin C, compared to 8 percent on low-income non-FSP participants.

Supplement use of the vulnerable groups identified in the Congressional request is also reported. When the supplement usage of females of childbearing age and the elderly was examined by income (Table 6), supplement usage varied considerably by age-sex group, with elderly females the -most likely to use supplements. For all sex-age groups, however, use of supplements was consistently higher among those in the higher-income category.

Pregnant women were much more likely than other groups to use supplements, with 90.4 percent of pregnant women reporting supplement usage (Table 6). Use of supplements by lactating women was also high, with 74.1 percent reporting their use. Use of single-nutrient supplements by pregnant and lactating women was quite low, however, with most pregnant and lactating women taking either a multivitamin-mineral combination or a multivitamin. Eleven percent of pregnant women took iron or iron-vitamin C supplements, the highest use of this category of supplements by any age-sex group examined.

Use of Multiple Supplements

Most supplement users (75 percent) reported using only one supplement (Table 7). Of the remaining one-quarter of supplement users 11.8 percent used two supplements, 5.6 percent used three supplements, 2.8 percent used four supplements, 1.6 percent used five supplements, and 2.7 percent used six supplements or more. Lower-income individuals were less likely to use multiple supplements than higher-income individuals - 80.4 percent of lower-income supplement users used only one supplement compared to 74.2 percent of higher-income supplement users. FSP participants were less likely to use multiple supplements than low-income non-FSP participants, with 87.9 percent of FSP participants who took supplements using only one supplement, compared to 76.2 percent of lower-income non-FSP supplement users.

DISCUSSION

The results of this analysis indicate that Americans' dietary intakes of vitamins and minerals differ little by income. For both population groups, median intakes fell below 100 percent of the RDA for vitamin E, calcium, magnesium, and zinc, and differences between income groups in the median intakes of these nutrients were not large. As mentioned previously nutrient intakes below recommendations cannot be interpreted as nutritional deficiencies. However, information on population distributions of intakes can be used by public health professionals to indicate which aspects of dietary improvement should receive priority, and which population groups should be targeted for nutrition intervention.

Food Stamp Program participation, however, seemed to result in more differences between vitamin and mineral intakes of low-income individuals (with low income being defined as household income of 1-30 percent or less of Federal poverty guidelines). Both FSP participants- and low-income nonparticipants had median intakes of vitamin F, calcium, magnesium, and zinc that fell below-recommendations, but non-FSP participants also had median usual intakes of vitamins A and B_6 that failed to meet recommendations. In addition, a higher percentage of FSP participants had usual intakes that met recommendations for all the vitamins and minerals examined.

Membership in a physiologically vulnerable group also appeared to be an important factor influencing dietary quality. When the vitamin and mineral intakes of vulnerable groups identified by Congress as being of special interest were examined, those groups did, in fact, have low intakes of more nutrients than did the population as a whole. More of those dietary differences, however, seemed to be associated with biological factors than with economic factors. All females of childbearing ages had low median intakes of iron, regardless of income. All of the elderly had low median intakes of vitamin B_6, regardless of income, as did women 19-50. All females 12-18 years had low intakes of vitamin A and phosphorus, regardless of income. Among females in. their childbearing years, there were some differences by income, with younger females (12-18 years) in the low-income group having median intakes of vitamin B_6 that fell below recommendations, whereas the higher-income group did not, and low-income females 19-50 having vitamin A intakes that failed to meet recommendations, whereas the higher income comparison did not. Median usual Vitamin A intakes were also below recommendations for lower-income elderly females, but not higher-income ones.

Supplement usage patterns differed considerably more by income than did dietary intake patterns, with low-income individuals less likely to use vitamin-mineral supplements than higher-income individuals. This was particularly true of low-income individuals who participate in the Food Stamp Program. Supplement usage also varied considerably by age and sex and by physiological status. A large majority of pregnant and lactating women took vitamin-mineral supplements. Elderly women also were an age-sex group that appears highly likely to take vitamin-mineral supplements. The reasons why individuals take supplements, the factors dictating their choice of supplements, and the extent to which supplements contribute to nutrient intakes of individuals are not currently well understood. Information on these issues is not available from the CSFII, therefore we cannot draw any conclusions from this analysis on these factors. Generally, information is limited on these topics, and a recent report has called for more research on these issues (Commission on Dietary Supplement Labels, 1997).

CONCLUSIONS

Data from USDA's 1994 and 1995 CSFII were used to estimate usual vitamin and mineral intakes of Americans, and to estimate differences in intakes by income, Food Stamp Program participation, and by biological vulnerability, that is being a female of childbearing age. a pregnant or lactating woman, or an elderly individual. Using recommended methodologies for estimating usual intakes, it was found that median usual intakes fell below 100 percent of the RDA for vitamin E, calcium, magnesium, and zinc for the population as whole and for subgroups examined by income. Among the Food Stamp Program eligible population, nonparticipants also had median usual intakes of vitamins A and B_6 that were below recommendations, but participants did not. Among vulnerable groups studied, there also were more nutrients for which median intakes fell below recommendations than for the population as a whole, with iron and vitamins A and B_6 appearing to be of particular concern. Supplement usage patterns differed considerably more among subgroups than did dietary intake patterns, with low-income consumers less likely to use supplements than their higher-income counterparts. Factors influencing consumer decisions to take supplement and to choose particular types of supplements are not currently well understood and would require further research.

ACKNOWLEDGMENTS

Data tables prepared by Mathematica Policy Research, Inc., except data on dietary intakes of pregnant and lactating females, which were prepared by Iowa State University Department of Statistics.

Table 1: Dietary Supplement Use by Individuals -- 1994 and 1995 CSFII
Unweighted Counts

Type Supplement	Number of Individuals Reporting Use
	2 Day Data Set
Sample Size:	10,289
Any Supplement	4,722
Multi-Vitamin	2,220
Multi-Vitamin + Mineral	1,661
Iron-Vitamin C Combination	324
Single Vitamins/Minerals	
Any Single Vitamin	1,388
Specific Single Vitamins:	
Vitamin A	148
Beta Carotene	50
Vitamin B (not further specified)	366
Biotin	3
Vitamin C	845
Vitamin D	86
Vitamin E	535
Folacin	33
Pantothenic Acid	3
Vitamin K	2
Iron	140
Calcium	429
Zinc	140
Magnesium	25
Selenium	59
Chromium	86
Fluoride	44
Copper	3
Iodine	2
Phosphorus	2
Potassium	43
Chloride	0
Sodium	0
"Other" Single Nutrient	62
No Respondents Reported Taking:	Boron Molybdenum
Supplements Other than Vitamins or Minerals	
Fish Oil	162
Fiber	353

**Table 2: 1994-95 CSFII Data Set,
Unweighted Counts**

Group	Sample Size, Unweighted
All Individuals	10,289
Higher Income	7,483
Low Income	2,806
Low-Income	
FSP Participants	1,040
Non-FSP Participants	1,711
Vulnerable Groups	
Females 12-18, Low Income	107
Females 12-18, Higher Income	303
Females 19-50, Low Income	397
Females 19-50, Higher Income	1,115
Females 65+, Low Income	237
Females 65+, Higher Income	548
Males 65+, Low Income	199
Males 65+, Higher Income	601
Pregnant, All Income	44
Lactating, All Income	28

Table 3: Nutrient Intakes (% of the 1989 RDAs) at Selected Percentiles, by Demographic Characteristics – 1994-95 CSFII

	Vitamin A					Vitamin C				
Group	5th	25th	**50th**	75th	95th	5th	25th	**50th**	75th	95th
All Respondents	42	74	**107**	154	270	50	102	**158**	235	394
All Higher Income	45	76	**109**	156	232	51	101	**157**	235	391
All Low Income	36	66	**98**	148	291	50	103	**161**	240	400
Low Income:										
FSP Participants	40	73	**108**	159	320	57	117	**178**	259	418
Non-Participants	36	64	**94**	141	258	49	97	**151**	227	374
Higher Income:										
Nonpregnant Females 12-18	51	76	**99**	128	186	64	112	**159**	221	341
Nonpregnant Females 12-50	48	75	**103**	139	216	45	85	**127**	184	297
Females 65+	65	99	**136**	191	316	53	105	**158**	224	343
Males 65+	49	82	**117**	168	289	47	101	**156**	229	371
Low Income										
Nonpregnant Females 12-18	34	54	**71**	94	144	59	101	**141**	190	280
Nonpregnant Females 12-50	32	56	**83**	123	222	45	84	**123**	174	273
Females 65+	35	65	**96**	143	268	33	72	**113**	167	272
Males 65+	37	70	**106**	157	268	33	79	**130**	200	343
All Income:										
Pregnant Females **	56	93	**129**	176	265	59	111	**168**	242	374
Lactating Females **	44	68	**91**	119	172	45	91	**139**	204	332

* Groups mentioned under Objective 3 "Assess the impact of nutritional improvements ..... for women are of childbearing age, pregnant, or lactating, and elderly."

