
5 A Day for Better Health Program Evaluation Report

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Executive Summary

Introduction

The National Cancer Institute's (NCI) 5 A Day for Better Health Program (the Program) is a national program that approaches Americans with a simple, positive message: Eat 5 or more servings of vegetables and fruit daily for better health. In September 1999, the Director of the NCI established the 5 A Day Program Evaluation Group (the Evaluation Group) to review and evaluate the Program. Specifically, the Evaluation Group was asked to review (1) the science underlying the Program, (2) the implementation and accomplishments of the Program, and (3) the degree to which the Program has achieved its goals and objectives. The Evaluation Group also was charged with making recommendations to the NCI about the future conduct of the Program and to articulate NCI's role in large, coordinated efforts to promote healthy eating. Chapter 1 of this report provides more detailed information about the charge to, and process of, the Evaluation Group.

Chapter 2 of this report reviews the evidence that vegetables and fruit protect health, particularly the protection from cancer. Chapter 3 describes the origins and early years of the 5 A Day Program and includes information about its scientific and programmatic justifications.

Chapter 4 describes the 5 A Day Program as proposed to NCI's Board of Scientific Advisors in 1991.

Chapter 5 describes the media and health-message environment in which the Program operated. It reviews the recent expansion of the communications infrastructure, the large volume of food and nutrition advertising, and the contradictory nature of nutrition-related news. Finally, this section explores the effects of this environment on the delivery of the 5 A Day message.

Chapter 6, the Evaluation of the Program, is divided into four sections: (1) evaluation of the implementation of the Program; (2) evaluation of the Program using process measures (primarily, communication of the 5 A Day message); (3) evaluation of the Program using outcome measures—namely, measures of dietary change and factors that mediate dietary change (such as knowledge of dietary recommendations); and (4) evaluation of randomized, controlled trials of dietary interventions.

The conclusions of the Evaluation Group are found throughout the report and summarized in the next section. The recommendations of the Evaluation Group immediately follow the conclusions.

Conclusions of the Evaluation Group

The Evidence That Vegetables and Fruit Protect Health

When the 5 A Day Program was first developed, the recommendation to consume at least 5 servings of vegetables and fruit per day was supported by a diverse and convincing body of evidence. No subsequent finding has contradicted this conclusion. Indeed, since the start of the 5 A Day Program, further evidence has accumulated to support the hypothesis that a diet rich in vegetables and fruit reduces the risk of cancer and other chronic diseases. Specifically, the evidence for an inverse association with the risk of several epithelial cancers has been strengthened, evidence has begun to accumulate for hormone-dependent cancers, and a variety of mechanisms have emerged for the protective effect of specific constituents in vegetables and fruit, not only in animal studies, but also in humans.

Although evidence also has emerged for a role of vegetables and fruit in reducing the risk of cardiovascular disease, obesity, and diabetes, the most impressive body of evidence exists for protection against cancer. The recommended 5 servings of vegetables and fruit a day is a minimum rather than a maximum target for consumption, and any increase above current levels of consumption is to be encouraged for individuals and populations.

Implementation and Process Measures

Collaborations and Partnerships

NCI's collaboration with private industry had a positive effect on expanding the impact of the 5 A Day message and bringing additional resources to the task. In addition, this partnership marked the first time that the producers and retailers of vegetables and fruit joined to undertake a common task. Key elements in ensuring the effectiveness of the partnership were the valuable in-kind contributions and the strong commitment of the industry. Beneficial outcomes of the partnership included an expanded communication base for the 5 A Day message and the promotion of national nutritional objectives. The public/private partnership, with its identifiable structure and modules, represents a model for the implementation of other public health endeavors.

The industry partnership approach may have been too vulnerable to market considerations which, if not balanced by public health considerations, could readily lead to ignoring segments of the population not viewed as attractive markets. Further, the social marketing strategies of the NCI and its media partners tended to exclude the most underserved populations. These reasons may explain why the Program was less successful in reaching minority and low-income populations, even though research indicates clearly that such populations can be reached effectively.

The 5 A Day Program developed successful collaborations with a range of Federal, state, and voluntary agencies. These collaborations provided mechanisms whereby the 5 A Day message was incorporated into a range of programs, from the school lunch program to statewide public-health interventions.

Message Delivery and Environment

The 5 A Day promotion campaign used a combination of strategies that leveraged advertising from its industry partners and developed relationships with media outlets to generate and inform news stories related to the Program. The media placement data suggest that media relations strategies were less successful after the first 1-2 years of the campaign, and that advertising strategies dominated.

Commercial advertisers have learned that a consistent and prominent presence in the marketplace is key to achieving and holding market share. Expenditures for the marketing of food, fast food, and beverages (nearly \$10 billion in 1999 alone) dwarf the \$1 million spent each year by the NCI during the first 10 years of the 5 A Day Program. The difference in magnitude is instructive and speaks in support of what the 5 A Day Program accomplished with modest means. It also speaks to the magnitude of the behavior-change problem in the United States in continued overconsumption of total calories and less healthful eating patterns.

Although new channels offer the possibility of more tailored communication to specific groups, the fragmentation of the communication system makes it more difficult to reach the majority of Americans consistently and inexpensively. The volume, inconsistency, and often contradictory nature of information in the marketplace have created less than ideal conditions for healthful behavior change. The effect of these factors is that the public frequently is overwhelmed by the sheer

volume of information and left confused by the pastiche of entertainment, news stories, advertising, and other sources of health information about food, diet, and nutrition.

Other Implementation and Process Measures

The 5 A Day Program was implemented in ways that differed substantially from what was planned; most importantly, neither the central capacity for outcome evaluation nor the senior leadership and administrative support for the Program was ever established effectively. This may explain, in part, why efforts to monitor implementation of the Program, particularly at the state level, were not entirely successful. Consequently, NCI's ability to conduct a comprehensive evaluation of the Program was compromised.

The redirection of resources from community/state capacity building to university-based research strengthened the opportunities to test well-designed intervention strategies for specific channels and targeted populations. This redirection, however, left little support for capacity building at the state and community level.

Changes in Nutrition Policy and Public Health Practice

Changes in the focus of dietary intervention research and public health nutrition policy have occurred during the period of implementation of the 5 A Day Program. Most important, there has been a shift from the nutrient-based message—for example, eat more fiber—to the food-based message—eat more vegetables and fruit. This has been reflected, particularly, in an increased emphasis on eating vegetables and fruit in the Dietary Guidelines for Americans and in the U.S. Department of Agriculture's (USDA) Food Guide Pyramid. Though not necessarily a consequence solely of the 5 A Day Program, these shifts reflect the incorporation of the 5 A Day message into nutrition-related health promotion programs by Federal, state, and private agencies.

Dietary Change and Related Outcomes

Knowledge and Awareness

NCI scientists found that the strongest predictors of dietary change were knowledge of the recommendation to eat 5 or more servings per day, taste preferences, and self-efficacy (in this context, confidence in one's ability to eat vegetables and fruit in a variety of situations). Changes in these factors can be used as secondary indicators of intervention program effectiveness.

Before the 5 A Day Program, a small proportion (8%) of the American public understood at least part of the 5 A Day message. Subsequently, there have been increases in knowledge of the 5 A Day Program (18%) and its message (20%). The message has reached more women than men, and more whites than Latinos or African Americans.

Consumption

There has been a slow and steady increase in vegetable and fruit consumption in the United States during the period of the implementation of the 5 A Day Program and continuing through at least 1998. Possible inferences from these changes on the effectiveness of the 5 A Day Program are limited. Most important, there is no comparison group that was not exposed to the Program. The possibility cannot be ruled out that, without the 5 A Day Program, there would have been substantial decreases in vegetable and fruit consumption, paralleling the rapid increase in obesity over the same time period. It is also possible that other factors may be influencing dietary behavior change in the United States, and that increases in vegetable and fruit intake are attributable to other programs. Nevertheless, the results are consistent with the inference that the 5 A Day Program has contributed to the continuous small increases in vegetable and fruit consumption over the past decade.

Because insufficient capacity existed for monitoring program implementation at the state level and for relating program implementation to changes in vegetable and fruit consumption, no conclusions can be drawn from the extensive data collected on state-level implementation intensity.

Even though safety is not an issue if vegetables and fruit are handled properly, the potentially undesirable sensory qualities of some vegetables and fruit (e.g., bitterness, sourness, pungency, astringency) may act as significant barriers to the adoption of a diet that is high in vegetables and fruit, especially among children. The dilemma here is that the strong-tasting compounds as a group overlap extensively with the compounds that are potentially protective against cancer; therefore, removing strong-tasting compounds may reduce the protective effect.

Randomized Trials and Other Experimental Studies

The NCI-funded randomized trials represent a significant body of research and offer a persuasive argument that behavioral interventions can have a positive impact on vegetable and fruit consumption. Elementary school behavioral and food service interventions had a positive impact on student vegetable and fruit consumption. The studies proved it is possible to change the elementary school environment and to reinforce the healthy dietary practices taught through the classroom curricula. The average effect increase was 0.62 servings per day, and the largest was 1.68 servings per day.

Among adults, changes in the worksite, church, or family social environment were found to be possible, and these changes led to increases in the availability and consumption of vegetables and fruit. The average effect size was 0.48 servings per day, and the largest effect was 0.85 servings per day. For both school-based and adult studies,

larger effects were observed in fruit consumption than in vegetable consumption.

Surveillance

There are inadequacies in the surveillance and monitoring of vegetable and fruit intakes in the U.S. population. In particular, these include inconsistencies in measurement techniques and assessment methodologies, a lack of coordination across surveys such as the Continuing Survey of Food Intake by Individuals (CSFII) and the Behavioral Risk Factor Surveillance System (BRFSS), and weaknesses in the analyses of the resulting data.

Recommendations of the Evaluation Group

Overall Recommendations

- That the NCI continue the 5 A Day Program as a multifaceted program to support research and applied public health programs to promote increased vegetable and fruit consumption.
- That the NCI continue to lead the 5 A Day Program and, to accomplish this task, ensure that it has a strong senior leader and specific scientific expertise in evaluation, intervention methods development, media, and community-based interventions, as well as nutrition and epidemiology.
- That the NCI partner more closely with the USDA to focus dietary guidelines better and to promote research in agricultural and economic policies that encourage vegetable and fruit consumption.
- That the NCI partner with other National Institutes of Health (NIH) institutes to (1) promote research into the role of specific vegetables and fruit and their components in lowering disease risk more generally, (2) promote methodologic and applied behavioral

research, (3) expand awareness of the scope of chronic and deficiency diseases that may benefit from the increased consumption of vegetables and fruit, and (4) develop a comprehensive and rigorous surveillance plan to monitor vegetable and fruit consumption and the related psychosocial and economic factors. This last effort should include the Centers for Disease Control and Prevention (CDC) and possibly the US Food and Drug Administration (FDA).

- That the NCI partner with the CDC to develop and manage state-level 5 A Day programs.

Implementation

The Media and Message Delivery

- That the 5 A Day Program, as part of its continuing public relations efforts, seek to prevent the further growth of "dietary helplessness," to help the public differentiate between good and poor information, to provide a larger context for personal dietary decisions, and to help clarify the confusion engendered in the message environment. In the dense, fragmented, and competitive message environment surrounding diet and behavior, there is a need for reliable and credible sources of information.

Resources

- That direct expenditures and leveraged resources furthering delivery of the 5 A Day message be increased.

Message Design

- That the NCI reconsider the design and emphasis of the 5 A Day message. Specifically, media process-evaluation data suggest the need to "reinvent" the 5 A Day message on a regular basis to prevent "wear-out" and to enhance its continuing attractiveness to the mass media. In addition, the current strategy seems less successful in reaching minorities and low-income groups, which suggests that any change in

message emphasis should take these groups into consideration.

Media Strategies

- That the 5 A Day Program devote additional resources to a variety of media strategies, including a systematic media relations effort to educate reporters, editors, and producers about diet and nutrition issues. As part of this approach, program planners should consider pursuing partnerships with the media to develop a long-term community emphasis on the 5 A Day message. The goal is to influence both the quantity and quality of news coverage of the 5 A Day Program in particular and of diet and nutrition issues in general.
- That the 5 A Day Program rethink its channel-use strategy, with a particular focus on new media, tailored communications, and how media channels may be used as part of a collective approach to reaching lower socioeconomic groups and the disadvantaged.

Evaluation of Communication Efforts

- That the NCI and the 5 A Day Program partners pay close attention to developing a package of media evaluation approaches that are consistent, simple, complete, and affordable.

Industry

- That NCI's collaboration with the Produce for Better Health (PBH) Foundation be continued and expanded.
- That the NCI use its relationships with industry specifically to ensure that vegetables and fruit become more available to high-risk and underserved communities.

States

- That the NCI increase the resources, staffing, and expertise made available to the states for the dissemination, monitoring, and evaluation of the 5 A Day Program.

Minorities and the Underserved

- That the NCI, in partnership with relevant organizations, develop operational strategies aimed at understanding and reducing disparities among ethnic groups and across educational and socioeconomic differences.

Evaluation

- That the NCI continue to take the lead in evaluating the effectiveness of the 5 A Day Program. This evaluation must include the extensive involvement of the states.
- That the NCI undertake a comprehensive evaluation of each of the 5 A Day Program components: media; research; and industry, private nonprofit, state, and Federal partnerships.

