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# Chapter 10: Personalized health interventions: Tailoring prevention and treatment strategies using predictive genetic insights

## 10.1 Introduction

Genetics has always had a hand in determining how long and how well people live. Today, widespread advancement in predictive genetics is illuminating more health risks not previously seen. Indeed, along with other trends in genetic research, predictive genetics is poised to affect personalized health interventions that may significantly change public health practices. In light of this, the ethics, practicality, and potential repercussions of largely untailored prevention and treatment strategies are considered.

In simpler terms, genetic change causes diseases. Some of these are rare, highly penetrant mutations, such as Huntington's Disease. Most other genetic conditions with known causes are also rare, however. Most diseases have multifactorial causes, but research in the last twenty years is unearthing a trove of mostly non-discretionary personal health risks and susceptibilities. Genetic diversity between people leads to incredible phenotypic variation, a lot of which affects public health. Techniques such as genome-wide association studies can rapidly and cheaply provide insight into loads of personal disease risks and personal responses to various treatments.

The essay argues that improved health comes with the understanding how health risks can manifest and be managed, and advances in predictive genetics make it very inadvisable to not get genetically educated. The advent of highly public, personal genetic insights gives the ability to choose more exact health choices, better positioning health management. Major health science professional institutions are already urging a basic understanding of and routinely including genetics in preventive and therapeutic decisions, as genetics could certainly be used to argue that rational health management could not be done without genetic insights.On the other hand, it unveils a deeper knowledge about the body's Achilles' heels, and without timely intervention these insights can transform a mere theoretical vulnerability into a grim clinical reality. With the unlocking of the genetic code of humans and a myriad of organisms it is inevitable that interpretation of the information intended to adapt it to specific purposes related to health be widely addressed. Genetic testing has a broad array of applications. It is however the analysis of predictors of diseases which garners most public attention. On occasion a swing between extravagant hype, admonitory doomsday scenarios, and denial bordering on irrational fear can be observed among scientists and policymakers, usually determined by genetic callings or vested interests. In this mix the often missing, occasionally misleading variables are the objective.

