

Genomics and the Future of Healthcare in the United States

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Introduction

Since the release of a “completed” human genome analysis in 2003, scientists, medical care providers, insurance companies and politicians have all hotly debated the role of genomics in future medical practice. The last five years have seen genetic analyses vastly reduced in price. Sequencing of Single Nucleotide Polymorphisms (aka: SNPs, the common regions of variance between two individuals’ DNA that often gives rise to differences in phenotype) has become steadily cheaper, with start-ups such as 23andMe offering SNP analysis for only \$999 (*23andMe*). On a grander scale, the X prize foundation, at the encouragement of Dr. Craig Venter, has offered a \$10 million prize to anyone who can devise a rapid and complete human genome analysis for under \$1,000 (*You and the \$1000 Genome*). The growing affordability of genetic analysis (and the promise of even more thorough and more affordable DNA sequencing options in the near future) makes real the possibility that healthcare in the United States will, in the very near future, be custom tailored according to each patient’s genetic needs.

For the most part, DNA structures predispose, rather than directly cause, an individual to contract a given disorder. As a result, doctors such as Francis Collins of the National Human Genome Research Institute have argued that genomics will have “profound” affects on diagnostics and preventive healthcare (Collins). Many doctors envision a revolution in medicine, in which a new age of preventive medicine, informed largely by the analysis of each patient’s genome, results in a trend toward socialization. However, many doctors, economists and politicians have opposed this vision of medicine’s future, contending that the benefits of

genomics to preventive medicine would be minimal, uneconomical and best harnessed under a privatized medical system directed by insurance companies. This essay intends to explore both perspectives in order to evaluate what would be the most plausible and most beneficial course of development for healthcare in the post-genomic age.

Genomics and Preventive Medicine

According to the *Oxford Textbook of Primary Medical Care*, genomics will result in improvements to nearly all facets of medical care. It will allow for optimal understanding of nutrition needs at different stages of life, result in improved diagnostics, help prevent disease, and facilitate the discovery of new, more effective and less toxic drugs, for “common, multifactor diseases” (Jones 627). Although the *Oxford Textbook of Primary Medical Care* concludes that genomics will most revolutionize the treatment of these multifactor diseases, preventive medicine remains the primary focus of most arguments for or against the greater inclusion of genetic analysis in clinical healthcare.

Gordon Duff, professor of molecular medicine at the University of Sheffield, has argued that the preventive medicine enabled by genomics constitutes an economic necessity for the governments of both developed and developing nations. He asserts, “We cannot afford not to embrace genomic medicine. Health budgets cannot go on rising as they did in the second half of the twentieth-century. Preventive medicine is an economic necessity, and genomic medicine represents the best route we have to preventive medicine” (Richards). Duff’s analysis of the modern medical-economy assumes a socialized system in which state governments bear the responsibility of providing medical care for the majority of their citizens. Because governments operate with (at least in theory) a budget limited to the taxes they collect, governments would seek to minimize expenditure. An arrangement in which medical care could be improved while

medical costs reduced, would be highly appealing in a state whose medical system was controlled by its central government.

If genomic, preventive medicine really reduced the need for medical expenditure on the order of magnitude suggested by Duff, the price of insurance premiums would likely decrease and the profits of insurance companies greatly diminish in turn. Privatized healthcare, in the vain of America's medical status quo, might find itself hard-pressed to survive if advances in economical genome sequencing cause preventive medicine to become a commonplace clinical practice.

As a result, in his 2001 paper for the Journal for the American Medical Association entitled *Implications of the Human Genome Project for Medical Science*, Dr. Francis Collins discusses a "social agenda of genetics" that, he argues, must be advanced as vigorously as the "medical agenda" of genetics (Collins). In the paper, Collins predicts that the complete integration of genomic research into clinical medicine would require approximately twenty-five years, hypothesizing that by 2010, predictive genetic tests would be available for various common conditions and that by 2020, pharmacogenetics would allow for better predictions of drug responsiveness and the development of more effective drugs designed according to molecular pathways.

As of 2008, much of the technology requisite for both predictive genetic tests, as well as for pharmacogenetic research, exists. The failure to make such practices the clinical norm stems, not from technological failure, but from the social obstacles to genomic and preventive medicine. Collins identified the American medical care system as a major impediment to preventive healthcare and predicted that "Access to healthcare, already a major problem in the United States, will complicate these new advances, unless our medical care system changes in

significant ways” (Collins). This assessment of the state of healthcare in the United States amounts to an attack on the privatized insurance industry which, due to a lack of profit potential, has failed to encourage the “new advances” of genomic, preventive medicine. Even though a change in policy among the insurance companies could constitute “change,” it appears more likely that Collins understands this era of “dramatic change in medicine” as sympathetic with the aims of nationalized medical care (Collins).

Under such a program, access to healthcare would become a non-issue. Moreover, as a consequence of government backing, genetic-based medicine would not be as vulnerable to denigration by “anti-technology movements” as Collins fears it would be if the current socio-cultural dynamics of the United States persist. In light of the recent passage of the Genetic Information Nondiscrimination Act (GINA), barring employers and insurance companies from discriminating based upon one’s genetic make-up, Collins’s first “crucial step” for the proliferation of genomics and preventive medicine into clinical healthcare has been fulfilled (*Genetic Information Nondiscrimination Act 2007-2008*). What remains to be done, at least according to Collins, is the promotion of a social agenda that expands healthcare to all Americans, likely under the auspicious of a government-supervised, cost-efficient medical system like that envisaged by Gordon Duff.

