The sequencing of the human genome was completed in April, 2003. This enormous scientific achievement gave us the ability to read, for the first time, the entire genetic blueprint for a human being. Much is anticipated as a result of unraveling the human genome and the ongoing advances in genetics and genomics. Genetics, once a field of rare and single gene disorders such as cystic fibrosis and sickle cell anemia, now comprises common conditions across the lifespan.

Genomics, the study of genes and their functions, increases our understanding of the interaction of multiple genes with each other and the environment in complex diseases such as heart disease, diabetes, and cancer. As more genes that confer susceptibility to common complex diseases are identified, the implications for health management are clear. Unveiling the full potential and clinically relevant applications of the human genome will take decades.[1]

Scientists hope that insights into disease processes made possible by genetic research will form the backbone of personalized healthcare – individualized care in which genetic susceptibility is used to tailor disease prevention. Although individualized healthcare is still largely in the future, an early example of this paradigm is the identification of breast cancer gene mutations to prevent breast cancer.[2]

Our healthcare system is shifting from one that reacts to illness to one that prevents illness and discards the "one size fits all" approach. With advances in our understanding of the genetic basis for disease comes public awareness and interest in what these advances have to offer. Public awareness of genetic and genomic information brings the necessity to effectively and responsibly integrate genetics into primary care. Family members share not only genes; but may also share environments, lifestyles, and habits and consequently, they may share risk for disease.

Geneticists have long recognized that the gateway to discovering genetic inheritance and disease susceptibility is a thorough recording of family medical history.[3] This article will offer measures to help primary care providers effectively integrate genetics into their practices: eliciting a family history, identifying genetic red flags, and stratifying personal risk based on risk factors.

The Family History as Genetic Screen

Family history is the first genetic screen and crucial element in risk assessment. Not only is family history accessible, noninvasive, reliable, and inexpensive to obtain, but it can also influence management of disease and improve prevention efforts.

Clinicians in primary care may find it difficult to adopt the practice of obtaining thorough health histories. Some are reluctant to assess family history as a risk factor for disease because of concerns that collecting an adequate family history takes too much time, or that they will be unable to sufficiently interpret the information.[4]

In a study of family history acquisition in primary care settings, during 4454 patient visits to 138 family physicians, family history was discussed during only 51% of visits with new patients and 22% of visits with established patients.[5] In a comprehensive cancer care center, Sweet and colleagues[6] documented inadequate family history taking and a failure to identify patients at high risk of hereditary cancer. Of families at greatest risk (evidence confirming high risk of early-onset cancer or hereditary cancer syndrome), only 20% had a notation in the medical record acknowledging this risk. Only half of these high-risk family members were referred for genetic counseling. Failure to identify patients at highest risk seemed to correlate with insufficient data collection, risk assessment and documentation. If patients at highest risk of hereditary cancer are not identified, then those with less overt risk are most certainly falling through the cracks.

Some providers struggle to incorporate genetics into clinical practice because they lack knowledge about genetics with regard
to health, and disease. A 2003 report found that only 29% of physicians considered themselves qualified to provide genetic counseling. Only 40% of primary care physicians felt qualified compared with 84% of oncologists.[7]

Rapid growth in gene science can outpace our ability to keep up with developments in the field. In a recent literature review, Burke and Kirk,[8] identified gaps in genetics education for nursing professionals. This finding was affirmed at a recent national nurse practitioner (NP) conference, during which NP faculty members were surveyed regarding the inclusion of genetics courses in NP curricula. Of those surveyed, 95% believed it was important to integrate genetics into NP curricula, but only 10% reported having separate genetics courses in their programs.[9]

**Family Health History and Public Health**

Conveying the value of the family health history and its relationship to genetic susceptibility to the general public is essential. Upon recognizing the importance of family history for disease prevention and health promotion, the National Office of Public Health Genomics (NOPHG) launched the *Family History Public Health Initiative* in 2002. Thanksgiving Day 2003 was declared the first annual National Family History Day to encourage Americans to talk about and write down problems and illnesses that run in the family.

In 2004 the Centers for Disease Control and Prevention (CDC) analyzed data from 6000 surveys on health related attitudes and behaviors. The analysis indicated that 96.3% of survey respondents believe their family history is important to their health, even though few had actively collected information from family. This survey identified the need for continued public health efforts to help individuals collect their family health history information and share it with their providers.[10] The Office of the Surgeon General, in collaboration with agencies within the US Department of Health developed a tool, the "My Family Health Portrait" to assist families to record their family health information.[11]

**Family History as a Risk Factor for Disease**

A positive family history increases risk for common diseases by 2 to 10 times that of the general population. Table 1 displays prevalence and risk for disease based on family history.

