THE EUROPEAN SOCIETY OF MEDICINE
Medical Research Archives, Volume 13 Issue 6

REVIEW ARTICLE

Intergenerational Interventions to Address Epigenetics and the Food Environment Conundrum

Cynthia Myers-Morrison, EdD [1]; Ilene Ray, MS [2]

[1] Certified Food Addiction Professional, INFACT; SUGAR™ Certified and Licensed, Certified Holistic Medicine for Addiction; Genogram Practitioner; Lead Author for THE FIX for cravings and We Eat Rainbows; and Board Member for Food Addiction Institute; retired educator with Los Angeles Unified School District (teacher, the English Specialist for the District, and a school site administrator); Previously Licensed Marriage and Family Therapist in CA and PA.
[2] Virginia Polytechnic Institute and State University, MA Duke University with a Certificate of Health Policy. Teaching experience includes 7 years at Temple University (Botany, Plant Physiology, Mycology, and Woodland Ecology); Middle School through High School (Biology, Earth Science, Physical Science); Head of Durham County NC Science K-12; Carolina Biological, training teachers in science education throughout the US; Board for Science and Technology for North Carolina, and the North Carolina Infrastructure for Science Education Statewide Initiative for elementary hands on science (NCISE). Retired.

OPEN ACCESS

PUBLISHED
30 June 2025

CITATION
Myers-Morrison, C., and Ray, I., 2025. Intergenerational Interventions to Address Epigenetics and the Food Environment Conundrum. Medical Research Archives, [online] 13(6).
https://doi.org/10.18103/mra.v13i6.6597

DOI
https://doi.org/10.18103/mra.v13i6.6597

ISSN
2375-1924

ABSTRACT

Preconception optimal health and well-being of both potential parents are critical determiners of epigenetic impacts on fetal development and subsequent health for 3-5 generations. With a comprehensive review of existing literature in Google Scholar, PubMed, and local resources, the biological and societal consequences of the obesity pandemic and epigenetics emphasize the critical need for systemic change. The disparity between the current food supply of ultra processed or ultraformulated foodstuffs with bodies that do not recognize them as nutrition has aided in the creation of our obesogenic global society, undernourished and overfed. Some attempts, like the ban on sugary sweetened beverages were thwarted by Big Food; however, individual and local attempts to improve the well-being of children and families are succeeding. To ascertain the status of sustainable interventions across generations, we note trending changes moving toward healthy real food. The impetus for an Intergenerational Families of Choice Model (IFCM) with non-genetic members supporting each other, like those groupings in 12 step recovery communities, addresses the need for intergenerational connections and support systems in an era of fractured families in which parents, grandparents, and newer generations frequently lack proximity in a shared community. Key insights include the links among parental health, long-term outcomes for offspring, the role of community in mitigating these effects, and the potential benefits of an “Intergenerational Family of Choice" Model or IFCM. This model invites intentional, intergenerational support networks to foster connection, resilience, and shared resources. These include creating spaces—such as schools or community centers—where generations can work and play together, share meals with real nutrient rich food at inexpensive costs, and build relationships, instead of the isolating and unhealthy patterns of fast-food culture. This framework underscores the holistic, community-driven approaches to preconception health, empowering families to break cycles of addiction, improve wellbeing mentally, physically, and socially, while nurturing a thriving, connected future generation.

Keywords: "preconception health," "obesity," "food addiction," "fetal development," "intergenerational support," “Developmental Origins of Health and Disease (DOHaD),” and "community-based models"

Introduction

This review addresses the fervent need for solutions to the intergenerational global society impacts of epigenetic changes due to lifestyles. The maternal and paternal impact of obesity, overweight, or active food addiction at conception and the subsequent adverse effects on the physical and mental wellbeing of the offspring for 3-5 successive generations are highlighted. The challenges are multifaceted: genetics, epigenetics, the current food environment, and sedentary lifestyles. The field of epigenetics has shown that the changes in a person's health and lifestyle can impact on the health of future generations. This change can be passed for 3 to 5 generations and what happened in the previous three to five generations is what is impacting on today's children.

There have been numerous attempts to regulate the amount of sugar and other nutritionally toxic additives in our food. Big business has fought back against these changes with its substantial resources and political power. To heal from the obesity epidemic some communities and researchers have come together to provide healthy intergenerational settings where everyone has access to real food to provide proper nutrition. These communities offer the benefits of recreational opportunities, education, and belonging while sharing meals and learning how to achieve healthy lifestyles. The suggestions from these researchers and the data gathered from intergenerational settings show these interventions can actively improve health. A major concern for future generations is assisting those of a reproductive age in reaching their optimum health prior to conception. Both father and mother pass on the epigenetic changes from their lifestyles. By having medical professionals and community resources supplying healthier lifestyle plans to implement, it is possible to turn the tide.

This paper reviews research studies showing the need and possible methods to assist future generations to avoid the plague of the impacts of obesity, overweight, and active food addiction at the time of conception. It also provides hope that communities can work together to improve the health of everyone by creating Intergenerational Families of Choice to support the families of creation geographically separated from families of origin.

Additional research is needed to support the scientific basis and sustainability of all these suggestions; however, there is no time to wait for the research to be accomplished. This is a call to action.

Understanding Epigenetics

Epigenetics is defined as the study of how gene expression is influenced by environmental factors and lifestyle choices. The authors note that epigenetic changes can be passed down through generations, impacting health outcomes significantly. Optimal preconception health is crucial for both parents, as it can alter the trajectory of health for future generations.

Epigenetics impacts phenotypical expression and how cells are committed to a particular form and function transmitted through lineages. Non-DNA variations can be transmitted in the cell and its lineage. Epigenetic changes from the impact of lifestyles can affect the activation of genes for future generations.[1] Up to 62 percent of gene expressions may be turned on or off dependent on environmental factors.[2]

An important contribution to understanding obesity comes from researchers who study the epigenetics or heritable and environmental impacts (both internal and external changes) that do not change the DNA but instead modify the expression of the genes. These effects might be considered as sheathing the gene's expression positively or negatively. Lifestyle changes in consumption, movement, sleep, and stress can alter outcomes. At conception, the most optimal conditions provide the greatest likelihood of a healthy placenta, fetus, and child for a life with the least negative epigenetic consequences. Thus, preconception care (PPC) for both male and female can be instrumental in altering the course of the medical costs and more importantly, the health and wellbeing of the population globally. Dr. Nora Volkow at the American Psychiatric Association Conference in 2023 remarked that the National Institute of Drug and Alcohol (NIDA) had research in place to look at pregnancies and their impact on downstream health and long-term benefits. A participant in the "Food Addiction: A new substance use designation" suggested that preconception was a more advantageous time to intervene instead of waiting until pregnancy.

"Comparatively few interventions have been made for preconception diet and lifestyle, independent of socioeconomic level."[3] However, there have been research studies and some interventions proposed and implemented. In England, the Foresight Foundation[4] worked to address these issues. Sweden and Finland have moved forward in this arena.[5–7] In 2014 as part of a Swedish longitudinal pregnancy-planning study, men were invited to complete a questionnaire about their preconception preparation. They reported choices to restrict or eliminate alcohol, drug use, and smoking, with an increase in physical activity in some cases. In Finland "What we do today is the past of the future."[8] With this belief, the interventions to remove toxins, to increase wellbeing, and to acquire healthy attitudes and practices for optimal health outcomes for the potential parents and their offspring for 3-5 generations may be manifest. Nicole Avena PhD has written two books that might be helpful resources.[9,10]

With the awareness of the apparent continuation of challenges health wise from one generation to the next, one might immediately look to the genes. The genetic implications are varied and change slowly over time; however, when we consider epigenetics and the multigenerational impacts of lifestyle, the opportunities and need for education become clear. Change the inputs today and future generations will be changed. David J.P. Barker offered the Barker Hypothesis known as the Developmental Origins of Health and Disease (DOHaD)in the 1990s and in 1992 when his book was published titled "Fetal and Infant Origins of Adult Disease."[8]

There are some researchers who differ with the epigenetic impacts. They support cultural intergenerational transmission of psychopathology through observation, imitation, and aspects of attachment

theory meshed with socioeconomic factors and chaotic home situations. These produce multigenerational replications for several generations.[9] These researchers do not always accept the biological aspects of epigenetic transmission discussed in this paper. Their hypotheses may serve additional transmission methods; however, the epigenetic transmission has adequate support in human and animal models.