Research

- That the NCI maintain and support intramural and extramural research in the following areas, noting particularly the need to modify, where appropriate, available funding and specific peer-review expertise:
 - (1) Research into dissemination methods—how to translate small-scale research findings into large-scale, long-term, sustainable community programs—with particular emphasis on programs of demonstrated efficacy and for underserved populations;
 - (2) Research into behavior change—how to translate established data on changes that will plausibly reduce risk into choices individuals and communities can make. In particular,
 - (a) Research into the development of more effective dietary intervention programs, determining which components of such programs contribute most to program effectiveness;

- (b) Studies of children and adolescents as the development of food preferences begins;
 - (c) Studies on ways to develop supportive environments and increase the availability of vegetables and fruit; and
 - (d) Randomized controlled trials of school-based interventions targeting middle and high school students.
- (3) Policy research—particularly on ways to establish an optimal environment for making healthy food choices in a free-market economy;
 - (4) Research into environmental influences on dietary behavior and behavior change, including agricultural production, food distribution and availability, food labeling, pricing structures, taxation and price supports, purchase habits, advertising, cultural and social norms, and so on;
 - (5) Research into the mechanisms by which vegetables and fruit reduce cancer risk, particularly in humans;
 - (6) Research into influences on food choice, particularly genetic and environmental influences on taste preferences; early life experiences involving exposure to food; and education about food, food choice, and food preparation;
 - (7) Research into methods of measuring dietary behavior, particularly the further development of short- and long-term biological markers. In these research endeavors, access to relevant data collected by industry partners seeking to understand human preferences, behavior, and biology could prove a significant resource.

- That research focused on vegetable and fruit consumption measure and report vegetables and fruit separately, rather than combining the two into a single measure.

Surveillance

- That the NCI, in partnership with other relevant Federal agencies— including the US. Public Health Service, the CDC, and the USDA— coordinate, facilitate, and strengthen surveil-

lance and monitoring of (1) national vegetable and fruit consumption; (2) psychosocial mediators of dietary behavior change such as self-efficacy, knowledge, and taste preferences; and (3) if future research establishes their importance, possible environmental mediators of dietary behavior and behavior change, including food availability, price structures, taxation policy, and so on.

1. Introduction

The National Cancer Institute's 5 A Day for Better Health Program

NCI's 5 A Day for Better Health Program (the Program) is a national program that approaches Americans with a simple, positive message: Eat 5 or more servings of vegetables and fruit daily for better health. The Program, a partnership between the vegetable and fruit industry and the NCI, has four major components: mass media, point of purchase, community coalitions, and research. Over the past 10 years, it has emerged as the most prominent population-based initiative focused on cancer prevention through dietary change.

Charge to the Evaluation Group

Because the 5 A Day for Better Health Program was initiated in 1991 as a 5-year effort that included a formal evaluation, the NCI believes that any new commitments to the Program should be informed by an objective, thorough review. Consequently, in September 1999, the Director of the NCI established the 5 A Day Program Evaluation Group (the Evaluation Group) to review and evaluate the Program. Specifically, the Evaluation Group was asked to review (1) the science underlying the Program, (2) the implementation and accomplishments of the Program, and (3) the degree to which the Program has achieved its goals and objectives. The Evaluation Group also was charged with making recommendations to the NCI about the future conduct of the Program and to articulate NCI's role in large, coordinated efforts to promote healthy eating.

Process of the Evaluation Group

In completing its charge, the Evaluation Group met face-to-face three times during 2000—in January, April, and September—and by conference call on several other occasions.

The Evaluation Group interpreted its charge as follows:

1. To review briefly the science underlying the possible protective role of vegetables and fruit against cancer;
2. To describe and analyze the origins of the Program, including the policy background;
3. To describe and analyze the media and health-message environment in which the Program operated; and
4. To evaluate the Program based on: (a) implementation, (b) process measures (communication of the 5 A Day message), (c) dietary change and factors that mediate dietary change, and (d) controlled trials that were part of the Program.

The Evaluation Group planned at the outset to provide specific conclusions as well as recommendations. To do so, the Evaluation Group needed specific data from NCI scientists and asked for specific analyses to be undertaken. These analyses are, in part, presented in this report. Additional data, particularly regarding media activity, were analyzed by members of the Evaluation Group and also are, in part, presented in this report.

The Evaluation Group's first meeting, held in Arlington, Virginia, on January 12-13, 2000, focused on presentations from staff at the NCI and the 5 A Day Program partners (CDC, the PBH

Foundation, state health agencies, the vegetable and fruit industry, the American Cancer Society [ACS], and other Federal agencies). The meeting also included testimony from 15 representatives of professional societies and associations, schools of public health, state health departments, industry, and advocacy groups. All of the testimony showed enthusiastic support for the Program.

During its second meeting, held in Seattle, Washington, on April 27-28, 2000, the Evaluation Group received and discussed additional background information and reviewed new analyses of data provided by the NCI and the EBH. These data focused on dietary behavior change and knowledge

of the 5 A Day message. The Evaluation Group also reviewed findings from controlled trials of 5 A Day interventions and discussed and revised an outline for a final report.

During the following 4 months, members of the Evaluation Group drafted sections of the report and critiqued and edited them via e-mail and teleconferences. The Evaluation Group dedicated its final face-to-face meeting, held in Minneapolis, Minnesota on September 18-19, 2000, to sharpening conclusions and reaching a consensus regarding its recommendations.

2. The Evidence That Vegetables and Fruit Protect Health

The recommendation to consume at least 5 servings of vegetables and fruit per day is supported by a diverse and convincing body of evidence. The most fundamental case can be made on the basis of well-established principles of nutritional adequacy. Vegetables and fruit are important sources of several essential nutrients, including vitamin C, folate and other B vitamins, pro-vitamin A and other carotenoids, potassium, calcium, and iron. Vegetables and fruit also provide dietary fiber.

The recommendation to consume vegetables and fruit for protection from chronic diseases draws primarily upon epidemiologic evidence linking higher consumption of vegetables and fruit to lower rates of cancer, cardiovascular diseases, and other chronic diseases. A large majority of relevant expert reviews have concluded that higher consumption of vegetables and fruit will reduce chronic disease risks, and no reviews have found evidence of adverse effects.¹⁵ Highlights of the evidence follow.

Cancer

The largest body of evidence relating vegetable and fruit consumption to health has examined effects on cancer risk. The most extensive review to date has been published by an international interdisciplinary panel convened by the World Cancer Research Fund (WCRF). This review concluded that, "Overall, when cancers of all anatomical sites are taken together, 78 percent have shown a significant decrease in risk for higher intake of at least one vegetable and/or fruit category examined."³ The review identified 217 observational epidemiologic studies (196 case-control studies and 21

prospective cohort studies) that evaluated at least one association of fruit or vegetable intake with incidence of any type of cancer. For a variety of variables describing vegetable consumption, 69 to 80 percent of studies found an inverse association with cancer risk. For fruit in general and citrus fruit in particular, 64 and 66 percent of studies, respectively, found an inverse association with cancer risk. In keeping with established criteria for the evaluation of epidemiologic research, evidence was considered conclusive (termed "convincing" in the WCRF report) if there were an adequate number (at least 20) of relevant studies, including some with prospective designs.³ The WCRF panel also required that studies be conducted in diverse populations, with control for important potential confounding factors. For example, because higher vegetable and fruit consumption is often correlated with lower fat intake and is more often observed in nonsmokers, the possible effects of fat intake and of smoking on cancer risk had to be considered in the design and analysis of studies of the effect of vegetable and fruit intakes on cancer risk. The overall body of evidence demonstrated conclusively that vegetables and fruit protect against cancer. The evidence was most conclusive for vegetables and fruit and cancer of the mouth and pharynx, esophagus, lung, and stomach and for vegetables alone and cancers of the colon and rectum. The association of vegetables and fruit with cancer incidence was judged to be strong, particularly for vegetables, with about a halving of risk overall found to be associated with consuming at least 5 servings of vegetables and fruit per day as compared to only 1 or 2 servings.

^a In contrast to designs in which data are collected retrospectively, prospective designs assure that the presumed causal factor (e.g., a certain level of vegetable and fruit intake) occurred in the time period before the disease developed.

The specific evidence of a dose-response, in which increasing intakes confer increasing protection in a graded manner, adds to the strength of the case for vegetable and fruit intakes. Such a dose-response was shown convincingly in several examples in the WCRF report.³ For example, for lung cancer, there was a halving of the relative risk as intakes increased from 150 to 400 grams (g) per day (i.e., from about 2 to about 5 servings per day, assuming 80 g per serving). Similar dose-response relations were noted for stomach cancer and both vegetables and fruit.³ Because the upper limit of the dose-response range that can be evaluated is limited by the ranges of intakes in populations studied,³ few data exist to support specific, quantitative recommendations for intakes of vegetables or fruit above 350 or 400 g per day.

The hypothesis that increasing vegetable and fruit intakes reduces cancer risk was not confirmed in one randomized trial. The US Polyp Prevention Trial (PPT) tested the ability of dietary changes that included increasing vegetable and fruit intake (3.5 servings per 1,000 kcal) to prevent the recurrence of colorectal adenomas over 4 years of followup. However, it was not designed to isolate the effect of changes in vegetable and fruit intake from the other changes targeted (e.g., increased whole grain intake and lower fat intake).⁶ In any case, the trial found that there was no difference in the recurrence of adenomas between the intervention and control groups. Thus, in the particular cancer-risk situation tested in the PPT, neither the increase in vegetable and fruit intake (about 2 servings per day), nor any of the other dietary changes, had a protective effect. This finding does not, however, rule out protection by vegetables and fruit against other types of cancers or in populations with different colon cancer risk profiles. It also is not clear whether a longer observation period or dietary changes earlier in life might yield significant risk reduction.

The lack of human experimental data leaves open the question of whether vegetables and fruit might only be a marker for some other aspect of

dietary or lifestyle behavior with which they are closely correlated. However, the consistency of the association of vegetable and fruit intakes with cancer risk in populations with diverse lifestyles supports the conclusion that vegetables and fruit per se are responsible for the effect.

An important conclusion of the WCRF review was that the evidence supported a broad recommendation for increasing vegetable and fruit consumption for reducing cancer risk, rather than recommendations for specific types of vegetables and fruit. The numerous imperfections in the evidence base were acknowledged, including the wide variability in inclusion criteria, grouping, or specificity when defining and measuring vegetable and fruit intakes, as well as the possibility of overreporting or overestimating absolute intake levels. One reason that the recommendation for vegetable and fruit consumption remains broad is that the specific protective constituents in vegetables and fruit, alone or in combination, have not been identified with certainty. Relevant substances in vegetables and fruit include phytochemicals such as dithiolthiones, flavonoids, glucosinolates, and allium compounds, as well as carotenoids, other antioxidants, vitamins, folate, and minerals such as selenium and calcium. A large number of plausible mechanisms can explain how these various nutrients or bioactive constituents in vegetables and fruit can prevent or arrest carcinogenesis, and some are supported by animal and *in vitro* experiments.

Testing hypotheses experimentally requires large-scale, long-term studies as well as a best guess about which set of bioactive constituents to feed and at what level. The dose of vegetables and fruit associated with a particular effect can be reasonably estimated, but the specificity required to translate this information into a dose of any particular constituent does not exist in the present set of studies. Because of these uncertainties, the null findings of the chemoprevention trials of beta carotene do not detract substantially from the conclusion that vegetables and fruit reduce cancer risk.

These findings, however, raise the question of whether any single constituent of vegetables and fruit or single pathway will be found responsible for protection from cancer. Multiple agents acting on multiple pathways, in parallel or interactively, are probably responsible. If so, the results of the chemoprevention trials argue in favor of recommending vegetables and fruit as foods, rather than attempting to achieve the effect with vitamin or mineral supplements.³

Other Health Benefits

Epidemiologic studies also have demonstrated or suggested associations of vegetables and fruit or their constituents with reduction in risk of cardiovascular disease (CVD, ie., heart disease, stroke, hypertension, atherosclerosis), cataracts, chronic obstructive pulmonary disease (COPD), and other conditions.⁷ For example, Klerk et al. estimated that vegetable and fruit consumption was associated with a 20 to 40 percent reduction in the occurrence of coronary heart disease (CHD) based on a review of 12 epidemiologic studies conducted after 1994.⁸ Ness and Powles⁹ also found a reduced risk of CHD based on their review of 39 studies. The inverse association of vegetables and fruit or, from the Nurses' Health Study, vegetables alone, with stroke may be even larger than that for CHD.¹⁰ The evidence supporting a role for constituents of vegetables and fruit in protection against the development of cataracts and COPD has increased in recent years, and vegetables and fruit also may confer protection from conditions such as diabetes mellitus and diverticulosis because of their high content of dietary fiber.⁷

Using the criteria for inferring causality employed in the WCRF review,³ the literature on the association between vegetables and fruit and these other health outcomes must be considered less comprehensive and less convincing than that for cancer. However, this additional literature is important in several respects. It extends the rationale for increasing vegetable and fruit consumption to include protection from CVD, which is the major cause of premature death in most populations.¹¹ In

addition, because CVD is more common than cancer and because intermediate variables that can serve as surrogate CVD endpoints have been characterized, clinical trials can be conducted to directly ascertain whether increasing vegetable and fruit intakes will reduce CVD risks. One such trial, the Dietary Approaches to Stop Hypertension (DASH) trial, demonstrated larger reductions in blood pressure in association with either of two diets that were high in vegetables and fruit.¹² The broader evidence also confirms that health effects, when observed across a variety of outcomes, are consistently in a protective direction. This evidence eliminates any concern that recommending increased consumption to prevent cancer would elevate the risks of some other condition.

