

GENOMIC MEDICINE – NEW NORMS REGARDING GENETIC INFORMATION*

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Clinical genetics has traditionally centered on the delivery of information, perhaps more than any other field of health care. While information disclosure is important in all fields of medicine, other fields typically use information in the context of offering choices of medical treatment such as surgical or other interventions. In clinical genetics, the sharing of information has been the main purpose of the clinical visit, but often the information has been centered more on lifestyle choices – such as reproductive decisions or whether to learn about untreatable risks—than on actual treatment decisions. As a result, the information gathering process has taken on special significance in genetics and presented a range of issues, including when and under what circumstances genetic information should be sought, in what manner information should be obtained and disclosed, and who should make those determinations.

With the development of new technologies, we are moving from “classical” or traditional genetics to genomic/personalized medicine. Fundamentally, the goals of both kinds of genetic analysis are similar – to help patients make important decisions and, where possible, to prevent disease. But, the technological differences between classical genetics and genomic medicine will lead to important differences in both the quantity and nature of information generated. These changes will (and are already beginning to) challenge some of the underlying norms of clinical genetics regarding the delivery of information. First, it will pose enormous obstacles to the kind of

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informed consent that has shaped classical genetics and which is rooted in a strong commitment to patient autonomy. Second, it will raise questions about the appropriate scope of testing and analysis that should be offered, when it should be offered, and what information should be reported and disclosed to patients. Such questions force us to re-examine some of the underlying ethical principles that have shaped classical genetics, such as how much autonomy patients should have regarding their genetic information, how much the health care profession should protect patients from “toxic” or confusing information, and what additional obligations the medical profession owes to others besides the patient.

This piece will begin by describing the transition from traditional clinical genetics to genomic medicine and how this shift will change many features of genetic analysis such as the nature of the patient population and providers, the purpose of testing, and the scope and kind of information it will generate. Part II will explore the challenges to informed consent posed by the enormous amount and variety of information that genomic analysis makes possible. It will also consider whether alternatives exist that honor the spirit of and address the concerns that animate the specific and detailed consent of classical genetics. Part III will address additional concerns about the expansion of genomic analysis and argue that, in spite of worries about the potential costs and challenges of genomic medicine becoming routine too soon, various factors will push toward more widespread genomic analysis for an ever growing number of people sooner than may be ideal. As such expansion occurs, Part IV suggests, it will further challenge norms by encouraging broader disclosure of information to patients, whether or not patients want this information. Finally, Part V explores how the issues associated with the expansion of genomic analysis will begin to de-exceptionalize genetic information and challenge the emphasis on promoting patient autonomy that has been so central to classical genetics. While offering some tentative proposals for addressing these challenges, the piece concludes by describing the various ways genomic analysis may actually undermine autonomy, in spite of the common claim that the expansion of genomics promotes autonomy.

I. FROM “CLASSICAL” CLINICAL GENETICS TO GENOMIC MEDICINE

A. The History of “Classical” Genetics

Genetics did not begin as a discipline within medicine, but instead arose as part of a movement to eradicate social ills such as crime, poverty, and lack of general fitness. The early geneticists were focused more on how the eugenics movement could eradicate traits thought to be inherited and the source of many social issues of the time.¹ It was not until the latter part of the 20th century when the science of genetics was integrated with clinical care and became a true branch of human medicine.² In part, because of its different origins from many other branches of medicine, the field of clinical genetics has often approached certain issues in health care somewhat differently from the rest of medicine.³

One distinction has been the especially strong emphasis on preserving patient autonomy in decision-making through informed consent. While informed consent has been important in all fields of medicine, it is often more in theory than practice,⁴ informed consent has historically been at the center of genetic counseling, largely because the enterprise has been about delivering information to help patients make lifestyle and reproductive decisions. Genetics professionals have put high value not only on ensuring that patients are adequately informed, but also on attempting not to bias the decision making process through nondirective approaches to the decision making process.⁵ To some extent some of these norms reflect general trends in contemporary medicine that resist the paternalism of old-

¹ Sonia M. Suter, *A Brave New World of Designer Babies?*, 22 BERK. TECH. L.J. 897, 902-905 (2007) [hereinafter Suter, *Brave New World*].

² *Id.* at 918-19.

³ For example, the field has long had a strong emphasis on nondirective counseling to promote autonomous decision-making. Sonia M. Suter, *Sex Selection, Nondirectiveness, and Equality*, 3 U. CHICAGO L. SCH. ROUNDTABLE 473, 479 & n.2 (1996) [hereinafter Suter, *Sex Selection*].

⁴ See, e.g., Jay Katz, *Informed Consent - A Fairy Tale? - Law's Vision*, 39 UNIV. PITT. L. REV. 137 (1977); see also Marjorie M. Schultz, *From Informed Consent to Patient Choice: A New Protected Interest*, 95 YALE L.J. 219, 290-91 (1985).

⁵ Sonia M. Suter, *The Routinization of Prenatal Testing: Cause and Effect*, 28 AM. J. LAW. & MED. 233, 242 (2002) [hereinafter Suter, *Routinization*]; Suter, *Sex Selection*, *supra* note 3, at 478-80.

school medicine. Even so, arguably no branch of medicine has put as much stock and faith in the principle of promoting autonomy in decision making as the field of human genetics.