Key Findings on Obesity

The costs of obesity and metabolic health insults are astronomical in the US and Europe.[3,13]

- In 2022, 1 in 8 people in the world were living with obesity.
- Worldwide adult obesity has more than doubled since 1990, and adolescent obesity has quadrupled.
- In 2022, 2.5 billion adults (43 % of those 18 years and older) were overweight. Of these, 890 million or 16 % were living with obesity.
- In 2022 over 390 million children and adolescents aged 5–19 years were overweight, including 160 million who were living with obesity.
- In 2024, 35 million children under the age of 5 were overweight.[14]

Addressing these preventable diseases caused by obesity, overweight, or active food addiction in either parent at the time of conception include: asthma, obesity, some cancers (including breast and colon), chronic kidney disease, stroke, cardiovascular disease, ADHD, autism, and metabolic diseases, including type 2 diabetes mellitus (T2DM) would save money and lives. Children of obese women tend to have high blood pressure, left ventricular thickening, increased abdominal fat mass, hyperlipidemia with reduced high-density lipoprotein levels, increased aortic root diameter, insulin resistance, and elevated inflammatory markers, which culminate in a three-fold greater risk of cardiometabolic complications than children from normal weight mothers.[15] Fathers have also been implicated in perpetuating identifiable health issues through sperm morphology and methylation. [16,17]

The addition or deletion of methyl groups on DNA can silence or turn on genes or alter gene expression by changing how the information from the genes is transcribed. Histone modifications also act as epigenetic markers to influence chromatin structure and gene expression. Noncoding RNA influences with two types: 1) Infrastructual which have housekeeping roles and 2) regulatory ones involved in expression and other cellular processes.[18]

Nutritional educational programs that include familial groups augment the incorporation of suggested strategies. Intergenerational learning for males and females is an important part of lifelong learning and in our aging societies, it is a way to enhance the social capital amongst individuals and social networks.[19]

The origins of lifetime health around the time of conception are critical. A woman who is at optimal weight and well-being when the egg starts its transit four months prior to conception is more likely to have a successful pregnancy and a healthy child. For the father, the optimal weight and well-being needs to be three months before conception for the sperm and methylation to be optimal.[20] The importance of proper nutrition in both parents, especially in adolescence and prior to conception, are public health issues that should be integrated into all health planning.

In a study of non-human primates, maternal under-nutrition (MUN) during pregnancy altered the molecular response to over-nutrition in multiple organs and tissues of non-human primate juvenile offspring. In utero exposure to MUN alters molecular pathways and regulatory mechanisms that likely lead to major changes in appetite, energy management, and storage in MUN juvenile offspring. This continues for 3-5 generations. Changed eating habits with improved nutrition before conception alter these outcomes.[21]

Obesity and eating disorders are often studied and treated separately. While the increases in obesity prevalence are well known, examination of the prevalence of obesity as a marker for sugar/carb addiction and its co-occurrence with eating disorders continues to be a challenge for public health. It is important because eating disorder behaviors are known to contribute to obesity onset and maintenance, and vice versa."[22] Their treatments are different: abstinence for substance use disorders (sugar, alcohol, drugs) and moderation for eating disorders. When they co-occur, each case is treated uniquely.

Additional concerns include eating disorders and unrecognized food addiction as a substance use disorder. Binge eating disorder and bulimia, however, may be more likely to coexist with bipolar disorder than with anorexia nervosa. Obesity may add to brain alterations in bipolar disorder and may play a role in the effects of medications on the brain. Clinicians and researchers should routinely screen for eating disorder and food addiction features when treating and diagnosing bipolar disorder to inform their physical and mental health interventions.[23]

The food environment of human ancestors was one of scarcity and random opportunities to acquire nutrient dense foods, so humans developed memory systems to attain access to resources whenever they were in that location again. In modern times, the difference between ancient options and current options changed more rapidly than our human genome might adapt. Thus, in the last 75 years, we have gone from circumstances that were more like ancient times with some irregularities with food resources e.g., wars, famines, and droughts, to increasingly consistent access to ever more ultraformulated substances that bodies can barely recognize as food. Once the population of the world lived with hunger and now with malnutrition, undernutrition, and obesity resulting from overconsumption of products provided with low or no nutrient density, only excess calories. The outcomes lead to overweight, obesity, metabolic syndrome, and sugar/carb addiction (known colloquially as food addiction or ultra processed food substance use disorder.)

The results of the epigenetic changes have led to infertility and overconsumption of food resources. The

maternal and paternal health and wellbeing of potential parents 4 months prior to conception have diminished to create the multigenerational impacts on subsequent 3-5 generations. Polycystic Ovary Syndrome (PCOS) and methylation issues interfere with conception; hormones in the fat cells interrupt the smooth transition to placental development for fetal development. Parents pass on epigenetically impairments that influence development in utero and after birth through adulthood and earlier deaths for the offspring.

To eradicate these impacts, education, preconception planning, and preparation are essential. To accomplish these changes, society must enhance the lifestyles to support healthier development of potential parents and their offspring. This may require substantial changes in how individuals choose to spend their money: i.e., real food instead of formulated products; familial experiences instead of the acquisition of tangible things; enjoyable movement; adequate sleep; and clean water and air to support human growth and longevity. With the power of the purse and a vote, each person can choose the desired future for self and 3-5 generations of offspring.

Current Food Environment

This document discusses the modern food environment, characterized by the availability of ultra-processed foodstuffs that contribute to obesity and related health issues. The shift from ancestral diets, which were nutrient-dense, to contemporary diets filled with low-nutrient foods has led to widespread health problems, including metabolic disorders and food addiction.

A new field of nutrigenomics shows that the genes may not change; however, the epigenetic mechanisms such as DNA methylation and histone modification, which can be influenced by the intake of specific nutrients, change outcomes of epigenetic expression through multiple generations. Micronutrients and macronutrients, including vitamins and minerals (zinc and magnesium) and macronutrients (carbohydrates, proteins, and fats) also play critical roles.

The interplay among nutrition, genetics, and environment highlights how these factors also play critical roles in shaping health outcomes. As our understanding of these connections deepens, it underscores the necessity of a holistic and proactive approach to health that considers not only immediate dietary choices but also their long-term impacts on future generations. (An example might be B12 deficiency in vegans,[24] if not adequately supplemented, or the micronutrient deficiency when diets are too restricted by individual or cultural choices.[25] (A sidenote: the leaders in the Mayan culture were fed seafood even when they did not reside close to the ocean, which led to increased height and wellbeing per guides at Tulum.)[26]

Connecting generations to mitigate epigenetic effects of poor diets may be useful as the grandparents' generation may have eaten more real food than the current generation and their offspring and grandchildren. This helps only when the grandparents are aware of the hyper palatability of ultra processed or ultraformulated foodstuffs. There is a need for holistic strategies to increase collaboration among individual, interpersonal, community, and societal dimensions to improve micronutrient health for equity across different cultural and socioeconomic groups.

THE ROLE OF NUTRITION

Nutritional education and intergenerational learning can enhance the health of families. Advocates are needed for community-based interventions that promote the consumption of real, nutrient-dense foods rather than processed alternatives. The need is highlighted for holistic strategies that address education and access to real food.

Numerous examples have shown the biochemical and biological outcomes of dietary habits when changing from scarcity to overeating less than adequate nutrient deficient formulations instead of real food.[27] Snacking and volume eating with supersized meals have overtaken the ability of human bodies to use the formulated substances, as people have additionally become increasingly sedentary. Food deserts have limited access to real food.

Numerous complaints about the costs of healthy foods fail to consider the costs of junk food, fast foods, sugary sweetened beverages, chewing gum, and candies.[28] Real food from farmers' markets, home-grown gardens, and community gardens can provide healthy alternatives and changes to sedentary lifestyles.

Traditional food and cultural heritage have aspects that may have come from historically impoverished lives and circumstances. With worldwide markets and global resources, options are available that seasonally did not exist before; however, still it may be helpful to eat locally and seasonally available real foods.