Safety Considerations

The WCRF review noted that "there is the theoretical possibility that consumption of vegetables and fruits might increase health risk because of the presence of certain microconstituents or contaminants," including goitrogens, nitrates, both naturally occurring and from fertilizer residues, pesticide residues, and contamination with aflatoxin.³ They concluded that "there is no evidence at present that any vegetables and fruit, properly stored and cleaned, have any significant adverse health effects."³

Sensory and Consumer Issues

Marketing studies on the determinants of food consumption invariably show that consumer choices are determined largely by taste.¹³ Dietary intake, as measured by reported frequencies of food consumption, also is closely associated with food likes and dislikes.¹⁴ Many bioactive phytonutrients in vegetables and fruit are bitter, sour, spicy, pungent, and/or astringent, and therefore elicit various degrees of aversiveness among consumers.¹⁵⁻¹⁹ By contrast, high-fat and high-sugar foods usually have desirable sensory characteris-

tics and meet with high consumer acceptance.²⁰ This is because responses to tastants and trigeminal irritants (such as the capsaicin in hot peppers or the piperin in black pepper) are innate, and they dictate that consumers reject bitter-tasting stimuli and trigeminal irritants because they may signal potentially harmful chemicals, such as poisonous plant alkaloids. Olfactory preferences, on the other hand, are learned, with exposure driving preference. Furthermore, some genetic taste markers, such as sensitivity to the bitter taste of phenylthiocarbamide (PTC) and 6-n-propylthiouracil (PROP),²¹ have been linked to an increased avoidance of bitter foods and beverages (including some vegetables and fruit) in the diet.^{22,23} Those individuals sensitive to PTC and PROP—so-called tasters or super-tasters—may therefore be at increased risk. The dilemma here is that the strong-tasting compounds as a group overlap extensively with the compounds that are potentially protective against cancer; therefore, removing strong-tasting compounds may reduce the protective effect.

Fortunately, food preferences are driven by both sensory and cognitive factors, and even though they begin developing early in childhood, they continue to evolve during the lifespan and can be modified. Because children's food preferences generally are guided by sensory quality rather than attitudes and beliefs about foods,²⁰ however, the palatability issues discussed above may act as an even greater barrier to the adoption of a diet high in vegetables and fruit among the young. Nonetheless, there is evidence that preferences for, and consumption of, vegetables and fruit by elementary school children can be enhanced through the use of intervention programs that emphasize cognitive factors. For example, researchers in the United Kingdom successfully used a video-based intervention program, in children's own homes and in school settings, that combined both peer modeling and rewards for eating previously refused foods, to increase (and sustain) vegetable and fruit consumption by 5-7 year-olds.^{24,25}

3. Origins of the 5 A Day Program

Scientific Rationale for the Program

In 1981, Doll and Peto concluded that about 35 percent of all cancer deaths were related to nutrition, with a plausible range of 10 to 70 percent.²⁶ This conclusion was driven largely by data on dietary behaviors that might increase risk. Evidence for the role of plant foods in cancer risk coalesced in the late 1980s and early 1990s, based on summaries of the epidemiologic literature specific to the relationship between vegetables and fruit and cancer.²⁷⁻³⁵

The evidence supporting the role of vegetables and fruit in cancer prevention provided a foundation for several documents that were the basis of national nutrition policy in the 1980s and 1990s. In 1982, the National Research Council (NRC) published the seminal document, *Diet, Nutrition and Cancer*, which summarized the research literature on the relationship between various chronic diseases and dietary patterns.³⁶ Other Federal documents followed such as *Healthy People 2000*,³⁷ the first Surgeon General's Report on Nutrition,²⁷ *Dietary Guidelines for Americans*,³⁸ and the Food Guide Pyramid.^{39,b}

Despite the strong evidence linking vegetable and fruit consumption with protection from cancer, national surveys showed that vegetable and fruit consumption remained low. National survey data available in 1991 included the 1976-80 National Health and Nutrition Examination Survey (NHANES) II⁴⁰ and the 1985 CSFII,⁴¹ which found a mean intake of vegetables and fruit of

2.9 servings, including french fries.^{42,43} CSFII data for 1989 showed that mean intake was 3.9 servings, excluding french fries, with only 32 percent consuming 5 or more servings a day.⁴⁴ Similarly, the 5 A Day Program baseline survey conducted in October 1991 found a mean intake of 3.8 servings a day, with 23 percent consuming 5 or more servings a day. Though there were substantial differences in estimates of vegetable and fruit consumption due to differences in survey methods,^c all of the surveys showed vegetable and fruit consumption well below the 5 A Day goal.

Policy Background

The National Cancer Act of 1971 mandated that the NCI "...shall establish programs as necessary for cooperation with State and other health agencies in the diagnosis, prevention, and treatment of cancer." Amended in 1996, the Public Health Service Act stated, "... the NCI shall establish and support demonstration, education, and other programs for the detection, diagnosis, prevention, and treatment of cancer and shall include locally initiated education and demonstration programs (and regional networks of such programs) to transmit research results and to disseminate information."

NCI's Cancer Control Objectives for the Nation: 1985-2000⁴⁵ projected that 30,000 lives could be saved annually through modification of dietary habits. NCI's cancer control objectives called for the population to reduce fat consumption to 30 percent or less of calories and increase fiber

^b In addition, the accumulating scientific evidence contributed to strengthening the focus on vegetable and fruit messages in these documents. In the *2000 U.S. Dietary Guidelines* and *Healthy People 2010*, vegetable and fruit objectives have been expanded and strengthened. The *Healthy People 2010* includes two nutrition objectives focusing on vegetables and fruit, as opposed to only one in 2000. In the recently released *2000 U.S. Dietary Guidelines*, there is a stand-alone, prominently placed vegetable and fruit guideline, versus a combined fruit, vegetable, and grain guideline in 1990.

^c Measures of vegetable and fruit consumption will differ based on the definition of serving size, whether or not small amounts of vegetables and fruit in mixed foods are disaggregated and included in the total, whether or not fried and high-fat vegetables and fruit included in baked goods and candy are included, and whether or not information on portion sizes and mixed foods is captured.

consumption (including vegetables and fruit) to 20-30 g per day. The appropriate roles for the NCI, as stated in the document, included guiding and supporting research on the cancer-related effects of dietary fat and fiber, chemoprevention, and dietary behavior, and conducting public education programs on the health advantages and cancer risks of relevant dietary components. A list of recommended actions for state and local health agencies also was provided and included (1) reviewing school menus and educational programs in relation to NCI's dietary recommendations, (2) assisting private-sector groups in modifying health promotion programs to include cancer risk reduction, (3) encouraging restaurants to provide sufficient information to consumers on choosing nutritious foods, (4) coordinating activities with state departments of agriculture and aging, (5) working with local mass media to educate the public, and (6) addressing the needs of high-risk populations.⁴⁵ These roles for state health agencies were incorporated into the state component of the national 5 A Day Program.

Program Origins

The 5 A Day Program was initiated in 1991 as a public/private partnership between the vegetable and fruit industry and the U.S. Government. The Program aimed to increase the average consumption of vegetables and fruit in the United States to 5 or more servings every day, with the long-range goal of reducing the incidence of cancer and other chronic diseases through dietary improvements. The specific program objectives were to increase public awareness of the importance of eating 5 or more servings of vegetables and fruit every day and to provide consumers with specific information about ways to incorporate more servings of vegetables and fruit into their daily eating patterns.

The NCI Program was built on an initiative of the California Department of Health Services, which was funded in 1988 by an NCI capacity-building grant.⁴⁶ The California 5 A Day Program

established a model for statewide dietary-change efforts with three types of simultaneous activities: public awareness and professional education, food-system change, and organizational change. According to statewide population surveys conducted in 1989 and 1991, vegetable and fruit consumption rose by 0.3 servings for both Caucasian and African American adults, a rate four times higher than secular trends.⁴⁷

The recommendation to target a minimum of 5 servings of vegetables and fruit had its origins in the California program and was based on an extensive review of the scientific literature. In addition, (1) at least 5 servings represented a considerable increase in consumption, nearly doubling the 1987 estimated level of about 2.5 servings; (2) at least 5 servings provided health benefits by improving the quality of the overall diet for problem nutrients, such as folic acid, and possibly also by displacing less healthful foods; (3) although epidemiologic studies rarely specified how many servings were optimal, at least 5 servings allowed for a daily mix of items high in provitamin A and vitamin C, fiber, and from plant families such as cruciferous vegetables and citrus fruits, and therefore seemed likely to include choices associated with reduced cancer risk; (4) at least 5 servings was not so high as to be seen as impossible to attain by consumers, and the number was consistent with other dietary recommendations; and (5) the number 5 was memorable and provided a platform for creative message and program development.⁴⁸ The recommendation to eat 5 or more servings a day was made in several relevant policy documents at this time, for example, by the NRC in its Diet and Health report,²⁸ USDA/Department of Health and Human Services (DHHS) in their dietary guidelines,³⁸ DHHS in Healthy People 2000,³⁷ and USDA in its Food Guide Pyramid.³⁹

The planning for a national program began with discussions in 1990 among representatives of industry, the California program, and the NCI. The PBH Foundation was formed in May 1991 with contributions from about 60 companies and commodity groups totaling \$415,000. The nonprofit

PBH was conceived as a partner with the NCI to oversee industry participation, thus enabling the NCI to interface with only one industry organization. California negotiated an agreement to assign legal rights to the program logo, slogan, and program standards to the NCI. As a result, NCI's Board of Scientific Counselors approved the concept proposal for the program in October 1991 with a budget of \$27 million for 5 years and the option of continuing the program for a second 5-year period. The concept formed the basis of a Request For Applications (RFA) totaling \$16 million and designed to fund research on the impact of 5 A Day interventions on dietary behaviors in controlled trials.

Intervention Models

The techniques of social marketing guided the communications strategies for the program. Various studies had shown that the media played a vital role in increasing consumer awareness of health issues and, in some instances, even in changing individual patterns of behavior.⁴⁹⁻⁵¹ Data suggested that, while members of the public were concerned about diet and health, they lacked sufficient knowledge to act effectively on these concerns.⁵²

Although use of the media alone can produce behavioral change, research had shown that the effect may be increased when supplemented by other community-based educational efforts.⁵³⁻⁵⁵ Three major theories used in the cardiovascular health promotion trials guided the national 5 A Day Program: the Health Belief Model,⁵⁶ Social Cognitive Theory,^{57,58} and the Transtheoretical Model or Stages of Change Model.^{59,60} Key constructs from these theories were applied across a range of settings, including the media, supermarkets, schools, worksites, food assistance programs, churches, food service/restaurants, and health care settings. The theoretical models suggested targeting increasing awareness and motivation, building skills, providing social support for behavior change, and establishing environmental and policy supports.⁶¹ These

theoretical constructs were incorporated into the guidelines for licensed 5 A Day Program participants, and some were used in the community-based research grants.

Collaborations and Sponsorship

The partnership between the NCI and the PBH promoted national nutrition objectives using media and campaign strategies to promote and reinforce appropriate messages. The formation of the PBH provided a vehicle for building collaborations within the vegetable and fruit industry and provided an infrastructure for the national program. The roles of the NCI were to maintain the scientific credibility of the program, plan and conduct evaluations, create an RFA for developing community interventions, and develop materials and training through NCI's Office of Cancer Communications (NCI/OCC). The roles of the PBH were defined as performing public relations functions, fundraising and providing in-kind support, implementing the point-of-purchase plan, recruiting additional partners, and monitoring implementation of the campaign. Through the community component of the 5 A Day Program, the NCI began licensing state and territorial health agencies in 1993 to coordinate and deliver 5 A Day activities through community channels. The roles of funded state health departments included developing coalitions with the food industry, monitoring implementation and conducting evaluations of state programs, and providing local placement of mass media. Statewide coalitions included state and county health agencies; state departments of education and agriculture; cooperative extension; Special Supplemental Nutrition Program for Women, Infants, and Children (WIC); voluntary agencies; businesses; media organizations; health care organizations; and state dietetic associations, although the structure and composition of these coalitions were left to the discretion of the state program coordinators. This flexibility enabled the coordinators to tailor program design to the needs of each state.

In 1996, the NCI expanded the 5 A Day Program to other Federal government health-promotion programs by licensing the U.S. Uniformed Services (Air Force, Army, Navy, Marines, and Coast Guard) and the Indian Health Service. The NCI also developed an agreement with the USDA Food and Nutrition Service (Team Nutrition) to promote 5 A Day in school classrooms and cafeterias across the Nation. 5 A Day messages also were integrated into the nutrition education efforts of the WIC Program, the Farmer's Market Nutrition Program (FMNP), the Commodity Supplemental Food Program (CSFP), and the Child and Adult Care Food Program (CACFP). NCI's partnership with the CDC, Division of Nutrition, was developed based on an interagency agreement to evaluate, award, and monitor grants to state health agencies. In 1994 and 1995, the CDC funded 38 intervention grants for 1 year addressing 5 A Day project areas in new and relatively untested community channels. In coordination with the CDC, the NCI in 1995, 1996, 1997, 1998, and 1999 also funded 31 grants to evaluate 5 A Day interventions implemented at the state level within specific community channels.