One reason for the strong emphasis on patients' making their own choices, fully informed of their options, and without any (intentional) pressure on the ultimate decision, is the fact that there is often no clear medically optimal decision.⁶ Instead, many of the decisions in classical genetics are related to lifestyle preferences and values. For example, when clinical genetics resided primarily in the realm of obstetric and pediatric medicine, genetic information was largely valuable to help parents make reproductive choices.⁷ For the most part, no treatments were available for conditions identified in the fetus or child; to a large extent that remains true today. For intended parents with family histories of genetic diseases, genetic information is therefore still primarily valuable as a means to learn about the risks of having an affected child. If the risks are relatively high, they can seek other means of becoming a parent (e.g., through adoption or gamete donation), become pregnant and undergo prenatal testing to decide whether to continue the pregnancy, or simply be prepared to deal with the condition if the fetus carries the relevant mutations.⁸ The main medical considerations in the reproductive context have been the probabilities of having an affected child and the risks of miscarriage associated with prenatal testing via amniocentesis or chorionic villus sampling ("CVS"). Loathe to direct parents facing such deeply personal choices to choose one course over another, genetic counselors have been not only nondirective but also eager to ensure that families undergoing genetic testing understand the limits of genetic testing and the medical risks associated with the prenatal procedures.⁹

As increased knowledge of the human genome expanded the ability to test for the risk of late-onset conditions, such as neurological conditions and cancers, clinical genetics began to

⁶ Suter, *Sex Selection*, *supra* note 3, at 479-80.

⁷ Suter, *Routinization*, *supra* note 5, at 236-37.

⁸ Suter, *Brave New World*, *supra* note 1, at 924.

⁹ Suter, *Routinization*, *supra* note 5, at 243-44.

include adult genetics.¹⁰The coin of the realm, however, has largely continued to be information rather than treatment. What changed was the nature of decisions affected by the information. In adult genetics, the decisions concern lifestyle and sometimes prophylactic measures to lessen risks of cancers and other conditions. Unlike with prenatal testing, the risks associated with obtaining genetic information about adult-onset conditions are not physical. Nevertheless, the genetics community has worried about the risks of “toxic” information.¹¹The oft-cited example is the psychosocial risk of learning that one carries the gene for Huntingtons, which guarantees development of the condition later in life. With no prospect of treatment or prevention, one faces possible anxiety, distress, social stigma, and/or discrimination.¹²Similar, though less stark, risks exist with respect to learning about genes associated with cancers, which although sometimes preventable still present potential psychosocial risks.¹³These concerns have reinforced the genetics profession’s emphasis on detailed informed consent and highlighted the idea that patients have a right not to learn about their genetic risks.

As we move toward personalized and genomic medicine, the hope is to use information about each patient’s genetic variations to improve health through preventive and individualized measures such as lifestyle changes and effective drug therapy at the appropriate dosages.¹⁴ Although the ultimate goal of genetics has long been prevention of illness, so far the gap between information that offers clinical benefits and information that simply allows for life planning has been large. In spite of efforts to close that gap, we are

¹⁰ *Id.* at 237.

¹¹ Suter, *Routinization*, *supra* note 5, at 239 n.42; see LORI ANDREWS ET AL., *ASSESSING GENETIC RISKS: IMPLICATIONS FOR HEALTH AND SOCIAL POLICY* (Institute of Medicine, 1994).

¹² See, e.g., Maurice Bloch et al., *Predictive Testing for Huntington Disease in Canada: The Experience of Those Receiving an Increased Risk*, 42 AM. J. MED. GENETICS 499 (1992); Marlene Huggins et al., *Predictive Testing for Huntington Disease in Canada: Adverse Effects and Unexpected Results in Those Receiving a Decreased Risk*, 42 AM. J. MED. GENETICS 508 (1992); Suter, *Routinization*, *supra* note 5, at 237.

¹³ Gail Geller et al., *Genetic Testing for Susceptibility to Adult-Onset Cancer: The Process and Content of Informed Consent*, 277 J. AM. MED. ASS’N. 1467, 1470-72 (1997).

¹⁴ Perry W. Payne Jr., *Should the Affordable Care Act’s Preventative Coverage Provision Be Used to Widely Disseminate Whole Genome Sequencing to Americans?*, 39J. HEALTH POLITICS, POL’Y, & L. 239, 243 (2014).

still, and will likely remain for some time, a long way from doing so, even as we expand the kind of genomic information patients can receive.¹⁵

B. The Differences Between Classical Genetics and Genomic Medicine

The transition from traditional, classical genetics toward genomic medicine will lead to several changes that influence who obtains genetic information, who provides it, and the nature of information obtained. One fundamental difference is what drives the genetic analysis in the first place. In classical genetics, the analysis focuses on single genes or chromosomes and the goal is “hypothesis driven” – i.e., testing is intended to help diagnose someone who presents with symptoms of a genetic condition or who has a family history of an inherited disorder. In contrast, the scope of testing in genomic medicine is much more expansive – it involves broad scale testing involving analysis of thousands of variants in the genome or sequencing the genome in its entirety. Significantly, such expansiveness allows for “hypothesis-free” analysis.¹⁶

This difference affects what kind of patient seeks genetic information. Until recently, genetic analysis has been offered only when there are medical indications, such as a family history of genetic conditions, a child with a putative genetic condition, certain ethnic backgrounds, or other factors that might increase the risk of genetic anomalies in oneself or one’s future children. In classical genetics, therefore, genetic analysis has been limited to a narrow region of the genome, usually a single gene or a few genes based on the medical indication.¹⁷ But in the last few years, genetic analysis has become more expansive and less targeted with the introduction of

¹⁵ Eric T. Juengst, *Personalized Genomics and the Rhetoric of Patient Empowerment*, 42 HASTINGS CTR. REP. 34, 36 (2012).