EFFECT OF FOOD MARKETING AND ADVERTISING ON DIETARY CHOICES

Children can be influenced by even 5 minutes of marketing targeting them.[29,30] Children are also influenced by the location, i.e., placement of highly palatable ultra processed and formulated substances at eye level for a child in the supermarket. This may be addressed by parents and educators to create an informed group even for 5-year-olds. These youngsters then may be able to educate their parents and grandparents. Spain, Britain, and the US have been changing responses nationally to foodstuffs children are eating.[31–33]

Gentrification has impacts on what and how children eat. One study of children in gentrified neighborhoods, documented that when children had a greater number of healthy food opportunities, their BMIs were lower.[34] There is conflicting research that suggests that in different boroughs in New York City, for example, that obesity increased when gentrification occurred with more access to junk food; however, this was not universal.[35,36] Even when gentrification has occurred in cities, the population health results have been mixed.

Almost 30% of youth in a study had excess BMI, including 736 (15.0%) with overweight and 672 (13.7%) with

obesity, and statistically more Black and Hispanic compared to white, Asian, and non-Hispanic youth ($p < 0.01$). Those with obesity or overweight were less physically active, slept less than recommended, snored more frequently, and spent more time using an electronic device ($p < 0.01$).[37]

In addition to biological factors, there are sociological factors. Young people are moving to cities from towns and rural areas where the older population continues to reside. Small numbers of people over 65 reside in neighborhoods with young people. The divisions have increased the mental, health, and social care costs. Increased anxiety and loneliness are frequently noted outcomes worldwide.[19] Opportunities for social connection between generations in the UK have diminished over the last few decades due to changes in the way people live and work.[38] There are many potential economic, social, and political impacts of generations living separate and parallel lives, such as higher health and social care costs, an undermining of trust between generations, reduced social capital, and increased levels of anxiety and loneliness. Furthermore, government agencies closed the spaces, like libraries and community centers, where people of differing ages used to mingle, and religious attendance also declined. Opportunities to interact and access services are significant modulators of social interaction.[39]

A narrative review provides a description of how different food literacy competencies develop in childhood and adolescence to integrate cognitive, social, and food-related development, thus targeting the multidimensional nature of food literacy and promoting the development of the 3 types of competencies: relational, functional, and critical. Positive early childhood experiences contribute to healthier and more sustainable eating habits.[40] During the first 1000 days of life, children experience pleasure with foods as they become familiar with different ones.[41] This process had started during pregnancy and breastfeeding with the mother's preferences for foods or substances.[42] Complementary feeding and children's transitions to omnivorous eating plans can support varied flavors and textures and diversity in food resources. Adolescents often reject parental choices to adhere to peers' choices. Becoming educated and resourceful is part of food literacy. Learning to optimize the choices within budgetary confines is a skill set that adolescents and young adults need to navigate preconception preparation with ease. Intergenerational communication supports these endeavors.

Sedentary Lifestyles

"Even when people present an adverse genetic condition that predisposes them to be obese," increased physical activity can reduce excess adiposity in youths.[43,44] The waist-to-hip ratio appears to be a useful one to identify young people and teens who are overweight.[45]

Besides the Western diet, sedentary lifestyles and low levels of physical activity have been referenced with an increased risk of chronic diseases. Of 3316 Finnish participants between 25 and 74 years of age, higher levels of physical activity offered a reduced risk of type 2 diabetes.[46] With 88,140 participants aged 40–85 years, higher levels of physical activity are associated with a reduced cardiovascular disease risk."[47]

By limiting sedentary behavior, such as sitting for extended periods of time, new habits of getting up and moving on a regular basis throughout the day can help reduce the risks of chronic diseases. Workplace wellness programs can encourage workers to change sedentary habits.[27]

DEVELOPMENTAL ORIGINS OF HEALTH AND DISEASE (DOHaD)

When societies in the west purveyed their ultra formulated foods, making them available in markets around the world at fast-food vendors, the health changed from hunger to overconsumption without addressing nutritional needs. [48,49]

Interventions around the world need to be offered at all ages as the impacts have been cross generational. To change the most radically and quickly, the children need their food to be real food. They also require movement, clean water, clean air, and adequate sleep. When these children reach the age of conception, they will be healthy enough to find partners who are equally healthy to then plan pregnancies before conception occurs. The removal of toxins and molds, the increase of micronutrients, and an increased variety of healthy options for wellbeing will be optimal to create the next generation.

A review of the biological nature of preconception challenges, solutions, and a three pronged approach includes the Developmental Origins of Health and Disease (DOHaD) hypothesis by Barker, reiterated by Campbell, Myers-Morrison, Tan, and others.[11,15,50,51]

David A. Kessler, previously the commissioner of the Food and Drug Administration (FDA), 1990 to 1997, published in 2025 *Diet, Drugs, and Dopamine, the new science of achieving a healthy weight.*[52] He recognizes that obesity is not a matter of willpower and identifies the power of the ultra-processed substances/foods, and he refers to them as "ultraformulated to manipulate the brain's reward system."[53]

While health and weight suggestions have been made to young adults for decades, gynecologists have reported that most women arrive at the OBGYN *after* they are pregnant. To intercede prior to conception, gynecologists might make interventions during the *first* OBGYN visit of a preteen and offer educational materials then for optimal weight and well-being 4 months before conception. For males at any medical visit, the information on the importance of the male in the conception process might be reviewed with a focus on optimal weight and well-being 3 months before conception. Masculinity may be the point of access for discussion with males.

Male fertility and sperm motility are connected to nutrition and body composition in humans and rodents. Elevated BMIs are associated with reduced sperm motility, increased sperm abnormalities, reduced serum testosterone, and increased estradiol concentrations. Consumption of a 'Western-style' diet laden with sugar, fat, and processed foodstuffs is also connected with reduced sperm motility; while consumption of energy-

dense diets (often low in nutrition) in men and rodents is associated with poor sperm motility, morphology, and DNA integrity.[13]

In 2021, the United States Department of Agriculture (USDA) revealed that 12.5% of US households with women of reproductive years and children experienced food insecurity.[54] Poor maternal nutrition during pregnancy is linked to intrauterine growth restriction (IUGR) and negative health outcomes listed previously. These may occur with overnutrition as well as under nutrition as both are considered malnutrition. Most multigenerational studies aim to disentangle genetic, lifestyle, and environmental contributions to the developmental origins of health and diseases across generations. More research is needed on large multigenerational groupings of up to four or even more generations, and more studies from low- and middle-income countries are needed as well. Greater recognition that developmental origins play a significant role in epidemiology has entered the literature.

How disease results from a complex interaction of lifestyle factors, disease states, and environmental exposures, all influencing biological processes like inflammation, oxidative stress, metabolism, and the epigenome was proposed for the *Transgenerational consequences of pre-conceptional and in utero exposure to real-life chemical mixtures on fertility and metabolic health* by Vasantha Padmanabhan and his colleagues at University of Michigan at Ann Arbor. Children can experience developmental programming across generations. These factors must be considered.

Lifestyle factors include dietary choices and nutrition, a sedentary lifestyle, substance abuse, psychosocial stress, and medical interventions—all of which can contribute to physiological stress and disease risk. Disease states include obesity, polycystic ovary syndrome (PCOS), gestational diabetes, preeclampsia, and genetic mutations. Environmental factors further influence health outcomes and include exposure to plastics, pesticides, industrial emissions, phytoestrogens, and more inclusive climate-related effects.

Together, these elements interact with the body's internal systems—represented by endogenous signals, the microbiome, and the epigenome—driving the disease model through inflammatory responses and oxidative stress. Hormones (androgens, estrogens, insulin, leptin), and inflammatory indicators, may be used to indicate or monitor the disease processes.[55]

In the 2024 Tan et al. study of 28 multigenerational cohorts in 19 countries worldwide, they looked at the gaps in the Developmental Origins of Health and Disease (DOHaD) and intergenerational inheritance research with a scoping review of multigenerational cohort studies.[51] According to the DOHaD hypothesis, lifetime impacts of development and disease are connected to a variety of experiences, events, and toxins during pre-conception through prenatal, birth, and early life periods and affect an individual's development.[56–61] Beyond the DOHaD hypothesis, recent evidence suggests-prior exposures can be transferred across generations even when the exposure experience is not in the current generation.[55,62–64] Thus, it is essential to consider doing genogram-like interviews to capture the cross-generational factors to determine health risks. Taking into consideration the multigenerational relationships has profound implications for those implementing public health interventions to prevent diseases.[65] Tan suggests the cohort study of multiple generational effects of 4 or more generations amongst human subjects will be vital to the directions of research on epigenetic versus genetic changes.

