NHSNEWS

Dietary patterns that benefit your health - and the planet

Nurses' Health Study researchers have long studied the link between diet and human health. More recently, they have also examined dietary patterns that support both long-term health and environmental sustainability. The detailed information you have reported about what you eat provides an unparalleled opportunity to assess these impacts.

Dietary patterns and risk of chronic disease and death

A recent study comparing eight dietary patterns found that seven were linked to lower risks of several major chronic diseases, including heart disease, type 2 diabetes, and cancer. This suggests that there are numerous ways for individuals to achieve a healthy diet, a flexibility that could help people overcome challenges, including cultural and individual preferences and differences in food access. Across these dietary patterns, we consistently observed that diets higher in fruits, vegetables, coffee, whole grains, and wine in moderation but lower in processed meats,

FRANK SPEIZER, ORIGINAL FOUNDER OF NHS, TURNS 90!

Frank Speizer was the original founder of NHS in 1976 and has remained closely involved as an active investigator. Still sharp and spirited, he regularly attends the biweekly investigator meetings as an active participant with many great suggestions. Join us in celebrating Frank as he nears his milestone 90th birthday later this year.

DEAR COLLEAGUES,

The NHS is entering its 49th year! The NHSII is entering its 36th year! And founding principal investigator, Dr. Frank Speizer, is turning 90! The impact of these studies on women's health has been profound, made possible by the dedication of our incredible participants. It is not possible to emphasize adequately the scientific value of the NHS data—no other study worldwide has the repeated measures of diet and other information over many decades that you have provided.

As federal funding landscapes shift, we are once again adapting to ensure the sustainability of our research. For years, the National Cancer Institute (NCI) funded critical infrastructure for our studies, including data collection and biospecimen management. However, this funding mechanism is no longer available, and we are actively seeking alternative approaches.

Since 2020, we have been transforming our funding model, supported by Brigham and Women's Hospital, Harvard T.H. Chan School of Public Health, and individual donors. Our focus is on reducing costs and diversifying funding to sustain our vital research. By answering questionnaires online, many participants help reduce our expenses significantly. We are also deeply grateful for donations from NHS participants and their families, as well as other supporters, which help support junior faculty as they launch their careers.

We appreciate each of you for your continued contributions to advancing women's health. As we approach our 50-year milestone in 2026, we look forward to many more years of impactful science together!

refined grains, sugary drinks, red meat, and French fries were associated with lower risks of chronic disease.
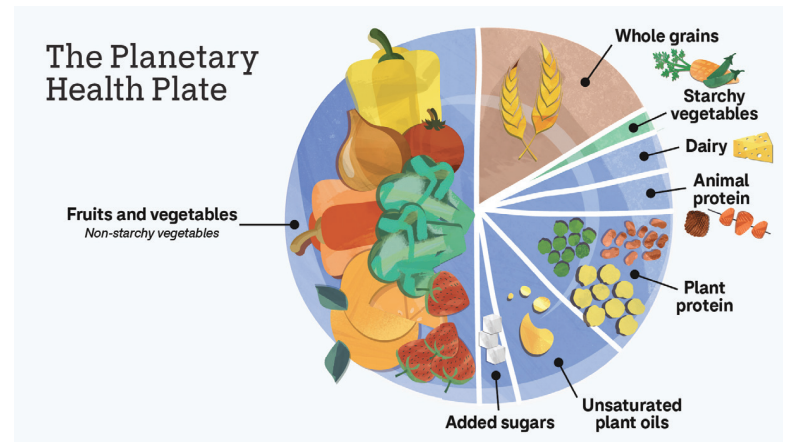
In a complementary study we observed a lower death rate among individuals who more closely followed the United States Dietary Guidelines for Americans, a Mediterranean Diet, a Healthy Plant-Based Diet, or the Alternative Healthy Eating Index (AHEI: a dietary pattern developed at Harvard to reduce chronic disease risk). These four diets all emphasize higher consumption of whole grains, fruits, vegetables, and nuts and lower consumption of sugar and saturated fat.