¹⁶ Sarah Bowdin, et al., *The Genomic Clinic: A Multidisciplinary Approach to Assessing the Opportunities and Challenges of Integrating Genomic Analysis into Clinical Care*, 35 HUMAN MUTATION 513-14 (2014).

¹⁷ Karyotyping for prenatal testing or other purposes is more global, however, in the sense that it analyzes all of the chromosomes. But, the analysis is quite broad, evaluating for the presence, absence or deletions of parts of chromosomes, rather than a true exploration of the genome. MedlinePlus, *Karyotyping*, (Nov. 2, 2012), <http://www.nlm.nih.gov/medlineplus/ency/article/003935.htm>.

multiplex testing, which allows for the possibility of analyzing not just one gene but several at once.¹⁸ This technique has been employed in both the prenatal and adult genetics context. For example, in the latter context, individuals with family histories of one kind of cancer, are now often offered the possibility to test for mutations associated with other cancers that have not appeared in the patient's family.¹⁹

Another, quite significant expansion of genetic analysis has come in the form of array-based genotyping, where thousands of single-nucleotide polymorphisms (variations within parts of the genome) can be analyzed.²⁰ This is just beginning to emerge in the clinical context.²¹

It has, however, been used most widely outside of the clinical context by drug-to-consumer ("DTC") companies that offer people the ability to learn about a number of genetic variants, ranging from medically relevant information (such as susceptibility to diseases) to "recreational" information (such as information about genealogy and "recreational" traits, like whether asparagus affects the odor of one's urine).²² In addition, this technology has been used widely in genetic-wide association studies, which will further our capacity to use this technology for personalized medicine in the future, where the hope is to use genetic information to determine susceptibility to disease and for pharmacogenomics purposes.²³

Finally, there is the "holy grail" of genomic medicine, the ability to analyze not just thousands of variants in the genome, but the entire genome via whole genome sequencing ("WGS") or sequencing the exome (the part of the genome that codes for proteins).²⁴ With

¹⁸ Iris Schrijver et al., *Opportunities and Challenges Associate with Clinical Diagnostic Genome Sequencing: A Report of the Association for Molecular Pathology*, 14 J. MOLECULAR DIAGNOSTICS 525, 525-27 (2012).

¹⁹ Denise Grady & Andrew Pollack, *Finding Risks, Not Answers in Gene Tests*, N.Y. TIMES, Sept. 22, 2014, available at <http://www.nytimes.com/2014/09/23/health/finding-risks-not-answers-in-gene-tests.html?r=0>.

²⁰ Heglason et al., *The Past, Present and Future and Direct-to-Consumer Genetic Tests*, 12 DIALOGUES CLINICAL NEUROSCIENCE 61, 62 (2010).

²¹ *Id.* at 63.

²² *Id.*

²³ Juengst et al., *supra* note 15; Kyung-Won Hong & Bermseok Oh, *Overview of Personalized Medicine in the Disease Genomic Era*, 43 BMB REP. 643 (2010).

²⁴ Richard R. Sharp, *Downsizing Genomic Medicine: Approaching the Ethical Complexity of Whole-*

advances in bioinformatics and sequencing technology, the ability to sequence the whole genome or exome ("WG/ES") is becoming faster, more accurate, and cheaper.²⁵ All of these advances, as we shall see, raise the possibility of the creation and delivery of exponentially more genetic information than ever before and expand both the kind and number of individuals who will seek genetic analysis, which has enormous implications for health care.

Such expansive testing has not yet become a part of ordinary clinical care, although genomic analysis is being offered in certain instances based on medical indications. For example, individuals with family histories of cancer are being offered testing of panels of cancer genes. Similarly, in some instances where a complex disorder has not yet been diagnosed but a genetic variant is suspected, clinicians have used WG/ES to search for potentially responsible mutations. This kind of expansive screening is part of an effort to end the "diagnostic odysseys" for many rare disorders, sometimes with breathtaking success.²⁶ Thus, we currently find ourselves at a point where traditional genetics (with a limited pool of patients based on genetic risk) is beginning to overlap with genomic analysis (where testing is less targeted and more expansive).²⁷

It is the dream, however, of many that expansive genetic analysis will become a routine part of personalized medicine in the near future as individuals undergo array-based genotyping or even WG/ES to learn about susceptibility and risks for various genetic conditions. The hope is that such broad analysis will allow people to alter their lifestyles, use prophylactic measures to prevent conditions, and/or make relevant reproductive choices, all with the goal of improving health.²⁸ When and if such a shift occurs, we will have

Genome Sequencing by Starting Small, 15 GENETICS IN MED. 191 (2011).

²⁵ Gene Support Council, *Should You Have Your Whole Genome Sequenced?*, 73 Gene Advocate, 1 (2013), available at <http://www.geneticandrarediseasenetowork.org.au/resources/Gene-Advocate-Issue-73.pdf>.