** Insufficient sample numbers to separate by income, distribution data for these subgroups provided by Iowa State University Department of Statistics.

Table 3: Nutrient Intakes (% of the 1989 RDAs) at Selected Percentiles, by Demographic Characteristics – 1994-95 CSFII (Continued)

	Vitamin B_6					Folate				
Group	5th	25th	**50th**	75th	95th	5th	25th	**50th**	75th	95th
All Respondents	53	79	**102**	129	181	58	98	**144**	210	361
All Higher Income	55	80	**102**	129	179	58	99	**143**	206	351
All Low Income	48	76	**100**	129	184	52	97	**148**	225	397
Low Income:										
FSP Participants	52	81	**106**	136	193	57	106	**165**	254	438
Non-Participants	47	74	**97**	124	173	51	94	**138**	205	361
Higher Income:										
Nonpregnant Females 12-18	57	80	**100**	122	160	70	101	**128**	160	218
Nonpregnant Females 12-50	54	74	**91**	111	145	60	89	**116**	151	216
Females 65+	51	73	**93**	116	155	62	95	**125**	162	229
Males 65+	51	74	**94**	119	165	62	96	**130**	173	258
Low Income										
Nonpregnant Females 12-18	53	75	**93**	112	144	61	89	**112**	140	190
Nonpregnant Females 12-50	47	67	**84**	102	135	55	81	**104**	133	189
Females 65+	39	60	**77**	99	136	51	78	**104**	136	199
Males 65+	40	62	**83**	110	159	53	86	**118**	159	239
All Income:										
Pregnant Females **	50	66	**80**	97	125	21	37	**50**	66	106
Lactating Females **	55	83	**108**	138	193	53	89	**124**	172	267

* Groups mentioned under Objective 3 "Assess the impact of nutritional improvements ..... for women are of childbearing age, pregnant, or lactating, and elderly."

** Insufficient sample numbers to separate by income, distribution data for these subgroups provided by Iowa State University Department of Statistics.

Table 3: Nutrient Intakes (% of the 1989 RDAs) at Selected Percentiles, by Demographic Characteristics – 1994-95 CSFII

(continued)

	Vitamin E					Calcium*				
Group	5th	25th	**50th**	75th	95th	5th	25th	**50th**	75th	95th
All Respondents	43	66	**86**	115	180	28	50	**72**	103	171
All Higher Income	45	67	**88**	116	180	29	51	**72**	101	163
All Low Income	39	60	**82**	111	173	25	48	**73**	109	199
Low Income:										
FSP Participants	38	63	**87**	118	188	25	51	**80**	122	228
Non-Participants	39	59	**78**	104	160	25	47	**70**	101	174
Higher Income:										
Nonpregnant Females 12-18	61	72	**81**	91	106	33	47	**59**	73	97
Nonpregnant Females 12-50	50	70	**87**	110	155	34	50	**64**	80	111
Females 65+	42	62	**81**	104	154	23	36	**49**	63	89
Males 65+	39	60	**80**	107	170	30	46	**60**	78	108
Low Income										
Nonpregnant Females 12-18	52	65	**75**	86	105	30	42	**52**	63	83
Nonpregnant Females 12-50	48	66	**80**	97	126	26	42	**55**	71	98
Females 65+	32	47	**62**	81	121	21	33	**43**	55	75
Males 65+	28	46	**63**	85	127	24	38	**51**	69	101
All Income:										
Pregnant Females **	44	63	**79**	98	130	53	83	**107**	136	183
Lactating Females **	56	59	**78**	108	186	46	76	**103**	134	187

* Standard for calcium intake is 1997 DRI.

** Insufficient sample numbers to separate by income, distribution data for these subgroups provided by Iowa State University Department of Statistics.

Table 3: Nutrient Intakes (as % of the 1989 RDAs) at Selected Percentiles, by Demographic Characteristics – 1994-95 CSFII

(continued)

	Phosphorus*					Magnesium*				
Group	5th	25th	**50th**	75th	95th	5th	25th	**50th**	75th	95th
All Respondents	81	124	**163**	209	296	37	60	**81**	111	182
All Higher Income	83	127	**164**	209	293	38	61	**81**	109	175
All Low Income	74	117	**157**	206	302	34	58	**83**	121	207
Low Income:										
FSP Participants	77	121	**132**	214	310	37	63	**92**	136	228
Non-Participants	74	117	**155**	201	286	34	56	**79**	111	186
Higher Income:										
Nonpregnant Females 12-18	55	74	**88**	104	130	36	53	**68**	86	117
Nonpregnant Females 12-50	95	124	**146**	172	214	44	60	**72**	87	111
Females 65+	78	110	**135**	164	210	41	58	**72**	88	117
Males 65+	105	144	**175**	209	263	40	55	**68**	83	108
Low Income										
Nonpregnant Females 12-18	58	73	**83**	95	115	37	53	**66**	81	108
Nonpregnant Females 12-50	82	113	**136**	162	205	38	53	**64**	77	99
Females 65+	67	94	**115**	139	176	35	49	**60**	72	92
Males 65+	85	121	**152**	188	250	33	47	**60**	74	100
All Income:										
Pregnant Females **	120	165	**200**	237	293	46	64	**79**	96	126
Lactating Females **	116	168	**209**	254	326	53	76	**99**	128	189

* Standards for phosphorus and magnesium intakes are 1997 DRIs.

** Insufficient sample numbers to separate by income, distribution data for these subgroups provided by Iowa State University Department of Statistics.

Table 3: Nutrient Intakes (as % of the 1989 RDAs) at Selected Percentiles, by Demographic Characteristics -- 1994-95 CSFII

(continued)

	Iron					Zinc				
Group	5th	25th	**50th**	75th	95th	5th	25th	**50th**	75th	95th
All Respondents	58	93	**125**	169	264	47	65	**82**	102	145
All Higher Income	60	94	**127**	171	267	47	66	**82**	102	143
All Low Income	54	86	**118**	160	251	44	64	**82**	104	145
Low Income:										
FSP Participants	56	90	**123**	166	255	47	68	**88**	112	155
Non-Participants	53	85	**115**	153	234	44	62	**78**	97	132
Higher Income:										
Nonpregnant Females 12-18	54	71	**86**	105	139	50	65	**78**	93	119
Nonpregnant Females 12-50	49	68	**84**	102	137	48	63	**76**	92	122
Females 65+	69	97	**120**	149	205	43	57	**68**	82	107
Males 65+	83	120	**157**	204	300	43	59	**75**	94	132
Low Income										
Nonpregnant Females 12-18	49	68	**82**	98	127	51	66	**78**	91	114
Nonpregnant Females 12-50	49	64	**77**	94	124	43	59	**72**	88	116
Females 65+	55	81	**105**	134	192	33	47	**59**	74	107
Males 65+	79	114	**146**	188	268	39	54	**67**	83	112
All Income:										
Pregnant Females **	30	40	**49**	52	75	44	60	**72**	85	107
Lactating Females **	64	96	**132**	180	262	43	59	**72**	89	120

* Groups mentioned under Objective 3 "Assess the impact of nutritional improvements ..... for women are of childbearing age, pregnant, or lactating, and elderly."

** Insufficient sample numbers to separate by income, distribution data for these subgroups provided by Iowa State University Department of Statistics.