NCI's 5 A Day Program also developed partnerships with a variety of voluntary associations. The collaboration with the ACS included the participation of 32 representatives from state and local ACS chapters in 23 state coalitions affiliated with the 5 A Day Program. The ACS partnered with NCI's 4-year research grants—contributing to research in black churches in North Carolina, worksites in Arizona, elementary schools in Alabama, and high schools in Louisiana. Recently, the NCI and the ACS began collaborating on a project to diffuse and disseminate the approach used in the black churches study. The NCI 5 A Day Program also established an alliance with the American Dietetic Association (ADA). This alliance included collaborating on ADA nutrition month activities, 5 A Day communication training for ADA media advisors, and collaborating on 5 A Day Fact Sheets in the *Journal of the American Dietetic Association*. The 5 A Day Program also linked with the American School Foodservice Association and the USDA to undertake 5 A Day activities for School Lunch Week.^d

^d This section is derived extensively from Chapter 2 of the forthcoming 5 A Day monograph by Stables, G., J. Heimendinger, E. Pivonka, S. Foerster. "National Program Structure Components" (in press).

4. Description of the 5 A Day Program as Proposed

As previously noted, the 5 A Day Program was proposed as a 5-year collaborative effort between the NCI and the PBH. In addition, the NCI planned to fund community coalitions or health departments to develop, implement, and evaluate community health-education interventions. The major planned components of the 5 A Day Program included a media campaign, retail point-of-purchase program, and community-level interventions. A coordinating committee, composed of two representatives each from the NCI and the PBH, directed the project. The roles of the NCI were to maintain the scientific credibility of the program, plan and conduct evaluations, create an RFA for developing community interventions, and develop materials and training through the NCI/OCC. The roles of the PBH were defined as performing public relations functions, fundraising and providing in-kind support, implementing the point-of-purchase plan, recruiting additional partners, and monitoring implementation of the campaign. The roles of the licensed state health departments included developing coalitions with the food industry, monitoring implementation and conducting evaluations of state programs, and providing local placement of publicity.

Funding and Program Plan

Funding for the 5 A Day Program was initially projected to be up to \$25 million, from FY 1992 through FY 1996. A sixth year (FY 1997), with up to \$2 million in funding, was subsequently included to allow completion of evaluation efforts, production of program materials, and communication of

the message (see Table 1). Activities for the 5 A Day Program were scheduled to occur in two phases: Phase I (Year 1) activities involved creating a strategic plan, revising the California 5 A Day materials, collecting and analyzing baseline data, planning the national media campaign and point-of-purchase programs, and developing the RFA for community coalitions. The NCI created two new staff positions, a program director and evaluation manager, to support the 5 A Day Program. Phase II (Years 2-5) activities were directed toward implementing the 5 A Day Program based on the strategic plan. During Year 2, the NCI would be responsible for implementing the national media campaign, developing program materials, and monitoring industry participation and campaigns. Industry partners would distribute program materials and implement the point-of-purchase program. Also during Year 2, the RFA would be advertised to invite coalitions/health departments to serve as channels for creating state and local-level intervention programs. During Years 3 and 4, Year 2 activities would continue; in addition, community-level projects would develop a national network to maintain consistent scientific quality and to compare data across studies. Year 5 would include continuation of 5 A Day activities and an assessment of the program's effectiveness. If the assessment included a recommendation to continue the 5 A Day Program, strategic planning would begin during Year 5. Otherwise, if the program were terminated, 5 A Day interventions would be transferred to the community programs for continuation, and a final evaluation would be completed.

Table 1. Estimated NCI cost by fiscal year (dollars in millions) as proposed in the original concept

	Office of Cancer Commu- nications	Support Contracts	Requests for Applications	Total
FY 1992	\$1.0	\$1.0	—	\$2.0
FY 1993	\$1.0	\$1.0	\$4.0	\$6.0
FY 1994	\$1.0	\$1.0	\$4.0	\$6.0
FY 1995	\$1.0	\$1.0	\$4.0	\$6.0
FY 1996	\$1.0	\$1.0	\$4.0	\$6.0
FY 1997	—	\$1.0	—	\$1.0
Total	\$5.0	\$6.0	\$16.0	\$27.0

Evaluations planned for the 5 A Day Program included those of outcome, process, and implementation. The outcome evaluation would determine whether a change in public awareness and knowledge had occurred. National trends in consumption of vegetables and fruit would be obtained from existing national surveys as well as from the study baseline and followup surveys. The process evaluation was intended to be a formative evaluation to establish whether the program was appropriate for the target subpopulations, and was to include an assessment of materials and communication strategies. The implementation evaluation was intended to consist of measures of industry participation, implementation of community interventions, and media coverage of the 5 A Day Program.

5. The 5 A Day Message Environment

The public arena for diet-related health information struggles for the increasingly fragmented “scarce resource” of public attention.⁶² This trend is influenced by three factors: (1) the expansion and diversification of the Nation’s communications infrastructure, (2) the ubiquity of food and nutrition advertising, and (3) news media reporting and advocacy group activity regarding food and nutrition issues.

Expansion of the Communications Infrastructure

Profound changes in the Nation’s communications infrastructure have been occurring since the 1980s. The availability of consumer satellite television receivers, consumer videocassette recorders (VCRs), and cable television systems increased dramatically during the period after 1980. For example, cable television increased from about 4,000 systems in 1980 to more than 12,000 systems nationwide in 1996.⁶³ Although cable systems originated in the 1950s to rebroadcast local television signals to hard-to-reach areas, in the 1980s they expanded across the country to carry dozens of channels to more than 6 out of 10 U.S. households. The expansion of this capacity coincided with the proliferation of new channels of entertainment and news. Digital Broadcast Satellites first came online in 1993, with a typical system providing more than 300 different channels. In 1999, the National Association of Broadcasters estimated that, of the Nation’s 100 million households, about 98 percent had at least one television, 74 percent had two or more televisions, and 66 percent received an average of 45 channels. With the advent of Digital and HDTV, systems of 1,000-1,500 channels are projected in the near future.⁶⁴ Television is switched on in the average American household for a little

more than 7 hours per day, although actual viewing is about 4 hours. Television consumes about 40 percent of American leisure time, and about 70 percent of Americans report television as their main source of news.

The World Wide Web (WWW), also developed in the 1990s as a new interactive multimedia format using the Internet, was first established in 1969. The growth of the WWW has been extremely rapid over a relatively short period. It is estimated that registered domain names of Web sites now number more than 12 million worldwide.⁶⁵ Health and medicine in 1998 were estimated to be the principal emphasis of more than 15,000 U.S. Web sites.⁶⁶

From 1994 to 1998, the number of American homes with a personal computer almost doubled, from 24.1 percent to 42.1 percent.⁶⁷ By February 2000, more than one-half of U.S. households were online and, of these, 90 percent used the Internet.⁶⁸ More recent survey data show that nearly two-thirds of Americans over age 12 have access to the Internet, and one-half go online every day.⁶⁹ The use of computers and the Internet is even higher when worksite access is factored in, and is projected to increase further with the emergence of high-speed cable and digital service telephone lines delivered to homes.⁶⁷ Although all income groups have demonstrated remarkable increases in computer ownership and Internet use, higher income groups report both greater computer ownership and greater Internet use. For example, 80 percent of households earning \$75,000 or more per year reported owning a computer; 44 percent reported Internet use. This has led to concerns about a “digital divide” between the rich and the poor, with particular concern that fewer health-related benefits will accrue to the disadvantaged poor.⁷⁰

Although the development of new media has driven the proliferation of channels, traditional media have grown as well. For example, although the number of nondaily newspapers has remained static since the 1970s, there has been a steady, significant increase in circulation.⁷¹ In the past 10 years, the number of published magazines has increased 37 percent, to about 18,500 titles.⁷² The number of US radio stations is about 11,000, with 96 percent of Americans 12 years old and above reporting daily listening.

One benefit of this growth in communications infrastructure is that even relatively small communities receive virtually the same media programming as do large metropolitan areas. However, this growth also is having profound effects on traditional media-use patterns. Current evidence indicates that new media use has fragmented the use of more traditional media. This is a double-edged sword for commercial and noncommercial media campaign planners alike. The emergence of new communication channels (e.g., the Internet, World Wide Web, Digital Satellite Television) offers more opportunity for communication overall, and the possibility of more tailored communication to specific groups. However, the fragmentation of the communications system makes it more difficult to reach the majority of Americans consistently and inexpensively.

Food and Nutrition Advertising

The 5 A Day Program also occurs in a communications environment that is dense and multi-layered with commercial messages about food and nutrition. Overall, various categories of food and beverage advertising in the United States typically rank among the highest categories of expenditures.⁷³ In 1999, US advertising expenditures totaled some \$215 billion across all communications media.⁷⁴ This was about a 7 percent increase over 1998. Advertising for food and food products

ranked 6th of all product categories in 1998 at about \$3.3 billion. Fast-food advertising (which is not included in advertising for food and food products) ranked 8th at about \$3.1 billion. Non-alcoholic beverage advertising ranked 16th at \$1.3 billion, and candy and snack advertising ranked 19th at about \$1.1 billion. Beer and wine advertising ranked 23rd at \$896 million, with liquor advertising 36th at \$292 million. In addition, advertising for fitness and diet programs and health spas ranked 41st at \$149 million.

Fast-food corporations, in particular, rank among the most prolific brand-name advertisers. For example, McDonald's Corporation, which is ranked first among fast-food burger restaurants, alone controls about 43 percent of that market. It has the highest advertising expenditures in that category, ranks 14th among the leading US national advertisers at about \$1.03 billion in advertising expenditures, and generates about \$5 in sales for every advertising dollar spent.⁷⁴

During the first 10 years of the 5 A Day Program, the NCI directly spent about \$1 million annually on media and communications in support of the Program. Contributed resources leveraged through the 5 A Day public/private partnership added an estimated \$35 million annually (these in-kind funds were spent by industry to include the 5 A Day logo and message in supermarket ads and industry marketing). As impressive as these figures may be, they are dwarfed by commercial advertising for food and beverages. Expenditures for the marketing of food, fast food, and alcoholic and nonalcoholic beverages totaled about \$10 billion in 1999 alone. The difference in magnitude is instructive and speaks in support of what the 5 A Day Program has managed to accomplish with modest means. However, it also speaks to the magnitude of the behavior-change problem in the United States of continued overconsumption of total calories and less healthful eating.

Reporting of Nutrition, Food, and Diet-Related News

News about science and health ranks high as a content choice among media consumers. Recognizing this, newspapers, in the 1980s, began to develop special sections for reporting health, medicine, and science.⁷⁵ Television and radio outlets have occasionally hired physicians and scientists with communications skills to report health and medical stories. Personal health and fitness also ranks high among magazine titles. For these, a recent survey of Internet users found that health as a general subject ranked among the top five uses of the World Wide Web, with 30.8 million people (46% of Internet users) reporting use of the Web to search for information about a medical, health, or personal problem.

The scientific enterprise in the United States indirectly generates a considerable amount of this information about diet-related health. Studies appearing weekly, monthly, or quarterly in refereed scientific journals often find their way into the popular media. Because scientists and journalists work differently and are guided by different values, the public is frequently ill-served in developing a comprehensive understanding of diet-related health issues.⁷⁶ Scientists work in an empirical framework in which each study is, at best, an incremental advance over previous work. A single study is seldom decisive, and scientists are trained to qualify their results, to tolerate ambiguity, and to consider a single study in a larger research context. Journalists, on the other hand, apply news values to their work and therefore seek to emphasize the new, the unusual, the contradictory, the "breakthrough," and other information they judge to be of interest to their audience. Although science and health stories usually are reported accurately from a factual standpoint, they often lack a larger context for interpretation. In addition, journalists have a low tolerance for qualification and

ambiguity, having been trained to seek clarity or contrast in the interests of their audience. This, and the scientific community's penchant for reporting positive results, often concludes in an "overdose of optimism" in the reporting of health research.⁷⁷

Entertainment media, especially television, also are a source of diet-related health information, albeit indirectly through modeling healthy or unhealthy eating patterns. Past content analyses of entertainment programming have noted the frequently unhealthy nature of depicted eating and drinking patterns, seldom linking them to unhealthy outcomes, and even framing them as "normal" and "legitimate."⁷⁸

It is clear that a great deal of promotional activity—including 5 A Day—drove diet and nutrition-related messages in the media during the 1990s. Major media report diet and nutrition messages in a variety of contexts. In addition to scientists, food, health, and science-advocacy groups have generated a great deal of news coverage about diet and nutrition issues. Industry commodity groups frequently promote the results of studies that favor the positive effects of the products they promote. Public-interest advocacy groups frequently target specific foods as unhealthy to counter food-industry influence and advertising. Such activity seeks to influence both the agenda and the setting or context of media reporting on health and diet-related issues.⁷⁹

Effects on the 5 A Day Message Environment

The volume, inconsistency, and often contradictory nature of information in the marketplace in combination with the other factors described above have created less than ideal conditions for healthful behavior change. The effect of these factors is that the public frequently is overwhelmed by the sheer volume of information and left confused by the pastiche of entertainment, news

stories, advertising, and other sources of health information about food, diet, and nutrition. A recent national survey sponsored by Cornell University's National Nutrition Information Center reported that 64 percent of respondents said that they often "change their minds" about nutrition when "the study of the week" contradicts previous work or traditional dietary advice.⁸⁰ Although 59 percent admitted that conflicting nutrition information had caused them to change their eating patterns in the past 2 years, about 20 percent said they had ceased to pay attention to nutrition studies altogether because of the confusion they often engendered.

In the context of this environment, there is a need for reliable and credible sources of dietary

information to prevent the further growth of "dietary helplessness," to help the public differentiate good from poor information, to provide a larger context for personal dietary decisions, and to help clarify the confusion engendered in the message environment. The 5 A Day Program, as a public/private partnership, is in an excellent position to further these efforts with perhaps an increased emphasis on influencing media news reporting and the "framing" of health-related dietary issues.⁷⁹ The Program will never have the resources equivalent to the private sector, yet there is good evidence that local health promotion activity can have a beneficial effect on changing dietary patterns even in the context of a message-dense, fragmented, and competitive environment.