²⁶ PRESIDENTIAL COMMISSION FOR THE STUDY OF BIOETHICAL ISSUES, PRIVACY AND PROGRESS IN WHOLE GENOME SEQUENCING at 114 (2012) [hereinafter PRESIDENTIAL COMMISSION].

²⁷ Of course, DTC genetic analysis, which is not part of clinical care but offered almost as a consumer product, does not fit neatly into this description since more expansive testing is available to individuals regardless of medical indications.

²⁸ FRANCIS COLLINS, *THE LANGUAGE OF LIFE: DNA AND THE REVOLUTION IN PERSONALIZED MEDICINE* (2010); Leroy Hood & S.H. Friend, *Predictive, Personalized, Preventive, Participatory*

fully transitioned from targeted genetic testing to genomic medicine.

As we move toward that goal, we will see an expansion of the categories of people who undergo genetic analysis from those with heightened risks of inherited disease to those with ordinary population risks of genetic disease, i.e., potentially anyone. Second, the number of individuals seeking genetic information will increase, potentially dramatically. Whereas traditional genetic testing, which targets a particular gene only makes sense when there is a reason to suspect a possible mutation in that gene (based on family history or clinical symptoms, for example), WG/ES by definition (whether to assess disease susceptibility or for pharmacogenomic purposes) is not targeted or hypothesis driven. It is open-ended in its search for information.

Given that each of us has some genetic mutations (though the quantity and significance varies from person to person), genomic analysis can potentially reveal something to all of us about at least some of these variations.²⁹ Indeed, the goal of personalized medicine is to test everyone to determine what risks they face. This means that as array-based genotyping or WG/ES becomes more widely used in clinical care, the kind of individual seeking genetic information will change and the line between “genetic” and “non genetic” patient will blur. Everyone will have the potential to be a genetic patient in the sense of seeking and acting, in some way, in response to genetic information.

This evolution in genomic analysis will not only expand and change who becomes a “genetic” patient, but it will also expand the categories of individuals who offer genetic analysis and explain the

(P4) *Cancer Medicine*, 8 NATURE REVIEWS CLINICAL ONCOLOGY 184, 184 (2011) (some describe these goals as “personalized,” “predictive,” “preventive” and “participatory”); Robert Pear, *Obama to Request Funding for Treatments Tailored to Patient’s DNA*, N.Y. TIMES, Jan. 24, 2015 (even the President, in his most recent State of the Union address, shared such hopes in his budgetary plans to allocate “hundreds of millions of dollars for a new initiative to develop medical treatments tailored to genetic and other characteristics of individual patients”).

²⁹ Holly K. Tabor et al., *Pathogenic Variants for Mendelian and Complex Traits in Exomes of 6,517 European and African Americans: Implications for the Return of Incidental Results*, 95 AM. J. HUMAN GENETICS 183 (2014) (a recent study found that each individual harbors a mean of 15.3 risk alleles); Dan Koboldt, *Return of Results from Next-Gen Sequencing*, Sept. 10, 2014, available at <http://massgenomics.org/2014/09/next-gen-sequencing-return-results.html> (“These findings challenge the assumption that secondary findings (actionable results) and incidental findings (potential clinical utility) uncovered by exome or genome sequencing are rare.”).

results. For the better part of the history of classical genetics, those individuals have tended to be genetic professionals – masters-level genetic counselors or MD and/or PhD trained professionals who specialize in genetics.³⁰ As a result, genetic testing has largely remained in the realm of clinical genetics, not other disciplines. In the last decade or so, that has been less true of reproductive genetics, which has begun to seep into routine obstetrics care.³¹ Adult genetic testing, in contrast, has tended to reside in the province of genetics clinics. As genomic analysis enters clinical care, however, we will undoubtedly see its presence extending beyond genetics clinics into broader areas of medicine – primary care and internal medicine, for example. If the goals of personalized medicine – to individualize health care for all patients via genomic information – come to fruition, this kind of broad-scale genomic analysis would inevitably become a part of ordinary clinical care.

Another kind of expansion of providers has arisen in the last few years with the emergence of DTC companies. These companies offer genetic analysis not only outside of genetics clinics, but outside of clinical care altogether.³² This phenomenon raises questions about the appropriate norms for delivering genetic information and how we understand the nature of genetic information in the first place.

Finally, the most significant and perhaps most obvious change will be the sheer amount of information that array-based genotyping and especially WG/ES analysis will provide. By moving from targeted testing, which focuses on information concerning a

³⁰ See HuiZang et al., *On the Globalization and Standardization of Medical Genetics and Genomics as Clinical and Laboratory Specialties*, 7 N. AM. J. MED. & SCI. 194, 197 (2014).

³¹ Suter, *Routinization*, *supra* note 5, at 245.