Table 4: Percent of Individuals with Usual Intakes Below 100% of 1989 RDAs – 1994-95 CSFII

		All			Low Income		Higher Income			Vulnerable Groups		Lower Income	
Nutrient (Below 100% of RDA)	All	High Inc.	Low Inc.	FSP	Non-FSP	NPF1218	NPF1950	Fem 65+	Male 65+	NPF1218	NPF1950	Fem 65+	Male 65+
Vitamin A	45	43	51	45	54	51	48	26	39	80	62	53	46
Vitamin C	24	24	24	18	18	19	34	22	25	24	35	42	36
Vitamin B_6	48	47	50	44	44	51	62	59	57	60	73	76	67
Folate	26	25	27	22	22	24	35	29	28	36	46	47	36
Vitamin E	64	63	67	62	62	90	66	72	70	92	79	88	86
Calcium*	73	74	70	64	64	96	91	98	92	99	96	100	95
Phosphorus*	12	11	15	14	14	69	7	17	4	82	14	32	11
Magnesium*	67	69	63	56	56	87	89	87	91	92	95	98	95
Iron	31	29	36	33	33	69	72	29	12	77	82	45	16
Zinc	73	73	72	64	64	83	83	92	80	86	87	93	90

* Standards for calcium, phosphorus, and magnesium are based on 1997 DRIs.

Table 5: Dietary Supplement Use by Individuals,
by Household Income and Food Stamp Program Participation;

2- Day Data Set, Weighted Frequencies,* (Unweighted Counts)

1994-95 CSFII

	All Households			Low-Income Households**	
	All Households	Higher Income	Low Income**	FSP	Non-FSP
1. Any Supplement	46% (4,722)	49.1% (3,752)	36.3% (970)	30.0% (367)	41.5% (594)
2. Multi-Vitamin	22 (2,220)	23.1 (1,791)	16.6 (429)	13.2 (160)	19.8 (268)
3. Multi-Vitamin + Mineral(s)	16 (1,661)	16.8 (1,308)	12.7 (353)	12.6 (154)	12.7 (196)
4. Iron-Vitamin C Combination and/or Iron Supplement	5 (449)	4.9 (336)	4.3 (113)	4.1 (49)	4.5 (63)
5. Vitamin A	1.4 (148)	1.5 (119)	1.1 (29)	0.2 (4)	1.2 (22)
6. Vitamin B	3.8 (366)	4.0 (294)	3.1 (72)	1.1 (11)	4.5 (59)
7. Vitamin C	9.0 (845)	9.9 (711)	5.1 (134)	1.5 (20)	8.0 (111)
8. Vitamin E	5.2 (535)	5.9 (461)	2.5 (74)	0.7 (12)	4.0 (61)
9. Folacin	0.4 (33)	0.4 (27)	0.2 (6)	0	0.4 (6)
10. Calcium	4.5 (429)	5.0 (368)	2.1 (61)	0.8 (12)	3.1 (46)
11. Zinc	1.4 (140)	1.5 (116)	0.8 (24)	0.3 (4)	1.2 (17)
12. Magnesium	0.2 (25)	0.3 (21)	0.1 (4)	<0.1 (1)	0.1 (3)
13. Phosphorus					

* Frequencies based on valid percentages (missing values excluded).

** Low income defined as Household Income under 131% of Federal Poverty Level.

Table 6: Dietary Supplement Use by Individuals, by Household Income and Age-Sex Group

2-Day Data Set, Weighted Frequencies (Unweighted Counts)

1994-95 CSFII

Supplement Type	Nonpregnant Females 12-18				Nonpregnant Females 19-50				Females 65+			
	Higher Income		Low Income		Higher Income		Low Income		Higher Income		Low Income	
1. Any Supplement	42.2%	(120)	48.4%	(284)	34.4%	(72)	90.4%	(40)	54.1%	(289)	50.9%	(117)
2. Multi-Vitamin	18.2	(54)	22.3	(134)	15.1	(33)	30.1	(14)	23.5	(134)	18.2	(41)
3. Multi-Vitamin + Minerals	12.5	(27)	14.7	(84)	12.7	(22)	55.0	(24)	15.6	(86)	15.8	(37)
4. Iron-Vitamin C	5.0	(16)	3.0	(14)	4.9	(8)	3.7	(2)	1.9	(12)	2.9	(7)
5. Vitamin A	0.4	(2)	2.9	(15)	2.1	(6)	0.0	0	3.2	(16)	3.3	(8)
6. Vitamin B	0.4	(3)	7.7	(43)	1.9	(5)	1.2	(1)	8.2	(37)	5.7	(15)
7. Vitamin C	7.9	(26)	14.7	(87)	5.2	(13)	5.0	(2)	16.4	(77)	11.4	(25)
8. Vitamin E	1.6	(6)	13.5	(77)	4.9	(12)	0.0	0	12.8	(60)	6.3	(14)
9. Folacin	0.0	0	0.5	(3)	0.5	(1)	0.0	0	0.6	(3)	0.0	0
10. Calcium	3.1	(10)	6.1	(35)	1.2	(4)	6.2	(2)	12.6	(69)	8.4	(19)
11. Zinc	0.4	(2)	4.1	(21)	1.8	(5)	2.6	(1)	2.0	(10)	1.5	(4)
12. Magnesium	0.0	0	0.1	(1)	0.4	(1)	2.6	(1)	0.8	(3)	0.0	0
13. Phosphorus	0.0	0	0.2	(1)	0.0	0	0.0	0	0.0	0	0.0	0

Table 6: Dietary Supplement Use by Individuals, by Household Income and Age-Sex Group (Continued)

2-Day Data Set, Weighted Frequencies (Unweighted Counts)

1994-95 CFSII

Supplement Type	Males 65+				Pregnant		Lactating	
	Higher Income		Low Income		All Incomes		All Incomes	
1. Any Supplement	48.4%	(284)	34.4%	(72)	90.4%	(40)	74.1%	(21)
2. Multi-Vitamin	22.3	(134)	15.1	(33)	30.1	(14)	28.2	(7)
3. Multi-Vitamin + Minerals	14.7	(84)	12.7	(22)	55.0	(24)	50.2	(14)
4. Iron-Vitamin C	3.0	(14)	4.9	(8)	3.7	(2)	5.3	(1)
5. Vitamin A	2.9	(15)	2.1	(6)	0.0	0	0.0	0
6. Vitamin B	7.7	(43)	1.9	(5)	1.2	(1)	0.0	0
7. Vitamin C	14.7	(87)	5.2	(13)	5.0	(2)	2.5	(1)
8. Vitamin E	13.5	(77)	4.9	(12)	0.0	0	0.0	0
9. Folacin	0.5	(3)	0.5	(1)	0.0	0	0.0	0
10. Calcium	6.1	(35)	1.2	(4)	6.2	(2)	5.1	(1)
11. Zinc	4.1	(21)	1.8	(5)	2.6	(1)	0.0	0
12. Magnesium	0.1	(1)	0.4	(1)	2.6	(1)	0.0	0
13. Phosphorus	0.2	(1)	0.0	0	0.0	0	0.0	0

Table 7: Number of Vitamin-Mineral Supplement Products Reported Being Used by Vitamin Users**

1994-95 CSFII

Number of Products	All Income	Higher Income	Lower Income	FSP Eligible: FSP	FSP Eligible: Non-FSP
	% Using*	% Using*	% Using*	% Using*	% Using*
1	75.2%	74.2%	80.4%	87.9%	76.2%
2	11.8	11.8	11.9	10.6	13.0
3	5.6	6.1	3.1	0.4	4.8
4	2.8	3.0	1.9	0.3	2.4
5	1.6	1.7	1.3	0.2	2.0
>5	2.7	2.8	1.4	0.7	1.7

* Valid percents – less than 1% missing values.

** Sample for this analysis is CSFII 94-95 participants who reported using vitamin-mineral supplements. Therefore percentages represent the percent of supplement users who use 1,2,3,4,5 or more than 5 supplement products.

