

Direct to Consumer Genetic Testing: Public Right or Public Harm?

Libby Greismann
Stanford University

PART 1: What is Genetic Testing? Science and Existing Policy
For only \$400, you can purchase your genome. In fact, you can purchase much more than that. A complete kit from companies such as 23andme and Navigenics also includes information about the relative risks for over 90 diseases, conditions, and traits, as well as ancestry tracking through maternal and paternal markers, and “community sharing” that allows you to compare your genome to others in the database.

Moreover, this relatively new technology bypasses the healthcare profession completely, allowing private companies to market their products directly to consumers via television, print advertisements, or the Internet. While *TIME* magazine named 23andme’s Personal Genome Service the 2008 Invention of the Year (Hamilton, 2008), many physicians and bioethicists have expressed concern over the under-regulation of the developing industry.

Worries have emerged about the risks of consumer vulnerability in light of the average person’s ignorance about genetics, and subsequent consequences of uninformed decisions about personal health. On the other hand is the hope of promoting awareness of genetic disease, and making preventive care more effective and feasible. Perhaps most contentious is the idea of the “right to know,” that is, the right to know genetic information that is a “fundamental part of you” (Magnus, 2009). Thus the issue is whether the government has the right to regulate the technology at all, or whether this regulation would be infringing on the protectable interest of knowing information about one’s own body.

In 2003, the Human Genome Project released an essentially complete sequence of the human genome, comprising 20,000 – 25,000 genes and more than three billion nucleotides. This major breakthrough allowed advancements in the fields of biology and medicine, especially in the fundamental linking of genes to proteins (Wellcome, 2004). By knowing what genes map to what proteins, we have, in theory, a blueprint of the human body, though it is hard to say that there is a single gene “responsible” for hair color, and more appropriate to say that there is a gene family, or set of genes, that contributes to the trait.

With this knowledge, we see that even a complete read-out of one’s genome does not give clear and simple information about a phenotypic, or

physically apparent, trait. Rather, it is a complex and additive process that is not easily mapped out. For example, “it is likely that human intelligence relies on many gene loci, as more than 100 genes have been identified, and eye color has been linked to at least three genes, with the exact contributions not yet known, according to the most recent studies” (Sternberg and Grigorenko, 1997, p. 6). Therefore, when 23andme claims on its website that eye color is one of the traits that it analyzes, focusing on “information on SNP rs12913832, a marker that influences your trait for Eye Color” (“23andme”), the company acknowledges that it looks at only one contributor to the overall trait of eye color.

The “SNP” that 23andme refers to is a single nucleotide polymorphism, or a variation that occurs when a single nucleotide in the genome differs between members of the same species. This variation could be harmless, such as the SNP involved in hair color, or it could be a marker associated with a serious genetic disease. Genetic diseases often do follow the one-gene-one-trait pattern, with very clear genetic mutations associated with them. Huntington’s disease, “a single-gene disorder that leads to neural degeneration later in life,” is associated with CAG repeats near the tip of chromosome four, with an excess of 40 repeats associated clearly with an onset of the disease, and an excess of 60 associated with early onset (Sternberg and Grigorenko, 1997, p. 92). 23andme screens for 550,000 SNPs spread across the genome, and analyzes the results according to recent scientific data that a particular genotype is associated with an increased chance of developing a certain condition or disease (“23andme”). The debate rests on whether the public is capable of safely interpreting what this increased risk means, and making informed decisions related to their health, without the aid of a doctor or genetic counselor.

In June 2008, the California Department of Public Health sent cease and desist letters to thirteen genetic testing companies, including 23andme and Navigenics. A federal advisory committee claimed, “there were significant gaps in the oversight of genetic tests that could lead to patient harm” (Pollack). The CDPH ordered that proof of federal and state clinical lab certification be obtained, and that all genetic tests be ordered directly by a doctor. 23andme and Navigenics responded by saying that they are offering “personal genetic information services and not medical services,” and that “the tests are ordered by a physician because a doctor on contract to the company reviews customer orders” (Pollack, 2008, sec. C:1). The misleading and ambiguous nature of the rhetoric these companies are using has allowed them to avoid dealing with the regulation issues head on. Without a strict precedent having been set, it becomes difficult to determine whether guidelines are being met, and which guidelines should be applied at all. This ambiguity, combined with the public’s objections against infringements on their right to know genetic information, forced the CDPH to accept this effort as satisfactory. 23andme and Navigenics were granted state certifications, and the companies continue to market

their products despite worries from the medical and legislative communities.