³² The emergence of DTC companies as sources of clinically relevant genetic information outside of the clinical setting has led to concerns that consumers, without guidance from professional genetic counseling, will make misguided decisions about their health care or lifestyles. H. Skirton et al., *Direct to Consumer Genetic Testing: A Systematic Review of Position Statements, Policies and Recommendations*, 82 CLINICAL GENETICS 210 (2010). In addition, there are worries that DTC companies will offer genomic information without adequate accuracy or clinical validity. European Society of Human Genetics, *Statement of the ESHG on Direct-to-Consumer Genetic Testing for Health-Related Purposes*, 18 EUR. J. HUMAN GENETICS 1271 (2010). In fact, in 2013, the FDA prohibited 23andMe from selling some of its personal genome services because of poorly validated claims regarding the health implications of some of its tests. A. Gutierrez, *Warning Letter to 23andMe. Inspections, Compliance, Enforcement, and Criminal Investigations of the U.S. Food and Drug Administration*, available at <http://www.fda.gov/oc/ce/enforcementactions/warningletters/2013/ucm376296.htm>,

particular gene, to genomic analysis, which produces information about different parts of the genome, the amount of information generated will be enormous.³³ Although the goal of such expansive testing is to provide more information so that people can make important health-care and life-style decisions, as Parts II and III describe, the explosion and complexity of information will present a number of challenges and dilemmas for the health care system related to, respectively, informed consent and the amount and kind of information that should be reported and disclosed to various categories of patients.

II. MORE INFORMATION, BUT LESS INFORMED CONSENT?

As we move from traditional genetics toward genomic medicine and as the lines blur between genetic and non-genetic patients and genetic and non-genetic providers of genetic information, the traditional norms and methods of information delivery in genetics will be challenged in significant ways. This Part will address the logistical issues in trying to adequately inform patients about the implications of undergoing genomic analysis given the great volume and variety of information that such analysis creates. In short, genomic medicine will challenge one of the central goals of genetics: to ensure that patients offer truly informed consent when seeking genetic information. As a culture, we tend to value information for its own sake under the theory that “knowledge” is power. But all information is not equal in its usefulness or value (positive or negative), in general, or to specific patients. Genomic medicine forces us to consider whether we can adequately educate patients about the benefits and harms of receiving information so that they can make informed choices about what information to receive. While informed consent may be possible, as this Part suggests, it will require a rethinking of what informed consent should entail.

A. The Value of Informed Consent in Genetics

To understand the challenges of informed consent in a world of genomic medicine, it is important to take a moment to consider the

³³ See *infra* text accompanying notes 49-53.

value of informed consent, generally, and in the genetics context, in particular. Informed consent has long been an aspirational goal in bioethics if not also in the practice of medicine. The notion that every competent patient should have the ability not only to make their own medical decisions, but to do so fully informed of the risks, benefits, and alternatives is rooted largely in one of the primary bioethics principles of the West, autonomy,³⁴ although beneficence can also justify informed consent.³⁵ Philosophers, lawyers, physicians, and courts have written extensively on the justifications of informed consent and some of the challenges of achieving it in practice.³⁶ While courts impose on physicians the obligation to disclose material information to patients,³⁷ the law has never fully incorporated all of the aspirational goals of informed consent. Physicians are merely obligated to disclose information, but not to ensure the kind of comprehension that would make a patient's consent meaningfully informed.³⁸ In addition, the scope of disclosure is defined either by what a reasonable physician would disclose or by what a reasonable patient would find material,³⁹ but not by what *this* particular patient would find material. These limitations are rooted in practical

³⁴ Kam C. Wong, *A Matter of Life and Death: A Very Personal Discourse*, 1 GEO. J. L. & PUB. POL'Y 339, 341 & 359 (2003).

³⁵ Gerald S. Schatz, *Are the Rationale and Regulatory System for Protecting Human Subjects of Biomedical and Behavioral Research Obsolete and Unworkable, or Ethically Important but Inconvenient and Inadequately Enforced?*, 20 J. CONTEMP. HEALTH L. & POL'Y 1, 13 (2003) (arguing that informed consent in the U.S. is constitutionally grounded).

³⁶ See, e.g., AMERICAN MEDICAL ASSOCIATION, AMA CODE OF MEDICAL ETHICS, OPINION 8.08 (updated Nov. 2006), available at [³⁷ See, e.g., *Canterbury v. Spence*, 464 F.2d 772, 786 \(D.C. Cir. 1972\); *Lacaze v. Collier*, 437 So. 2d 869 \(La. 1983\) \(Dennis, J., concurring\) \(citing *Schloendorff v. Soc'y of N.Y. Hosp.*, 105 N.E. 92 \(N.Y. 1914\)\); *Truman v. Thomas*, 611 P.2d 902, 906-07 \(Cal. 1980\).](http://www.ama-assn.org/ama/pub/physician-resources/medical-ethics/code-medical-ethics/opinion808.page?;NEIL C. MANSON & ONORA O'NEILL, RETHINKING INFORMED CONSENT IN BIOETHICS 4-5 (2007).</p></div><div data-bbox=)

³⁸ 464 F.2d 772 at 780, n. 15 ("The focus of attention is more properly upon the nature and content of the physician's divulgence than the patient's understanding or consent . . . [T]he vital inquiry on duty to disclose relates to the physician's performance of an obligation, while one of the difficulties with analysis in terms of "informed consent" is its tendency to imply that what is decisive is the degree of the patient's comprehension").