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The High Cost of Poor Eating Patterns in the United States

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Abstract

Dietary patterns in the U.S. are associated with increased risk of several chronic diseases such as coronary heart disease, cancer, stroke, diabetes, hypertension, overweight, and osteoporosis. This study looked only at the first four conditions, which account for over half of all deaths in the U.S. each year. After accounting for comorbidity and potential double-counting, it is estimated that healthier diets might prevent $71 billion per year in medical costs, lost productivity, and the value of premature deaths associated with these conditions.

Introduction

Scientific research increasingly confirms that what we eat may have a significant impact on our health, quality of life, and longevity. In the U.S., high intakes of fat and saturated fat, and low intakes of calcium and fiber containing foods – such as whole grains, vegetables, and fruits – are associated with several chronic health conditions that can impair the quality of life and hasten mortality. In particular, 14 percent of all deaths have been attributed to poor diets and/or sedentary lifestyles (McGinnis and Foege, 1993).

Diet is a significant factor in the risk of coronary heart disease (CHD), certain types of cancer and stroke – the three leading causes of death in the U.S., and responsible for over half of all deaths in 1994 (table 1). Diet also plays a major role in the development of diabetes (the seventh leading cause of death), hypertension and overweight.[2] These six health conditions incur considerable medical expenses, lost work, disability, and premature deaths – much of it unnecessary, since a significant proportion of these conditions is believed to be preventable through improved diets (Frazao, 1995, 1996).

However, no estimates are currently available on the total economic costs that might be associated with food consumption patterns in the U.S. and the economic benefits that might derive from improved diets. This is partly because of the difficulties involved in estimating the direct effect of diet on health conditions. For example, an individual's risk for chronic disease can be increased by genetic predisposition, stress levels, smoking, and activity level, as well as diet. Further, because these chronic diseases occur in middle age, later in life, and dietary patterns tend to change over time, it is not clear which dietary patterns may be more important in establishing the risk for chronic disease: is it eating patterns during infancy? during early childhood? during adolescence? during adulthood?

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[2] Diet also plays an important role in the risk for osteoporosis, neural tube birth defects, and other health conditions that are not addressed in this study.

Efforts to improve dietary patterns could markedly decrease morbidity and mortality associated with chronic health conditions. These benefits would result in lower medical care costs, lower institutional care costs, less lost productivity, improved quality of life, and increased life span. For example, studies have found that even fairly small reductions in intakes of fat, saturated fat, and cholesterol would likely yield substantial benefits (Browner, Westenhouse, and Tice, 1991; Zarkin and others, 1991). The economic impact analysis for the 1993 nutrition labeling regulations estimated that a 1 percent reduction in intake of fat and saturated fat and a 0.1 percent reduction in intake of cholesterol would prevent over 56,000 cases of CHD and cancer, avoid over 18,000 deaths, and save over 117,000 life-years over 20 years (USDA, 1993; DHHS, 1993a).

This study uses estimates from the medical literature on the likely effects of diet on specific chronic health conditions to estimate the medical costs and lost productivity that could be prevented through improved dietary patterns. The study also provides a more complete estimate of the total economic costs associated with diet by estimating the value of diet-related premature deaths. It should be noted, however, that the methodology for estimating the value of diet related premature mortality is still being refined, and further work is needed to assess the appropriateness and relevance of the social values that have been incorporated in the estimates.

Health Consequences of Poor Eating Patterns

Coronary Heart Disease [3]

Mortality data for 1994 show that coronary heart disease (CHD) was the cause of over 480,000 deaths in the U.S. – nearly two-thirds of all deaths from heart disease, and more than one of every five deaths (table 1). Individuals 55-74 years of age accounted for 31 percent of all CHD deaths in 1994, and individuals 75 years and older accounted for 63 percent of these deaths (table 2).

The American Heart Association (1997) estimates that as many as 1.1 million Americans suffer a new or recurrent heart attack each year, that over 13.9 million people alive today have a history of CHD, and that someone dies from a heart attack about every minute. And although heart attacks affect mainly the old, 40 percent occur in people age 40-64 (American Heart Association, 1996a).

Although genetics pays an important role in an individual's risk of CHD, environmental factors are also significant. Major modifiable risk factors for CHD include high blood cholesterol levels, diabetes, overweight, hypertension, physical inactivity, and smoking. Diet – in particular, consumption of saturated fats – can influence blood cholesterol levels in some people. New research also suggests that increased intake of antioxidants and folic acid – a vitamin available in dry beans, and may fruits and vegetables – may reduce the risk of CHD (Boushey and others,

[3] Although mortality statistics least "heart disease" as the leading cause of death, this paper focuses on coronary heart disease (CHD), also known as ischemic heart disease, the type commonly associated with diets.

1995; Willett, 1994; Plotnick, Corretti and Vogel, 1997). And diet can also influence other risk factors for CHD, such as diabetes, hypertension, and overweight (see below).

Although CHD currently represents over 20 percent of all deaths in the U.S., mortality rates from heart attacks have been declining since the 1950's. However, it is not clear that the incidence of heart disease have been declining. Rothenberg and Koplan (1990), for example, found that the frequency of hospitalization for CHD was increasing in spite of downward trends in mortality, while hospitalization from stroke increased 24 percent from 1979 to 1995 (American Heart Association, 1997). Hunink and others (1997) examined the decline in mortality from CHD between 1980 and 1990 and determined that 25 percent of the decline was explained by primary prevention and an additional 29 percent was explained by secondary reduction in risk factors in patients with coronary disease. Other improvements in treatment explained 43 percent of the decline in mortality. They concluded that more than 70 percent of the overall decline in mortality occurred among patients with coronary disease. An analysis conducted at the Harvard Center for Risk Analysis also suggests that most of the decline in mortality from CHD between 1980 and 1990 was due to improvements in the management of patients who already had the disease rather than due to reduced incidence of CHD (Goldman and Hunink, 1997). It is difficult to isolate the effect of dietary changes, because of other concomitant practices – such as lower-dose oral contraceptives, and increased use of cholesterol-lowering drugs and postmenopausal estrogen replacement therapy – that also reduce blood cholesterol levels (Johnson and others, 1993).

Cancer

Cancer claimed over 530,000 lives in the U.S. in 1994 (table 1). Individuals 55-74 years of age accounted for nearly half (47 percent) of all cancer deaths, while individuals 75 years and older accounted for an additional 40 percent (table 2).

The American Cancer Society (1997) estimates that over 1 million new cancer cases are diagnosed each year, and that about 560,000 people will die of cancer in 1997 – more than 1,500 people per day.

Even though genetics is an important factor in cancer risk, epidemiologic studies suggest that cancer is not an inevitable consequence of aging (World Cancer Research Fund and American Institute for Cancer Research, 1997; Wynder and Gori, 1997; American Cancer Society, 1997). Changes in cancer patterns over time – such as the sharp increase in incidence of breast and lung cancer and the decline in stomach cancer in the U.S. in the past decades – support the hypothesis that environmental and lifestyle factors may play an important role in the occurrence of cancer. This hypothesis is further strengthened by studies showing that when population migrate their cancer patterns change in a fairly short time to approximate the patterns prevalent in the new area of residence (Higginson and Muir, 1979; Doll and Peto, 1981; National Research Council, 1982; Page and Asire, 1985).

Studies increasingly demonstrate a strong protective effect against cancer assoicated with increased consumption of fruits and vegetables (Block, Patterson, and Subar, 1992; World Cancer Research Fund and American Institute for Cancer Research, 1997); the evidence on the role of high-fat diets and cancer risk is less clear. The increased risk of cancer attributed to a high-fat diet may really be due to low intake of something else – such as fruits and vegetables (Subar and others, 1994) or due to the increased risk of obesity associated with high-fat diets (World Cancer Research Fund and the American Cancer Research Institute, 1997).

Stroke

Stroke (cerebrovascular disease) affects over 500,000 people each year – averaging nearly one every minute – and killed over 150,000 people in 1994 (table 1). Individuals 55-74 years of age accounted for 23 percent of stroke deaths in 1994, while individuals 75 years and older accounted for 71 percent of stroke deaths in 1994 (table 2).