PART 2: My Genome, My Right: An Argument Against Regulations

Proponents of an unregulated genetic testing industry argue that the public has the “right to know” information about their own health. The concept of this “right to know” is rapidly evolving, as medicine offers more and more information about our own bodies. Most basically, there is the notion that an individual has the right to know his or her medical condition. If I go to the doctor, thinking I have a cold, and a test comes back positive for mononucleosis, then that is information that I am entitled to know. From a consequentialist standpoint, it directly affects my health, the path I choose to take to recovery, and, significantly, relates to the idea of informed consent in medical decision-making.

Applying this logic to genetic testing, the government has no right to restrict knowledge of medical information that would confer a benefit on the consumer. This knowledge of the risk of developing a certain disease or condition could help that person make serious decisions about their health, and would aid in preventive care. Dr. Shahla Massood (2008, p. 219) writes, “it is a social and moral responsibility for physicians involved in breast health care to...educate a woman who is a member of a high-risk population about her high risk for breast cancer.” Similarly, if information could be available about *genetic* risk for breast cancer, would it not be a social and moral responsibility to make this information accessible? Of course, this assumes that genetic and medical information are one and the same. As previously discussed, 23andme and Navigenics in fact assert that their services are *not* medical services, but according to this argument, genetic risk is equated to medical risk.

This argument holds true for medical information that confers a significant benefit, and no significant psychological harm. But there are often cases where the burden of knowing information about your own condition may indeed outweigh the benefits of being in possession of this information. For example, patients with dementia or Alzheimer’s, who have no treatment available to them, and who may be in states of diminished capacity, may be better off spared the awful diagnosis. The argument in favor of the “right to know” still applies, say advocates from a deontological (i.e., the ethical position that focuses on what is morally right or wrong regardless of the consequences) standpoint,.

There is the assumption that “lying is wrong, and that clinicians, like everyone else, have a moral duty to tell the truth. Patients have a right to know their diagnosis, this information belongs to them and they should be told the truth regardless of the consequence” (Marzanski, 2000, p. 111). According to this logic, no matter what the negative outcome may be, a patient is entitled to know his or her diagnosis. To apply this theory to genetic testing is to assert that no matter how burdensome the

psychological or emotional consequences, the patient has a right to know his or her increased risks for genetic conditions. Huntington's disease, a horrible degenerative condition for which there is no cure, is easily identifiable through genome SNPs. What benefit would you obtain in knowing that, in ten or twenty years, your brain will slowly degenerate, you will lose control of your muscles, and you will die a slow and painful death, with no hope of delaying or averting this outcome? Arguably none, and the mental burdens are significant. However, the argument in support of this right is that the knowledge itself is a benefit, if the patient desires it, and indeed a right to be claimed.

Yet the tenets of this argument are tenuous on the following grounds. The key difference between a doctor's diagnosis and direct-to-consumer genetic testing is just that: test results are *not* a diagnosis. The benefits that could be realistically derived from a diagnosis of a disease, such as setting up a life insurance plan, deciding not to have children that may have a chance of carrying the disease, or considering treatment options, become meaningless. Making such decisions can only confer a benefit under the assumption that the disease is in fact present and fatal, otherwise, these sacrifices are made for naught. Genetic information is not marketed as medical information, nor is it advertised as a diagnosis. It is a service, simply offering information about the human genome with associated disease risks.

PART 3: Protection of the Ignorant: An Argument in Favor of Regulation

Because of this ambiguous definition, direct-to-consumer tests fall into a gap in the regulatory structure set in place for other medical procedures and tests, and thus no restrictions on their administration or practice exist. Those in favor of regulation acknowledge that there is a right to genetic information, but J.S. Mill's (1859) liberty-limiting principle of paternalism can be applied to make an argument against this right. This fundamental principle, which allows the government to intervene in order to stop individuals from harming themselves, can be invoked under the assumption that distributing genetic information without regulation or medical assistance would, in fact, harm those individuals. The Secretary's Advisory Committee on Genetics, Health, and Society cited "inaccurate disease diagnoses, misguided disease management, inadequate family planning counseling, an exacerbation of health disparities, and unnecessary costs," as the major harms associated with direct to consumer genetic testing (Gniady, 2008, p. 2448). Proponents of regulation say that Americans must be protected from information that they lack the capacity to adequately interpret when there is a high risk of making hasty or unsafe medical decisions.

The proposed regulatory changes range from banning direct-to-consumer testing completely, to ensuring that a genetic counselor is present to help the individual interpret his genetic risk results. Under every

option, a physician must order the test, precluding the consumer's ability to purchase the tests freely. Mari Baker, the chief executive of Navigenics, stated publicly that her test, "doesn't say you have a disease, it says you carry a genetic predisposition for the disease" (Pollack, 2008, sec. C:1).