³⁹ Sonia M. Suter, *The Politics of Information: Informed Consent in Abortion and End-of-Life Decision Making*, 39 AM. J. L. MED. 7, 14 (2013) [hereinafter Suter, *Politics of Information*]. See also Jaime S. King & Benjamin W. Moulton, *Rethinking Informed Consent: The Case for Shared Medical Decision-Making*, 32 AM. J.L. & MED. 429, 430 (2006).

considerations. Ensuring comprehension by patients could be a daunting task for physicians when patients vary tremendously in their education, intelligence level, and general medical literacy.⁴⁰In addition, requiring physicians to shape the scope of disclosure based on individual desires of the patient would impose potentially burdensome demands in trying to discern precisely what *this* patient's taste for medicine is.⁴¹

Because the coin of the realm in genetics is information, however, genetic counseling has gone beyond what the law demands in trying to ensure that patients fully understand what their testing options are and the implications of these options. It is fair to say that the genetics community has taken the notion of informed consent more seriously than practically any other discipline in medicine.⁴²The amount of information discussed as part of the informed consent process in genetics not only exceeds what the law requires, but also goes beyond what is shared in other areas of medicine when patients are tested for potential health risks – such as blood tests for cholesterol or glucose levels to test for the risks of, respectively, heart disease or diabetes. For example, with classical, targeted genetic testing, the informed consent process typically includes disclosure about the nature of the condition at issue, the patterns of inheritance, the probabilities of inheriting mutations associated with the condition, the penetrance or likelihood of the condition manifesting, the typical age of onset, as well as the lifestyle and reproductive implications of carrying the particular mutation.⁴³Prenatal counseling sessions can be like a mini-course in biology with diagrams about chromosomes, meiosis, and nondisjunction, as well as age-related statistics about

⁴⁰ *Canterbury*, 464 F.2d at 780 n. 15.

⁴¹ *Id.*; *Truman v. Thomas*, 611 P.2d 902, 905 (1980) (“Material information is that which the physician knows or should know would be regarded as significant by a reasonable person in the patient's position when deciding to accept or reject the recommended medical procedure”). In addition, one might worry about a plaintiff's 20/20 hindsight in believing, after the fact, that information was important, when it might not have been at the time. Or worse, fraud may be a concern if the plaintiff falsely claims to desire undisclosed information after the fact.

⁴² “Informed Consent in Genetics Research”, *Genetics and Social Science* (2015), available at http://www.nchpeg.org/bssr/index.php?option=com_k2&view=item&id=112:informed-consent-in-genetics-research&Itemid=141.

⁴³ Suter, *Routinization*, *supra* note 5, at 236-37.

having a child with chromosome abnormalities.

Such in depth discussions, however, have been possible in traditional clinical genetics, because the reason for seeking genetic information was based on a particular medical indication, e.g., a family history or symptoms suggestive of a heritable disorder. Moreover, the conditions have tended to be monogenic disorders, i.e., based on a single gene.⁴⁴ As a result, the informed consent process focused on the implications of finding mutations associated with just one gene. In many ways, this approach reflects the view that genetic information is “exceptional” and requires special attention and protection as compared with other medical information.⁴⁵

Even within “classical” genetics, however, there have been concerns about the informed consent process. One worry has been the shortage of health care providers trained in genetics, especially as the demand for traditional genetic services has increased.⁴⁶ The fact that so few medical professionals are adequately trained in genetics and perhaps do not put as much emphasis on informed consent before obtaining medical information has only furthered this fear.⁴⁷ Further, long before we were close to sequencing the entire genome for clinical purposes, there was concern about informed consent as we developed the capacity to test for multiple mutations at once making the informed consent process, even for geneticists, much more difficult.⁴⁸ As we shall see in the next section, this concern was prescient.

B. Informed Consent Challenges in the Genomic Era

For a number of reasons, genomic analysis will raise a number of informed consent challenges. Perhaps most significant is the sheer volume of information that can be generated and the vast range of

⁴⁴ See, e.g., WORLD HEALTH ASS'N, GENETIC RESEARCH CENTER, GENETIC TESTING (Jan. 7, 2014), <http://www.who.int/genomics/elsi/gentesting/en/>.

⁴⁵ See generally, Sonia M. Suter, *The Allure and Peril of Genetics Exceptionalism: Do We Need Special Genetics Legislation?*, 79 WASH. U. L.Q. 669, 705-06 (2001) [hereinafter Suter, *Genetics Exceptionalism*].

⁴⁶ Henry T. Greely, *Get Ready for the Flood of Genetic Testing*, 469 NATURE 289, 291 (2011).

⁴⁷ Mark A. Rothstein, *The Case Against Precipitous, Population-Wide Whole Genome Sequencing*, 40 J. LAW, MED. & ETHICS 682, 686-87 (2012).

⁴⁸ Greely, *supra* note 46; *Multiplex Genetic Testing*, 28 HASTINGS CTR. REP. 15 (1996).

conditions for which mutations might be found through WG/ES and other forms of genomic analysis.⁴⁹ Full informed consent would require describing the biology and probabilities with respect to not one disease gene, but several or almost all genes at once. Further complicating this process is the fact that the variants that can be identified from genomic analysis are associated with conditions that differ in their patterns of heritability: for example, some are recessive and some are dominant. They also differ as to whether they are monogenic or not: many will be multifactorial conditions, meaning multiple genes and environmental factors play a role. These differences can affect the individual's likelihood of developing the disease and whether the variants have reproductive implications.

Even more important, the implications of having variants associated with different conditions differ in many respects: 1) age of onset, 2) penetrance (whether the variant always leads to the condition), 3) expressivity (the variability of the condition's severity), 4) availability of treatment or prophylactic measures, 5) clinical nature of the condition, and 6) reproductive implications (for example, being a carrier of a variant for a recessive condition won't affect the carrier, but increases the chance of having an affected child).⁵⁰ Explaining all of these elements for any one condition is time consuming enough in the ordinary course of traditional clinical genetics. Attempting to offer this kind of information for each potential variant becomes an impossibility.