6. Evaluation of the Program

Implementation

This section assesses the implementation of the 5 A Day Program and addresses two questions: (1) to what degree were resources made available to the Program and (2) to what extent were the components of the Program implemented as conceptualized and proposed to NCI's Board of Scientific Counselors?

Media Campaign

As a joint effort between the NCI/OCC and the PBH, the media component of the 5 A Day Program was implemented as proposed. Using the Consumer-Based Health Communications Model, formative research was conducted, the 5 A Day target audience selected, and communications strategies and messages designed and implemented. By 1997, \$5.15 million (\$5 million proposed) had been directed to a national media campaign that spread the 5 A Day message through media events and activities to improve public awareness. Since 1997, the NCI has allocated another \$2.6 million to continue the national media campaign.

Community-Level Interventions

The community component of the 5 A Day Program underwent a shift in emphasis as the program was implemented. Originally planned as a channel to create state and local-level interventions in collaboration with local industry partners and community groups, the emphasis shifted from community/state capacity building to a more research-oriented agenda. The NCI allocated the original \$16 million proposed for state/community support through the RFA process to university-based investigator research to develop and evaluate community-based interventions. This shift strengthened the opportunities to test well-designed intervention strategies for specific channels and

targeted populations, but left little support for capacity building at the state and community level. Although all states eventually became licensed by the 5 A Day Program and used educational materials developed by the NCI and the PBH for national distribution, few states had adequate resources to support or evaluate the program. In 1998, about two-thirds of the states reported devoting less than one full-time equivalent (FTE) to 5 A Day Program activities. When grant funds and expenditures on personnel are ignored, the estimated expenditures for the 5 A Day Program were \$50,000 or less per year for most states. However, 31 grants to states were allocated through a partnership between the NCI and the CDC to support and evaluate state health agency programs. These grants totaled \$1.75 million from 1992 to 1997 and an additional \$1.15 million since 1997.

Point-of-Purchase Program and Industry Partnerships

Agreements between the NCI and the PBH (Memoranda of Understanding, License Agreements) about national structure, organizational roles, how the program would operate, and criteria/guidelines for using the 5 A Day logo/service mark were developed and signed. The NCI and the PBH established a positive working relationship with producers and retailers and implemented the industry component of the 5 A Day Program as planned. By 1994, more than 1,000 licensed partners, representing 35,000 point-of-purchase locations, actively participated in the program. These partners made in-kind contributions totaling an estimated \$368 million from 1992 to 1999. Promotions and educational programs engaging consumers in practical methods to increase vegetable and fruit consumption were produced for

food service organizations and retail promotions. The beneficial outcomes of the partnership include an expanded communication base for the 5 A Day message and the promotion of national nutritional objectives. This public-private partnership, with its identifiable structure and modules, represents a model for the implementation of other public health endeavors.

Other Partnerships

The 5 A Day Program developed successful collaborations with a range of Federal, state, and voluntary agencies. These collaborations provided mechanisms whereby the 5 A Day message was incorporated into a range of programs, from the school lunch program to statewide public-health interventions. As a result of these efforts, the 5 A Day message is highlighted in the USDA modifications in the school lunch program and the Team Nutrition campaign, the dietary guidelines of the ACS, the Department of Defense health promotion programs, the Indian Health Service nutrition and dietetics programs, and the USDA food assistance programs (Food Stamps; Special Supplemental Nutrition Program for Women, Infants, and Children (WIC); and the Child Care Food Program). In addition, the food industry has modified products and materials to fit the 5 A Day message criteria. The message is generally accepted in the United States and incorporated into most nutrition programs. This is the kind of modification of norms that most programs hope to create.

Research

A research component was added to the original implementation plan for the 5 A Day Program as the original RFA process developed. The NCI funded nine behavior-change research and evaluation studies to determine the effectiveness of 5 A Day interventions. These projects were conducted in community settings (e.g., schools, churches, worksites) and accounted for \$18 million in funding in 1992-1997. The NCI expended another \$9.6 million after 1997 on investigator-

initiated behavioral change research focusing on 5 A Day. The results of these studies have been published in peer-reviewed journals as multiple-site collaborative papers and as reports from individual study sites.

Central Capacity

A 5 A Day program director was hired, and various staff from NCI's OCC performed the functions of the nutrition specialist. The position of evaluation manager was never filled, and the \$6 million for contractual administrative support was never allocated to the program by the NCI.

Table 2 lists the actual expenditures of the 5 A Day Program from its inception in 1992 through 1999. For the original 5-year plan, 1992-1997, the actual expenditure of \$26.6 million was very close to the goal of \$27 million. Total expenditures for the 5 A Day Program were \$40.41 million, with the majority of funds (\$27.6 million) having been allocated for behavior-change research.

Table 2. Actual NCI cost by fiscal year (dollars in millions)

	Nutrition and Behavior-Change Research (RFA)	State Health Agency Research	Media (Including OCC)	Program Evaluation	Total
FY 1992	—	—	\$0.40	—	\$0.40
FY 1993	\$4.00 ^a	—	\$1.00	—	\$5.00
FY 1994	\$4.00 ^a	\$0.30	\$1.00	—	\$5.30
FY 1995	\$4.00 ^a	\$0.40	\$1.00	\$0.68	\$6.08
FY 1996	\$4.00 ^a	\$0.50	\$1.00	\$0.66	\$6.16
FY 1997	\$2.00 ^a	\$0.55	\$0.75	\$0.42	\$3.72
FY 1998	\$4.00 ^b	\$0.50	\$1.50	\$0.25	\$6.25
FY 1999	\$5.60 ^b	\$0.65	\$1.10	\$0.15	\$7.50
Total	\$27.60	\$2.90	\$7.75	\$2.16	\$40.41

^a Supported by funds for RFA.

^b Supported by funds for investigator-initiated research.

Process Measures

This section assesses the Program's impact through its various media components. It answers the overall question: "To what extent have the mass media communicated the 5 A Day message since the Program began?"

Specifically, this section answers the following questions:

- When did the 5 A Day message first appear in the media?
- What are the national trends in media communication of the message?
- What are the trends in local media communication, especially in areas covered by the state/community coalitions?
- To what extent has the public responded to the basic message?

When Did the 5 A Day Message First Appear in the Media?

The media rollout of the 5 A Day Program occurred officially in September 1991. However, the concept of eating at least 5 servings of vegetables and fruit each day has been an established dietary guideline since it was first recommended by the USDA in 1916.²¹ The general dietary recommendation to consume larger amounts of vegetables and fruit has varied little through the years, with the exception of the specific number of servings, which has varied from 3 to 5. Beginning in 1980, the USDA and the DHHS began to coordinate dietary recommendations through a joint publication, *Dietary Guidelines for Americans*, which has been revised every 5 years since then. This publication and numerous government-sponsored reports have been consistent in their recommendation to consume more vegetables and fruit. Over the years, in fact, this recommendation has been elevated in prominence, especially in the *Dietary Guidelines* edition published in 1995. This background is important to consider because the 5 A Day Program's basic message is not new. By the September 1991

rollout, the essential message had been around for 75 years, with more intensive promotion by the USDA, the DHHS, and other organizations since at least 1980.

National and Local Media Communication Trends

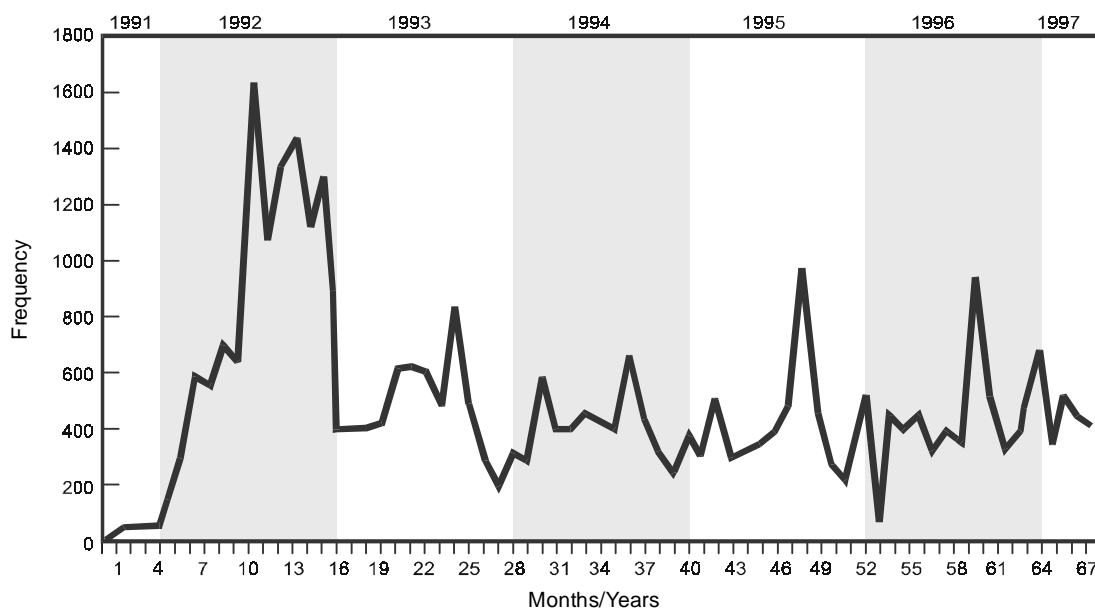
Figure 1 documents the Program's media news and advertising activity from 1991 through 1997. The figure is based on data provided by a professional clipping service and includes both print advertising and print news stories that were entered into a database. However, because the data have occasional gaps and no independent reliability checks were performed, the data should be interpreted more as an index of media placement activity (number of items in the database) than as reliable data about media coverage of the 5 A Day Program. Nevertheless, interpreted in this way, the data demonstrate that substantial placement activity occurred for the 69 months documented. The "launch period" (September 1991-December 1992) showed the greatest amount of activity. It took about 4 months after the rollout for the media to begin publishing large numbers of stories and advertising about 5 A Day, with a major increase occurring in December 1991. Throughout 1992, published material increased sharply to a peak of more than 1,600 items in July 1992. This stayed well above the 1,000 mark through December 1992. Thereafter, activity declined to between 200 to 980 items per month through May 1997, when media clipping ceased.

The taller "spikes" in each year through about 1996, reflect a renewed surge of media promotion activity, usually occurring in September. Following the initial rollout, the *Atlanta Constitution and Journal* and the *North County Times* (Oceanside, CA) were the first daily newspapers to report on the Program on September 26, 1991. Through the end of 1991, California print media were the most active in publishing 5 A Day material, perhaps not surprising given the state's reliance on vegetables and fruit in its agricultural economy and its previously established 5 A Day activity.

In the peak year of 1992, all 50 states, Puerto Rico, and the District of Columbia published considerable amounts of material about the Program. The most active state media were in Texas (n = 1,750) and Georgia (n = 1,469), with more than double the promotions of the next most active states: Kansas (n = 676), Oklahoma (n = 593), Florida (n = 527), South Carolina (n = 502), Missouri (n = 440), New Jersey (n = 395), and New York (n = 381). By 1996, the last complete year of media placement data, the rank order of the top 10 most active states was Illinois, California, Kansas, New York, South Dakota, Pennsylvania, Texas, Michigan, Georgia, and Massachusetts.

Table 3 summarizes 5 A Day media placement activity across different regions of the country. The table includes only complete years of data (1992-1996). The most active regions were the Midwest and the South, accounting for about 35 and 34 percent of news and advertising activity, respectively. The Northeast was the next most active, followed by the West, but each of these regions showed about one-half the rate of activity of the Midwest and the South. Midwest activity was fairly consistent throughout the 5 years, while about one-half of the South's activity occurred in 1992. More than one-third of all media activity occurred in 1992, and more than one-half of total activity (52.5%) occurred during 1992-1993.

