Direct to consumer genetic testing: Avoiding a culture war

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There are times in history when a new scientific idea becomes so powerful and compelling that it transforms the culture at large. This happened in the 17th century as the Copernican model of the universe gained traction and again in the 1940s as physicists emerged from their laboratories to usher in the atomic age. It may be happening now in genetics as genomic analysis promises to transform medical care and simultaneously becomes available to the world through direct to consumer (DTC) genetic testing. Although nearly everyone agrees with the general prediction that genetics will ultimately revolutionize the practice of medicine, the emergence of DTC genetic testing has been marked by a noticeable degree of acrimony and soul searching within the community of academic genetics. DTC genetic testing raises numerous questions involving privacy, the nature of what constitutes a medical test, who should regulate access to genomic information, and how different individuals might understand and value such information. However, in parallel to these controversies, a clash of cultures is occurring, which may help explain the passion with which genetics is now routinely discussed both within and outside the field. Accusations of paternalism on the one hand or recklessness on the other risk igniting a culture war. In hopes of avoiding such an outcome it seems appropriate to take a deep breath and examine where we stand, where we should go, and how to get there in a way that takes advantage of the best from both worlds.

Perhaps, we should start by distinguishing between the DTC companies that use high-quality genetic testing and who seek to leverage published and peer-reviewed scientific evidence (such as 23andMe, deCodeMe, and Navigenics), and many DTC genetics companies that do not even do legitimate laboratory testing or make pseudoscientific claims for the role of genetics in nutrition, cosmetics, and matchmaking.[1,2] As an evidence-based field, we should indeed be at war with pseudoscience and fraud, but we should acknowledge that the leading DTC companies are using state-of-the-art SNP chips, legitimate analytic methods, comprehensive literature reviews, and advanced information technology. We may disagree with their choices, interpretations, or presentations, but they have already been transparent enough about their methods that they cannot be considered fraudulent. Disruptive technologies are, by definition, new and controversial, and we can all too easily fall prey to suspecting the motives of their founders and leaders. However, given their scientific and technological track record, it is clear that they are fascinated by genetics and genuinely hope to harness the new synthesis of genetics and information technology to empower individual self-knowledge and promote health. Thus, our goals are closely aligned with theirs, and we should resist the urge to impugn their motives, simply because they lead for-profit companies. Although many of us may perceive their efforts as naïve from a medical standpoint, we must acknowledge that we are at the very start of the "genetic revolution" and admire their willingness to plunge into this new science.

So, if we and the leaders of DTC companies share a mutual fascination with the field of genetics and a hope that genetic progress will benefit human health, why do we hesitate to cheer them on? In part, it may be simply that many of us have toiled in the laboratory or at the bedside in obscurity to promote the field of genetics while suddenly consumer genetics has gotten a great deal of public attention. In part, it may be the institutional slowness of the medical profession to translate new discoveries into medical practice, something that many in our society find unconscionable.[3] Indeed, it has been well recognized that the medical profession, in order to preserve professional autonomy, actively resists the utility of technologies that assist in medical decision making, even when these are demonstrated to be superior.[4] The sorry state of adaptation in something as elementary as electronic medical records is testament to the enormous dysfunction of our medical culture when it comes to adopting useful and even lifesaving technologies.

However, there is more to this cultural frisson than the inertia of modern medicine. In medical genetics, we have seen first hand in the faces of expectant mothers undergoing prenatal testing or in the families of patients with rare disorders, the power of information to disrupt emotions and lives. We both formally and viscerally understand how poorly equipped the world is to understand probabilities; we have directly experienced the myriad opportunities for misunderstanding that exist and the iatrogenic cost of unnecessary tests and procedures. Not all of us who have criticisms for the DTC community are technological luddites or blind acolytes of medical orthodoxy. Our great hope is also to harness genetics for human betterment, and although we may seem at times to be naysayers, we have learned through difficult and bitter experience that when dealing with human health, following certain rules and adhering to methodical approaches can be literally lifesaving.

Two principles also inform our hesitation: (1) the need to constantly remember that we have great power to harm and (2) as frustrating as it is true, that the practice of medicine cannot ultimately be decided by good ideas. Personal genetic information in the hands of individuals, without interpretation by clinicians, can certainly directly empower them to make healthy choices, and who would argue with that? However, because information can also cause anxiety, lead to unnecessary medical procedures, and eat-up valuable health resources, it can both directly and indirectly cause harm.[5] Moreover, because the benefit of genetic risk information available at this time is questionable, even for readjusting risk,[6] it would seem reasonable to be cautious about the benefits of such information and careful about the potential adverse impact.