The Argument for the Status Quo

Not all doctors believe that the preventive medicine enabled by genomic research will prove cost-efficient and they argue that radical change in the status quo is not necessary in order to advance preventive medicine to the forefront of clinical practice. In an essay for the *Annals of Internal Medicine*, Drs. Richard Cooper and Bruce Psaty contend that “it is inefficient to design tailored interventions for the vast array of individual susceptibility profiles” (Cooper). Cooper

and Psaty ground their conclusion in the assumption that life-style, consumption and environment—rather than genetics—act as the “primary disease-producing forces.” Preventive measures aimed at reducing disease-inducing behaviors in the general population could vastly reduce the rates of common conditions, such as heart disease, cancers and diabetes, among all Americans. However, by relegating the curative capacity of genomics to “a few rare disorders,” Cooper and Psaty overlook the importance of genetic screening for both preventative and curative purposes on the individual level.

For example, an individual with a known genetic predisposition to colon cancer should undergo colonoscopies more frequently than a member of the general population. Although a healthy lifestyle would likely reduce one’s likelihood of contracting colon cancer, the only means of preventing the diseases is to detect and eradicate it in its early stages through the colonoscopy procedure. As the cost of sequencing continues to diminish, determining the genome of patients, and then providing increased preventive treatment to those with a strong genetic disposition to diseases with high degrees of penetrance would certainly prove more cost efficient than expanding the same degree of preventive treatment to the entire population. Similarly, by determining the genetic bases of an individual’s predispositions to heart disease, cancer and diabetes, doctors could not only provide patients with more effective treatments tailored to their specific pathologies but could also devise for their patients more effective preventive regimens.

Cooper and Psaty’s conclusion that “it is inefficient to design tailored interventions,” is reechoed by libertarians and other economic conservatives. Those who vehemently favor a privatized insurance scheme believe that insurance should protect against “unexpected loss,” rather than covering the entire gamut of medical care (Bailey). These critics condemn the current state of health insurance but also the very premise of universal, socialized healthcare, in

their assertion that “Instead of insuring against large, unpredictable costs such as chemotherapy or a heart bypass, many policies cover what is essentially routine maintenance” (Bailey). Such a vision of healthcare appears compatible with the position of Cooper and Psaty and antithetical to that of Duff and Collins. Few individuals would seek to have their genome sequenced if they were required to pay for the service out of pocket and as a result, privatized healthcare designed only to insure “large” and “unpredictable” costs would only promote preventive medicine at the most simplistic, broad, and inexpensive level. The government and insurance companies could try to encourage people to diet, exercise and avoid toxic agents such as tobacco and excess alcohol through education and media campaigns. However, such efforts would do far less to cut disease rates and improve the treatment of common diseases than the transformation of the American medical status quo into a system in which patients engage in life-long health management plans formulated around their individual genetic vulnerabilities.

Conclusion: Genomics and Medicine at the Close of Collin’s 25 Years

Francis Collins estimated that it would take twenty-five years from the publication of his article in 2001 to the full implementation of predictive medicine and pharmacogenetics in clinical practice. After nearly a decade, technology has advanced dramatically. The entire three-billion base pair human genome has been successfully sequenced, the function of many genes and the disease implications of many SNPs have been determined, SNP sequencing has become affordable, a strong financial incentive (in the form of an X prize) exists for the development of a cost-efficient whole-genome sequencing process, and the US government has recently taken the vital step of providing its citizens with legal protection against genetic discrimination by employers or insurers. However, in spite of the many advances the last seven years have witnessed, the preventive medicine enabled by genomics has yet to emerge as a dominant clinical

practice. The questions that remain before us are whether such preventive medicine will ever rise to the fore of clinical healthcare and, if it does, how such a medical revolution will change the current healthcare system of the United States (*Obama Introduces Bill*).

These questions will be determined in large part by economic theory and political will. The cost-efficiency of preventive medicine lends itself to the non-profit nature of nationalized healthcare systems, which seek to reduce their expenditure in order to reduce the tax premiums assessed on their citizens. More and more Americans are clamoring for the socialization of healthcare. Although a February poll by the Harvard School of Public Health and Harris Interactive found Americans split among party lines—with seventy percent of Democrats favoring socialized healthcare and seventy percent of Republicans opposing it—the poll recorded that, overall, forty-five percent of Americans expected socialization to improve healthcare whereas only thirty-eight percent believed it would worsen it (*Poll: US Split on Socialized Medicine*). Senior figures in the Democratic Party have been the primary champions of socialized healthcare in the world of politics and Barack Obama, the presumed nominee for the Democrat's 2008 presidential campaign, has been a strong advocate of increased funding for genomic research aimed primarily at pharmacogenetics and the development of more intelligently designed drugs. Perhaps, the promise of “revolutionary advances in medicine” that Obama has attributed to genomics may soon become a clinical reality.

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