Adding to the complexity of informed consent is the possibility of finding variants in various regions of the genome that, given our still limited understanding of the genome, are of uncertain significance (VUS).⁵¹ It may be unclear whether the variant is associated with morbidity and, if so, what kind. Or it may be unclear whether a variant is clinically significant in a person who does not have a family history of the medical condition.⁵² When there is a

⁴⁹ Rothstein, *supra* note 47, at 682.

⁵⁰ *Id.* at 683-84; Jonathan S. Berg, et al., *Deploying Whole Genome Sequencing in Clinical Practice and Public Health: Meeting the Challenge One Bin at a Time*, 13 *GENETICS IN MED.* 499, 501-03 (June 2011).

⁵¹ Eline M. Bunnik, *A Tiered-Layered-Staged Model for Informed Consent in Personal Genome Testing*, 21 *EUR. J. OF HUM. GENETICS* 596, 598 (2013).

⁵² *Id.*; Berg et al., *supra* note 50.

family history, the strong risk of disease in individuals with the variant may be due not only to the variant, but also to other familial genes, epigenetics, or unknown factors.⁵³Such factors may not be present in those without such a family history, which is why the significance of the variant is unclear.

The New York Times recently described the challenges of such uncertainties for a woman with a family history of breast cancer.⁵⁴Rather than offer to test just the genes associated with inherited forms of breast cancer, the providers offered her the possibility of testing a panel of thirty genes related to different cancers. Although she was not found to have any mutations associated with breast cancer, she did have a variant associated with stomach cancer in individuals with family histories of stomach cancer.⁵⁵The protocol for someone with this variant and a family history would be to remove the patient's stomach. Given her lack of a family history, however, clinicians could not determine her risk of stomach cancer. Her physicians advised against removing her stomach and recommended instead that she have regular endoscopy procedures, potentially for the rest of her life.⁵⁶Perhaps this information will ultimately save her from serious illness if cancer is detected early, but, in any event, it has definitely caused anxiety and confusion about her future risks.⁵⁷True informed consent for such multiplex testing would require an understanding of the possibility of discovering such uncertain and unsettling information.

Describing all of the potential variants that could be found, the diseases with which they are associated, the patterns of inheritance, the likelihood of disease, the age of onset, and the uncertainty surrounding many variants (even if the discussion is limited to general categories of diseases as opposed to every known genetic condition) has been estimated to take 2-6 hours of face-to-face discussion over several sessions.⁵⁸In an era where economic pressures

⁵³ Bowdin, *supra* note 16, at 514.

⁵⁴ Grady & Pollack, *supra* note 19.

⁵⁵ *Id.* (noting the panel also found a mutation that may increase the patient's risk of breast cancer.).

⁵⁶ *Id.*

⁵⁷ *Id.*

⁵⁸ Berg et al., *supra* note 50, at 499.

motivate health care professionals to spend ever less time with patients, it is unimaginable to provide such counseling to all patients undergoing genomic analysis, especially when the decisions concern whether to undergo a test as opposed to whether to accept a highly profitable medical intervention. Talk in medicine is not cheap; it simply does not yield much profit. Even for genetic counselors, who are less highly paid than physicians, the returns are simply too low to expect that each counselor can afford to spend so many hours obtaining informed consent from each patient. Furthermore, even if economics could justify such lengthy discussions, there are just too few trained professionals who could provide such information,⁵⁹ making what has been a long-term concern in genetics even more marked and troublesome.

C. The Implications of Informed Consent Challenges

The fact that the in-depth genetic counseling and informed consent are no longer possible presents a deep quandary for the genetics profession. But it also raises larger questions about some of the underlying norms of informed consent generally and specifically in this context. While many supporters of informed consent lament the failures of the doctrine in practice and as incorporated in the law,⁶⁰ there are others who argue that the tendency has gone too far the other way – where both ethics and the law have overwhelmed patients with too much complex information, far beyond what patients actually want or need.⁶¹ In this context, how much is lost if specific informed consent is no longer possible in a genomic medicine world?

One of the rationales for the “exceptional” approach to counseling and informed consent in genetics is the potential “toxicity” of some genetic information, which can present

⁵⁹ Rothstein, *supra* note 47, at 684.

⁶⁰ See, e.g., Jay Katz, *Informed Consent - A Fairy Tale? - Law's Vision*, 39 U. PITT. L. REV. 137, 161 n.76 (1977) (stating that omitting a material medical fact is a dignitary wrong to the patient because the patient's power of choice is reduced, even if the patient would have made the same decision and even if no physical harm occurred); Schultz, *supra* note 4, at 290-91 (discussing the benefits of recognizing at least some types of intangible interests in patient choice).