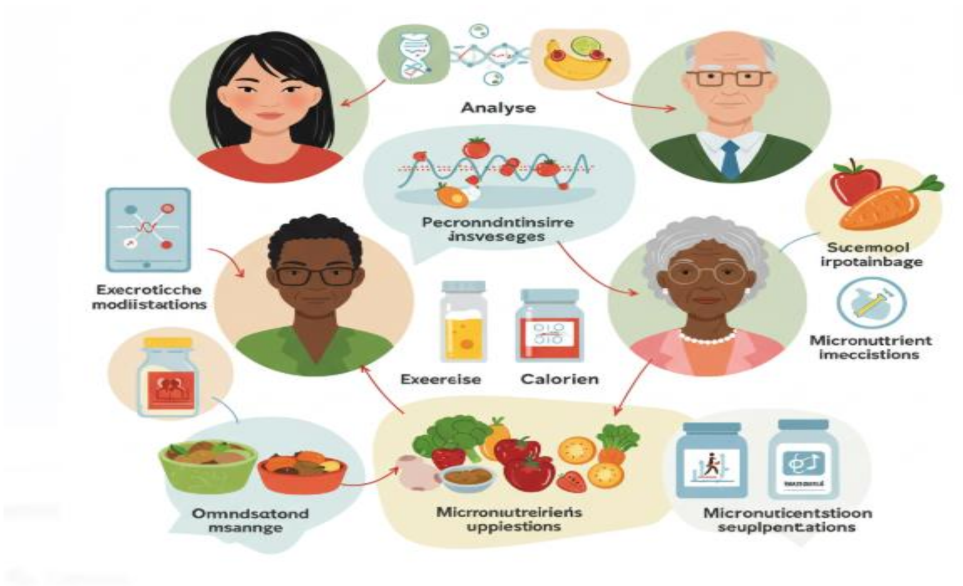


**Fig 10.1:** Personalized Nutrition Tailoring Dietary Recommendations through Genetic Insights

## 10.2. The Role of Genetics in Health

Genetics is foundational for understanding the human body, with profound implications on health outcomes. The completion of the Human Genome Project has set the stage for developing an understanding of how genetic factors contribute to health and disease. The basic principles underpinning genetics are at play in all individuals and determine who or what they are, with the exceptions of accidents and the environment. Genetic variability among individuals contributes to differences in health outcomes such as drug efficacy, disease development, and progression. Especially complex disorders like cancer or diabetes arise from a combination of genetic, behavioral, and environmental factors. Genetics also underlies why certain genes are associated with an increased likelihood of developing a disease that would otherwise remain cryptic. Genetics study, through predictive testing, hones in on the analysis of specific genes that increase the probability of particular diseases. A comparison of genetic test findings with personal and family health history can identify whether an individual is predisposed to those conditions for which they are being tested and which prevention and treatment options are available.

The objective of this work is to reveal the hidden and describe the evident, the humoral, the holistic, and the predictable, especially in regard to health. Genetic insights have both a detrimental and salubrious effect on health. On one hand, it provides the means for tailoring personalized preventive and treatment strategies (Singireddy, 2022; Koppolu et al., 2023; Paleti et al., 2024).

### 10.2.1. Understanding Genetic Variability

When examining the state of humanity in particular, our hearts, lungs, and intestines seem to be quite uniform across all people. Uniting all humans more than physical likeness is the complexity and uniqueness of their genetic makeup. Understanding the sources of genetic variation will make healthcare professionals more knowledgeable about how those differences can affect a person's health. Genetic variation arises from a variety of sources, ranging from spontaneous mutations to polymorphisms that are common in the population to intricate gene-gene and gene-environment interactions. A single given gene can have an abundance of genetic variation as well. The genetic makeup of the human heart, lung, and intestine is unique to each individual; hence, the corresponding health outcomes will also be unique to each person. Compared to a more general understanding of genetic variation, it is easier to describe genetic predispositions in broad demographic terms due to the prevalence of certain polymorphisms or mutations across individuals within the same demographic group. However, such observations represent only a small fraction of the genetic uniqueness of a human being. People inherit their genetic information from their parents, whose genetic information is inherited from their parents, and so on for many generations into the past. With many primary caregivers, grandparents, and more distant relatives, this means inheriting genetic information from a large number of people. Furthermore, genetic information is not the only thing passed down; environmental factors that affect how that genetic information is expressed are also inherited. It is easier to talk about population genetics and average behavior of genes in different demographic groups, but these are only a rough representation of genetic makeup. To assess the true genetic uniqueness of a human being requires a precise account of each gene and environmental factor affecting that person, a task far beyond the contemporary capabilities of science.

### 10.2.2. Genetic Predisposition to Diseases

Genetic predisposition refers to an individual's increased likelihood of disease based on genetic makeup. The very first genetic predisposition in cancer research was identified in 1866 by German pathologist Rudolph Virchow, who noticed malignant neoplasms occur more frequently in certain families than would be expected by random chance. Since then, a number of genetic markers have been revealed concerning other diseases like diabetes, heart diseases, late-onset neurodegenerative disorders, or psychiatric diseases. Many are also interested in personalized interventions based on an individual's genotype. The modulation of genetic risk is considered a higher goal than modification of lifestyle risks, opening new avenues in the development of new drugs and therapies. On deepening knowledge and understanding of genetic risk factors, it is hoped that risk assessment will be improved, and adequate prevention and treatment strategies will be developed.