Figure 1. 5 A Day media and advertising activity September 1991-May 1997 (n = 69 months)



Source: Porter-Novelli

Table 3. 5 A Day media activity by year and region (full years of data only)

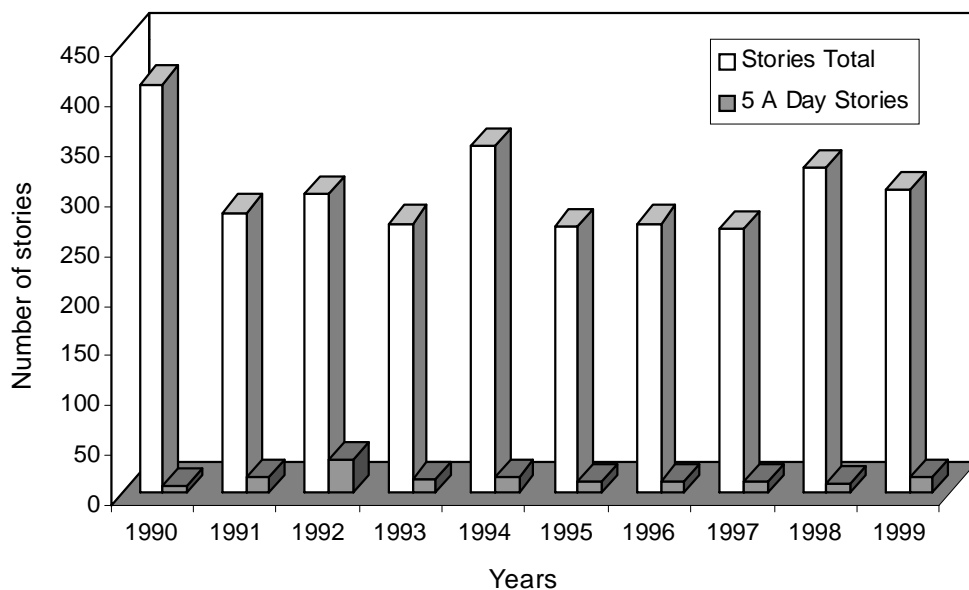
Region	1992	1993	1994	1995	1996	Totals	Percent of Totals
West	1,097	1,107	770	641	796	4,411	14.0%
Midwest	2,977	2,043	1,875	2,079	1,991	10,965	34.9%
Northeast	1,358	1,125	925	931	1,016	5,355	17.0%
South	5,360	1,527	1,417	1,285	1,333	10,699	34.0%
Totals	10,792	5,802	4,987	4,936	5,136	31,430	100%
Percent of Totals	34.0%	18.5%	15.9%	15.7%	16.0%	100.0%	

Because of the unreliability and incompleteness of the media clipping data, the Evaluation Group conducted an independent analysis of media coverage during the period 1990-1999 to validate trends in news coverage of the 5 A Day message and program. The Lexis-Nexis™ academic database was used, and the search was limited to daily newspapers published during the entire period 1990-1999. This included 12 major U.S. dailies: the New York Times, the San Francisco Chronicle, the Seattle Times, USA Today, the Los Angeles Times, the St. Louis Post-Dispatch, the Washington Post, the San Diego Union-Tribune, the Boston Globe, the St. Petersburg Times, the Louisville Courier-Journal, and the New York Journal of Commerce. The search algorithm included "cancer" in the headline or first paragraph of the story, in combination with "fruit(s)" or "vegetable(s)" in the body text to locate stories related to the 5 A Day message. A second search was conducted using the algorithm "cancer" plus "5 A Day" or "5 A Day for Better Health" in the body text. The results are displayed in Figure 2. Using the first algorithm, the search located 3,041 news stories published in the 12 dailies from 1990

to 1999. This was an average of about 25 stories per month across the newspapers. Using the second algorithm, the Evaluation Group located 135 stories specifically mentioning 5 A Day in conjunction with cancer prevention.

The data demonstrate that the use of the message recommending greater consumption of vegetables and fruit was actually quite high at the beginning of the period (1990), prior to the 5 A Day Program rollout. However, consistent with the clipping data, there was an increase in news coverage of the message from 1991 to 1992, although these data suggest an even greater peak in 1994 compared to the previous 3 years. A smaller proportion of stories mentioned the 5 A Day Program per se, at least using this particular search algorithm. Nevertheless, similar to the clipping database, it appears that news stories about the program peaked in 1992, the year after its initial launch. Although stories leveled off from 1995 through 1996, an additional upswing in coverage of the message occurred in 1997 through 1998. The small number of news stories specifically

Figure 2. Major newspaper coverage of cancer, and role of vegetables and fruit, 1990-1999 (12 major market U.S. dailies)



mentioning 5 A Day is less important than the large number of stories on the message itself, that of consuming at least 5 servings of vegetables and fruit a day.

The 5 A Day promotion campaign used a combination of strategies that leveraged advertising from its industry partners and developed relationships with media outlets to generate and inform news stories related to the Program. The media placement data suggest that media relations strategies were less successful after the first 1-2 years of the campaign and that advertising strategies dominated.

Public Response

A great deal of promotional activity drove the 5 A Day message during the 1990s, and major media reported the message in a variety of contexts. To what extent do members of the public know the message, and what are their attitudes toward it? Independent survey data from a variety of sources were examined to answer this question.

Even before the 5 A Day Program, it was clear that a large proportion of the American public understood at least part of the 5 A Day message. In nine national surveys conducted by The Harris Poll, Inc.⁸² between November 1985 and November 1992, Harris asked, "Thinking about your personal diet and nutrition, do you try a lot, try a little, or don't try at all to eat enough fiber from whole grains, cereals, vegetables and fruit?" Results varied little over the 8-year period. Between 52.8 percent and 60.3 percent of U.S. adults reported that they "tried a lot" to eat more fiber from these sources. Only between 8 and 11 percent said they did not try at all.

A second set of national surveys has been conducted biennially since 1991 by the A.D.A. The most recent was released in January 2000.⁸³ Although 85 percent of Americans say diet and nutrition are important to them personally, about 28 percent say they have made significant changes in their eating patterns to achieve a healthier and more nutritious diet. According to the survey, this number increased

by 2 percent since 1997 and is the highest since the survey began in 1991. Moreover, 47 percent of those surveyed said they are doing more to change their diets than they did 2 years ago. About 40 percent of the American public says they know they should eat a more healthful diet but for many reasons have not been able to reach their goal. This number decreased by 2 percent since the 1993 survey. Finally, about 32 percent of Americans say they are unconcerned about making dietary changes, a decrease of 8 percent since the 1997 survey.

A third set of surveys from Federal government sources (FDA, USDA, DHHS), summarized by Guthrie, Derby, and Lewy, show that Americans have a high level of awareness about the connection between diet, health, and chronic disease.⁸⁴ For example, in an open-ended question asked from 1982 to 1995 in the FDA's Health and Diet Surveys, the proportion of people mentioning "fats" as linked to heart disease increased from about 20 percent to more than 60 percent. Similarly about 9 percent spontaneously mentioned the increased consumption of vegetables and fruit as preventive of cancer in 1982. By 1995, this had risen to about 33 percent, an almost fourfold increase. Two surveys in 1994 and 1995 (1994 DHHS/FDA Food Label Use and Nutrition Education Survey [n = 1,945]; 1995 DHHS/FDA Health and Diet Survey-Food Label Use and Nutrition Education Survey Replicate [n = 1,001]) asked specific questions about awareness of the 5 A Day Program. In 1994, 22 percent of those surveyed said they were aware of the Program; 24 percent said they were aware of the Program in 1995.

A fourth set of surveys surrounding the 5 A Day Program was conducted under the auspices of the NCI. A baseline survey conducted in 1991 found that only about 8 percent of Americans thought they should eat at least 5 servings of vegetables and fruit each day.⁸⁵ However, 6 years later (in 1997), a followup survey found that this number had risen to 20 percent.⁸⁶

Dietary Change and Related Outcomes

This section assesses the Program's impact on dietary change and factors that mediate dietary change. The original concept for the 5 A Day Program proposed an evaluation based on two sets of outcomes: (1) changes in two psychosocial factors believed to mediate program effectiveness, specifically the U.S. population's awareness of the 5 A Day Program and knowledge of the 5 A Day dietary recommendation; and (2) changes in the U.S. population's consumption of vegetables and fruit. To collect these data, the evaluation plan included two random-digit-dial, cross-sectional surveys of the U.S. population. Both surveys assessed demographic characteristics, psychosocial factors related to vegetable and fruit consumption, and usual servings of vegetables and fruit. The 1991 baseline survey included 2,834 participants (response rate = 42.8%),⁸⁷ and the 1997 followup survey included 2,602 participants (response rate = 44.5%).⁸⁸ Staff at the NCI, with the assistance of external consultants, completed analyses of data from both these surveys and other data sources to examine outcomes related to 5 A Day Program effectiveness. The results of these analyses, along with a review of other published reports on U.S. trends in vegetable and fruit consumption, are described on the pages that follow.

Changes in Psychosocial Factors That Mediate Dietary Behavior Change

The assessment of psychosocial factors related to dietary intake is an important and often overlooked component of research and evaluation in public health nutrition. This is because large-scale public health nutrition programs take many years to develop and implement, and thus their influence on dietary behavior will most probably be gradual and cumulative over time. For program evaluation, then, it is useful to examine changes in diet-related psychosocial factors that are believed to mediate intervention effectiveness.^{89,90} There is only a small literature on mediating factors for

dietary change, but the following factors appear to be most important: knowledge of dietary recommendations,⁹¹ taste preference,⁹² awareness of the benefits of dietary change,⁹³ barriers to change,⁹³ and self-efficacy (confidence that one can perform the desired new behavior).⁹⁴ Many of these constructs were measured in the 5 A Day surveys, with an emphasis on psychosocial factors related specifically to the consumption of vegetables and fruit. Thus, the 5 A Day surveys can be used both to investigate associations of psychosocial factors with vegetable and fruit consumption and to examine how these factors may have changed after the 5 A Day Program was implemented nationwide.

Psychosocial Factors Related to Vegetable and Fruit Intakes

The baseline 1991 5 A Day survey assessed only a small number of psychosocial constructs, and inferences from this survey are limited. The strongest factors predicting vegetable and fruit intakes were knowledge of the dietary recommendation to eat 5 or more servings per day and taste preferences.⁴⁴ In the followup 1997 survey, a more extensive effort was made to include new and revised items to improve the quality of measurement and to assess a broader domain of diet-related psychosocial factors. Table 4 provides results from a comprehensive analysis of the 1997 survey by NCI staff. The single strongest independent predictor of vegetable and fruit intakes was self-efficacy, followed by knowledge of the 5 A Day dietary recommendation and taste preferences. There were weak associations between awareness of the 5 A Day Program, perceived barriers, and perceived norms on the one hand and vegetable and fruit intakes on the other. However, these associations were inconsistent between men and women. There were no associations with perceived benefits, threat, or social support. These analyses suggest that continued monitoring of knowledge of dietary recommendations, self-efficacy for dietary change, and taste preferences can be useful

as secondary indicators of 5 A Day Program effectiveness. Improved study and evaluation designs will provide stronger conclusions in the future.

Table 4. Percentage increase in vegetable and fruit consumption (frequency/day) associated with a one-unit increase in scales measuring diet-related psychosocial factors

	Vegetables and Fruit (servings per day)	
	Adjusted for Demographic Characteristics ^a Percentage increase	Adjusted for Demographic Characteristics and Other Psychosocial Factors ^b Percentage increase
Awareness^c		
Knowledge of message	33.3 ^h	22.2 ^h
Program awareness	16.4 ^h	5.4
Intrapersonal^d		
Affect	7.8 ^h	4.0 ^h
Self-efficacy	8.6 ^h	5.9 ^h
Perceived benefits	5.5 ^h	1.0
Perceived barriers ^e	3.0 ^h	1.5 ^g
Perceived threat	-0.4	-0.4
Interpersonal^d		
Social support	2.3 ^h	0.3
Norms	4.0 ^h	1.1 ^f

Source: National Cancer Institute's 1997 5 A Day Survey, U.S. Adults.

^a Sex, race/ethnicity, age, education, income, marital status, smoking status, BMI, and self-rated health.

^b Demographic characteristics above plus other psychosocial scales in table.

^c Scales scored 0,1 (no, yes).

^d Scales scored 0-11 (lowest to highest).

^e Scale reversed before analysis.

^f p<0.05.

^g p<0.01.

^h p<0.001.

Changes in Psychosocial Factors Related to Vegetable and Fruit Intakes

There is only a little overlap between the diet-related psychosocial factors measured in the 1991 5 A Day survey and those in the 1997 survey. Comparisons are possible based on Program awareness, knowledge of dietary recommendations, and "Stages of Change" toward adopting diets high in vegetables and fruit. Between 1991 and 1997, there were substantial increases in knowledge of the 5 A Day Program, defined as having heard about the Program and correctly identifying it as one that encourages consumption of vegetables and fruit (see Table 5). In 1991, almost no one was aware of the Program. In 1997, 18 percent of Americans were aware of the Program, although when comparisons are made within demographic subgroups, awareness was higher among women, younger people, whites, and better educated people. There also was a substantial increase in the proportion of Americans who knew of the recommendation to eat 5 or more servings of vegetables and fruit each day.

In summary, the 5 A Day message has significantly increased awareness of the importance of eating more vegetables and fruit, in particular among younger and better-educated people.

Table 6 shows the changes in the proportions of the U.S. population in each stage of change toward adopting a diet high in vegetables and fruit. Stages of Change is a heuristic model that describes a sequence of cognitive and behavioral steps in successful behavior change:

- Precontemplation: no recognition of need for or interest in change
- Contemplation: recognition of need for and thinking about change
- Preparation: planning for change
- Action: adopting new behavior
- Maintenance: continuing practice of new behavior.

Table 5. Mean percentages of U.S. population aware of the 5 A Day Program and knowing program recommendations in 1991 and 1997

	Program Awareness		Knowledge of Program Recommendation	
	1991 ^a (%) ^c	1997 ^b (%) ^c	1991 ^a (%) ^c	1997 ^b (%) ^c
Total	2	18 ^e	8	19 ^e
Sex				
Male	2	14 ^e	4	11 ^e
Female	2	21 ^e	11	27 ^e
Age				
18-34	2	22 ^e	7	20 ^e
35-49	3	19 ^e	8	21 ^e
50-64	2	14 ^e	10	18 ^d
65+	0	9 ^e	6	16 ^e
Race/Ethnicity				
White	2	19 ^e	8	21 ^e
African American	1	12 ^e	6	13 ^e
Latino	1	10 ^e	6	8
Education (years)				
<12	1	16 ^e	5	17 ^e
12	2	16 ^e	7	15 ^e
13+	2	20 ^e	8	22 ^e

Source: National Cancer Institute's 5 A Day Surveys, U.S. Adults.

^a n = 2,834.

^b n = 2,602.

^c Adjusted for age, sex, ethnicity, education, poverty level, and smoking and marital status.

^d vs. 1991, p<0.01.

^e vs. 1991, p<0.0001.