**Table 1. Prevalence and Relative Risk to Family History of Selected Diseases[12]**

<table>
<thead>
<tr>
<th>Disease</th>
<th>US Prevalence of the Disease</th>
<th>Risk Due to Family History</th>
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<tbody>
<tr>
<td>Cardiovascular disease</td>
<td>58 million</td>
<td>OR = 2.0 (1 first-degree relative) OR = 5.4 (2 or more first-degree relatives with onset &lt;55 yr)</td>
</tr>
<tr>
<td>Breast cancer</td>
<td>3 million women</td>
<td>RR = 2.1 (1 first-degree relative) RR = 3.9 (3 or more first-degree relatives)</td>
</tr>
<tr>
<td>Colorectal cancer</td>
<td>Yearly incidence= 130,000</td>
<td>OR = 1.7 (1 first-degree relative) OR = 4.9 (2 1st-degree relatives)</td>
</tr>
<tr>
<td>Prostate cancer</td>
<td>Yearly incidence= 200,000</td>
<td>RR = 3.2 (1 first-degree relative) RR = 11.0 (3 first-degree relatives)</td>
</tr>
<tr>
<td>Melanoma</td>
<td>200,000</td>
<td>OR = 2.7 (1 or more first-degree relatives) OR = 4.3 (1 first-degree relative)</td>
</tr>
<tr>
<td>Type II diabetes</td>
<td>13 million</td>
<td>RR = 2.4 (mother) RR = 4.0 (maternal and paternal relatives)</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>8 million women 2 million men</td>
<td>OR = 2.0 for osteoporotic fracture (female first-degree relative) RR = 2.4 for wrist fracture (father)</td>
</tr>
<tr>
<td>Asthma</td>
<td>17 million</td>
<td>OR = 3.0 (mother) RR = 7.0 (mother and father)</td>
</tr>
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Odds ratio (OR) and relative risk (RR) ratios are also given in Table 1. The odds ratio reflects how much more likely it is that the disease will occur given the family history (e.g., twice as likely, 10 times as likely, etc.), compared with the general population. Relative risk, calculated differently, conveys the probability of developing the disease based on family history. For example, the OR for colorectal cancer in someone with 2 affected first-degree relatives is 4.9, meaning that this person has almost 5 times greater odds of developing colorectal cancer than the general population. The probability of someone acquiring type II diabetes is 2.4 times greater if his/her mother had type II diabetes.

### Table 1. Prevalence and Relative Risk to Family History of Selected Diseases[^12^]

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OR = odds ratio; RR = relative risk

Studies indicate that more than 30%, and perhaps as many as 40%, of patients have a significant family history, placing them at risk of developing a chronic disease[^13^]. Family history remains underutilized as a tool to assess risk and guide early detection and prevention strategies.

A recent study of early and late onset coronary heart disease in first- and second-degree relatives identified an increased risk of approximately fivefold for early onset heart disease given a strong familial risk, and a twofold increase given a moderate familial risk. The data identified that diabetes, hypercholesterolemia, hypertension, and obesity aggregate in high-risk families, and the risk of coronary heart disease associated with moderate and strong risk increases when these conditions are present and decreases when they are absent[^4^]. This emphasizes the importance of stratifying risk based on family history and intervening where possible.

### Barriers to Obtaining and Utilizing Family History in Primary Care

Because a complete and thorough family history seems to be more the exception than the rule, it is important to explore
barriers that impede clinicians’ ability to elicit this information in a thorough and precise manner. More than a knowledge deficit on the part of clinicians, other barriers also affect the clinician’s ability to interpret family histories and counsel patients regarding risk. Suther and Goodson identified additional constraints such as time limitations, lack of referral guidelines, a dearth of genetics professionals, and reimbursement issues.\[14\]

Pedigree analysis (a multigenerational graphic recording of family medical history using symbols to recognize patterns) can take up to 30 minutes, which is often prohibitive during primary care office visits. A study by Acheson found that the average discussion time devoted to obtaining family history in primary care was less than 2.5 minutes.\[5\] Improved collection tools must be developed to assist healthcare providers to efficiently gather a family history and effectively assess risk.