The topics studied included: "cardiovascular diseases (stroke, heart failure, angina pectoris, myocardial infarction, coronary heart disease, and atrial fibrillation), and child health (low birthweight of infancies, child physical and/or mental development). Followed by mental health (depression, anxiety, autism, post-traumatic stress disorder, suicide), respiratory health (asthma, chronic obstructive pulmonary disease), diabetes mellitus, and hypertension. Besides, cancers (breast cancer, ovarian cancer, prostate cancer, endometrial cancer), cognition function (dementia), reproductive health (preeclampsia, gestational hypertension, endometriosis), allergic disease (atopic dermatitis, eczema, rhinitis, food allergy) and social inequality were also taken as outcomes by some cohorts. Few studies also investigated more specific diseases, such as headaches and oral health."[51]

LifeLines cohort study, the Uppsala Birth Cohort, and the Framingham Heart Study are three multi-generational cohort studies. From these studies identification and detailed reviews of specific data points will be necessary to expand these into the multigenerational research crucial to verify the above-mentioned multigenerational effects among human subjects reported by David Barker, Herbert Rinkel et al, Hoffman et al, and Myers-Morrison. A unified framework to categorize multigenerational cohort studies or to summarize their characteristics remains a need to make the changes in societies and stop the current tolls of physical and mental carnage.

If these suggestions are implemented with universal education and clear, concise information on the unintended and devastating outcomes, we may move the needle. Because of the impact of 3-5 previous generations and even on those children already conceived, there need be no shame and no blame for past experiences; however, once one knows, one knows and cannot blithely continue. Breaking the chains of addiction is part of the preparation. Breaking the chains of intergenerational negative impacts prior to the next conception is an individual responsibility for each member of a couple and for each family group.[13]

Interventions

A NEED FOR INTERGENERATIONAL CONNECTIONS

Highlighting the importance of shifting from merely multi-generational gatherings to active intergenerational engagements that promote mentoring and community service aims to support individuals. By pursuing healthier lifestyles and creating families of choice to provide support systems when traditional family structures are geographically distant, we can foster trust and belonging which can lead to improved health outcomes for families of creation and choice over generations.

Some resources may be useful to expand the broken traditional family by adopting a chosen family of choice intergenerationally in proximity to the family unit. If generations are brought together in communities, even though they may not be genetically related but instead are extended families of choice, the intergenerational interactions in family and community gardens, local food co-ops, community farming, and community sponsored agriculture may give younger generations and older generations the opportunities for cross generational learning frequently possible in traditional families in a previous era.

School based nutrition initiatives can prepare children for the marketplace and help them to navigate the gauntlet evident in markets today. Taking children shopping with parents and grandparents after the children have gained marketing skill sets may help all the generations. Strategies like circling the external perimeter of the market and rarely going into the aisles are now subverted by glazed donuts, breads, and cakes on the outer perimeter. Food literacy skills, cooking skills, and cognitive strategies can all help youths choose micro nutrient rich, real foods.[66]

Family and community workshops on how to cook in healthier ways at home, how to "batch cook", how to prepare crock pot meals while at work, and how to shop farmers' markets to access real food at lower prices than those in the supermarket may help change the direction of eating habits and health outcomes.

Communities, counties, and states or other municipalities may advocate healthier food policies with the elimination of special interest groups in the government. People in underserved areas or food deserts might be offered government incentives to be able to go to nearby places where food choices are healthier in their availability.

Suggesting societal interventions with the acknowledgement that these may be unlikely allows for a fallback position which is for the revolution of individuals who express the power of their purses to purchase only real food and healthy experiences in place of the ultra-processed or ultraformulated foodstuffs (UPFS) and previous acquisition of more belongings. Additional research is needed to support the scientific basis and sustainability of all these suggestions; however, there is no time to wait for it to be accomplished. Globally we need to stop purchasing foodstuffs and stop acquiring belongings while we start to implement healthier lifestyles and sustainable practices.

Strategies to contribute to healthy eating habits are shown below:

1. 1."Disseminate the need for health planning in the pre-pregnancy phase. The quality of eating habits during the pre-conception period positively influences the health of the future baby.
2. Offer nutritional support to pregnant women {and the partner for a healthier lifestyle when the baby arrives} and then adoption of a healthy lifestyle for newborns, toddlers, young children, and teens.
3. Choose structured eating practices to support the child's autonomy, healthy choices, and ongoing practices.
4. Avoid coercive, restrictive and prohibitive practices, and avoid indulgent or permissive eating styles.
5. Promote children's self-regulation and healthy eating habits modeled by the parents.
6. Promote a positive and safe emotional and physical home environment.
7. Be a good example. Share family meals often with quality interactions and communication during meals. Avoid screens at mealtimes.
8. Limit access to food ads.
9. Ensure nutritious, affordable, attractive meals at home. Children can witness pleasurable meals and conversation while eating healthy foods with multigenerational family groups.
10. Abstain from offering or permitting the offer of food as a reward or consolation."[67]

In six of the countries studied by Doak et al., 22–66% of households had dual burdens with an underweight person and an overweight person. In these settings obesity prevention approaches might focus on benefits of good health for all, such as increasing fruit and vegetable intake while improving overall diet quality and increasing physical activity.[68]

Dr. Georgia Ede, psychiatrist, has suggested in *Change Your Diet, Change Your Mind* that emphasis on real food with single item labels, fruit, vegetables, animal and vegetable protein, and olive/avocado/butter/coconut oil and the elimination of grains, sugar, alcohol, powders, and legumes may resolve many challenges physically and mentally.[69]

THE GLOBAL SYNDEMIC

"OECD countries" refers to the 38 member nations of the Organization for Economic Co-operation and Development which share concern about the impacts of obesity on health, Gross Domestic Product (GDP), and other outcomes burdening the globe.[70]

In 2011 OECD reported, "Unlike other major causes of preventable death and disability, such as tobacco use, injuries, and infectious diseases, there are no exemplar populations in which the obesity epidemic has been reversed by public health measures. This absence increases the urgency for evidence-creating policy action, with a priority on reduction of the supply-side drivers."[71]

Malnutrition presents in diverse forms: obesity, undernutrition, and other dietary risks. Globally this is the leading cause of poor health. Soon, climate change with its impact on malnutrition will become a pandemic because of its decimating effects on the health of humans and the planet. "These three pandemics—obesity, undernutrition, and climate change—represent The Global Syndemic…. They constitute a syndemic, or synergy of epidemics, because they co-occur in time and place, interact with each other to produce complex sequelae, and share common underlying societal drivers."[72] The OECD Commission recommended in 2019 "comprehensive actions to address obesity … which represents the paramount health challenge for humans, the environment, and our planet in the 21st century."[72] We are now in 2025, and still no exemplary population exists as a nation. GreySheeters Anonymous may be a 12-step group exemplar with its report of the median of

12 years of abstinence from grains and sugar for all those who have over one year of abstinence (greysheet.org/census). Even though the group is relatively small, the sustainability of an eating plan free from many of the components of ultra processed/ ultraformulated substances may be a helpful model.

To create solutions, communities need to be involved: city governments, community planners, medical professionals, educators, family members, and dentists. We are currently draining resources for healthcare, and we need to stop the outflow. Efficiency of the workforce is being depleted. Cognitive resources are impaired with foggy brains. Ameliorating the impacts of these preventable disorders and diseases could release trillions of dollars worldwide to provide access to research, medical access, and social assistance to those in need and future generations.

We know that communities have made various attempts to address the cultural, familial, community, national, and global challenges with significant strides forward, at times. This review article offers multiple solutions adapted in communities worldwide, suggesting ways to accomplish them in various settings. Calls to action in the following areas: familial/kinship, education, economics, politics, spiritual, associations, and health offer venues for those who support change in the global health crisis. Peace Corps has for years used the program outline above in the calls to action to change situations in countries considered to be "third world" at the time. Now these same calls to action are needed around the globe. In addition, technology, values, and sustainability might be added. Evidence-based science is still needed; however, do we have time to wait? Many would say, "No!"

INTERGENERATIONAL AND COMMUNITY POSSIBILITIES FOR SOCIETAL CHANGE

A collective effort from communities, policymakers, and families can address the health crisis stemming from obesity and undernutrition. Individuals can leverage their purchasing power to choose healthier food options, thereby influencing broader societal change more rapidly.

We need to address the intergenerational and community possibilities and gather evidence rather than waiting for it to be presented. We need to act now rather than wait for another generation to be plagued by obesity and its deadly health issues.