Stages of Change is a key construct of the Transtheoretical Model,⁹⁵ which has been used to design interventions for a wide range of health-related behaviors, including diet.⁹⁶ Between 1991 and 1997, there was a modest 5 percentage point decrease in the proportion of the population in precontemplation, an 11 percentage point decrease in the proportion in maintenance, and a 12 percentage point increase in the proportion in action. Interpretation of these results is not straightforward because the data are from two cross-sectional samples and do not allow direct interpretation of an individual's shift across stages of change. Slight evidence indicates that the proportion of the population that is unaware of, or not at all interested in increasing, its intake of vegetables and fruit has decreased. More speculatively, the decrease in the proportion of the population in maintenance and the increase in those in action stages suggests that about 10 percent of the population has reevaluated its need to increase consumption of vegetables and fruit and is actively engaged in making appropriate dietary behavior changes.

Table 6. Distributions of the U.S. population's Stages of Change for adopting a diet high in vegetables and fruit in 1991 and 1997

Stage of Change	Between 1991 and 1997		
	1991 ^a (%)	1997 ^b (%)	Change (%)
Precontemplation	22.1	16.9	-5.2
Contemplation	3.1	2.2	-0.9
Preparation	12.5	18.1	+5.6
Action	35.2	47.2	+12.0
Maintenance	26.7	15.6	-11.1

Source: National Cancer Institute's 5 A Day Surveys, U.S. Adults.

^a Includes all forms, including condiments, candy, chips, and fried food.

^b Mean standard error, adjusted to be representative of the U.S. population during the years of each survey.

Changes in Vegetable and Fruit Intakes

It is extremely difficult to evaluate whether the 5 A Day Program, or indeed whether any mass media-based nutrition campaign, has affected population-level dietary patterns. The reasons are (1) there are no groups not exposed to the 5 A Day campaign that can be used as a comparison to those exposed; (2) there are many other national and local programs to improve dietary patterns, a large proportion of which also include a focus on increasing vegetable and fruit consumption; and (3) low-intensity, public-health oriented dietary intervention programs yield relatively small changes in dietary patterns that may take many years to detect. It is important to consider these issues when interpreting the results for the analyses described on the pages that follow.

The national 5 A Day Program began in 1991 with a national media campaign and promotional activities organized by the EBH; states did not begin intervention programs until 1994. Two strategies are available to evaluate whether the 5 A Day Program has affected dietary behavior during Program implementation: (1) surveillance of U.S. trends in vegetable and fruit consumption and (2) examination of associations at the state-level between the intensity of 5 A Day Program implementation and the magnitude of change in vegetable and fruit consumption.

Surveillance of U.S. Trends in Vegetable and Fruit Intakes

Key outcomes from the two 5 A Day surveys are shown in Table 7. Total consumption of vegetables and fruit (not including french fries) increased by 0.12 servings per day, which was not statistically significant. There were significant increases in vegetable and fruit consumption among Latinos and persons 18-34 years of age. There was a borderline statistically significant difference ($p = 0.051$) among race/ethnic groups; total consumption decreased among African

Americans and increased among Latinos and whites. There were nonstatistically significant larger increases among women compared to men, people with at least a high school degree compared to those not completing high school, and younger compared to older people. Table 7 also includes percentages of the population consuming vegetables and fruit 5 or more times per day in 1991 and 1997. Overall, there was a 4 percentage point increase in the proportion of the population eating 5 or more servings of vegetables and fruit per day, and differences among subgroups were similar to those found for total intake.

There are two additional sources of representative data on U.S. dietary intake that cover the time period corresponding to 5 A Day Program implementation. The CDC maintains the BRFSS Survey, and has published an analysis based on 16 states for the years 1990, 1994, and 1996 (see Table 8).⁹⁷ Vegetable and fruit consumption increased between 1990 and 1994 by 0.14 servings per day ($p < 0.01$), with no further increases between 1994 and 1996. Increases were somewhat larger among women than men. Overall, the percentage of individuals consuming 5 or more servings per day increased by 3.7 percentage points, and increases were larger among women than men. NCI staff have completed a more comprehensive analysis of the BRFSS data based on all 50 states and covering the years 1994, 1996, and 1998 (see Table 9). Between 1994 and 1998, consumption of vegetables and fruit increased by approximately 0.18 servings per day ($p < 0.001$). The proportion of the population eating 5 or more servings of vegetables and fruit per day increased from 21.5 percent to 24.7 percent ($p < 0.001$).

The USDA maintains the CSFII. NCI staff completed an analysis of CSFII data covering the periods 1989-1991 and 1994-1996 (see Table 10).⁹⁸ Total vegetable and fruit consumption increased by 0.3 servings per day among children and by 0.6 servings per day among adults.

Table 7. Mean vegetable and fruit consumption (frequency/day) in 1991 and 1997

	1991 (n = 2,834)		1997 (n = 2,602)	
	Freq/day (Mean) ^a	5+/day (%) ^a	Freq/day (Mean) ^a	5+/day (%) ^a
Total	3.8	23	3.9	26
Sex				
Male	3.5	18	3.5	20
Female	4.1	28	4.2	31
Age				
18-34	3.5	19	3.8 ^b	23
35-49	3.7	23	3.8	25
50-64	3.9	24	3.9	25
65+	4.3	33	4.3	33
Race/Ethnicity				
White	3.8	23	3.9	25 ^b
African American	4.0	29	3.8	25
Latino	3.6	23	4.0 ^b	31
Education (years)				
<12	3.5	19	3.6	21
12	3.6	21	3.7	22
13+	4.0	26	4.1	29

Source: National Cancer Institute's 5 A Day Surveys, U.S. Adults.

^a Adjusted for age, sex, race, ethnicity, education, poverty level, and smoking and marital status.

^b vs. 1991, p<0.05.

Table 9. Mean of 50 U.S. States' mean vegetable and fruit consumption (frequency/day) in 1994, 1996, and 1998¹

	1994	1996	1998
Total	3.77^a	3.85^b	3.95^c
Fruit	0.77 ^a	0.80 ^b	0.81 ^b
Juice	0.70 ^a	0.72 ^a	0.75 ^a
Vegetable	1.48 ^a	1.50 ^a	1.55 ^b
Salad	0.48 ^a	0.48 ^a	0.49 ^b
Potatoes	0.37	0.38	0.37 ⁹
Percent 5+/day	21.5^a	23.2^b	24.7^c

Source: CDC's Behavioral Risk Factor Surveillance System.

¹ Mean, adjusted for smoking, obesity, agricultural sales, age, sex, race, and marital status.

^{a, b, c} Means without same superscript differ significantly across years (p<0.05).

Table 8. Mean vegetable and fruit consumption (frequency/day) in 1990, 1994, and 1996^a

	1990		1994		1996		Change 1990-1996	
	Freq/day se	5+/day (%)	Freq/day se	5+/day (%)	Freq/day se	5+/day (%)	Freq/day se	5+/day %, se
Total	3.27 0.02	19.0	3.41 0.02	22.1	3.40 0.02	22.7	0.13 0.03	3.7, 0.6
Sex								
Male	3.10 0.03	16.5	3.19 0.03	18.1	3.20 0.03	19.1	0.10 0.04	2.6, 0.8
Female	3.44 0.03	21.3	3.64 0.03	26.0	3.61 0.02	26.2	0.17 0.04	4.9, 0.8

Source: CDC's Behavioral Risk Factor Surveillance System, 16 states.

^a Adjusted to 1990 pooled age and sex distributions of 16 participating states. se = standard error

Table 10. Mean vegetable and fruit consumption (servings/day) in 1989-1991 and 1994-1996

		Fruit ^a		Vegetables ^a		Total Vegetables and Fruit ^a	
		1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Total Age	Total (2+ yrs)	1.3 ± 0.03 ^b	1.5 ± 0.03	3.2 ± 0.03	3.4 ± 0.04	4.5 ± 0.06	4.9 ± 0.05
	2-19 yrs	1.3 ± 0.06	1.6 ± 0.05	2.6 ± 0.07	2.7 ± 0.06	4.0 ± 0.09	4.3 ± 0.08
	20+ yrs	1.3 ± 0.04	1.5 ± 0.03	3.4 ± 0.05	3.7 ± 0.04	4.6 ± 0.06	5.2 ± 0.05

Source: USDA's Continuing Survey of Food Intake by Individuals (CSFII).

^a Includes all forms, including condiments, candy, chips, and french fries.

^b Mean standard error, adjusted to be representative of the U.S. population during the years of each survey.

Taken together, these three large survey programs suggest small increases both in mean vegetable and fruit consumption and in the proportion of individuals consuming vegetables and fruit 5 or more times per day in the time period during implementation of the 5 A Day Program. Increases in vegetable and fruit consumption were substantially smaller based on the 5 A Day and the BRFSS surveys as compared to the CSFII survey, which may have several explanations. First, both the 5 A Day and the BRFSS surveys used a short food frequency questionnaire method that captured only the frequency of consuming vegetables and fruit, without information on portion size, and included only those forms of vegetables and fruit that are targeted by the 5 A Day intervention. In contrast, the CSFII survey used multiple dietary recalls that captured details on all forms of vegetables and fruit, including those found in mixed dishes and condiments. Second, the analyses of both the 5 A Day and the BRFSS surveys were designed to examine change over time, by adjusting the data from each survey to a common distribution of population demographic characteristics; the analyses of the CSFII data are based on the population demographic characteristics at the time of each survey. Consequently, some of the increase observed in the CSFII survey is probably due to the increasing age and educational level and decreasing smoking rates in the U.S. population, as all of these characteristics are associated with higher vegetable and fruit consumption.

In summary, there has been a slow and steady increase in vegetable and fruit consumption in the United States during the implementation of the 5 A Day Program. Possible inferences from these results on the effectiveness of the 5 A Day Program are limited. The possibility cannot be ruled out that without the 5 A Day Program there would have been substantial decreases in vegetable and fruit consumption, paralleling the enormous increase in obesity over the same time period. Also, it is likely that other economic and cultural factors are influencing dietary behavior change in the United States. Nevertheless, these results are consistent with the inference that the 5 A Day Program has contributed to the continuous small increases in vegetable and fruit consumption over the past decade.

Intensity of 5 A Day Program Implementation and Changes in Vegetable and Fruit Intakes

The original 5 A Day concept included a process evaluation based on biannual state surveys of program activities. Data collected between 1995 and 1998 were used to create a state-level "implementation index" a summary scale with a range of 1 to 4 based on: (a) state health agency 5 A Day expenditures, (b) state health agency 5 A Day staff hours, (c) 5 A Day print materials used, and (d) 5 A Day ancillary materials used. In addition, a newspaper clipping service collected data on the number of articles that specifically mentioned the

5 A Day Program between 1991 and 1997. It was therefore possible to examine whether there were associations at the state level between the intensity of program implementation and the annual number of newspaper articles, and the magnitude of change in vegetable and fruit consumption.

NCI staff completed two sets of analyses. The first set examined whether the implementation index was correlated with change in mean state-level vegetable and fruit consumption during the period 1994 through 1998. This analysis asked the question, "Were there larger increases in consumption of vegetables and fruit in the states that more fully implemented 5 A Day Program activities?" These analyses found no associations between implementation intensity and change in vegetable and fruit consumption. A second, parallel analysis examined the associations between the number of newspaper articles and changes in consumption but found none. Additional analyses examined these associations in sex and age subgroups, but also found none.

There are several limitations to these analyses based on implementation intensity. The data used to calculate the implementation index were designed for process evaluation only, and the entire domain of activities describing state-level program implementation was not captured. The intensity of program implementation was not large; even the most populous states had no more than one FIE of staff time devoted to the 5 A Day Program. Newspapers are only a small portion of the media; television is not captured using this approach. Finally, many of the state programs targeted school-aged children, but the only available measure of state-level vegetable and fruit consumption is based on adults.

In summary, these findings suggest that more intensive 5 A Day Program implementation and more newspaper coverage were not associated with larger increases in vegetable and fruit consumption. However, given the limitations in the data available for these analyses, these conclusions are not strong.

Randomized Trials and Other Studies

The NCI funded nine formal, randomized experimental trials to investigate the effects of behavioral programs on fruit, juice, and vegetable consumption. These studies, taken as a whole, were successfully implemented and substantially increased understanding of how to motivate healthy eating practices under a variety of settings and within diverse populations. Four of the nine studies tested interventions in school settings. The remaining five studies focused on adults in worksites, churches, and WIC clinics. Tables 11 and 12 present a summary of the findings from eight of the nine studies; one has not yet been completed.