In 2005, the CDC began evaluating a Web-based tool and algorithm called “Family Healthware.”\[15\] This tool collects information about health behaviors, use of screening tests, and health history for 6 diseases (coronary heart disease, stroke, diabetes, and colorectal, breast, and ovarian cancer). This tool also provides recommendations for lifestyle changes and screening. With current research focused on the development of family history risk assessment instruments, research on the validity and clinical utility of these tools will be ongoing.

### Responsibilities of Primary Care Providers

In 2001, the National Coalition for Health Professionals Education in Genetics (NCHPEG) developed a set of core competencies to help clinicians integrate genetics effectively and responsibly into routine care. NCHPEG recommends that at a minimum, every healthcare professional should: (1) self-examine competence of practice on a regular basis, identifying areas of strength and areas where professional development related to genetics and genomics would improve competence; (2) understand that health-related genetic information can have important social and psychological implications for individuals and families; and (3) know how and when to make a referral to a genetics professional.\[16\] Underlying these competencies is the ability to accurately gather family health history information and identify those who would benefit from a genetics referral.

### Collecting the Family History

History collection can be either targeted or comprehensive, depending on the reason for the visit. A targeted history is appropriate for a visit focused on a specific disorder or symptom. Both histories can be collected with a self-administered tool or by patient interview; in a text format or using a pedigree map. The advantages and disadvantages of each method of obtaining and documenting a patient history are highlighted in Table 2.

### Table 2. Family History Methods

<table>
<thead>
<tr>
<th>Collection Type</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| Self-administered | • Less costly  
• Less provider time  
• Can be completed outside of clinical interaction | • The validity of tools is unproven  
• Literacy, language, medical terminology constraints  
• Less detail  
• Individual cannot "check in" with the provider to ensure that he or she understands the question |
| Interview | • More detail; can follow up on responses  
• Establishes rapport between patient and provider  
• Open-ended, without forced choice responses; provides the opportunity for the individual to engage in a free, though guided, narrative of his/her life | • More time- and labor-intensive for provider  
• Not systematic  
• Provider use requires some training and practice |
| Format | **Advantages** | **Disadvantages** |
| Text | • No need for new skills or training  
• Easy to record and store electronically or on paper | • Patterns are not easily recognizable  
• More difficult to update/edit |
The most important element in the family history is the information, not the format. Any method of collection can be appropriate as long as it is accurate, can be easily updated, and allows providers to detect patterns within the family health history.[17]

The comprehensive history should contain information such as:

- Family structure;
- Major medical concerns or chronic conditions;
- Demographic information; and
- Environmental risk factors.[17]

History of family structure should include all first-degree relatives (parents, siblings, and children), second-degree relatives (grandparents, aunts, uncles, nieces, nephews, grandchildren, and stepsiblings) or as many members as practical (third degree includes cousins and great grandparents). In describing the family relationship it is essential to not only distinguish maternal from paternal, but also half relationships from full.

For each family member, include chronic medical conditions or concerns along with the age at diagnosis, and relevant interventions and procedures. Cause of death is always valuable to document. It may be necessary to encourage patients to go back to family members to clarify unknown or questionable areas such as cause of premature death. In addition, if the provider suspects an inherited disorder in the family, the patient can communicate that suspicion to relatives and encourage them to seek medical consultation for personal risk assessment or screening.

Demographic information regarding each family member should include gender, age (and age at death, if no longer living) and may include ethnicity and country of origin. Environmental information includes risk factors such as smoking or protective environmental modifications including lifestyle changes, treatments, and surgeries.[17]

If a risk is identified, more detailed information or referral to a genetics professional who will prepare a more comprehensive history may be necessary. A three generation pedigree is ideal but not always realistic in primary care. In the setting of preventive medicine, collection and interpretation of family history information might have its greatest impact when focused on common chronic diseases such as cancer and cardiovascular disease. An algorithm with basic questions that every provider should ask, can guide providers in assessing risk (Figure 1).