Coming back to the overall burden, it is hoped that increased awareness of advances in genetics will improve genetic literacy and knowledge of the utmost importance of melding numerous environmental and genetic interventions in health prevention or management. No disease develops due to genetic factors alone; genetic predisposition has to be taken as a joint outcome of lifestyle and genetic factors. Prevention measures due to genetic insights are not limited to new treatises or new chemical agents. Slow changes in tissue deadly for health, like small polyps resulting from the accumulation of cancerous mutations in the colon, may be mechanically removed. The host of cancer predisposition syndromes is already based on these assumptions. As the underlying cause of diseases in these conditions are germline mutations in DNA repair genes, a course of rigid surveillance of target tissues coupled with surgical resection is recommended. On the other hand, young healthy women harboring BRCA1 mutations may opt for a prophylactic mastectomy, which results in unprecedented risk reduction of cancer due to this genetic factor.

## 10.3. Predictive Genetic Testing

Predictive genetic testing has advanced the capabilities of foreseeing potential health risks based on our genetic profile. There are different types of genetic tests able to assess health conditions, carrier testing, predictive testing, identification testing for the families having a condition, and prenatal testing, not for the condition but for the possibility of having a child with a genetic condition. With predictive testing, it is possible to find out if there is a risk of developing a condition, before it actually happens. Most such tests provide a level of risk, which in turn depends on the type of the condition and the reliability of the test. The more accurate tests are in individuals' understanding, the more necessary aspects can be done for reducing the risk of the condition. The risk may be high enough for different actions by the individuals, family, or for additional tests or precautions (Singireddy, 2023; Singireddy et al., 2024).

Most tests that are available at the moment generally provide a broad risk level: near-average, average, and above-average. Since these tests do not have extreme accuracy, it is important to understand the risk result in the right context. For example, while the risk of developing a certain condition may be affected by genetic factors, overweight, smoking, and age possess high risk as well. Thus, it is very important to understand the result numeracy.