Healthy and sustainable dietary patterns

Taking this a step further, NHS researchers have aimed to identify healthy dietary patterns that minimize environmental impacts. Food production contributes to greenhouse gas emissions and resource depletion, making sustainable eating essential.

In a recent study, we compared the health and environmental impacts of four different dietary patterns: an overall plant-based diet, a healthy plant-based diet, an unhealthy plant-based diet, and the AHEI. We found that participants who more closely followed a healthy plant-based diet or the AHEI had a lower risk of heart disease and a lower environmental impact. Both dietary patterns emphasize higher intakes of whole grains, nuts, legumes, fruits, vegetables, and plant-based oils, while the AHEI further emphasizes sources of omega-3 fatty acids and less red and processed meat, trans fat, sodium, and sugary drinks.

A 2024 NHS study on the Planetary Health Diet, a dietary pattern specifically designed to capture food components that promote healthy and sustainable food systems, found a 30% lower risk of premature death among those who followed it most closely compared to those in the bottom 10%. These results were consistent for

The Planetary Health Plate

Whole grains · Starchy vegetables · Dairy · Animal protein · Plant protein · Unsaturated plant oils · Added sugars · Fruits and vegetables *Non-starchy vegetables*

all major causes of death, including cancer and cardiovascular, neurodegenerative, pulmonary, and infectious diseases. The Planetary Health Diet was first described in the 2019 EAT-Lancet Commission report, headed by Dr. Walter Willett. The Planetary Health Diet emphasizes minimally processed plant foods and allows for modest consumption of foods with larger impacts on the environment, such as one serving of dairy foods per day and an additional one serving of fish, poultry, eggs, or other meat.

Dietary intakes consistent with the Planetary Health Diet, AHEI, and healthy plant-based diet were further linked to lower greenhouse gas emissions, fertilizer needs, cropland use, and irrigation water needs in these studies. Interestingly, we also found that nuts, often thought to use a large amount of water, require less water per calorie than red meat, showing they can be part of a healthy, sustainable dietary pattern.

Conclusions

NHS research provides evidence that various healthy dietary patterns that emphasize plant sources of protein, even if not necessarily strictly vegetarian diets, can reduce chronic disease risk, premature death risk, and environmental impact. These findings reinforce that healthy and sustainable diets, including the traditional Mediterranean diet, can be adaptable across cultural and flavor preferences while benefiting both human and planetary health.

RECENT RESEARCH INSIGHTS

Navigating your diet with type 2 diabetes

Managing type 2 diabetes starts with smart dietary choices. NHS investigators are dedicated to understanding how different diets affect people with diabetes, offering valuable guidance for balanced eating. We hope to offer some tips to encourage healthy choices!

Focus on a balanced plate

There's no one-size-fits-all approach, but a balanced diet with plenty of vegetables, fruits, nuts, plant-based fat sources like olive or canola oil, and whole grains is a great foundation. These foods are packed with nutrients and fiber, which help manage blood sugar levels. Limiting the consumption of red and processed meats, sugar-sweetened beverages, and sodium is also important.

Exploring low-carb options

Our recent publication suggests that adhering to a healthy plant-based, low-carbohydrate diet is associated with a lower risk of premature death in people with newly diagnosed type 2 diabetes. Instead of focusing solely on carbohydrate intake, pay more attention to choosing healthful options within each category, such as whole grains, fruits, vegetables, and low-fat dairy products. Be sure to discuss any dietary changes with your doctor to ensure they fit your needs.

Mindful beverage choices

Sugar-sweetened drinks, like soda and juice, are linked to an increased risk of death for individuals living with type 2 diabetes. Opt for water, unsweetened tea, or coffee instead.

Other healthy lifestyles matter

Beyond diet, regular exercise (≥150 min/week moderate-to-vigorous physical activity), avoiding smoking, moderate alcohol consumption (1 drink/day for women; 1-2 drinks/day for men), and maintaining a healthy weight (BMI 18.5-25), is linked with a reduced risk of diabetic microvascular complications such as nerve damage and eye problems.