Politicians could redirect political paper leafletting investments into actual service and meeting the constituencies. After-school activities, field trips, and homework assistance can be supported by groups such as the League of Women Voters, Shriners, Soroptimists, religious groups, local companies (with provision of space and coupon offers), and resource exchanges for businesses, depending on the individual communities. Working with colleges and universities to support the younger population brought positive outcomes in AmeriCorps, Teach for America, and the Peace Corps, for example.

In WWII, Britain's canteen model successfully fed populations across socioeconomic levels.[73] Restaurants today provide leftover food for community pantries. At the same time, a few people might prepare the food in a revitalized school or office building where children and young people can stay after school to do homework in a supervised setting with seniors. Parents might then arrive to eat real food in an inexpensive setting with their children and teens and unrelated seniors. Dancing, game nights, readathons, community gardening, sing-alongs, and classes in meal preparation with real food could precede or follow the meal.

Franchised healthy vending machines with the removal of unhealthy choices and the inclusion of healthy options (water, fresh fruit, nuts, seeds, protein snacks, egg wraps, dried veggies, jerky, plain yogurt, cottage cheese, vegetable sticks, or Lactaid milk) might also be available for those requiring vending machine products.

Once a model has been created, the template might be packaged and replicated, like the process of Collaboration for Kids in Britain now. Collaborative Health Community (CHC) Grants support the creation and then replication and research on programs of this sort.

Residential settings for young adults who have been experiencing drug and alcohol addiction, oppositional behaviors, and mental health issues may now be helped to transition to college or workforce settings in the community. With a structured environment and peer group activities and support, these circumstances are like those parents in the 50s through the 70s or 80s might have provided on visits home from college and for those transitioning into the post-high school workforce.

Intergenerational or Multigenerational Centers in New Mexico, Arizona, and Texas[74] currently offer activities and fresh food, locally sourced for elementary, middle school students, teens, adults, and seniors. This service could be replicated to increase the populations served and include people of various ages worldwide. This replication of aspects of the canteens available to WW11 Brits might instead of the general population now include parents, grandparents, and young people who previously were stopping to get expensive and nutrient-deficient fast food instead of preparing real food at home. Supporting the collectives of farmers' markets can increase the use of local, seasonal fresh fruits and vegetables, eggs, buffalo, grass-fed beef, and butter. The costs would be lower and the nutrition density higher.

Churches, synagogues, ashrams, mosques, and other non-denominational groups, including Shriners, Junior Chamber of Commerce, Rotary Club, and others, could be involved collectively throughout the year, providing celebrations and models of Community Get Togethers. We can start to mend the spiritual, ethnic, socioeconomic, and racial divides. Removal of collective stressors can improve the mental and physical well-being of everyone involved, from preconception potential parents to age-wise folks. The Daniel Plan, with architects Pastor Rick Warren, Dr. Mark Hyman, and Dr. Daniel Amen,[75] has been implemented already in religious organizations, including churches, mosques, and synagogues.

So many attempts have been made successfully, but sustainability has not been proven. Aware of the problem

for 75 years (since Herbert Rinkel and Theron Randolph 1951 coined the term "food addiction"[76]), groups and individuals have tried to make changes locally; however, we are still floundering globally. New York City Mayor Bloomberg implemented the ban on sugary sweetened beverages over 16 ounces. Published nationwide in the US, it brought attention to the American diet's excess sugar and its detrimental effects. A flurry of activities followed, with some school vending machines being changed to healthier products, but eventually Big Food or Beverages won out.[77] Sugar taxes have been useful.[79] Juices were an incremental improvement. Flavored sparkling water instead of soda and juice was an improvement, but the inclusion of plain water only made it into some of the machines. There's been an underlying awareness that we need change; however, Big Food, Big Pharma, and individual manufacturers also have fought to maintain their profits. In addition, research, focus, and sustainability are essential.

In 2007, a meta-analysis identified the effects of soft drinks on health. From 1999-2008 with 24-hour recall data and later in a 2012 report sugar consumption patterns including SSB heavy consumption tripled for all but children. In 2015, nutrition education still suggested limiting soft drink consumption. Decreases in SSB were mitigated by increased consumption of high energy sports drinks.[79] In Idaho, in April 2025, SNAP banned candy and soda purchases. The CDC supported this recommendation.[80] Progress is slow.

With the increase of the obesogenic environment in the marketplace and the widespread use of High Fructose Corn Syrup (HFCS), obesity increased. In the US, farmers received subsidies to raise corn, which was then used to produce HFCS. Due to the surge in HFCS in industrialized food supplies and ultra-processed foods, food chemists became masters of addictive ultraformulated foodstuffs. Highly palatable, ultra-processed foods appear to be causing weight problems. Children are now suffering from non-alcoholic fatty liver disease (NAFLD), type 2 diabetes, and heart issues at earlier ages.[81]

Simultaneously, advancements in technology made phones and screens accessible to young children, resulting in a notable decrease in their activity levels. Their social interactions and physical activity declined because they were increasingly connected with their screens. Children stopped eating meals with family members, instead shifting from watching TV together to eating alone in separate rooms. They socialized more with similarly aged peers, often unsupervised. This, along with increased exposure to drugs, alcohol, gaming, and other addictive behaviors, compounded the problem.

The grandparent generation has become isolated, often placed in nursing homes because both parents were working, and children were not competent caregivers. Societal structures weakened with the increased mobility of the workforce. The number of latchkey children rose in the 1970s and 1980s. Over the past 80 years, societal breakdowns resulted from migration for education and work, such as through the GI Bill. Grandparents, in many cases, became the primary caregivers, offering foods remembered from their childhoods; however, those foods, now ultra-processed, are no longer the same. Parents providing meals are often fast food, prepackaged items, or snacks, due to their own exhaustion at the end of the workday. The shift in activity levels from the 1950s to today has contributed to declining health. Increased urban density, reduced physical engagement, and screen time at work and during leisure have taken a toll. Incorporating physically active lifestyles is part of the solution.

Social inequity adds to the burden, thus requiring programs like SNAP and WIC. In food deserts, small markets often lack access to fresh, healthy food. Changes to support the new concept of families of choice with multiple generations included are essential to support children, teens, young parents, empty nesters, and seniors. All have become isolated, and the solutions they have found have included substances that are not real food. These solutions have led to the intergenerational challenges we now experience.

FRIEDENS'S HEALTH IMPACT PYRAMID MODEL

Dr. Thomas R. Frieden created the health impact pyramid. In his model the top segment is counseling and education while the base includes the socioeconomic factors as possibilities to change the health and wellbeing of the population. The top includes dietary counseling and programs to increase movement, and these require the most individual effort and have the least population level impact. The benefit is that individual people can make changes in their own lives and in the lives of subsequent generations, if they have children or participate in families of choice. The socioeconomic factors at the base of the pyramid include addressing education, poverty, and the food providers. This level has the greatest potential population impact with the smallest amount of individual effort, but this requires systemic change. This has the disadvantage of requiring large population groups to agree on what needs to be done. Clinical interventions, long lasting protective interventions, and changing the context to make individuals' default decisions healthy are sections of the pyramid that are between the bottom and the top. [82]

The pyramid is a feedback loop, that is informed at the ground level by scientific discoveries and population statistics; whereby, health professionals and universities can develop programs to help change the food environment, eating patterns, and the sedentary lifestyles contributing to the obesity pandemic. Scientific information and understanding of how individual body energy systems work will inform people at every level of the pyramid. Hopefully, the individual changes at the top will pressure the public resources at the bottom in a continuous feedback loop. Education of people at all levels about scientific discoveries is essential for the loop to circulate.

ACTIONABLE STRATEGIES

Various strategies to promote healthier eating habits and lifestyles, include 1) Preconception Health Planning: Emphasizing the need for nutritional support for potential parents and 2) Community Engagement: Encouraging intergenerational activities that foster connections and shared learning experiences.

The next question is what can be done to create intergenerational interventions?