Nor can we endorse DTC genetic testing simply because we believe it will have benefit in the future. The history of medicine is riddled with the corpses of both good ideas and patients (e.g., the extracranial/intracranial bypass,[7] the use of hormone replacement therapy,[8] and most recently, perhaps, the prostate spe-

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cific antigen test[9,10]). Unfortunately, when it comes to providing medical advice, good ideas are not enough; actual evidence of benefit must be generated before we apply new technologies regardless of how attractive the notion.

So, how do we avoid the incipient culture war between purveyors of DTC and the medical genetics community? How can we reframe this controversy in a constructive way so as to respect the power of new ideas, acknowledge a public that seems fascinated with genetic testing, eschew unwarranted paternalism, and yet not abandon the hard fought lessons learned by medical practitioners over many years?

The first step may simply be transparency. The simple expedient of requiring open labeling of tests and the ways in which they are conducted and interpreted will help avoid inappropriate paternalism and assumes that consumers who have access to open information can make reasonable decisions. Thus, it seems to us that a first step for the academic and clinical genetics communities is to insist on the provision of accurate and transparent information to consumers. It should be noted that the leading DTC companies seem to agree with this in principle and indeed have already taken laudable steps to publish on their sites the ways in which they construct their message and calculate their risk estimates.

However, more is needed. Genetic tests, whether provided by conventional medical laboratories or by DTC companies, should be accurate. CLIA-certified laboratories should not only be used but also we should acknowledge that even CLIA certification provides only a minimum standard for what has been called "analytic validity" and more rigorous standards are needed.[11] There is very little information available on the error rate for genome scans or the procedures used for quality control and accuracy among laboratories that conduct genetic tests.

Next, genetic tests provided by DTC companies should be honestly labeled. Those with no medical implications (e.g., your ear wax type, bitter taste perception, or ancestry) should be labeled as "nonmedical." However, if the results are primarily of medical interest (and after all, information about one's heart attack or cancer risk can hardly be construed as nonmedical), these tests should be labeled as such and not marketed implicitly or explicitly as anything but a medical test.

Finally, the question of whether such tests are useful should be examined honestly by both academics and DTC companies preferably in collaboration. Those tests with demonstrable utility, such as *BRCA* status, should be labeled as "medical information with demonstrated utility." Medical information that has no demonstrated utility could simply be labeled as such, for example: "medical information/no demonstrated utility." It should be stated, for example, that refining one's diabetes risk by genotyping without reference to information about family history weight or blood glucose is simply misleading.[12] Transparent labeling leaves the door open for those who wish to pursue such information for personal reasons, but makes it clear that such utility is not endorsed by current medical thinking.

Finally, the information provided to potential consumers of such information should be logically consistent. With respect to the recent inclusion of genotyping for the three common *BRCA1/2* Ashkenazi founder mutations, a spokesman for 23andMe has said: "In the Terms of Service section of its website, 23andMe stresses that data generated by its service is for information and education only and is not meant to help 'diagnose, cure, treat, mitigate, or prevent a disease or other impairment or condition, or to ascertain health'."[13] This seems an odd statement to make about information that is decisive in leading individuals to seek risk-reducing surgery, enhanced surveillance, or pharmacologic intervention.

As always with such questions, the issue of "who decides" about utility will be contentious. However, the task of determining the utility of medical information is one that a number of expert groups tackle on a regular basis, including the U.S. Preventive Services Task Force[8] and Evaluation of Genomic Applications in Practice and Prevention.[9] However, it remains to be seen how these groups can possibly keep up with the pace of scientific discovery and medical integration of those discoveries. Empirical studies can also contribute data on utility, as demonstrated by the randomized trials of *APOE* disclosure in the REVEAL Study.[14] Moreover, a clear role for societies such as the American College of Medical Genetics and the American Society of Human Genetics would be to work with reputable DTC companies to help guide the public as we begin to explore our genomes. Determining the utility of genomic information offers an exciting area of collaboration between the purveyors of such information and the medical community.

It is critical that the genetics community not be driven by excessive paternalism, a wish to inappropriately limit public access to information or simply by fear of change. At the same time, we must insist that purveyors of DTC genetic testing recognize the possibility that when medical information is used prematurely or inappropriately, it may cause real harm, either directly or by leading to medical interventions, which consume resources and carry the risk of iatrogenic effects.[5] In so doing, we can bridge the cultural divide and work together to enable people to explore their genome with the marvelous and exciting new tools at hand in a way that values medical experience and technological innovation.

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