Source: The National Coalition for Health Professional Education in Genetics (NCHPEG);[17] Available online at http://www.nchpeg.org; Reprinted with permission
Medical conditions with known genetic/familial components that warrant further exploration include:

- Heart disease, stroke, diabetes, high blood pressure, high cholesterol;
- Cancers (colorectal, breast, prostate, endometrial, ovarian, thyroid and skin);
- Lung diseases (asthma, chronic obstructive pulmonary disease, and emphysema, including tobacco use history);
- Blood disorders or blood clots;
- Kidney disease;
- Mental illness such as depression;
- Addictions such as alcoholism;
- Physical abnormalities/birth defects or developmental delays;
- Infertility or multiple miscarriages;
- Osteoporosis;
- Obesity; and
- Hearing or vision loss.

**Interpretation of Family Health History**
Red flags are indications that there may be an increased genetic risk and the need for more in-depth probing. The primary red flag for most common diseases is a large number of affected relatives with the same or related condition. Premature onset of disease is also a genetic risk factor and varies depending on the disease (Table 3).

Table 3. Diseases and Ages of Premature Onset[18]

<table>
<thead>
<tr>
<th>Disease Early Onset (yr of age)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast cancer &lt;50</td>
</tr>
<tr>
<td>Colon/colorectal cancer &lt;50</td>
</tr>
<tr>
<td>Coronary heart disease &lt;55-65</td>
</tr>
<tr>
<td>Diabetes &lt;20</td>
</tr>
<tr>
<td>Endometrial cancer &lt;50</td>
</tr>
<tr>
<td>High Blood Pressure &lt;40</td>
</tr>
<tr>
<td>Dementia &lt;60</td>
</tr>
<tr>
<td>Ovarian cancer &lt;50</td>
</tr>
<tr>
<td>Prostate cancer &lt;60</td>
</tr>
<tr>
<td>Stroke or mini-stroke &lt;60</td>
</tr>
<tr>
<td>Sudden unexpected death &lt;40</td>
</tr>
<tr>
<td>Thyroid cancer &lt;50</td>
</tr>
<tr>
<td>Hearing loss &lt;50-60</td>
</tr>
<tr>
<td>Vision loss &lt;55</td>
</tr>
</tbody>
</table>

A number of methods have been proposed for assessing and stratifying risk in the presence of red flags. Scheuner and colleagues[19] stratify risk based on family history into 3 groups: high, moderate, and average.

**High Risk**

- Premature disease in a first-degree relative;
- Premature disease in a second-degree relative (coronary artery disease only);
- Two affected first-degree relatives;
- One first-degree relative with late or unknown disease onset and an affected second-degree relative with premature disease from the same lineage;
- Two second-degree maternal or paternal relatives with at least 1 having premature onset of disease;
- Three or more affected maternal or paternal relatives; or
- Presence of a "moderate-risk" family history on both sides of the pedigree.

**Moderate Risk**

- One first-degree relative with late or unknown onset of disease; or
- Two second-degree relatives from the same lineage with late or unknown disease onset.

**Average Risk**

- No affected relatives;
- Only 1 affected second-degree relative from one or both sides of the family;
- No known family history; or
- Adopted person with unknown family history.

**Intervening in the Presence of Genetic Risk**

Clinical management and prevention strategies can be focused on individual risks. Often a plan of action is identified with the help of the genetics professional. Stratifying patients into risk categories, while not always straightforward or simple, is a valuable tool for guiding clinicians in making better patient management decisions. Scheuner and colleagues\(^{[19]}\) recommend that those at high risk should be offered personalized prevention and screening and referral for further evaluation; those at moderate risk should be provided with personalized prevention and screening recommendations, and for people with average risk, reinforce standard prevention and screening recommendations.\(^{[19]}\) An algorithm for stratifying risk and the appropriate measures to take is shown in Figure 2.

![Figure 2. Algorithm for management based on risk stratification.\(^{[19]}\)](http://www.medscape.com/viewarticle/575481_print)

**Referral to Genetics Professionals**

The following sections outline some of the reasons for referral to a genetics professional.\(^{[20]}\)

**Adult**

1. Health problem that occurs at an earlier age than expected (10 to 20 years before most people get the disease).

2. Same health condition in multiple family members per risk stratification.

3. Presence of condition in the less frequently affected gender (for example, breast cancer in a male family member).

4. Certain combinations of health problems within a family (for example, breast and ovarian cancer or heart disease and diabetes).
5. Multifocal or bilateral occurrence (ie, multifocal melanoma).