According to the American Heart Association (1997), stroke is the leading cause of serious long-term disability, and accounts for half of all patients hospitalized for acute neurological disease. Mortality rates from stroke have been steadily declining since 1950 (Singh, Kochanek, and MacDorman, 1996). Some of this decline has been attributed to improvements in the detection and treatment of hypertension (see below).

Diabetes

Diabetes is the seventh leading cause of death in the U.S., directly responsible for 56,000 deaths in 1994 (table 1). Forty-two percent of these deaths occurred among individuals 55-74 years of age; an additional 47 percent occurred among individuals 75 years and older (table 2). However, because people often die of the complications of diabetes rather than from diabetes itself, mortality statistics tend to underreport the true impact of diabetes (Centers for Disease Control and Prevention, 1997a; Geiss, Herman, and Smith, 1995; Rothenberg and Koplan, 1990; Herman, Teutsch, and Geiss, 1987). The American Diabetes Association (1998) estimates that diabetes contributes to at least an additional 100,000 deaths each year. For example, diabetes is the single leading cause of end-stage renal disease, and a risk factor for CHD, stroke, and hypertension. People with diabetes are two to four times more likely to have heart disease and to suffer a stroke (American Diabetes Association, 1998) and twice as likely to have hypertension as people who do not have diabetes (American Diabetes Association, 1993; Herman, Teutsch, and Geiss, 1987). Diabetes is also the leading cause of blindness, and the leading cause of non-traumatic lower limb amputation (American Diabetes Association, 1998).

Diabetes affects more than 15 million people in the U.S., although one-third are not aware they have the condition. Approximately 2,200 people are diagnosed with diabetes each day (American Diabetes Association, 1998). Both prevalence and incidence are higher among blacks and Hispanics than among whites – probably due to a combination of genetic factors and higher prevalence of risk factors such as obesity (American Diabetes Association, 1993).

There are two main types of diabetes. Type I, also called insulin-dependent or juvenile-onset diabetes is characterized by an absolute deficiency of insulin and usually appears before age 40. Type II diabetes, also called noninsulin-dependent or adult-onset diabetes, appears in midlife, most often among overweight or obese adults. Many times it can be controlled by diet and exercise alone. Over 90 percent of the diagnosed cases of diabetes are Type II. Undiagnosed cases are likely to be Type II, since the severity of Type I symptoms requires medical intervention.

The only therapeutic interventions known to be effective in noninsulin-dependent diabetes are the maintenance of desirable body weight and exercise (DHHS and USDA, 1992; American Diabetes Association, 1993). About 80 percent of people with Type II diabetes have a history of being overweight (DHHS, 1992; Herman, Teutsch, and Geiss, 1987). McGinnis and Foege (1993) estimate that half of Type II diabetes can be prevented by controlling weight (perhaps through dietary improvement and physical activity).

Hypertension

Hypertension, or high blood pressure, affects as many s 50 million people in the U.S. (American Heart Association, 1996)[4]. Mortality statistics for 1994 list 23,943 deaths from hypertensive heart disease and 2,494 deaths from hypertensive heart and renal disease, and 11,765 deaths from hypertension with or without renal disease (Singh, Kochanek, and MacDorman, 1996). If listed together, these three categories would add up to 38,202 deaths and would comprise the ninth leading cause of death. But mortality statistics report the two types of hypertensive heart disease under "diseases of the heart" and list hypertension with our without renal disease as a separate category.

Furthermore, because hypertension is a common and important risk factor for CHD, stroke, and renal disease (DHHS, 1993c), mortality statistics grossly underestimate the impact of hypertension on mortality (Weinstein and Stason, 1976). Milio (1981) estimates that hypertension contributes to 50 percent of stroke deaths and 6 percent of CHD deaths. The American Heart Association (1997) estimates that as many as 30 percent of all deaths in hypertensive black men and 20 percent of all deaths in hypertensive black women may be attributable to high blood pressure. In 1993, hypertension was listed as a contributing cause of death on more than 180,000 death certificates of stroke, heart attack, and heart failure victims (American Heart Association, 1996b).

Each year, some 2 million people start treatment for hypertension (DHHS, 1993b). Yet 1988-91 data from the National Health and Nutrition Examination Survey show that 35 percent of those with high blood pressure were unaware of their condition. In addtion, only 44 percent were on hypertensive medication, and only 21 percent were on adequate therapy and had their hypertension under control. Surveys conducted in 1991-92 estimated that 2.2 million Americans age 15 and over had disabilities resulting from high blood pressure (American Heart Association, 1996a).

Because hypertension can be controlled, but not cured, treatment is often costly. Further, since there are usually no symptoms associated with hypertension, and since the medication may cause

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[4] Hypertension, or sustained high blood pressure, is defined as systolic blood pressure (SBP) of 140 mm HG or greater and/or diastolic blood pressure (DBP) of 90 mm HG or greater.

side effects, compliance with the medication is not very good (DHHS, 1993b). Little is known about the implications of long-term drug therapy for the millions of people who take medication to try and control their hypertension (DHHS, 1988).

Age-related increases in blood pressure, as occur in the U.S., are associated with being overweight, and physically inactive, high intakes of sodium and alcohol, and low potassium intake (DHHS, 1993b).[5] The National Heart, Lung, and Blood Institute estimates that 20-30 percent of hypertension can be attributed to overweight (DHHS, 1993c), and a recent study suggests that efforts to prevent hypertension should focus on energy intake and preventing or controlling overweight (Pickering, 1997). Although not all individuals are equally susceptible to the effects of sodium, a lower sodium intake might also prevent blood pressure from increasing with age in the U.S. (DHHS, 1990). New research at Johns Hopkins University also suggests that increased consumption of fruits and vegetables can lower high blood pressure as effectively as some medications (Appel and others, 1997).

Improvements in the detection, treatment, and control of hypertension are believed to have contributed substantially to the decline in mortality rates from stroke and CHD in the past two decades. The National High Blood Pressure Education Program, launched in 1992, is credited with improving the number of hypertensives aware of their condition and receiving treatment for it (DHHS, 1993b).

Overweight

Being overweight is associated with increased risk for morbidity and mortality from a number of chronic health conditions, including CHD, high blood pressure, noninsulin-dependent diabetes, and some types of cancer (Centers for Disease Control and Prevention, 1997a; American Heart Association, 1998). Although not an official cause of death, being overweight is considered by some experts to be one of the leading precursors of premature death in the U.S. (Amler and Eddins, 1987; McGinnis and Foege, 1993). Prevention of obesity could reduce the incidence of hypertension by 20 percent (Pickering, 1997) and Type II diabetes by 50 percent (Herman, Teutsch, and Geiss, 1987).

Despite efforts to address overweight as a public health problem, and the enormous consumer interest in weight loss programs and in reduced fat foods, the prevalence of overweight has increased dramatically in the U.S. in the past two decades. Between 1976-80 and 1988-94, there was an increase of 10 percentage point in the proportion of the population classified as overweight (Centers for Disease Control and Prevention, 1997b).[6] The magnitude of the

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[5] In nonindustrialized countries, there is little increase in blood pressure with age (DHHS, 1993b). In the U.S., high blood pressure affects men more than women until early middle age, and then reverses. The prevalence of high blood pressure is greater for blacks than for whites, and is greater among less educated than more educated people.

[6] Being overweight was defined in that study as a body mass index (BMI, calculated as weight in kilograms, divided by height, in meters, squared) value of at least 27.3 for women and at least 27.8 for men. Children and adolescents were classified as overweight when their BMI's were at or above sex-and age-specific 95^{th}-percentile BMI cutoff points derived from the National Health Examination Surveys (Centers for Disease Control and Prevention, 1997b).

problem becomes even more sever using the American Heart Association's recently-released definition (1998), that individuals with a BMI of 25 and above are overweight.[7] This results in over half of all U.S. adults being classified as overweight in 1988-94: 59.4 percent of the men and 50.7 percent of women (Kuczmarski and others, 1997).

Since overweight is an important risk factor for CHD, stroke, some types of cancer hypertension, and diabetes, the adverse health implications of this increasing weight problem are significant. In particular, there is some concern that as the prevalence of overweight increases among children and teenagers, the chronic diseases that have typically been associated with people in their 50's may begin to appear at an earlier age (DeBrosse, 1997).