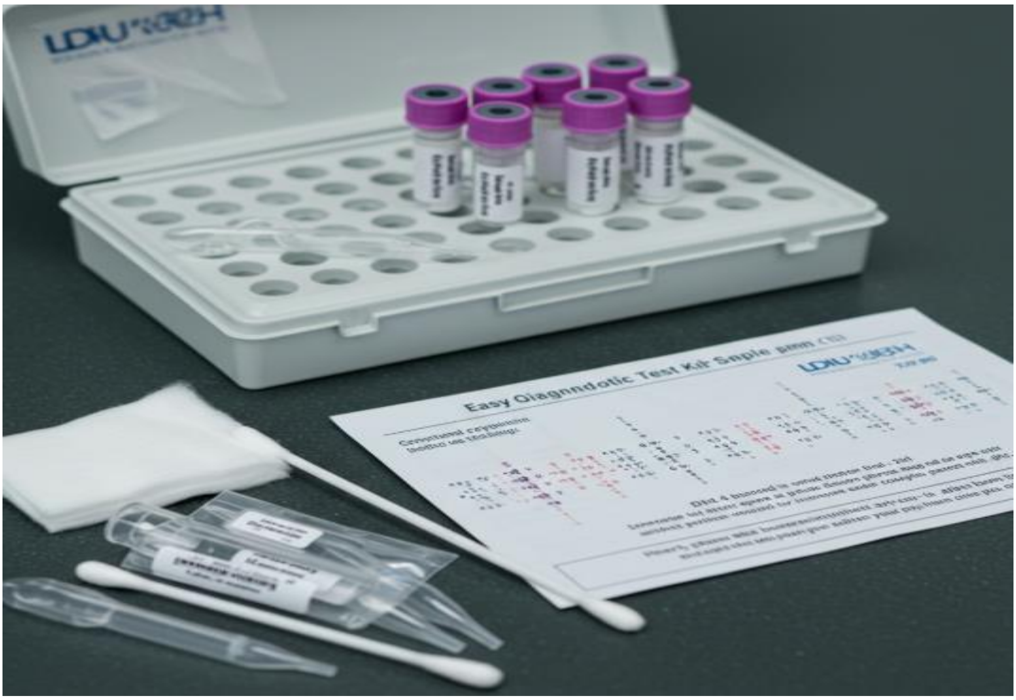

**Fig 10.2:** Genetic Tests

### 10.3.1. Types of Genetic Tests

A definitional categorization of genetic tests could entail three main types of genetic tests: diagnostic, carrier, and predictive. Diagnostic testing encompasses testing to identify or rule out established and suspect genetic conditions in a symptomatic individual, testing to sort out conditions in individuals with similar symptoms, as well as prenatal testing. Using various methods, information is analyzed in relation to an individual’s family medical history, age, ethnic and environmental backgrounds, and specific signs or symptoms. One function of diagnostic genetic testing is disease forecasting, but it also illuminates overall health risks meriting personalized prevention strategies. The early detection and monitoring of genetic diseases is another notable function of diagnostic genetic testing that can inform suitable treatment decisions eventually leading to personalized treatment strategies. For grandma at risk of Alzheimer's, carrier testing for E4 would indicate a chance of 60-75% of developing Alzheimer's by the age of 85.

Carrier testing is typically performed before becoming pregnant if a couple would like to know whether they may have a child affected by a genetic disorder. It involves the analysis of an individual’s DNA to determine whether they “carry” a gene altered by mutations that cause genetic disorders. Most individuals are carriers of at least one disease gene, and are asymptomatic and normal. Genetic diseases such as Tay-Sachs disease is an autosomal recessive disease and most frequently afflicts Jewish Ashkenazi and non-Jewish French-Canadians. Carrier testing is available for those who wish to know their carrier status for having children.

A third kind of testing is predictive testing, which is used to detect mutations that may cause disorders that develop later in life. This kind of genetic testing is difficult to interpret and is not always clinically useful. An example is testing for the BRCA1 and BRCA2 genes for breast and ovarian cancers. For example, those who obtain a positive result have an 87% chance of getting breast cancer in their lifetime and a 44% risk of developing ovarian cancer. However, it cannot be pointed out when and how symptoms occur. For diseases such as Alzheimer's, Huntington's disease, and schizophrenia, even if a person carries a putative gene, it does not necessarily mean one will inevitably get sick. Normal people under 55 years of age could use genetic tests to identify whether they carry the gene for Alzheimer's. If it is identified that they carry the disease-related gene, they would maybe choose to do a genetic test for their children before the age of 40, and if they inherit the gene, they would consider adoption.

Public inclinations to take such tests and disclose the results are negative. Testing embryos before implantation is called pre-implantation genetic diagnosis (PGD), which is a new test, and it is still experimental and considered taboo in some countries. It allows people who are at risk for having children with genetic disorders to avoid passing on the problematic gene. IVF with PGD may involve the mother’s eggs, which have been fertilized by the father’s sperm. The embryos are then tested. For the same purpose, the embryos can also be nurtured for 5 or 6 days to form a blastocyst, from which a cell is taken out and, with a used technique, the blastocyst is not harmed. If the embryo was healthy, it would be returned to the uterus to grow further, where there is, on average, a 30% chance to become a successful pregnancy.

### 10.3.2. Ethical Considerations

Eugunas Gefenas et al. have concisely outlined a set of ethical concerns raised by the "paradigm shift" happening in medicine today. The early detection of susceptibility allowed by advancements in the field of genetics significantly increases the range of possible preventive interventions. Thus, the "wake up call" to society is for this development should go "hand in hand" with responsible ethics and strong protection of personal genetic data. Against this backdrop, unleashing the potential of predictive and preventive (and eventually personalised) medicine raises the following ethical dilemmas: the extent to which the principle of clinical utility of genetic testing should be equaled and/or overridden by other ethical principles; the respect for private life and the right to know, arising from the increased sharing of genetic information within families and beyond; and the ethical implications of the possibility of obtaining genetic and health information without physical contact between medical personnel and the person tested.