In Table 11, the data from the youth studies provide evidence that multicomponent school-based interventions can improve the health behaviors of elementary school children from diverse ethnic and social backgrounds. The studies employed state-of-the-art intervention techniques and evaluation designs. The interventions included components such as classroom curricula; modifications to the school food service; direct marketing of fruits, juices, and vegetables to children at lunch and at school; involvement of the vegetable and fruit industry parent involvement; and community-based social marketing strategies. Across the studies, the net differences between the treatment and control groups at the first posttest ranged from 0.20 to 1.68 servings of vegetables and fruit per day. The average effect size was 0.68 servings per day; most programs found statistically significant increases. The strongest intervention effects were found on daily fruit consumption, possibly because of the higher palatability of fruits. For two of the studies (Georgia and Louisiana), significant intervention effects were observed after the first year of intervention, but these effects diminished in the last year of intervention. The Alabama study indicates that effects can be maintained without continued intensive intervention,

Table 11. Youth school studies: Effects of 5 A Day intervention studies on daily servings of fruit, juice, and vegetables

Project Title	Target	Intervention Strategy	Design	Main Outcome Measurement	Net Change Between Treatment and Control (Bold = P<.05)
5-A-Day Power Plus ⁹⁹ Minnesota	4th-5th graders 48% White 25% Asian 19% African American 6% Hispanic 60% Free/reduced lunch	2 years of intervention Classroom curricula Parent involvement School food service Industry involvement	10 school pairs Randomized Pre-posttest/control group School unit analysis N final cohort = 441	24 hour recall: -Total servings -Per 1,000 kcal Lunch direct obs. -Total servings -Per 1,000 kcal	PT: FV = .58; F = .62 ; V = -.02 PT: FV = .41 ; F = .36 ; V = .05 PT: FV = .47 ; F = .30 ; V = .16 PT: FV = .83 ; F = .72 ; V = .23
Gimmie 5 ¹⁰⁰ Georgia	4th-5th graders 85% White 15% African American	2 years of intervention Classroom curricula Parent involvement Food industry	8 school pairs Randomized Pre-posttest/control group School unit analysis N final cohort = 1,253	7 day recall	PT: FV = .20 ; F = .12; V = .08
Alabama High 5 ¹⁰¹ Alabama	4th-5th graders 83% White 16% African American 1% Other Median income @ \$45,000	2 years of intervention Classroom curricula Taught by program staff Parent involvement School food service	14 school pairs Randomized Pre-posttest/control group Delay intervention School unit analysis N final cohort = 1,426	7 days of 24-hour recall 5 a day FV score Lunch direct obs.	PT: FV = 1.68 ; 1F = .88 ; V = .69 FU: FV = .99 ; F = .56 ; V = .35 PT: FV = 1.46 ; F = .77 ; V = .50 FU: FV = .85 ; F = .50 ; V = .23 PT: FV = 0; F = .05; V = -.03 FU: FV = -.09; F = -.02; V = -.03
Gimmie 5: A Fresh Nutrition Concept ¹⁰² Louisiana	9-12th graders 84% White 4% African American 9% Hispanic 3% Other	3 years of intervention Food service marketing Student workshops Parent component	6 school pairs Randomized Pre-posttest/control group School unit analysis N final cohort = 1,911	Daily consumption of FJV; single item self report	PT: FV = .30

FV = Daily servings of fruit, juice, and vegetables. F = Daily servings of fruit. V = Daily servings of vegetables.
PT = Posttest (intake measured 3-12 months after intervention).
FU = Followup (intake measured 3-12 months after intervention).

although the differences were smaller at followup. Similar effects were found in an evaluation of the California Children's 5 A Day Power Play Program, which was not funded under this NCI mechanism. In this study, fourth and fifth grade students exposed to a school and community intervention ate 0.40 more servings of vegetables and fruit as compared to students in the control schools.

The school results, taken together, offer compelling evidence of program effectiveness for elementary school children across sex, race, and economic subgroups. The implications for research and practice include the need to: (1) fund the dissemination of elementary school interventions that work, perhaps by combining "best practices" from across programs; (2) continue research on why children eat the foods they do and explore other interventions in addition to those used in these research projects with promise for impact on vegetable and fruit consumption; (3) develop and evaluate innovative programs for middle and high schools; (4) develop and evaluate a stand-alone school food-service module that combines best practices from elementary schools; (5) develop and evaluate school and community policy approaches that increase the availability of vegetables and fruit in schools (e.g., fruit juice in vending machines, breakfast carts with vegetables and fruit, etc.); and (6) develop methods for innovative, effective, widespread teacher training.

The adult studies (see Table 12) also provide evidence that multicomponent interventions can improve the health behaviors of individuals in different cultural and social settings. These studies rigorously tested innovative intervention strategies among individuals at worksites, churches, and WIC programs. At the first posttest, each study found statistically significant increases in daily vegetable and fruit consumption as compared to controls. These increases ranged from 0.20 to 0.85 servings per day, with an average effect size of 0.48

servings per day. The strongest intervention effects were found for daily fruit consumption.

A common element among the studies was the inclusion of peer educators or intervention channels that also targeted the social environment. The Arizona and Massachusetts studies compared traditional worksite strategies to worksite plus peer education (Arizona) or worksite plus family education (Massachusetts) and found that family- or peer-led interventions were significantly more successful in increasing vegetable and fruit consumption than were interventions focusing exclusively on the worksite. These findings support the underlying hypothesis that dietary behaviors occur in a social context and demonstrate how the effectiveness of nutritional interventions can be enhanced when they take into account an individual's social context—including home, church, and peer networks at the worksite. The findings underscore the important role that social systems, including family members, coworkers, and church members, have to play in determining the climate of health behavior and how such social systems can assist in improving eating habits.

The adult results, taken together, also offer compelling evidence of program effectiveness across sex, race, and economic subgroups. The implications for research and practice include the need to: (1) fund dissemination of worksite-based programs, with a particular emphasis on programs targeting aspects of the workers' social contexts, perhaps by combining "best practices" across programs; (2) continue research on factors mediating the effectiveness of interventions in increasing vegetable and fruit intake; (3) develop and evaluate interventions in other settings, including point-of-purchase settings such as grocery stores and restaurants; and (4) develop and evaluate interventions that incorporate messages about vegetables and fruit with other behavioral risk factors such as physical activity or tobacco control.

Table 12. Adult studies: Effects of 5 A Day intervention studies on daily servings of fruit, juice, and vegetables

Project Title	Target	Intervention Strategy	Design	Main Outcome Measurement	Net Change Between Treatment and Control (Bold = P<.05)
<i>Healthier Eating for the Overlooked Worker</i> ¹⁰³ Arizona	75% Male lower income 46% White 41% Hispanic 6% African American 6% < high school 34% high school 49% > high school	1.8 years of intervention Peer education plus general 5 A Day compared to general 5 A Day alone	93 randomized work cliques Pre-posttest/control group Control group 6 month followup Clique unit of analysis N final cohort = 695	24-hour food recall 7-item 30-day food frequency	PT: FV = .77 ; F = .41 ; V = .26; J = .10 FU: FV = .41 ; F = .06; V = .24; J = .11 PT: FV = .46 ; F = .25 ; V = .19; J = .01 FU: FV = -.04; F = .03; V = -.08; J = .07
<i>Black Churches for Better Health</i> ¹⁰⁴ North Carolina	73% Female 65% < \$20,000 98% African American 37% < high school 34% < high school 29% > high school	20 months of intervention Multicomponent intervention: tailored print materials, direct education, lay health advisors, community coalitions, church activities, grocery	5 matched randomized county pairs 49 churches Pre-posttest/control group County unit of analysis N final cohort = 2,519	7-item 30-day food frequency	PT: FV = .85 ; F = .66 ; V = .19
<i>Maryland WIC 5-A-Day Promotion Program</i> ⁹⁴ Maryland	100% Female lower income 53% African American 43% White 19% < high school 41% high school 37% > high school	6 months of intervention Nutrition sessions by peer leaders Print materials and visual reminders Direct mail	16 WIC sites randomized Pre-posttest/control group 1 year followup WIC site unit of analysis N final cohort = 695	7-item 30-day food frequency	PT: FV = .43 FU: FV = .74
<i>Treatwell 5-A-Day</i> ¹⁰⁵ Massachusetts	84% Female 59% White 23% Hispanic 18% African American 20% = high school 36% some college, vocational 42% college	19.5 months of multicomponent intervention: worker participation, individual and environmental changes, family component	22 worksites randomized into minimal intervention (8), worksite plus family (7), worksite only (7) Pre-posttest/control group Worksite unit of analysis N final survey = 1,306	7-item 30-day food frequency	PT: FV, Worksite + Family = .50 PT: FV, Worksite FV = .20

FV = Daily servings of fruit, juice, and vegetables. F = Daily servings of fruit. V = Daily servings of vegetables. J = Daily servings of juice. PT = Posttest (intake measured 3-12 months after intervention). FU = Followup (intake measured 3-12 months after intervention).

7. Recommendations of the Evaluation Group

Based on the review and analysis, the Evaluation Group makes the following recommendations.

Overall Recommendations

- That the NCI continue the 5 A Day Program as a multifaceted program to support research and applied public health programs to promote increased vegetable and fruit consumption.
- That the NCI continue to lead the 5 A Day Program and, to accomplish this task, ensure that it has a strong senior leader and specific scientific expertise in evaluation, intervention methods development, media, and community-based interventions, as well as nutrition and epidemiology.
- That the NCI partner more closely with the USDA to better focus dietary guidelines and to promote research in agricultural and economic policies that encourage vegetable and fruit consumption.
- That the NCI partner with other NIH institutes to (1) promote research into the role of specific vegetables and fruit and their components in lowering disease risk more generally, (2) promote methodologic and applied behavioral research, (3) expand awareness of the scope of chronic and deficiency diseases that may benefit from increased consumption of vegetables and fruit, and (4) develop a comprehensive and rigorous surveillance plan to monitor vegetable and fruit consumption and the psychosocial and economic factors related to it. This last effort should include the CDC and, possibly, the FDA.
- That the NCI partner with the CDC to develop and manage state-level 5 A Day programs.

Implementation

The Media and Message Delivery

- That the 5 A Day Program, as part of its continuing public relations efforts, seek to prevent the further growth of "dietary helplessness," to help the public differentiate between good and poor information, to provide a larger context for personal dietary decisions, and to help clarify the confusion engendered in the message environment. In the dense, fragmented, and competitive message environment surrounding diet and behavior, there is a need for reliable and credible sources of information.

Resources

- That direct expenditures and leveraged resources furthering delivery of the 5 A Day message be increased.

Message Design

- That the NCI reconsider the design and emphasis of the 5 A Day message. Specifically, media process-evaluation data suggest the need to "reinvent" the 5 A Day message on a regular basis to prevent "wear-out" and to enhance its continuing attractiveness to the mass media. In addition, the current strategy seems less successful in reaching minorities and low-income groups, which suggests that any change in message emphasis should take these groups into consideration.

Media Strategies

- That the 5 A Day Program devote additional resources to a variety of media strategies, including a systematic media relations effort to educate reporters, editors, and producers about diet and nutrition issues. As part of this approach, program planners should consider pursuing partnerships with the media to develop a long-term community emphasis on the 5 A Day message. The goal is to influence both the quantity and quality of news coverage of the 5 A Day Program in particular and of diet and nutrition issues in general.
- That the 5 A Day Program rethink its channel-use strategy, with a particular focus on new media, tailored communications, and how media channels may be used as part of a collective approach to reaching lower socioeconomic groups and the disadvantaged.

Evaluation of Communication Efforts

- That the NCI and the 5 A Day Program partners pay close attention to developing a package of media evaluation approaches that are consistent, simple, complete, and affordable.

Industry

- That NCI's collaboration with the PBH be continued and expanded.
- That the NCI use its relationships with industry specifically to ensure that vegetables and fruit become more available to high-risk and underserved communities.

States

- That the NCI increase the resources, staffing, and expertise made available to the states for the dissemination, monitoring, and evaluation of the 5 A Day Program.

Minorities and the Underserved

- That the NCI, in partnership with relevant organizations, develop operational strategies aimed at understanding and reducing dispari-

ties among ethnic groups and across educational and socioeconomic differences.

- That the NCI continue to take the lead in evaluating the effectiveness of the 5 A Day Program. This evaluation must include the extensive involvement of the states.

Evaluation

- That the NCI continue to take the lead in evaluating the effectiveness of the 5 A Day Program. This evaluation must include the extensive involvement of the states.
- That the NCI undertake a comprehensive evaluation of each of the 5 A Day Program components: media; research; and industry, private nonprofit, state, and Federal partnerships.

Research

- That the NCI maintain and support intramural and extramural research in the following areas, noting particularly the need to modify, where appropriate, available funding and specific peer-review expertise:
 - (1) Research into dissemination methods—how to translate small-scale research findings into large-scale, long-term, sustainable community programs—with particular emphasis on programs of demonstrated efficacy and for underserved populations;
 - (2) Research into behavior change—how to translate established data on changes that will plausibly reduce risk into choices individuals and communities can make. In particular,
 - (a) Research into the development of more effective dietary intervention programs, determining which components of such programs contribute most to program effectiveness;
 - (b) Studies of children and adolescents as the development of food preferences begins;

- (c) Studies on ways to develop supportive environments and increase the availability of vegetables and fruit; and
 - (d) Randomized controlled trials of school-based interventions targeting middle and high school students.
- (3) Policy research— particularly on ways to establish an optimal environment for making healthy food choices in a capitalist economy;
 - (4) Research into environmental influences on dietary behavior and behavior change, including agricultural production, food distribution and availability, food labeling, pricing structures, taxation and price supports, purchase habits, advertising, cultural and social norms, and so on;
 - (5) Research into the mechanisms by which vegetables and fruit reduce cancer risk, particularly in humans;
 - (6) Research into influences on food choice, particularly genetic and environmental influences on taste preferences; early life experiences involving exposure to food; and education about food, food choice, and food preparation;
 - (7) Research into methods of measuring dietary behavior, particularly the further development of short- and long-term biological markers. In these research endeavors, access to relevant data collected by industry partners seeking to understand human preferences, behavior, and biology could prove a significant resource.
- That research focused on vegetable and fruit consumption measure and report vegetables and fruit separately, rather than combining the two into a single measure.

Surveillance

- That the NCI in partnership with other relevant Federal agencies—including the U.S. Public Health Service, the CDC, and the USDA—coordinate, facilitate, and strengthen surveillance and monitoring of (1) national vegetable and fruit consumption; (2) psychosocial mediators of dietary behavior change such as self-efficacy, knowledge, and taste preferences; and (3) if future research establishes their importance, possible environmental mediators of dietary behavior and behavior change, including food availability, price structures, taxation policy, and so on.

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