By adopting a balanced diet and healthy habits, individuals with type 2 diabetes can improve long-term health outcomes.

Thank you, Gary, for an amazing 36 years of service!

The NHS is lucky to have many members of our team who have worked on the study for a long time, many of them for decades! In January 2024, Gary Chase, who was the Senior Project Manager for the Nurses' Health Studies, retired after 36 years. Gary worked with the investigators to design the layout and wording on every NHS questionnaire from 1988 through 2023. Gary's team processes every completed questionnaire. Being on the "front line" of communicating with our wonderful nurses, he often acted as an ombudsman for participants, making sure that the study leaders were always aware of the concerns of the nurses.

Asked about what he liked best about working on the study, Gary noted: "The fact that the data we have collected appear in scientific papers and the mainstream press just about every month is really a cool benefit of this job. It may be 'just a desk job' but I've also been interviewed by The New York Times and PBS, which to me means what we're doing really matters. It was such a privilege to work with all the incredibly talented people who collaborate to make the Nurses' Health Study so successful."

Gary grew up in Lake George, NY and is planning to spend his retirement traveling and enjoying time with his wife and kids.

Can machine learning and artificial intelligence help us predict survival after colorectal cancer?

Colorectal cancer (CRC) is the second most common type of cancer death worldwide. A rapid, accurate diagnosis is critical for improving survival outcomes. However, traditional methods rely heavily on human expertise and lengthy genetic testing, which are time-consuming and not always available. NHS researchers are exploring whether AI (artificial intelligence) and machine learning can help improve the speed and accuracy of CRC diagnosis.

Currently, doctors manually look at images under a microscope and use their prior experience to evaluate the type and grade of a cancer. AI could accelerate this process, helping identify promising treatments more quickly while patients wait for more testing to refine their treatment regimens. In a recent study, NHS researchers developed the Multi-omics Multi-cohort Assessment (MOMA) platform, an AI model to evaluate microscope images of CRC cells to determine if cancer is present and classify their underlying molecular profile. They leveraged high-performance computing clusters that allowed them to train their model using high-resolution images containing billions of pixels. MOMA categorized CRC patients into long-term survivors, who responded well to standard therapy, and short-term survivors, who might need more aggressive treatment. It also predicted microsatellite instability, a key factor in treatment resistance—distinctions that are not visible to the human eye. Integrating MOMA into CRC prognosis strategies could significantly improve patient outcomes.

Another study analyzed 75 clinical, pathological, immune, microbial, and genetic factors in CRC prognosis using NHS and Health Professionals Follow-up Study cohort data. Applying machine learning to 815 stage II–III CRC patients, we identified seven key survival predictors, allowing us to classify patients into low-, intermediate-, and high-risk groups with significantly different survival rates.

These findings suggest that AI and machine learning could revolutionize CRC diagnosis and treatment, offering faster, more personalized care for patients. (Tsai PC et al. Nat Commun 2023;14(1):2102.)

Ultra-processed food intake and health

No association between aspartame consumption and breast cancer risk

Ultra-processed foods (UPFs) tend to be more shelf-stable, highly palatable, and profitable but often have a less favorable nutrition profile, with added sugar, salt, and saturated fat, while losing fiber and vitamins.

UPFs encompass a wide range of products, ranging from mass-produced, whole-grain, vitamin-fortified breads and cereals to nutrition-ally devoid soft drinks. While many UPFs are high in sugar, salt, and saturated fat, some healthier options, such as tofu, yogurt and whole grains, also fall into the catch-all UPF category. Given their diverse nutritional profiles, a nuanced approach is needed to assess their health impacts, and we are exploring these distinctions by examining individual UPF subtypes.