Genetic testing can bring social benefits, and benefits to first-degree relatives of the tested persons. At the same time, the growing possibility of obtaining health information without the "mobile" person's consent is likely to increase the risk of abuse, and conflicts among people's different interests under different circumstances. Kreepala B. Singh emphasizes that such potential contrary implications can only be managed to limit the potential for abuse, not only in the strict legal, but also in the broader socio-cultural, historical, and social context, by affirming and reinforcing the great value of health care trust. Enlarging societies need to stay cautious from the temptation induced by the cost-effectiveness of any kind of health screening to apply it too thoughtlessly. Horizons of social responsibility are brought into anticipatory focus, both in the ethical and in the medical marketing areas. Due attention is drawn to the conceivable counterparts transferred from clinical genetics to public health.

## 10.4. Personalized Health Interventions

Personalized health interventions are prevention and treatment strategies that are developed for a particular individual based on predictive genetic insights. Personalized interventions are designed based on a genetic understanding of how the particular patient is likely to develop a disease, respond to drugs, adjust in different lifestyles, and react to a changed environmental exposure. The medical care and intervention plan is aligned with the individual genetic profiles and indexes to either enhance effectiveness or decrease adverse effects, resulting in offering the patient care that is tuned according to his/her bodily and genetic constitution. A personalized health intervention usually involves an interdisciplinary approach integrating genetics, biological sciences and bioinformatics, technologies in diagnosis and treatment, and diverse lifestyle of the patient. Customizing the lifestyle approaches and treatment plans requires extensive knowledge of how the genetic and lifestyle factors interact with planned interventions. Case studies in successfully implementing the benefits of personalized health interventions are presented. The healthcare plan and lifestyle approaches can be designed tailored to the patient's genetic profile and preferences based on feedback. The patient's preference may be factored in as a preference weight indicates the effectiveness of a type of health intervention on a particular patient.

Personalized health interventions, along with genetics, have shown extensive potential in treating, preventing, and managing diseases like diabetes and cancer, with successful translational accomplishments in the past couple of decades. The importance of patient-centered healthcare which emphasizes the patient's preferences and expansive personalization in healthcare is raised. Cost considerations and somewhat inadvertent access inequality due to unequal effects of genetic testing and personalized interventions are discussed regarding the further developed healthcare paradigm. Instances where health interventions are expensive and the plan must be evenly distributed among all the diagnosed patients or where access is unequal based on patient's conditions and economic status are presented. Efforts are ongoing to design more reasonable intervention plans and assist the health authority in considering which patients to target for such health interventions, so that a call for a paradigm shift in healthcare that puts a stronger focus on the patient and offers more expansive personalization in healthcare is initiated and encouraged.

### 10.4.1. Definition and Scope

Personalized health interventions have the potential to transform the delivery of healthcare by tailoring prevention and treatment strategies to individual genetic insights. In its broadest definition, personalized health interventions encompass a wide range of strategies that integrate predictive genetic knowledge around its potential development and progression with clinical information, lifestyle factors, and patient preferences. These strategies include, but are not limited to, the optimal selection of screening and behavioral adherence support strategies, the identification of individuals who are suitable for specific novel or existing interventions, the selection of medications and dosages given genetic profiles, the elicitation of patient preferences, and the provision of information and support. Personalized health interventions are broadly applicable across many different health conditions and a wide range of health risks and can be targeted to and tailored for various subgroups of populations. Central to the design of personalized health interventions is the development and application of risk algorithms informed by genetic predictors modeled on a large sample of individuals and linked to interventions.