Economic Consequences of Poor Eating Patterns

Methodology and Data

This study follows the "cost-of-illness" methodology, in which the direct and indirect costs associated with a particular illness are estimated and then summed to obtain total economic costs. The direct costs measure resources used in the prevention, diagnosis, treatment, and continuing care of the disease, such as expenditures on medical care and services. The indirect costs represent the time and output lost from employment, housekeeping, volunteer activities, and/or leisure, either due to morbidity or due to death.

Measures of lost productivity, however, ignore other less tangible dimensions associated with the illness, such as deterioration in the quality of life, pain and suffering, and reduced life span (Brown, Hodgson, and Rice, 1996). In some cases, these intangibles may be more important than the lost wages.

Methods for valuing deaths have been developed that provide a more comprehensive measure of the value consumers attach to postponing death, or "value of life," than is provided by estimates of lost productivity due to death. Therefore, this study uses the data available on medical costs and lost productivity from disability associated with chronic health conditions that are affected by diet, but estimates its own value of diet-related deaths without using the data available in the literature on lost productivity due to deaths.

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[7] This definition for overweight was incorporated in the 1995 edition of the *Dietary Guidelines for Americans*, based on studies that mortality increased significantly above a BMI of 25 (USDA, 1995).

Value of Life

Consumers, often without realizing, demonstrate the value they place on life and health when they pay more for safer products or earn higher wages for riskier jobs (Aldrich, 1994). Economists have translated these actual behaviors – particularly through statistical analysis of wage premiums necessary for workers to accept riskier jobs or from consumer market studies for observable tradeoffs people make between risks and benefits (such as the decision to use automobile seat belts or smoke detectors) – into estimates of consumer willingness to pay to avoid death, or "value of life." Willingness-to-pay estimates can also be derived from contingent valuation surveys in which respondents are given a hypothetical situation and asked how much they would be willing to pay to reduce their risk of premature death by a specified small amount. In a survey of 24 wage-risk studies, Viscusi (1993) concluded that most estimates of the "value of life" fell between $3 million and $7 million per life, in 1990 dollars[8]. Updated to 1995 dollars, these estimates range from $3.6 million to $8.4 million per life.

Estimates of the "value of life" do not measure the value of life of any one identified individual, but represent the total amount that a group of individuals is willing to pay for small reductions in the probability of death. For example, if 100,000 people are each willing to pay $250 for a program that is expected to reduce the overall probability of death from 90 in 1000,000 to 80 in 100,000, the implied value of life for the 10 "statistical" (or unidentified) lives saved is $25 million. This translates into $2,500,000 per each "statistical life" saved, or a "value of life" of $2.5 million.

An individual's willingness to pay to avoid illness or premature death may be highly dependent on the expected risk or change in risk, as well as the individual's age, income, and/or health condition. Therefore, it is not clear that the "value-of-life" estimate obtained for one group of individuals can be applied to groups of individuals with different characteristics, or facing different risk choices or levels. In practice, however, because of the difficulties in obtaining value-of-life estimates, available estimates are applied. Of particular concern is the use of the same value of life regardless of age at time of death. The implicit assumption is that the value of life is the same for an individual who dies at the age of 5, 25, or 95. From a human capital perspective, age is clearly important, since an individual who loses 30 years of life incurs a larger productivity loss than an individual who loses 5 years of life. This remains a controversial issue.

Landefeld and Seskin (1982) developed age-specific estimates of the value of life by adjusting their estimates of lost productivity with a measure of willingness-to-pay for small changes in risk of death based on life insurance data. However, their estimates still do not include a measure of

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[8] Estimates vary because of variations across studies in populations, their levels of risk aversion, mean levels of fatal and nonfatal risks, and omission of nonpecuniary job attributes, etc.

other intangible factors, such as pain and suffering or the quality of remaining years of life, and therefore should be viewed as a conservative measure of the "true" value of life[9].

For this study, estimates derived from Landefeld and Seskin's (1982) age-specific value of life are applied to mortality data to obtain the value of diet-related deaths.

Medical Costs

Data on medical costs were obtained from the literature and updated to 1995 dollars using the consumer price index (CPI) for medical care. Note, however, that the data available (and presented in table 3) represent medical costs for all cases of each health condition. Because diet is only one of the many factors that influence an individual's risk for any of these health conditions, only a portion of the costs listed in table 3 may be attributable to diet. Further, the costs listed in table 3 should not be added, since they likely include considerable double-counting associated with the joint occurrence of more than one health condition in the same individual (comorbidity). For example, 55 percent of diabetics die from cardiovascular disease (Javitt and Chiange, 1995). This suggests that the costs of cardiovascular disease in diabetics are likely included under both diabetes and cardiovascular disease (which include CHD and stroke).

Before adjusting for double-counting, it is interesting to note that table 3 provides a very different picture of the disease burden associated with each of the six health conditions than the picture provided by the mortality statistics in table 1. Medical costs associated with diabetes and obesity are considerably higher than those for heart disease and cancer, the two leading causes of death in the United States. The high cost burden associated with diabetes is consistent with the assertions by many experts that mortality statistics underestimate the true health impact of diabetes (American Diabetes Association, 1993; Herman, Teutsch, and Geiss, 1987). Rothenberg and Koplan (1990), for example, found that of all the times diabetes appeared in a death certificate, it was listed as the underlying cause of death less than 25 percent of the time. Similarly, mortality statistics ignore the true health impact of hypertension and obesity – conditions strongly moderated by diet and which increase the risk of coronary heart disease, cancer, stroke, and/or diabetes, although neither condition is considered a major cause of death.

Although correlations between mortality and medical care expenditures tend to be poor (Hodgson, 1997), the simplest way to adjust for the double-counting in table 3 is to assume that the 55 percent of the costs associated with diabetes in table 3, and that these costs are already fully accounted for under CHD and stroke. Based on these assumptions, only the remaining 45 percent of the costs associated with diabetes represent incremental costs. This also assumes that the only significant comorbidity occurs between diabetes, CHD, and stroke.

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9 A measure has been developed, quality-adjusted life years (QALY), which adjusts the remaining years of life for their quality. The Panel on Cost Effectiveness in Health and Medicine, created by the Office of Disease Prevention and Health Promotion of the U.S. Public Health Service, recommends using a QALY measure in cost-effectiveness studies of health interventions (Harvard Center for Risk Analysis, 1996). However, data on QALY are not incorporated in Landefeld and Seskin's age-specific values of life.

The adjusted numbers, however, may not present an accurate reflection of the disease burden associated with specific health condition. For this reason, the adjusted costs, as well as the diet-related costs presented below, are estimated in the aggregate for CHD, stroke, and diabetes. Furthermore, due to lack of data, the study focuses from this point on only on the costs associated with four health conditions – CHD, cancer, stroke, and diabetes.

Adjusted medical costs of CHD, cancer, stroke, and diabetes are presented in table 4. However, these costs still apply to all cases of each disease. Studies suggest that improved diets could reduce CHD and stroke mortality by at least 20 percent, and cancer and diabetes mortality by at lease 30 percent (McGinnis and Foege, 1993; Willett, Colditz, and Mueller, 1996; and Trichopoulos, Li, and Hunter, 1996). These estimates are consistent with other estimates on the potential reduction in mortality based on risk removal (Rothenberg and Koplan, 1990; Gori and Richter, 1978). For lack of better data, we assume that if diet can reduce mortality by a certain percentage, it can also reduce the incidence of the disease by the same percentage – and that the same effect applies to costs. Therefore, this study attributes to diet 20 percent of the adjusted medical costs associated with CHD and stroke, and 30 percent of the adjusted medical costs associated with cancer and diabetes. Based on these assumptions, over $33 billion in medical costs associated with CHD, cancer, stroke and diabetes each year may be attributed to diet (table 4).

Lost Productivity Resulting from Disability

As with medical costs, data on lost productivity resulting from disability were obtained from the medical literature. The costs in table 5 represent the costs associated with all cases of each of six health conditions, updated to 1995 dollars using the Bureau of Labor Statistics average weekly earnings of employed full-time and part-time wage and salary workers. As with medical costs, these costs should not be added because they likely include double-counting. And as with medical costs, the unadjusted costs support the assertion that mortality data underestimate the true disease burden associated with diabetes.