Studies from the NHS, NHSII, and HPFS cohorts consistently show that higher overall UPF consumption is linked to adverse health outcomes, including type 2 diabetes, colorectal cancer, cardiovascular disease, and overall mortality. In UPF subtype analyses, sugar-sweetened beverages, ready-to-eat meals, and processed meat, poultry, and fish were all associated with a higher risk of type 2 diabetes, cardiovascular disease, and premature death. Several adverse associations were also observed for refined grain products; higher intakes

Aspartame is a widely used artificial sweetener found in many "sugar-free" or "diet" foods and beverages (Diet Coke®) and tabletop sweeteners (NutraSweet®, Equal®, and Sugar Twin®). Recently, the World Health Organization (WHO)'s International Agency for Research on Cancer (IARC), classified aspartame as "possibly carcinogenic to humans" (Group 2B) based on limited evidence from human and animal studies. IARC investigators called on the research community to enhance the understanding of the potential carcinogenic risks associated with aspartame consumption.

Leveraging decades of data from the NHS and NHSII, we examined aspartame consumption, primarily from diet beverages and sweetener packets, and found no association with invasive breast cancer risk.

While early animal and in vitro studies suggested a possible link between aspartame and cancer, more recent human studies have not consistently supported a link between aspartame and breast cancer risk. The majority

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of dairy-based desserts and highly processed breakfast foods were associated with higher risk of premature death, refined breads were associated with higher type 2 diabetes risk, and sweet snacks and desserts were associated with risk of colon polyps. Conversely, these analyses also revealed some inverse associations for other UPF subtypes. Higher consumption of ultra-processed cereals and breads (likely driven by dark- and whole-grain breads) was associated with decreased risk of type 2 diabetes and cardiovascular diseases. Further, fruit-based products, yogurt, and dairy-based desserts were associated with a decreased risk of type 2 diabetes.

Key Points

- Limit harmful UPFs like processed meats, soft drinks, sweet snacks and desserts, and refined cereals, which are consistently linked to poor health outcomes.

- Not all UPFs are bad—foods like tofu, whole grains, and yogurt can be part of a healthy diet.

- Some foods not classified as UPFs, like refined starches and red meat, can also be detrimental to health.

- Emphasizing minimally processed foods and cutting back on sugary beverages and processed meats can significantly improve diet quality.

While UPF classification helps identify trends, research suggests that not all UPFs should be universally eliminated from the diet. Keep an eye out for more updates on this evolving topic!

Is a mother's intake of ultra-processed foods (UPFs) related to their child's risk of obesity?

According to the Centers for Disease Control, about 1 in 5 US children and adolescents have obesity and this number has increased over recent years.

To study factors influencing weight changes in youth, we enrolled children of mothers in the NHSII in the Growing Up Today Study (GUTS I and II). In an analysis of nearly 20,000 mother–child pairs, investigators found that children of mothers with the highest UPF consumption had a 26% higher risk of obesity compared to those whose mothers consumed the least UPFs. Importantly, this association remained even after accounting for the children's own UPF intake, physical activity and sedentary behavior. In a related analysis, the authors did not observe a relationship between maternal UPF consumption during pregnancy and the subsequent risk of overweight or obesity in their children.

This study emphasizes that a mother's diet during child rearing can shape children's dietary and lifestyle choices, potentially affecting their long–term obesity risk. Reducing unhealthy UPF intake may be an important dietary strategy to help curb this risk. However, UPF intake tends to be higher among women of lower socioeconomic status, suggesting that the social determinants of health could result in barriers to reducing UPF consumption. Some common barriers may include limited time for meal preparation, higher costs, shorter shelf life, and reduced access to unprocessed food. Addressing these financial and social barriers is crucial for enabling healthier diets and reducing consumption of excessively processed foods.

of studies to date have focused on artificially sweetened beverages, which are considered a good proxy for aspartame exposure, as supported by data on the country and time period of aspartame use in beverages. In our prior analysis in the Nurses' Health Studies, findings suggested no increase in breast cancer risk among women with higher consumption of artificially sweetened beverages (caffeinated, noncaffeinated, and noncarbonated low-calorie or diet beverages).