In its current applications, the treatment aspect of personalized health interventions typically focuses on the optimal selection of medication types and dosages, given individual genetic profiles. For example, Clopidogrel is metabolized by the enzyme CYP2C19 in the liver, but individuals carrying two “defective” alleles associated with slower enzyme activity are not able to fully convert to its bioactive form, leading to an increase in poor outcomes in carriers. A well-powered meta-analysis conducted among 18,219 participants observed a 63% increase in poor outcomes in carriers after adjusting for standard baseline clinical factors. There is an ongoing argument in both the medical and public discourse that personalized or individualized interventions are increasingly being implemented in mainstream healthcare practices. In expecting that personalized care will become even more prevalent in the future there is a growing number of indicators related to an individual patient that are being evaluated to inform a personalized treatment plan. In health services, there are various trends that suggest that an increasing number of personalized interventions are utilized and that such interventions form part of established or novel pathways of care. Artificial intelligence technologies, particularly those using Bayesian approaches, have been at the vanguard of developing personalized treatment plans. Broadly, however, personalized interventions are characterized by matching individuals to interventions on the basis of a wide array of indicators. This creates several challenges including translation of scientific knowledge in a way that is understandable to patients and support the skills required for them to act on it effectively; and properly managing other aspects, including equity of access to personalized interventions and widespread availability of resources.

### 10.4.2. Benefits of Personalization

The benefits of personalization in healthcare are diverse and manifest on several levels. Personalized health interventions can achieve a higher success in preventing or effectively managing disease with better alignment of health interventions to an individual’s unique genetic profile or risk factors. This can translate into better efficacy and reduced side effects of drugs and preventive treatments. On the other hand, patients often express a higher satisfaction or engagement with medical decisions when they are at least partially informed or involved in making choices. This greatly enhances the follow-up of any care plan as well as reducing its duration and the consequent health care resources. It has also been suggested that a more accurate targeting of health interventions would prevent more effectively ailments in subjects at risk and save a substantial portion of the economic resources currently dedicated to curative treatments. This in turn might drive research and innovation toward a healthier society. The simple knowledge of being at higher risk of developing disease, based on personal genetic data, may lead people to adopt a healthier lifestyle, with a subsequent dramatic reduction of chronic pathologies such as diabetes or cardiovascular diseases. The active involvement of patients in the care decision results in a better adherence to the implemented therapies and in a reduction of hospital readmissions. A multilevel semantic content analysis identified a number of values and drivers associated with personalized health, urging policymakers and research managers to consider new approaches to foster research and deployment of health innovation. Personalized health was mainly seen as driven by prevention rather than treatment, as promoting a shift from a treatment to a prevention healthcare system, and as requiring individual responsibility. Crucial eventualities to deploy personalized health include the adoption of shared standards and infrastructures for data collection and processing, the promotion of public-private research quality and new funding instruments, the implementation of pilot initiatives broadly communicating their knowledge and the coverage of ethical, legal, and privacy issues.

## 10.5. Tailoring Prevention Strategies

Health is an underlying factor of survival and livelihood. It is considered that prevention is better than cure. Furthermore, setting preventive strategies for individuals involved is inevitable. In the past, prevention strategies are applied for the community regardless of their genetic background, health and personal information. However, personalized prevention strategies could be more useful because background genetic and environmental information linked to the proneness of the diseases could be analyzed. The risk assessment model can be developed by considering the personal genetic profile and environmental factors which affect disease propensity. Tailored prevention strategies could be designed by examining an effective way of preventive strategies for preventing common complex diseases such as breast cancer, prostate cancer, diabetes, frailty and Alzheimer’s disease considering individual genetic information.