- Focus of the intervention (the activities involved in the intervention might be at community centers, at libraries, or at home:
- Skill Development (cooking, dancing, making music, doing art or crafts, playing chess and other board games, younger helping older generations to learn and use technology)
- Physical Activities (sharing environmental activities, exercise, gardening, playing athletic games)
- Mentoring (teaching or sharing educational knowledge, history, language learning, practicing writing or texting each other, older generations helping younger generations to learn math, conducting science activities together)
- Shared Experiences (generations visiting places or attending events together, sharing meals sharing literature together, cultural experiences)
- Living together with students/young adults living with older generations with no familial connection.
- Reminiscing when older generations are encouraged to reminisce by the presence of younger generations.
- Sharing perspectives of being an older person/a child/young person.
- Storytelling one generation tells a story to another.
- Other—any intervention not covered by the descriptions above, such as general presence/assistance in a school context.[50]

A meta-analysis of mouse paternal and maternal protein undernutrition identified distinct parental periconceptional contributions to postnatal outcomes. They then proposed that "the evidence for periconceptional effects on lifetime health is now so compelling that it calls for new guidance on parental preparation for pregnancy, beginning before conception, to protect the health of offspring."[13]

We do suggest longitudinal studies identifying the long-term effects of such interventions as the GLP1s and other drugs now being recommended for younger people for whom these drugs now are termed "forever drugs" because the effects of weight loss are lost when the drug is removed if lifestyle changes have not occurred prior to the removal of the drug.

Conclusion

Immediate action is necessary to address the health challenges posed by the Global Syndemic of obesity, undernutrition, and climate change. By fostering intergenerational relationships, promoting healthy preconception practices, and creating supportive community environments, it is possible to improve health outcomes for current and future generations.

Preconception planning and its benefits have been shown scientifically in animal and human models to mitigate the epigenetic impacts of obesity and its causal agents: highly palatable and ultraformulated foodstuffs that are highly caloric and nutrient deficient and are inconsistent with our food environment.

Epigenetic analyses are evaluations needed in all future research on metabolic and health issues currently plaguing our global society. The research exists on the negative outcomes in this generation. The previous generations since the 50's have annually declined in a variety of measures. Seeking means to reverse the directions of these health measures is essential to leverage the epigenetic changes we can manipulate with commitment to lifestyle changes.

Might we look at small populations that have removed sugar and grains for decades to see what their health outcomes are? Can we look at the blue zones to see what the positive and negative impacts are? Might we look at the outcomes for those who have chosen vegan, carnivore, keto, low carb eating plans? Might we also look at the nutrition of those on GLP1s and make certain that nutritional needs are being met? Might we determine how best to do that while weaning off the GLP1s over time or merely revisiting them periodically? Brenda Wollenberg and Alicia Mazari-Andersen with the Gene Reset Blueprint make suggestions based on collections of genetic configurations with epigenetic lifestyle changes. Might these be of help to individuals?

Once successful eating plans have been identified, how might these be scaled to family and community plans and then national plans supported by the very stipends now supporting corn, tobacco, and wheat? In diverse communities, how might the strategies for broader implementation include cultural and ethnic flavors in ways that support the varieties of human experience while increasing the nutritional outcomes? Or is the best plan an individualized plan addressing the needs and tastes of each person? Might the guidelines be general and then the individual chooses from the alternatives to match the individual's genetic and epigenetic needs for optimal health? David Kessler in *Diet, Drugs, and Dopamine* comes close to this. A new wave of more individual responsibility and choice is now available. If we are not able to alter the Big Food and Big Pharma constituencies rapidly enough, we can return to the top of Frieden's pyramid to the changes individuals can make to achieve optimal health. This is the call to action.

Intergenerational interventions are needed to create families of choice which offer support to younger generations and augment the healthy interchanges that occurred earlier in history when family members lived in proximity to each other instead of fragmented and distant physically. Using the Intergenerational Families of Choice Model can assist the families of creation in their endeavors to raise healthy, happy young people with values that support wellbeing and health mentally, physically, and spiritually. Each child who grows up to young adulthood with a healthy sense of self and a healthy body will be a win. To turn the tide may take time; however, the tide can turn and these methods using the power of shared intergenerational strengths will ultimately have the surest and quickest impact.

Collaboration and healing of divides will be essential. Researchers, policymakers, communities, spiritual and religious organizations, associations, and kin can join to empower individuals, families, and communities to eliminate food cravings and achieve healthy lifestyles. Providing comprehensive support, preconception preparation, and lifestyle maintenance will foster a

healthier life for each one and for future generations. These are the goals.

Is this the time to remedy this situation? Yes. We have waited since the 50's and 70's and 90's and now 2025. With the fractured families, hyperpalatable ultra processed foodstuffs (UPFS), and the decreased shared activity levels added to the Global Syndemic of three pandemics (obesity, undernutrition, and climate change) most people in every country and region worldwide are impacted. Societal changes are needed. Now is the time.

There is enough evidence to support community action. We are responsible individually and collectively to make the changes described above. The call to action is to spread the information so more people might change their consumption patterns, prepare with planning for preconception to be at optimal health for both parents prior to conception, to choose to raise families with nutrient dense real food and vibrant experiences for mental, physical, emotional, and spiritual wellbeing and growth, and to engage in creating intergenerational families of choice to augment the families of origin and creation. Additionally, each person has a responsibility to support societal intergenerational experiences to connect and increase the sense of belonging and purpose over a lifetime of well lived days.

Conflicts of Interest Statement

The authors have no conflicts of interest to declare.

Acknowledgements

We extend our deepest gratitude to the researchers, clinicians, and community advocates whose pioneering work in epigenetics, nutrition, and intergenerational health has informed this review. Special thanks to the interdisciplinary teams whose studies on Developmental Origins of Health and Disease (DOHaD) and the Global Syndemic have provided critical insights. We also acknowledge the resilience of families navigating the modern food environment and the policymakers striving for systemic change. Finally, we appreciate the thoughtful feedback from our peers, whose constructive critiques strengthened this manuscript.