Overall, data from the Nurses' Health Studies and other studies support a lack of association between aspartame and breast cancer. The U.S. Food and Drug Administration (FDA) continues to classify aspartame as safe for the general population within the recommended intake limits, setting the Acceptable Daily Intake at 40 mg per kilogram of body weight - equivalent to ~90 Equal® packets for the average US adult.

"I've always felt that anyone who can has a responsibility to make a contribution to the betterment of all." — GENE-MARIE SPERDUTI

Gene-Marie Sperduti considers herself an "accidental nurse." Her ultimate goal was to become a history teacher, but at her mother's suggestion, she attended nursing school, which sparked an interest in trauma and intensive care, and led to a 40-year career as an anesthesia nurse.

Gene-Marie's time as a nurse cemented her belief in the importance of giving back, and inspired her involvement with the Nurses' Health Study—first as a participant and then, ultimately, as a benefactor when she left the study in her estate plans.

Based at Brigham and Women's Hospital and Harvard University, the Nurses' Health Study is among the largest-ever investigations into women's risk factors for major chronic diseases. Gene-Marie was thrilled to be offered the chance to participate, and equally impressed to see the far-reaching impact of the study, considered one of the most significant inquiries ever conducted on women's health.

So instead of teaching history, Gene-Marie has become part of it.

"I was honored to take part in something so much bigger than myself," Gene-Marie says. "It's a good feeling."

Gene-Marie's involvement in the Nurses' Health Study began in 1989 as part of NHSII. She believes the breakthroughs enabled by the study are crucial to the future of healthcare—and knows the important role that donors like her play in continuing to fund this work.

With this in mind, Gene-Marie decided to include the study in her estate plans. To honor her bequest, the Brigham welcomed her into the Brigham Legacy Society, which celebrates supporters who make a planned gift.

Gene-Marie views good health as essential to a society's well-being, and has seen firsthand how the study's findings on nutrition and lifestyle are shaping national guidelines for healthy living. She also realizes that additional questions will arise from this research, further solidifying the need for philanthropy.

Gene-Marie's story is a testament to the power of unexpected paths and the profound impact one person can have on the world. Her gift will help the Nurses' Health Study discover new ways to prevent the world's most devastating chronic illnesses.

"I've always felt that anyone who can, has a responsibility to make a contribution to the betterment of all," Gene-Marie says.

Friends of the Nurses' Health Study

Thank you for your ongoing commitment to the NHS led by Brigham and Women's Hospital and Harvard T.H. Chan School of Public Health. We are so grateful for the contributions you have made to science and public health advancements.

In this issue, you have read about Gene-Marie Sperduti, one of our nurse participants. She believes the breakthroughs enabled by the study are crucial to the future of healthcare—and knows the important role that donors like her play in continuing to fund this work. This belief also led to Gene-Marie's decision to include the NHS in her estate plans.

There are many ways to make an impact on our research

Make a gift today:

- Visit **bwhgiving.org/nhs** or mail a check using the enclosed envelope. Please make checks payable to Friends of the Nurses' Health Study.

- Make a qualified charitable distribution from your IRA. If you are 70½ or older, you can make a tax-free gift from your IRA to the NHS today.

- Recommend a grant now from your donor-advised fund (DAF). If you have a DAF, you can designate the residual funds to the NHS.

Make an estate gift:

- Name the NHS as a beneficiary of your will, trust, retirement plan, or life insurance policy. You may provide for your loved ones and direct a percentage of your assets to the NHS.

- Create a gift that provides you and/or a loved one with lifetime income. A charitable gift annuity allows you to make a gift to the NHS, and in return, you receive a fixed income payment for the rest of your lifetime.

To make the NHS part of your legacy, contact Danielle Lawlor, director of gift planning, at (617) 424-4334 or **dlawlor3@bwh.harvard.edu**.

Please let us know if you are able to connect us with anyone who might be interested in supporting research on women's health broadly or on specific issues such as healthy aging, breast cancer, or dementia prevention.

Thank you. Your support truly makes a difference.

Stay in Touch

To report name or address changes, please visit **www.nurseshealthstudy.org**
Letters and feedback are welcome!

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