Many diseases, especially chronic diseases, can be prevented or less severe if the symptoms are detected as soon as possible. Therefore, people use health tests for disease prevention. Polyps are discovered in colonoscopy, which is known as the best detection method for colorectal cancer. Sigmoidoscopies and fecal occult blood tests can only discover polyps in the lower colon. However, the lower colon is unreachable using colonoscopy. To solve this, stool DNA test is developed, which could potentially lead to detection of colorectal cancer at an early stage. Another similar story is about the case of the cancer cluster in the childhood home. In rare cases, genetic mutation increases hereditary risks which are not discovered using risk information of commonalities. Family screening and decision of risk reduction surgery are needed for prevention. Recently, genetic testing companies are on the rise. They provide information about genetic risks for lifestyle, it is necessary to know whether the forecasts using genetic information affects patients’ adoption of healthy behaviors. Personal risks ten years hence joviality for Alzheimer’s disease, obesity, diabetes, and hypercholesterolemia are chosen as a case study for the prevention strategies. It is considered that if a person clearly recognizes his proneness by medical examination and prompts improvement in his or her lifestyle, the possibility of disease can be reduced. Tailored prevention strategies could save time, cost and treatment fee in preventing medical costs overall society.


**Fig :** Personalized genetic testing

### 10.5.1. Risk Assessment Models

Several risk assessment models that integrate genetic, environmental, and lifestyle factors are now available to estimate an individual's risk of chronic diseases, and inform the tailoring of preventive strategies. These models have the potential to revolutionize public health strategies, by personalizing prevention based on genetic information. The development of models that predict disease for asymptomatic individuals based on individual level data becomes increasingly urgent. There are computational tools that can develop a risk score based on genetics and/or lifestyle, and in many cases are accompanied by advice on risk minimizing lifestyle changes, which have the potential to either help stratify the population by disease risk, guide the possibly necessary changes in screening implementation, or indeed help design the most appropriate screening strategy for a given set of socio-demographics, to maximize its effectiveness.

By complementing disease-specific information on genetic, environmental, and lifestyle determinants of chronic conditions with risk assessment models, prevention and early detection interventions can better prioritize the subset of the population they are most likely to benefit and act timely. To maximize their public health relevance, the validation and adaptation of these models using continuously updated data on genetic findings and/or estimates of the variance explained by them in combination with environmental, lifestyle and blood/urine markers, need to be carried out. The latter requires work with institutions for the collection and the management of prospective cohort studies larger than any single population-based dataset. Health professionals can play a big role in the uptake of risk assessment models by the implementation of genetic risk profiling to help individuals reduce the risk of developing chronic conditions including cancer. The downstream benefit of this is that those at high risk can be made aware and helped to develop and adopt personal prevention strategies. There are, however, a number of challenges to consider such as the fact that the broader the communication, the more likely the message is to reach the "worried well" or the worried people who are already well, meaning that ever more individuals are liable to seek expensive follow-up services. Furthermore, there are data privacy issues to be considered, as genetic data is regarded as more sensitive than other types of data. Finally, it is important to recognize the low genetic literacy level both in the general public and in the medical profession, meaning that appropriate educational resources would be needed before the implementation of targeted prevention at a population level.

### 10.5.2. Lifestyle Modifications Based on Genetic Insights

Lifestyle modifications are often thought to play a crucial role in prevention, and sometimes treatment, of medical conditions. Such lifestyle changes could become even more effective when informed by genetic insights about a patient's predispositions to certain conditions, such as nutrient-specific gene status. This analysis could help a person to know better of his genetic predispositions and lifestyle, such as diet, supplements, how frequently to exercise, or when to get check-ups compared to those without this information. As advances in precision health proceed and people can more precisely know of medically-relevant gene variants known, it is important that the development of effective ways to convey this information to patients are kept abreast.