6. Occurrence of disease in the absence of traditional risk factors or after conventional prevention strategies.

7. Birth defects, growth or development problems, pregnancy concerns, and other known genetic conditions in the family.

8. Mental disability without a known cause.

9. Unexplained infertility or multiple pregnancy losses.

10. Personal or family history of thrombotic events.

11. Adult-onset conditions such as hemochromatosis, hearing loss, or visual impairment.

12. Family history of adult-onset neurodegenerative disorder, such as Huntington's disease.

13. Features of a genetic condition such as neurofibromatosis (café-au-lait spots, neurofibromas on the skin) or Marfan syndrome (unusual tallness, dilation of the aortic root).

14. Personal or family history of cancer with a known or suspected inherited predisposition (such as early onset breast cancer, colon cancer, ovarian cancer, or retinoblastoma).

15. Family member with an unusual type of cancer.

16. Sudden death in relative who seemed healthy.

Pre-pregnancy and Prenatal

1. Maternal age of 35 years or older at expected time of delivery.

2. Either parent has had a child with a chromosomal problem.


4. Either parent has had a child with a birth defect or has a family history of birth defects.

5. Pregnancy history of 2 or more unexplained miscarriages.

6. Maternal diabetes, epilepsy, or alcoholism.

7. Maternal exposure to certain medications or drugs (such as some antiseizure medications) during pregnancy.


Pediatric

1. Positive newborn screening test.

2. One or more major birth defects.

3. Unusual (dysmorphic) facial features.
4. Suspicion of a metabolic disorder.

5. Unusually tall or short stature or growth delays.

6. Known chromosomal abnormality.

**Prevent, Detect, and Manage Disease**

Once a patient has been identified to be at an increased risk, the provider can often implement screening strategies and methods for disease prevention. Some patients at increased risk may already have begun to manifest disease. For these individuals, providers can often identify disease and suggest targeted lifestyle changes such as diet, exercise, and smoking cessation. The emphasis on disease prevention and management based on the family history often motivates a change in behavior that forestalls disease or reduces its adverse effects.

It is crucial for primary care providers to understand recommendations based on family history for screening for the normal population and those at risk. The US Preventive Services Task Force (USPSTF) publishes a pocket guide with recommendations for screening, counseling, and preventive medication. Based on systematic evidence reviews, the guide provides recommendations based on family history (Table 4).

**Table 4. Evidence-Based Screening and Prevention**

<table>
<thead>
<tr>
<th>Level</th>
<th>Topic</th>
<th>Recommendations and Clinical Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Aspirin for primary prevention of cardiovascular events(^{[22]})</td>
<td>Discuss aspirin chemoprevention with adults who are at increased risk for coronary heart disease (CHD). Risk assessment should include questions about age, sex, diabetes, elevated total cholesterol levels, low high-density lipoprotein, elevated blood pressure, family history, and smoking.</td>
</tr>
<tr>
<td>A</td>
<td>Screening for colorectal cancer (CA)(^{[23]})</td>
<td>Screen at age 50 or older for colorectal CA. In persons at higher risk (ie, those with first degree relative who had colorectal cancer before age 60); initiating screening at an earlier age. Expert guidelines exist for screening very high risk patients, including those with a history suggestive of familial polyposis or hereditary nonpolyposis colorectal CA, or those with personal history of ulcerative colitis. Early screening with colonoscopy may be appropriate, and genetic counseling or testing may be indicated for patients with genetic syndromes.</td>
</tr>
<tr>
<td>B</td>
<td>Behavioral counseling in primary care to promote a healthy diet(^{[24]})</td>
<td>Counsel adult patients with hyperlipidemia and other known risk factors for cardiovascular and diet-related chronic disease.</td>
</tr>
<tr>
<td>B</td>
<td>Chemoprevention of breast CA(^{[25]})</td>
<td>Discuss chemoprevention with women at high risk for breast CA and low risk for adverse effects of chemoprevention. Older age, family history of breast cancer in a mother, sister or daughter and a history of atypical hyperplasia on a breast biopsy are the strongest risk factors for breast cancer.</td>
</tr>
<tr>
<td>B</td>
<td>Abdominal aortic aneurysm (AAA) screening(^{[26]})</td>
<td>One-time screening for AAA by ultrasonography in men age 65 to 75 who have ever smoked. Major risk factors for AAA include being 65 and older, male, and a history of ever smoking (at least 100 cigarettes in a person’s lifetime). A first-degree relative of AAA requiring surgical repair elevates risk also.</td>
</tr>
<tr>
<td>A/B</td>
<td>Screening for lipid disorders in adults(^{[27]})</td>
<td>Screen men 35 yr and older and women 45 yr and older for lipid disorders and treat abnormal lipids in people who are at increased risk for CHD. Rating:AScreen younger adults (men 20-35 yr and women 20-45 yr) for lipid disorders if they have other risk factors for CHD. Rating:BScreening is recommended for men 20-35 yr and women 20-45 yr in the presence of any of the following: diabetes, family history of cardiovascular disease before age 50 in</td>
</tr>
<tr>
<td>Screening for type II diabetes in adults</td>
<td>The USPSTF recommends screening for type II diabetes mellitus in adults with hypertension or hyperlipidemia. Patients at increased risk for cardiovascular disease may benefit most from screening for type II diabetes, since management of CV risk factors leads to reductions in CV events.</td>
<td></td>
</tr>
<tr>
<td>Osteoporosis screeningpostmenopausal women</td>
<td>Women aged 65 and older should be screened routinely for osteoporosis. The USPSTF recommends that routine screening begin at age 60 for women at increased risk for osteoporotic fractures. Lower body weight (weight &lt;70 kg) is the single best predictor of low bone mineral density. There is less evidence to support the use of other individual risk factors (for example, smoking, weight loss, family history, decreased physical activity, alcohol or caffeine use, or low calcium and vitamin D intake) as a basis for identifying high-risk women younger than 65 years.</td>
<td></td>
</tr>
<tr>
<td>Screening for coronary heart disease</td>
<td>The USPSTF found insufficient evidence to recommend for or against routine screening with electrocardiography (ECG), exercise treadmill testing (ETT), or electron beam computed tomography (EBCT) for coronary calcium for either the presence of severe coronary artery syndrome or the prediction of CHD events in adults at increased risk for CHD events. A person's risk for CHD events can be estimated based on risk factors. Screening with ECG, ETT, and EBCT could potentially reduce CHD events by: detecting people at high risk for CHD events, detecting people who could benefit from more aggressive risk factor modification, or detecting people with existing severe CAS whose lives could be prolonged by CABG surgery. However, the evidence is inadequate to determine the extent to which people would benefit.</td>
<td></td>
</tr>
</tbody>
</table>

