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Editorial

A Pragmatic Consideration of Ethical Issues Relating to Personal Genomics

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At 23andMe, we welcome opportunities to discuss ways in which we can balance the need to educate and protect consumers with our intertwined missions: giving people access to their own personal genetic information (PGI), and creating a novel, participant-driven research model. As the president of the American College of Medical Genetics recently noted, "the train has left the station," no matter one's view on direct-to-consumer (DTC) testing (Toner 2009).

Our missions compel us to treat implications of personal access to genomic data in a highly nuanced manner, avoiding black and white idealizations. Below we list our perspectives on several issues raised in these pages, paired with positions we have taken in the interest of pragmatism.

1. **An individual's genome may include both highly and weakly predictive variants.** Some commentators assume that most or all of the data reported by DTC companies "are only weakly associated with disease risk" (Hall and Gartner 2009), but several DTC companies report on more predictive associations, such as that between factor V Leiden and thrombosis. In particular, 23andMe includes rarer, more predictive mutations on its custom array in addition to the common variants on standard genome-wide arrays. The 23andMe offering thus represents the spectrum of rare and common variants that will soon be available from full genome sequencing. Though there is uncertainty about whether the yet unidentified genetic contributions to complex diseases are due to rare variants, a combination of myriad common variants, or both, there is always a possibility that predictive information may be available from one's genome, whether now or in the future. *Rather than focusing on how predictive PGI is, ethical and policy discussions can focus on whether an individual has a fundamental right to access PGI.*
2. **Genetic information is both exceptional and non-exceptional.** An individual's PGI is unique, which is arguably the primary reason for the widespread curiosity about one's genetic make-up (McGuire et al. 2009). That genes are fixed also distinguishes them from other biomarkers. However, risk due to genetics can be treated similarly to risk from environmental factors. The magnitude of the modest risks conferred by common variants is comparable to that of incompletely predictive biomarkers already in clinical practice, suggesting a way to integrate genetic risk into the clinical setting. For example, if a patient's profile of common variants conferred 1.4-fold increased risk for myocardial infarction, a clinician could classify her as if her total cholesterol level were two standard deviations above average (McQueen et al. 2008). *Though genes are fixed, effects of genes on common, complex diseases can be treated similarly to non-genetic risk factors.*
3. **Genetic data with no clinical relevance today may become clinically relevant tomorrow—and we cannot know ahead of time.** Some genetic associations with so-called "normal traits" such as eye color also have associations with health-related conditions (Duffy et al. 2004). Genetic ancestry services report mitochondrial or Y haplogroup, yet associations between haplogroup and disease are known (Fuku et al. 2007). Extreme paternalism would suggest that gatekeepers control access to ancestry information or to studies linking normal traits to disease risk, but this level of paternalism could hinder education and active participation in one's own health. *Preventing all risk information from reaching consumers can be impractical.*
4. **Genetic information can be clinically non-actionable but personally actionable.** The Coriell Personalized Medicine Collaborative tests for medically actionable conditions only, excluding e.g. Alzheimer's susceptibility testing of the APOE gene. This restriction ignores the value of information to an individual's personal decisions. Actions that could be informed by knowing

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one's APOE genotype include purchase of long-term care insurance, informing family members, supporting Alzheimer's research studies, or other coping efforts (Angrist 2009). *Consumers can benefit from discussions of access to PGI considering both personal and clinical actionability, while acknowledging that the information's value varies among individuals.*

5. **A single data sharing policy cannot fit the needs of all.** One of Facebook's innovations is the granular customizability of data sharing. The option—and necessity—of customizing privacy settings can actively engage users to learn about the unintended consequences of sharing. Similarly, 23andMe users must opt in to share, choosing whether to share ancestry information only or ancestry and health-related information. Sharing PGI may even have unidentified benefits—for example, apomediation pioneered by early adopters of personal genomics as a guide to newcomers (O'Connor 2009). *Customizable privacy filters can satisfy a range of comfort levels while allowing research into the benefits of sharing PGI.*

As we continue to respond to feedback from customers and scholars in the scientific, medical, and ELSI communities, 23andMe becomes as much a reflection of its users and critics as of the people at 23andMe. The train may have left the station, but it's never too late to get on board. ■

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