There is growing interest in the personalization of lifestyle recommendations and interventions based on individual patient genotype, and several research groups observing gene-diet interactions may lead to tailored dietary and lifestyle recommendations for health. Indeed, in previous work differential effects on weight loss of multiple dietary interventions were shown, depending on the common genetic SNP data available to each person. At this juncture of personal genomics, there is an urgent need to better understand individuals who prefer different path IPs, particularly to recognize how population segments respond to certain genetic data in order to optimize lifestyle counseling and health educational efforts. On a broader scale, genomic insights may offer new information that informs the further refinement of public health recommendations targeting sub-populations at greater risk for various diseases. Though there is growing interest in the personalization of lifestyle recommendations by genetic variants, there is a great need for rigorous evaluation of such efforts, particularly within the scope of weight loss or other prevalent public health initiatives. Personalized lifestyle advice based on modeled genetic susceptibility offers promise to recommend dietary adjustments, exercise regimens, or other health behaviors unique to a patient's own genetic profile. Reducing the risk of developing common diseases, improving care of those living with these diseases, optimizing drug effects, or simply improving overall physical well-being can have health benefits of such lifestyle modifications. Given the rapid growth of the available literature on genetic determinants of common diseases and disease risk factors, such as BMI or lipids, there is potential for routine, low-cost genetic testing to inform these health choices for individuals.

## 10.6. Conclusion

Personalized Health Interventions offer a new paradigm of integrating genetic insights and understanding into healthcare. Preventive as well as treatment strategies are more effective when tailored to the individual, considering specific genetic controversies, lifestyle factors, and environmental exposure. There is potential for reducing health disparities by tailoring models to better address the diverse patient population and including tailored interventions in resource allocation decisions. With increasing accessibility and usage of genetic tests, expectation of advanced healthcare to consider and integrate patient's genetic knowledge has also increased. Meanwhile, the improved availability of Genetic Knowledge has increased the possibility of personalized approaches.

In the future, empirical research is needed to examine the benefits for patients, providers, and the healthcare system itself. Furthermore, the impact of integrating genetic insights across disciplines is not well understood. A comprehensive approach to care is required that may not only be limited to clinical interventions but also involves patient engagement and education that such approaches may be important for successful implementation of genetically tailored prevention and treatment strategies and the realization of their potential benefits. In conclusion, a new era of genetic knowledge embedded in health intervention beckons, and here it is argued that it should not be lost more time until the reality is considered deeply, offering also a flexible and feasible path to embrace.

Beside the technological advances that also have gained the potential to stronger genetic understanding of complex and polygenic traits, current evidence also shows predictions to be an individual risk that is important to consider when deciding preventive interventions. Seven significant projects develop a statistically diverse set of all or so-called add score-based poly general risk predictions for a variety of non-communicable diseases. Treatment genetics also demonstrates the potential for improving prevention and treatment strategies, and new biomarker findings have the promise to guide drug development and other targeted therapies. Ethical and social issues are also being raised both on acute concern and with long-lasting implications, calling for collaborative context-specific responses. Turned by these developments and challenges, this essay discusses the importance of personalizing health interventions through both prevention and treatment focus, emphasizing the urgent need to consider genetic Knowledge.

### 10.6.1. Future Trends

What does the future hold for genetics and personalized healthcare? And what can we say about future healthcare trends in general? We can usually think about future trends as predictable things; trends based on what we already see every day. Genetics, however, is moving so nearly fast and in so many potential directions that its future is quite hard to predict with any certainty, so we should be prepared for many unexpected sudden turns. The overarching trends look more certain: as genetics become more prevalent in daily life with improved, faster, more accurate sequencing methods and, more importantly, imputed records based on values derived from other sources, it can easily become part of regular health screening. With urgent treatment of health issues, reliance on individual genetics could skyrocket, probably going far beyond what is known about the interactions between genes and conditions. It’s important to note that there are fertile grounds for such sudden advances due to the massive amounts of data lurking behind medical records and gene databases. Healthcare will be increasingly informed by large data analysis, allowing for the identification of trends and health outcomes for specific conditions. The widespread use in personalized interventions will necessitate (and bring about) discussions on moral implications of breeding, and overall ethics of genetic interference. The necessary interdisciplinary approach means this could be one of the most significant challenges in introducing such advances. Improved understanding of the multigene nature of health conditions alongside better-designed preventive actions might make genetics education an essential part of general health education at a young age.

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