But it is doubtful that the American consumer knows this subtle difference. A "300 percent" increase in risk for coronary artery disease may mean that this individual's risk has been elevated from the standard one percent to three percent. Does this increase warrant worry? A change in diet? Preventive surgery? Regulation of genetic testing would help to ensure that the confusion would be eliminated. Of course, under this stipulation, the doctor can refuse to order the tests, and we return to the point of contention: whether the individual has an overriding right to know the information in question.

As Ashish Mahajan (2007, p. 1243), of the University of Alberta, states, "patients have unprecedented access to health information, but lack the skills to interpret it." Without these skills, patients are in danger of making false assumptions, and undergoing undue stress and other harms. For example, a recent ad campaign marketed to consumers urges women to consider being tested for mutations in the genes BRCA1 and BRCA2, two genes implicated in breast cancer. What the company doesn't mention about this \$3000 test is that only five to ten percent of all breast cancer cases are a result of a mutation in BRCA1 or 2 (Gniady, 2008, p. 2449). For a woman who knows she is at high risk for breast cancer, through family history or because she has developed the associated ovarian cancer, this test is well worth the cost. But a woman in a low-risk group is more likely to receive an inaccurate or misleading test, and the test may not be of benefit to her. Ordering the test through a doctor, rather than by the woman herself, creates the role of a gatekeeper, who can advocate for the test on behalf of those who would benefit, and prevent low-risk candidates from receiving potentially erroneous results.

Knowing genetic risk information presents harms more serious than a mental burden. "Misguided disease management" is not merely changing one's eating habits. Findings from a 2005 study showed that the frequency of suicidal thoughts increased from 9.1 percent in "normal" patients, to 23.5 percent in patients diagnosed with "possible Huntington's disease" (Paulsen, 2005). This figure illustrates the increased likelihood of significant self-harm as a result of knowing the mere possibility of developing this disease. Other examples include preventive surgery, or abortion upon knowledge of a (supposed) genetic condition. These harms are serious and deserve to be mediated. It would be dangerous to let individuals believe they are at risk for a condition without proper information to interpret the results.

PART 4: Where To Go From Here

The American sense of entitlement encourages citizens to have the newest, best technologies available. Our presumption in favor of autonomy

emphasizes the individual's right over government paternalism. When these two fundamental principles combine, consumers often make choices that promote liberty, but compromise the safety that a regulatory body would ensure. Genetic testing is such a case: a shiny new technology attracts customers who have little understanding of the true nature of the product and yet wholeheartedly resist restrictions on their freedom to use the product.

I agree that genetic testing is able to confer a significant benefit, if applied accurately and carefully. Knowing the risk of a disease from genetic information can be just as valuable as family history or environmental predispositions, information to which we give significant weight when making medical decisions. Implicit in this weight, however, is an understanding of what the relative risk connotes. It is easier to grapple with the idea that one should be more concerned if one's father had Parkinson's than if one's third cousin did. Yet translate these relative risks into statistics, and the concept becomes muddier. A 25 percent chance seems to be a clear cause of worry, but what about a 12 percent chance? Or a four percent chance? At what point does a number become problematic? My argument is that the average citizen does not have the answer to this question, and thus should not be permitted to engage in self-directed genetic testing.

Regulation in the medical world is common. Patients are not permitted to order any test or procedure that they wish: there must be a convincing medical reason for doing so. Even if a patient believed that he had a "right to know" what his kidney looked like, he could not demand to have one removed so he could examine it. However, it is not uncommon for Ashkenazi Jews, who are at a higher risk for breast cancer, to undergo prophylactic treatments. About one in forty Ashkenazi Jewish women has a genetic mutation in BRCA1 or BRCA2, the genes known to be implicated in the cancer, a rate almost four times as high as a Caucasian woman who is not Ashkenazi Jewish. Once the gene is identified, through a screening test that is recommended for the Ashkenazi population, measures such as increased surveillance, prophylactic oophorectomies and mastectomies, and chemoprevention can be taken to reduce risk of developing the cancer (Brandt-Rauf, Raveis, Drummond, Conte, & Rothman, 2006). The crucial difference in these two scenarios is that one confers undue risk, without tangible benefit, while the other is a decision made in the face of risk in order to achieve a significant gain. I contend that the same can be applied to genetic testing.