References

1. Alegría-Torres JA, Baccarelli A, Bollati V. Epigenetics and Lifestyle. *Epigenomics*. 2011;3(3):267-277. doi:10.2217/epi.11.22
2. Bian Z, Wang L, Fan R, et al. Genetic predisposition, modifiable lifestyles, and their joint effects on human lifespan: evidence from multiple cohort studies. *BMJ Evid-Based Med*. 2024;29(4):255-263. doi:10.1136/bmjebm-2023-112583
3. Stephenson J, Heslehurst N, Hall J, et al. Before the beginning: nutrition and lifestyle in the preconception period and its importance for future health. *Lancet Lond Engl*. 2018;391(10132):1830-1841. doi:10.1016/S0140-6736(18)30311-8
4. The End of an Era. Foresight. Accessed May 26, 2025. http://www.foresight-preconception.org.uk/
5. Berglund A, Lindmark G. Preconception health and care (PHC)—a strategy for improved maternal and child health. *Ups J Med Sci*. 2016;121(4):216-221. doi:10.1080/03009734.2016.1191564
6. Schmidt A, Bachmann G. An Overview of Finnish Maternal Health Care As a Potential Model for Decreasing Maternal Mortality in the United States. *Womens Health Rep*. 2021;2(1):37-43. doi:10.1089/whr.2021.0001
7. juhohakuni. For more than 100 years, Finnish "neuvola" clinics have given families a healthy start. thisisFINLAND. December 21, 2022. Accessed May 26, 2025. https://finland.fi/life-society/for-more-than-100-years-finnish-neuvola-clinics-have-given-families-a-healthy-start/
8. Tuomi J, ed. *Preconception Health and Care - Handbook for Education*. Tampere University of Applied Sciences; 2021.
9. Avena NM. *What to Eat When You Want to Get Pregnant: A Science-Based Four-Week Program to Boost Your Fertility with Nutrition*. Citadel Press, Kensington Publishing Corp.; 2021.
10. Avena NM. *What to Eat When You're Pregnant: A Week-By-Week Guide to Support Your Health and Your Baby's Development*. Potter/Ten Speed/Harmony/Rodale; 2015.
11. Barker DJ. The fetal and infant origins of adult disease. *BMJ*. 1990;301(6761):1111-1111. doi:10.1136/bmj.301.6761.1111
12. Branje S, Geeraerts S, de Zeeuw EL, et al. Intergenerational transmission: Theoretical and methodological issues and an introduction to four Dutch cohorts. *Dev Cogn Neurosci*. 2020;45:100835. doi:10.1016/j.dcn.2020.100835
13. Fleming TP, Watkins AJ, Velazquez MA, et al. Origins of lifetime health around the time of conception: causes and consequences. *The Lancet*. 2018;391(10132):1842-1852. doi:10.1016/S0140-6736(18)30312-X
14. WHO. Obesity and overweight. 2025. Accessed May 15, 2025. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight
15. Myers-Morrison C. Parental Obesity: The Pandemic of Intergenerational Physical and Mental Health Carnage. *Int J Integr Pediatr Environ Med*. 2023;8:1-18. doi:10.36013/ijipem.v8i.104
16. Oluwayiose OA, Wu H, Saddiki H, et al. Sperm DNA methylation mediates the association of male age on reproductive outcomes among couples undergoing infertility treatment. *Sci Rep*. 2021;11(1):3216. doi:10.1038/s41598-020-80857-2
17. Zhou WJ, Huang C, Jiang SH, et al. Influence of sperm morphology on pregnancy outcome and offspring in in vitro fertilization and intracytoplasmic sperm injection: a matched case-control study. *Asian J Androl*. 2021;23(4):421-428. doi:10.4103/aja.aja_91_20
18. Kaikkonen MU, Lam MTY, Glass CK. Non-coding RNAs as regulators of gene expression and epigenetics. *Cardiovasc Res*. 2011;90(3):430-440. doi:10.1093/cvr/cvr097
19. Clyde A, Ryall H. Intergenerational approaches to improving health and wellbeing. Published online 2014. https://generationsworkingtogether.org/downloads/536a04c11694b-GWT%20web%20FINAL.pdf
20. Fett R. *It Starts with the Egg: The Science of Egg Quality for Fertility, Miscarriage, and IVF*. Third edition. Franklin Fox Publishing LLC; 2023.
21. Cox LA, Puppala S, Chan J, et al. Maternal under-nutrition during pregnancy alters the molecular response to over-nutrition in multiple organs and tissues in nonhuman primate juvenile offspring. *J Dev Orig Health Dis*. 2024;15:e27. doi:10.1017/S2040174424000163
22. da Luz FQ, Sainsbury A, Mannan H, Touyz S, Mitchison D, Hay P. Prevalence of obesity and comorbid eating disorder behaviors in South Australia from 1995 to 2015. *Int J Obes*. 2017;41(7):1148-1153. doi:10.1038/ijo.2017.79
23. McAulay C, Dawson L, Mond J, Outhred T, Touyz S. "The Food Matches the Mood": Experiences of Eating Disorders in Bipolar Disorder. *Qual Health Res*. 2021;31(1):100-112. doi:10.1177/1049732320956267
24. Niklewicz A, Smith AD, Smith A, et al. The importance of vitamin B12 for individuals choosing plant-based diets. *Eur J Nutr*. 2023;62(3):1551-1559. doi:10.1007/s00394-022-03025-4
25. Stavitz J. Understanding Micronutrient Access through the Lens of the Social Ecological Model: Exploring the Influence of Socioeconomic Factors—A Qualitative Exploration. *Nutrients*. 2024;16(11):1757. doi:10.3390/nu16111757
26. McKillop H, Aoyama K. Salt and marine products in the Classic Maya economy from use-wear study of stone tools. *Proc Natl Acad Sci U S A*. 2018;115(43):10948-10952. doi:10.1073/pnas.1803639115
27. Clemente-Suárez VJ, Beltrán-Velasco AI, Redondo-Flórez L, Martín-Rodríguez A, Tornero-Aguilera JF. Global Impacts of Western Diet and Its Effects on Metabolism and Health: A Narrative Review. *Nutrients*. 2023;15(12):2749. doi:10.3390/nu15122749
28. Unhealthy snack taxes | County Health Rankings & Roadmaps. January 19, 2024. Accessed May 27, 2025. https://www.countyhealthrankings.org/strategies-and-solutions/what-works-for-health/strategies/unhealthy-snack-taxes
29. Bawden A. Children eat more after seeing just five minutes of junk food ads, study finds. *The Guardian*.

https://www.theguardian.com/society/2025/may/11/children-eat-more-after-seeing-just-five-minutes-of-junk-food-ads-study-finds. May 11, 2025. Accessed May 31, 2025.
30. Boyland EJ, Whalen R. Food advertising to children and its effects on diet: review of recent prevalence and impact data. *Pediatr Diabetes*. 2015;16(5):331-337. doi:10.1111/pedi.12278
31. Introducing further advertising restrictions on TV and online for products high in fat, salt or sugar: government response to consultation on secondary legislation. GOV.UK. Accessed June 4, 2025. https://www.gov.uk/government/consultations/introducing-further-advertising-restrictions-on-tv-and-online-for-products-high-in-fat-salt-or-sugar-secondary-legislation/outcome/introducing-further-advertising-restrictions-on-tv-and-online-for-products-high-in-fat-salt-or-sugar-government-response-to-consultation-on-secondar
32. Gómez SF, Rajmil L. Advertising, obesity and child health: the case of Spain. *BMJ Paediatr Open*. 2022;6(1). doi:10.1136/bmjpo-2022-001482
33. Powell LM, Leider J, Schermbeck RM, Vandenbroeck A, Harris JL. Trends in Children's Exposure to Food and Beverage Advertising on Television. *JAMA Netw Open*. 2024;7(8):e2429671. doi:10.1001/jamanetworkopen.2024.29671
34. Rhodes-Bratton B, Rundle A, Lovasi GS, Herbstman J. The relationship between childhood obesity and neighborhood food ecology explored through the context of gentrification in New York City. *Int Public Health J*. 2018;10(4):481-496.
35. Rick C, Han J, Elbel B, Schwartz AE. The link between gentrification, children's egocentric food environment, and obesity. *Hous Policy Debate*. 2023;33(1):85-106. doi:10.1080/10511482.2022.2125788
36. Zhou EG, Schwartz AE, Elbel B. Gentrification and childhood obesity: Evidence from New York City public school students in public housing. *Obes Silver Spring Md*. 2024;32(2):390-397. doi:10.1002/oby.23947
37. Brooks SJ, Smith C, Stamoulis C. Excess BMI in early adolescence adversely impacts maturating functional circuits supporting high-level cognition and their structural correlates. *Int J Obes 2005*. 2023;47(7):590-605. doi:10.1038/s41366-023-01303-7
38. Surkalim DL, Luo M, Eres R, et al. The prevalence of loneliness across 113 countries: systematic review and meta-analysis. *BMJ*. 2022;376:e067068. doi:10.1136/bmj-2021-067068
39. Vitman A, Iecovich E, Alfasi N. Ageism and Social Integration of Older Adults in Their Neighborhoods in Israel. *The Gerontologist*. 2014;54(2):177-189. doi:10.1093/geront/gnt008
40. Ares G, De Rosso S, Mueller C, et al. Development of food literacy in children and adolescents: implications for the design of strategies to promote healthier and more sustainable diets. *Nutr Rev*. 2024;82(4):536-552. doi:10.1093/nutrit/nuad072
41. Nicklaus S. The role of food experiences during early childhood in food pleasure learning. *Appetite*. 2016;104:3-9. doi:10.1016/j.appet.2015.08.022
42. Ustun B, Reissland N, Covey J, Schaal B, Blissett J. Flavor Sensing in Utero and Emerging Discriminative Behaviors in the Human Fetus. *Psychol Sci*. 2022;33(10):1651-1663. doi:10.1177/09567976221105460
43. Larrinaga-Undabarrena A, Albisua N, Río X, et al. Level of Physical Activity, Sedentary Behavior, and Sleep in the Child and Adolescent Population in the Autonomous Community of the Basque Country (6-17 Years Old): Protocol for the Mugikertu Study. *JMIR Res Protoc*. 2022;11(3):e31325. doi:10.2196/31325
44. Marrodán MD, Martínez-Álvarez JR, González-Montero De Espinosa M, López-Ejeda N, Cabañas MD, Prado C. Precisión diagnóstica del índice cintura-talla para la identificación del sobrepeso y de la obesidad infantil. *Med Clínica*. 2013;140(7):296-301. doi:10.1016/j.medcli.2012.01.032
45. Bacopoulou F, Efthymiou V, Landis G, Rentoumis A, Chrousos GP. Waist circumference, waist-to-hip ratio and waist-to-height ratio reference percentiles for abdominal obesity among Greek adolescents. *BMC Pediatr*. 2015;15:50. doi:10.1186/s12887-015-0366-z
46. Hu G, Eriksson J, Barengo NC, et al. Occupational, commuting, and leisure-time physical activity in relation to total and cardiovascular mortality among Finnish subjects with type 2 diabetes. *Circulation*. 2004;110(6):666-673. doi:10.1161/01.CIR.0000138102.23783.94
47. Zhao M, Veeranki SP, Li S, Steffen LM, Xi B. Beneficial associations of low and large doses of leisure time physical activity with all-cause, cardiovascular disease and cancer mortality: a national cohort study of 88,140 US adults. *Br J Sports Med*. 2019;53(22):1405-1411. doi:10.1136/bjsports-2018-099254
48. Dicken SJ, Batterham RL. Ultra-processed Food and Obesity: What Is the Evidence? *Curr Nutr Rep*. 2024;13(1):23-38. doi:10.1007/s13668-024-00517-z
49. Poti JM, Braga B, Qin B. Ultra-processed Food Intake and Obesity: What Really Matters for Health – Processing or Nutrient Content? *Curr Obes Rep*. 2017;6(4):420-431. doi:10.1007/s13679-017-0285-4
50. Campbell F, Whear R, Rogers M, et al. Non-familial intergenerational interventions and their impact on social and mental wellbeing of both younger and older people—A mapping review and evidence and gap map. *Campbell Syst Rev*. 2023;19(1):e1306. doi:10.1002/cl2.1306
51. Tan J, Zhang Z, Yan LL, Xu X. The developmental origins of health and disease and intergenerational inheritance: a scoping review of multigenerational cohort studies. *J Dev Orig Health Dis*. 2024;15:e1. doi:10.1017/S2040174424000035
52. Kessler DA. *Diet, Drugs, and Dopamine: The New Science of Achieving a Healthy Weight*. First edition. Flatiron Books; 2025.
53. Kessler DA. Opinion | In a World of Addictive Foods, We Need GLP-1s. *The New York Times*. https://www.nytimes.com/2025/05/07/opinion/ozempic-weight-loss-drugs.html. May 7, 2025. Accessed May 15, 2025.
54. P. Rabbitt, M, J. Hales L, Reed-Jones. Food Security in the U.S. - Key Statistics & Graphics | Economic Research Service. Accessed May 14, 2025.