Adjustments for double-counting of the lost productivity estimates in table 5 are identical to the adjustments made to medical costs, and assume that only 45 percent of the costs of diabetes represent incremental costs (table 6). The proportion of productivity losses attributed to diet is the same as the proportion of medical costs attributed to diet; 20 percent of the costs associated with CHD and strike, and 30 percent of the costs associated with cancer and diabetes. Over $9 billion per year in lost productivity associated with morbidity from CHD, cancer, stroke, and diabetes is attributed to diet (table 6).

The Value of Diet-Related Premature Deaths

As with costs, diet-related deaths from CHD, cancer, stroke, or diabetes are a subset of all CHD, cancer, stroke, or diabetes deaths. Although studies suggest that improved diets could reduce CHD and stroke mortality by at least 20 percent, and cancer and diabetes mortality by at least 30 percent, this study did not consider that all deaths were equally affected by diet, and therefore imposed some constraints on those deaths that could be potentially affected by diet.

For example, because everyone must eventually die, the study determined that improved diets could postpone, but could not prevent, deaths. Therefore, for purposes of this study, only premature deaths could be attributable to diet. Following the American Heart Association (1996) convention, deaths occurring after the age of 75 – the average life expectancy at birth – were not considered to be premature, and therefore were not considered to be affected by diet.

However, not all premature deaths from CHD, cancer, stroke, or diabetes can be attributed to diet, either. In particular, because the adverse health effects of diet are thought to be cumulative, they are not likely to manifest themselves during the early years of life. Therefore, CHD, cancer, stroke, or diabetes deaths among young individuals are probably not a result of poor dietary habits. However, the age at which the cumulative effects of diet begin to manifest themselves during the early years of life. Therefore, CHD, cancer, stroke, or diabetes deaths among young individuals are probably not a result of poor dietary habits. However, the age at which the cumulative effects of diet begin to manifest themselves is not known. According to Harper (1990), " a high proportion of those who die (from CHD) at ages below 55 suffer from genetic defects of lipid metabolism, which are not highly responsive to diets." On the other hand, McGill and others (1997) observed differences in arterial lesions that were associated with serum level of low-density lipoproteins in individuals as young as 15 years who had died of external causes. To be on the conservative side, a premature CHD, cancer, stroke, or diabetes death was potentially associated with diet only if it occurred in individuals older than 55. In summary, for this study, only deaths among individuals 55-74 years of age were considered to be potentially related to diet.

As shown earlier in table 2, in 1994, individuals 55-74 years of age accounted for 38 percent of all deaths from CHD, cancer, stroke, and diabetes (table 2). More specifically, this age group accounted for 31 percent of all deaths from CHD, 47 percent of all cancer deaths, 23 percent of all deaths from stroke, and 42 percent of all deaths from diabetes.

However, even among individuals age 55-74, not all CHD, cancer, stroke, and diabetes deaths can be attributed to diet. Following McGinnis and Foege (1993), 20 percent of CHD and stroke deaths and 30 percent of diabetes deaths were defined as being diet-related; following Trichopoulos, Li, and Hunger (1996) and Willett, Colditz, and Mueller (1996), 30 percent of cancer deaths were defined as being diet-related. Based on these definitions, there were 119,912 diet-related premature deaths in 1994 among individuals 55-74 years, accounting for 5.3 percent of all deaths in the U.S. Individuals 65-74 years accounted for 67 percent of all diet-related premature deaths from CHD, cancer, stroke, or diabetes.

The value of these diet-related premature deaths from CHD, cancer, stroke, or diabetes was estimated based on interpolations of the Landefeld and Seskin's age-specific estimates (Buzby and others, 1996b), averaged across genders and updated to 1995 values with usual weekly earnings of part-time and full-time employed wage and salary workers. We used the value of life at the midpoint of the relevant age ranges: $412,751 for a death at age 60, and $143,760 for a death at age 70[10]. Multiplying these values by the appropriate number of diet related premature deaths from CHD, cancer, stroke, or diabetes yields an economic value of $28 billion per year (table 7).

Conclusion

Total economic costs attributed to diet in the U.S. were obtained by adding diet-related medical costs, diet-related productivity losses from disability, and the economic value of diet-related premature deaths. The total economic costs attributable to diet associated with CHD, cancer, stroke, and diabetes add to $70.9 billion (table 8). Medical costs account for nearly half of the total (47 percent), premature deaths account for 39 percent, lost productivity associated with morbidity accounts for the remaining 13 percent.

The conservative assumptions used in this study suggest that the $70.9 billion estimate understates the true costs associated with current dietary patterns in the United States. For example, diet-related premature deaths from CHD, cancer, stroke, or diabetes, as defined in this study, account for only 5.3 percent of all deaths attributed to diet and/or inactivity by McGinnis and Foege (1993). Furthermore, the estimates do not include diet-related costs associated with osteoporosis, hypertension, overweight, and neural tube birth defects, which would clearly increase the costs associated with diets. For example, including the costs of diet-related osteoporosis hip fractures would add $5.1-$10.6 billion each year to the costs associated with poor diets.

In addition, although the dollar values of medical costs and lost productivity were updated to reflect changes in the price level of wages, earnings, and productivity, they do not reflect the increased number of cases associated with these health conditions, the number of cases is increasing because of the aging of the population. For example, the American Cancer society (1997) estimates there are 1 million new cases of cancer diagnosed each year.

Nor do the estimates reflect technological advances that improve treatment – but may also increase the cost of treatment as well as affect the quality of life of the remaining years. These may be particularly important issues for CHD and stroke, in particular, where declines in mortality appear to be due more to improvements in medical management and technology than to primary prevention and reduced incidence (Goldman and Hunink, 1997, Hunink and others, 1997). Survivors might have to cope with increased disability during their remaining years. The increased frequency of hospitalization associated with CHD and stroke that has accompanied the drop in mortality rates suggest that a large proportion of increased life expectancy may be associated with a gain in "disabled" years (Rothenberg and Koplan, 1990). However, the "value-of-life" estimates used in this study do not account for quality-of-life issues, and are considerable lower than the $3.6-$8.4 million per life (in 1995 dollars) obtained from willingness-to-pay studies (Viscusi, 1993). Valuing each of the 119,912 diet-related premature deaths at $3.6 million results **in total economic costs** of more than $474 billion each year attributable to diet!

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[10] These values are considerable lower than the $3.6 million lower bound of the "value of life" obtained by willingness-to-pay studies.

With the U.S. population growing older, the number of those affected by chronic health conditions is expected to increase, with important consequences for health expenditures and quality of life during the older years. The National Osteoporosis Foundation has estimated that because osteoporosis affects primarily the elderly, the direct medical costs of osteoporosis will increase six-fold by the year 2000 and 20-fold by the year 2040 (McBean, Forgac, and Finn, 1994).

In addition, the increasing weight problem in the U.S. – and, in particular, the increase prevalence of overweight among children and teenagers – is anticipated to bring about an increase in the prevalence of chronic health problems for which overweight is a predisposing or risk factor, such as CHD, cancer, stroke, diabetes, and hypertension. It is also possible that these chronic problems will begin to manifest themselves at an earlier age (DeBrosse, 1997). Both of these outcomes would lead to increased diet-related costs.

All of these factors suggest that the $70.9 billion in costs attributed to diet represent a low estimate, and that considerably larger economic benefits might result from more healthful dietary patterns. With health care spending topping $1 trillion in 1996 and accounting for over 13 percent of gross domestic product (Levit and others, 1998), the potential for large savings in health care costs from more healthful diets merits closer attention.

However, in spite of efforts by public and private agencies to educate consumers about healthier diets and how to achieve them, Americans are far from the mark. For many, dietary improvements are offset by pitfalls. Continued and improved efforts are needed to further inform, educate, and motivate consumers to make appropriate dietary changes.