Both arguments for and against regulation of genetic testing treat genome sequencing as a blanket term. The crucial mistake here is attributing the same risk-benefit value to each SNP assessment. Thus the predisposition for blue eyes is given the same "right to know" value as the predisposition for Alzheimer's, though one seems to carry a much more serious impact on daily life. In regulating genetic testing, it is important to distinguish between these two principles. I argue that the first, which I will

call the “curiosity principle,” cannot be infringed upon. The other, which I will call the “medical future principle,” can be restricted if a doctor deems the information unnecessary for the patient. This restriction, however, does not mean a total ban. It may range from preventing the customer from purchasing the test, to ensuring that the customer enlists adequate genetic counseling as a stipulation of signing off on the test order.

To further the proposition, direct-to-consumer genetics companies may offer two tiers of service: the curious, and the so-called “useful.” Those enterprising individuals that want access to their genetic information just for the sake of *knowing* should be given unrestricted access to such traits as hair color, eye color, freckling, baldness, odor detection, and avoidance of errors, all of which 23andme offers. This information cannot reasonably be construed as presenting a threat or harm to the beneficiary of the knowledge, as erroneous or misleading though it may be. Without any harm, there is no moral duty to prevent anyone from accessing statistics about these traits.

On the other side is the “medical future” tier. Risks of cancers, multiple sclerosis, brain aneurism, schizophrenia, Parkinson’s, diabetes, and countless other diseases and conditions would be included in this list. Each test should be conducted independently, and must be ordered separately. Consumers wishing to purchase information about their risk for disease must consult with a physician regarding their reasons for doing so. It will then be up to the physician to decide whether it is, in effect, beneficial for this patient to be undergoing such tests. An Ashkenazi Jewish woman whose mother had breast cancer would be a clearly appropriate target for the BRCA1 and 2 tests. On the other hand, a hypochondriac with suicidal tendencies may not be the best candidate for any of the second-tier tests. Of course, these are the two extremes. I acknowledge that circumstances put individuals on a wide spectrum between the two. For these cases, the paternalism principle must be invoked when appropriate. Granted, this may be a subjective and imperfect practice, but the same could be said of most medical advice.

The contradictory nature of these examples underlines the complexities inherent to genetic testing. The black and white arguments that propose a fundamental right to information versus the government’s right to protect people from themselves does not sufficiently capture the nature of this issue. The possible harms are not yet defined and fully played out, and until they are, regulation must be put in place to ensure the safety of the public.

References

23andme. Retrieved February 27, 2009 from 23andme.com.

Brandt-Rauf, S., Raveis, V., Drummond, N., Conte, J. & Rothman, S. (2006). Ashkenazi Jews and Breast Cancer: The Consequences of

- Linking Ethnic Identity to Genetic Diseases. *American Journal of Public Health* 96, 1979-87.
- Doebly, J. (2001). George Beadle's Other Hypothesis. *Genetics* 158, 487-93.
- Gniady, J. (2008). Regulating Direct to Consumer Genetic Testing: Protecting the Consumer Without Quashing a Medical Revolution. *Fordham Law Review*, 2429-475.
- Hamilton, Anita. (2008). TIME'S Best Inventions of 2008. *TIME Magazine*. www.time.com/time/specials/packages/article.html.
- The Health Insurance Portability and Accountability Act of 1996. (1996). *Health Information Privacy*. U.S. Department of Health and Human Services. Retrieved February 27, 2009 from <http://www.hhs.gov/ocr/privacy/index.html>.
- Magnus, D. (2009). Direct to Consumer Genetic Tests: Beyond Medical Regulation? *Genome Medicine* 1, 17.
- Mahajan, A. (2007). Do Patients Understand Risk? *The Lancet* 369: 1243.
- Marzanski, M. (2000). Would You Like to Know What Is Wrong With You? *Journal of Medical Ethics* 26, 108-13.
- Mill, J.S. (1859). *On Liberty*. Toronto: Dover Publications
- Masood, S. (2008). The Knowledge About Risk for Breast Cancer: The Patient's Right to Know. *The Breast Journal* 14, 219-20.
- Paulsen, J., Hoth, K.F., Nehl, C., & Stierman, L. (2005). Critical Periods of Suicide Risk in Huntington's Disease. *American Journal of Psychiatry* 162, 725-31.
- Pollack, A. (2008, June 26). Gene Testing Questioned by Regulators. *The New York Times*, sec. C:1.
- Prophylactic Mastectomy. (2007, November 20). *Breast Cancer*. Retrieved February 27, 2009 from <http://www.mayoclinic.com/health/prophylacticmastectomy/WO00060>.
- Sternberg, R., and Grigorenko, E. (eds). (1997). *Intelligence, Heredity, and Environment*. Cambridge: Cambridge UP.
- The Wellcome Trust Sanger Institute. (2004). Finishing the euchromatic sequence of the human genome. *Nature* 431, 931-45.