https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/key-statistics-graphics#children
55. Padmanabhan V, Cardoso RC, Puttabyatappa M. Developmental Programming, a Pathway to Disease. *Endocrinology*. 2016;157(4):1328-1340. doi:10.1210/en.2016-1003
56. Gage SH, Munafò MR, Davey Smith G. Causal Inference in Developmental Origins of Health and Disease (DOHaD) Research. *Annu Rev Psychol*. 2016;67(1):567-585. doi:10.1146/annurev-psych-122414-033352
57. Hanson MA, Gluckman PD. Early Developmental Conditioning of Later Health and Disease: Physiology or Pathophysiology? *Physiol Rev*. 2014;94(4):1027-1076. doi:10.1152/physrev.00029.2013
58. Hoffman DJ, Powell TL, Barrett ES, Hardy DB. Developmental origins of metabolic diseases. *Physiol Rev*. 2021;101(3):739-795. doi:10.1152/physrev.00002.2020
59. O'Donnell KJ, Meaney MJ. Fetal Origins of Mental Health: The Developmental Origins of Health and Disease Hypothesis. *Am J Psychiatry*. 2017;174(4):319-328. doi:10.1176/appi.ajp.2016.16020138
60. Oestreich AK, Moley KH. Developmental and Transmittable Origins of Obesity-Associated Health Disorders. *Trends Genet*. 2017;33(6):399-407. doi:10.1016/j.tig.2017.03.008
61. Warmink-Perdijk WDB, Peters LL, Tigchelaar EF, et al. Lifelines NEXT: a prospective birth cohort adding the next generation to the three-generation Lifelines cohort study. *Eur J Epidemiol*. 2020;35(2):157-168. doi:10.1007/s10654-020-00614-7
62. Arshad SH, Karmaus W, Zhang H, Holloway JW. Multigenerational cohorts in patients with asthma and allergy. *J Allergy Clin Immunol*. 2017;139(2):415-421. doi:10.1016/j.jaci.2016.12.002
63. Mørkve Knudsen T, Rezwan FI, Jiang Y, Karmaus W, Svanes C, Holloway JW. Transgenerational and intergenerational epigenetic inheritance in allergic diseases. *J Allergy Clin Immunol*. 2018;142(3):765-772. doi:10.1016/j.jaci.2018.07.007
64. Sutton EF, Gilmore LA, Dunger DB, et al. Developmental programming: State-of-the-science and future directions–Summary from a Pennington Biomedical symposium. *Obesity*. 2016;24(5):1018-1026. doi:10.1002/oby.21487
65. Hochberg Z, Feil R, Constancia M, et al. Child Health, Developmental Plasticity, and Epigenetic Programming. *Endocr Rev*. 2011;32(2):159-224. doi:10.1210/er.2009-0039
66. Guidelines for designing age-appropriate cooking interventions for children: The development of evidence-based cooking skill recommendations for children, using a multidisciplinary approach - ScienceDirect. Accessed May 28, 2025. https://www.sciencedirect.com/science/article/abs/pii/S0195666321000337?via%3Dihub
67. Fisberg M, Gioia N, Maximino P. Transgenerational transmission of eating habits. *J Pediatr (Rio J)*. 2023;100(Suppl 1):S82-S87. doi:10.1016/j.jped.2023.11.007
68. Doak CM, Adair LS, Bentley M, Monteiro C, Popkin BM. The dual burden household and the nutrition transition paradox. *Int J Obes*. 2005;29(1):129-136. doi:10.1038/sj.ijo.0802824
69. Ede G. *Change Your Diet, Change Your Mind: A Powerful Plan to Improve Mood, Overcome Anxiety, and Protect Memory for a Lifetime of Optimal Mental Health*. First edition. Balance; 2024.
70. OECD. *The Heavy Burden of Obesity: The Economics of Prevention*. OECD; 2019. doi:10.1787/67450d67-en
71. Swinburn BA, Sacks G, Hall KD, et al. The global obesity pandemic: shaped by global drivers and local environments. *The Lancet*. 2011;378(9793):804-814. doi:10.1016/S0140-6736(11)60813-1
72. Swinburn BA, Kraak VI, Allender S, et al. The Global Syndemic of Obesity, Undernutrition, and Climate Change: The Lancet Commission report. *The Lancet*. 2019;393(10173):791-846. doi:10.1016/S0140-6736(18)32822-8
73. British Restaurant. In: *Wikipedia*. ; 2025. Accessed May 13, 2025. https://en.wikipedia.org/w/index.php?title=British_Restaurant&oldid=1273258690
74. Norouzi N, Angel JL. Intergenerational Day Centers: A New Wave in Adult and Child Day Care. *Int J Environ Res Public Health*. 2023;20(1):809. doi:10.3390/ijerph20010809
75. Warren R. *The Daniel Plan Journal: 40 Days to a Healthier Life*. Paperback edition. Zondervan Books; 2020.
76. Rinkel HJ, Randolph TG, Zeller M. *Food Allergy*. 1st edition. Charles C Thomas Pub Ltd; 1951.
77. Coca-Cola's sneaky, evil politics: How Big Soda twisted race and used the Koch Brothers to fight a tax | Salon.com. Accessed May 28, 2025. https://www.salon.com/2015/10/17/coca_colas_sneaky_evil_politics_how_big_soda_twisted_race_and_used_the_koch_brothers_to_fight_a_tax/
78. Brownell KD, Frieden TR. Ounces of Prevention — The Public Policy Case for Taxes on Sugared Beverages. *N Engl J Med*. 2009;360(18):1805-1808. doi:10.1056/NEJMp0902392
79. Han E, Powell LM. Consumption Patterns of Sugar-Sweetened Beverages in the United States. *J Acad Nutr Diet*. 2013;113(1):43-53. doi:10.1016/j.jand.2012.09.016
80. Idaho submits waiver request to exclude soft drinks and candy from SNAP purchases | Idaho Department of Health and Welfare. Accessed June 7, 2025. https://healthandwelfare.idaho.gov/news/idaho-submits-waiver-request-exclude-soft-drinks-and-candy-snap-purchases
81. Chacón C, Arteaga I, Martínez-Escudé A, et al. Clinical epidemiology of non-alcoholic fatty liver disease in children and adolescents. The LiverKids: Study protocol. Karlas T, ed. *PLOS ONE*. 2023;18(10):e0286586. doi:10.1371/journal.pone.0286586
82. Frieden TR. A Framework for Public Health Action: The Health Impact Pyramid. *Am J Public Health*. 2010;100(4):590-595. doi:10.2105/AJPH.2009.185652