A = strongly recommended based on good evidence; B = recommended based on at least fair evidence; D = not recommended for asymptomatic patients based on at least fair evidence; I = insufficient evidence to recommend for or against
Although the *Guide to Clinical Preventive Services* is appropriate for quick access of recommendations made by the US Preventive Services Task Force, additional evidence based practice guidelines are usually necessary to make specific patient intervention decisions (i.e., dosage for aspirin chemoprevention). The National Guideline Clearinghouse (NGC) is a comprehensive database of evidence-based clinical practice guidelines and is an excellent resource for clinicians to further explore evidence for specific patient recommendations.

**The Future of Genomics in Healthcare**

There are ethical, legal, and social implications surrounding genetic advances. Providers must incorporate genetics and genomics effectively and responsibly. Labeling an individual as high or moderate risk may have social, economic, and psychological consequences. Despite these implications and considerations, enormous benefits are possible beyond screening and prevention. Confirming a suspected risk through genetic testing can relieve the anxiety a patient feels from not knowing. Specific preventive interventions may also relieve anxiety through the act of being proactive with regard to one’s risk. Americans are generally very supportive of the uses of genetic information to improve their health and the health of their families.

As we look to the future, experts forecast an era in which medicine will be personalized according to our individualized unique genotypes. It is highly conceivable that in the next 10 to 15 years practitioners may order a battery of genetic tests, or even a complete personalized genetic profile, in the same way that a complete blood cell count and metabolic panel are ordered today.

This does not mean that genetic tests will replace taking the family health history. The family history may be more important than ever for determining which tests to order. If genomic variants are identified in one’s personal genotype and considered direct evidence in making the case for risk, then family history would be analogous to circumstantial evidence. Both are powerful and have a place in identifying and managing risk.

**Related Resources**

To locate a genetics professional in your area:

- **National Society of Genetic Counselors (NSGC)** (click on "Find a Counselor")
- **CDC Family History**
- **CDC's National Office of Public Health Genomics**
- **Genetic Alliance**
- **Genomic Medicine Resource Center**
- **National Council for Health Professional Education in Genetics.**
- **National Guidelines Clearinghouse**
- **US Surgeon General Family History Initiative**

**References**


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