Table 1

Four of the Leading Causes of Death in the United States Influenced by Diet

Cause of Death, 1994	**Deaths**	**Share of All Deaths**
	Number	*Percent*
1. Heart Disease	732,409	32.1
***Coronary Heart Disease**	481,458	21.1
2. *Cancer	**534,310**	**23.4**
3. *Stroke	**153,306**	**6.7**
4. Chronic Obstructive Pulmonary Diseases and Allied Conditions	101,628	4.5
5. Accidents and Adverse Effects	91,437	4.0
6. Pneumonia and Influenza	81,473	3.6
7. *Diabetes Mellitus	**56,692**	**2.5**
8. Human Immunodeficiency Virus Infection	42,114	1.4
9. Suicide	31,142	1.4
10. Chronic Liver Disease and Cirrhosis	25,406	1.1
All Causes	2,278,994	100.0

* Health condition influenced by diet (excluding alcohol).

Source: Singh and others, 1996

Table 2

Number of Deaths, by Age, from Four Major Causes Influenced by Diet, 1994

Cause of Death	Age at Death: Less Than 55	55-64	65-74	75 and Older	Total [1]
	Total Number of Deaths				
Coronary Heart Disease	28,549	45,567	104,184	303,123	481,458
Cancer	68,857	89,251	163,795	212,391	534,310
Stroke	9,382	9,577	25,386	108,954	153,306
Diabetes	6,306	7,784	15,744	26,856	56,692
All 4 Causes	113,094	152,179	309,109	651,324	1,225,766

[1] Numbers may not add up to total number of deaths because no age is reported for some deaths.

Source: Singh and others, 1996

Table 3

Medical Costs for Six Health Conditions [1,2]

Health Condition	**All Cases [3]**
	Billion Dollars (1995)
Coronary Heart Disease	39.8
Cancer	47.4
Stroke	21.9
Diabetes	52.5
Hypertension [4]	18.3
Obesity	62.3

[1] Includes hospital and nursing services, physician services, drugs, rehabilitation and institutional care and special services.

[2] Estimates updated to 1995 dollars using the Bureau of Labor Statistics CPI for general medical care; estimates for obesity were updated to 1995 dollars using the Bureau of Labor Statistics CPI for all goods.

[3] Numbers should not be added since they likely include some double counting.

[4] Includes only costs associated with hypertension with and without renal disease; does not include costs associated with hypertensive heart disease or hypertensive heart and renal disease.

Sources: For coronary heart disease, stroke, and hypertension: American Heart Association, 1996 and conversation with Dr. Hodgson, 3/10/97; for cancer: American Cancer Society, 1997; for diabetes: adapted from American Diabetes Association, 1993; for obesity: adapted from Colditz, 1992 and Colditz and Wolf, 1996.

Table 4

Adjusted and Diet-Related Medical Costs, Four Heath Conditions [1]

Health Condition	All Cases, Adjusted Costs [2]	Diet-Related Costs [3]
	Billion Dollars (1995)	
Coronary Heart Disease, Stroke, and Diabetes	85.3	19.4
Cancer	47.4	14.2
All 4 Causes	132.7	33.6

[1] Includes hospital and nursing services, physician services, drugs, rehabilitation, and institutional care, and special services.

[2] Numbers have been adjusted for double-counting by including only 45 percent of the costs associated with diabetes (see text).

[3] Attributes to diet 20 percent of CHD and stroke costs and 30 percent of cancer and diabetes costs (see text).

Source: Estimated from numbers in table 3.

Table 5

Lost Productivity from Disability for Six Health Conditions [1]

Health Condition	All Cases [2]
	Billion Dollars (1995)
Coronary Heart Disease	5.8
Cancer	14.4
Stroke	4.5
Diabetes	22.0
Hypertension [3]	4.2
Obesity	4.9

[1] Estimates updated to 1995 dollars using the average usual weekly earnings of employed part-time and full-time wage and salary workers of all ages, rounded to the nearest dollar.

[2] Numbers should not be added since they likely include some double-counting.

[3] Includes only costs associated with hypertension with and without renal disease; does not include costs associated with hypertensive heart disease or hypertensive heart and renal disease.

Source: See table 3.

Table 6

Adjusted and Diet-Related Productivity Losses From Disability, Four Health Conditions [1]

Health Condition	All Cases, Adjusted Costs [2]	Diet-Related Costs [3]
	Billion Dollars (1995)	
Coronary Heart Disease, Stroke and Diabetes	20.2	5.0
Cancer	14.3	4.3
All 4 Causes	34.5	9.3

[1] Includes hospital and nursing services, physician services, drugs, rehabilitation and institutional care, and special services.

[2] Numbers have been adjusted for double-counting by including only 45 percent of the costs associated with diabetes(see text).

[3] Attributes to diet 20 percent of CHD and stroke costs and 30 percent of cancer and diabetes costs (see text).

Source: Estimated from numbers in table 5.

Table 7

Number and Value of Diet-Related Premature Deaths

	Age at Death	
Cause of Diet-Related Death	**55-64**	**65-74**
Number of Diet-Related Deaths [1]		
Coronary Heart Disease	9,113	20,836
Stroke	1,915	5,077
Diabetes	2,335	4,723
Cancer	26,775	49,138
All 4 Causes	40,138	79,774
	Billions of Dollars (1995)	
Value [2]	16.6	11.4

[1] Defined as 20 percent of CHD or stroke deaths, and 30 percent of cancer or diabetes deaths, among those who died between ages 55-74 years.

[2] Deaths among those age 55-64 years are valued at $412,751 in 1995 dollars, and deaths among those age 65-74 years are valued at $143,760.

Source: Adapted from Singh and others, 1996.

Table 8

Diet-Related Costs for Four Health Conditions Exceed $70 Billion

Diet-Related Health Condition	Medical Costs	Lost Productivity	Premature Deaths	Total Economic Costs
	Billions of Dollars, 1993			
Coronary Heart Disease, Stroke and Diabetes	19.4	5.0	9.9	34.3
Cancer	14.2	4.3	18.1	36.7
All 4 Causes	33.6	9.3	28.0	70.9

Source: Estimated from tables 4, 6, and 7.

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APPENDIX F

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APPENDIX G

LSRO PROJECT ANNOUNCEMENT REQUESTING INFORMATION AND RESPONDENTS

APPENDIX G
LSRO PROJECT ANNOUNCEMENT REQUESTING INFORMATION

ANNOUNCEMENT

The Life Sciences Research Office (LSRO) is convening an Expert Panel to address scientific issues and research regarding 1) the potential value of vitamin and mineral supplements in filling nutrient gaps, especially for low-income populations, and 2) the comparative impact of vitamin and mineral supplements, improved diets, and the intake of fortified foods on health status and health-care costs. Our document will serve as a resource to the U.S. Department of Agriculture as it prepares a report to Congress on the use of food stamps to purchase dietary supplements.

LSRO will focus on supplements of vitamins and/or minerals. A nutritionally adequate diet will be defined as meeting approximately 100% of nutrient allowances (e.g., RDAs) as well as the recommended number of servings from the five groups in the Food Guide Pyramid.

We invite you to provide us with information and your comments and views on the following:

(1) Quantitative comparisons of vitamin-mineral supplements, eating an overall better diet, and/or eating specific fortified foods for their relative abilities to help individuals achieve the standards for an adequate diet as defined above.

(2) Data showing improvements in health or health status from use of vitamin-mineral supplements, improved diets, and/or specific fortified foods. Is one approach better than the others in terms of economics, convenience, achievement of goal, etc.?

(3) Data on the relative quantifiable effects of vitamin-mineral supplements, improved diets, and/or specific fortified foods on health-care costs for individuals, groups, or this country in general.

(4) Data on consumer attitudes, behaviors, and preferences for increasing the vitamin-mineral content of their diets through use of vitamin-mineral supplements, improved food choices, and/or use of specific fortified foods.

Please respond to each question specifically and include relevant supporting documentation. In particular, LSRO is seeking scientific studies, analyses, case studies, and other data that have a direct bearing on these questions.

Please forward your remarks and any supporting documents to Dr. Paul Thomas at LSRO by April 1, 1998. If you have any questions about this project, please contact him at (301) 530-7030. Thank you in advance for your help.

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