⁶¹ CARL E. SCHNEIDER, *THE PRACTICE OF AUTONOMY: PATIENTS, DOCTORS AND MEDICAL DECISIONS*, 515 (1998); see also Suter, *Politics of Information*, *supra* note 39, at 16.

psychosocial risks of distress, anxiety, and confusion, as well as stigmatization and discrimination, particularly when we can only identify risks and not provide adequate treatment or prevention.⁶² Such genetic information potentially puts people in an uncomfortable no-man's land where one is not and may never become sick (because the risks are only probabilistic) but where one feels deep unease in knowing about the heightened risk of illness with minimal or no options to eliminate the risk. On top of this, the individual might face discrimination in employment, insurance, and other venues. In the genetics world, even information about risks for conditions for which there are some preventive or ameliorative measures, such as some inherited forms of cancer, is viewed as potentially harmful or "toxic" given the possible psychosocial risks.⁶³

But as the move toward genomic analysis further blurs the line (which admittedly has always been blurry)⁶⁴ between classic genetic information and other medical information, the shift toward more general consent may be less problematic, at least for the most part. Many of the variants will be associated with conditions we don't tend to think of as uniquely genetic – heart disease, hypertension, diabetes, etc. While such variants may indicate heightened risks, they will not necessarily present the kind of psychological discomfort as learning that one will, for example, certainly develop Huntington's disease. Moreover, physicians generally do not engage in detailed informed consent when testing for markers – such as cholesterol, blood pressure or glucose levels – associated with common disorders like heart disease or diabetes. In large part, this is because such tests are routine and they pose little physical risk for patients.⁶⁵ One might argue that the vast amount of information one could get from SNPs and WGES is really no different in kind (even if potentially different in quantity) from these more routine tests for which patients are generally not given copious amounts of information in advance of testing.⁶⁶

⁶² See *infratext* accompanying note 64.

⁶³ See *supra* text accompanying notes 11-13.

⁶⁴ Suter, *Genetics Exceptionalism*, *supra* note 45, at 705-06.

⁶⁵ *Informed Consent*, UNIVERSITY OF MISSOURI SCHOOL OF MEDICINE – CENTER FOR ETHICS (last updated June 08, 2011), <http://ethics.missouri.edu/Informed-Consent.aspx>.

⁶⁶ Cf. Michael J. Green & Jeffrey R. Botkin, "Genetic Exceptionalism" in *Medicine: Clarifying the*

This observation, however, does not answer the normative question of whether we should be moving medicine more in the direction of the genetic counseling approach toward informed consent, or vice versa. Given the enormous amount of information that physicians can potentially generate about a patient, beyond just genomic analysis, there are practical reasons to simplify the informed consent process and to treat most genomic information like the results of a blood pressure test. Just as the exceptionalized approach to HIV testing that was originally strongly advocated when AIDS was a new disease has become de-exceptionalized,⁶⁷ so might we argue the transition of genomic analysis into mainstream medicine warrants the same de-exceptionalization. For the most part, this is true, particularly for the vast amounts of genetic information that seem more “mundane.”

Nevertheless, small pockets of genomic information are still potentially toxic, in that the information can present significant psychosocial risks, especially when there are few clinical benefits. Recognizing both the differences among types of genomic information and the difficulties of achieving fully informed consent for genomic analysis, some have suggested an alternative. Rather than offering detailed information about every possible variant, providers could discuss *categories* of potential findings – e.g., variants associated with late-onset conditions, some of which are preventable, others of which have no treatments; variants associated with carrier status for recessive conditions in their children, with a range of severity and treatability; etc.⁶⁸ While this approach challenges the norms of detailed and specific informed consent in classical genetics,

Differences Between Genetic and Nongenetic Tests, 138 ANN. INTERN. MED. 571 (2003).

⁶⁷ See GorkOoms, et al., *Applying the Principles of AIDS ‘Exceptionality’ to Global Health*, GLOBAL HEALTH GOVERNANCE, <http://www.ghgj.org>.

⁶⁸ Berg et al., *supra* note 50, at 501-03; Bunnik, *supra* note 51, at 597-98. Berg and his coauthors describe an approach in which the whole genome is tested, but results are triaged into three “bins.” Deleterious genetic variants with immediate clinical utility are in “bin 1” and reported immediately. Known or presumed deleterious genetic variants that are not medically actionable are in “bin 2”. Bin 2 results are reported to patients in a risk-stratified manner through shared decision making by patient and provider. Incidental genetic variants of uncertain significance, or presumed benign genetic variants fall into Bin 3, and are generally not reported. Berg, *supra* note 50. Bunnik describes tiered informed consent for partial genome testing. Tiered informed consent allows patients to get genetic testing for clinical specific disease categories (e.g. somatic diseases or early-onset diseases), or test characteristics (e.g. clinical utility). Bunnik, *supra* note 51.

it may actually be truer to the spirit underlying the commitment to informed consent in genetics in the first place, as we shall see below.

Given that the greatest risk of psychosocial harm comes from information about variants associated with high risks of serious conditions with minimal or no preventive options, an informed consent process that focuses on the implications of receiving this kind of information may still achieve the underlying purpose of informed consent in genetics. In short, it would educate patients about the potential “toxicity” of certain categories of information.⁶⁹ Not only would this approach be consistent with the spirit of informed consent in genetics, but it would also comport with informed consent legal doctrine. That is, the implications associated with learning about a risk of an untreatable condition are precisely the kinds of risks associated with genomic analysis that a reasonable patient would likely find material and that would influence the patient’s decision about whether to obtain that information.

Moreover, this approach is also consistent with the direction in which informed consent has moved in the last few years as the law increasingly considers patient values, and not just medical factors, in the decision making process,⁷⁰ especially with respect to “preference sensitive care.” Such care is “medical care for which the clinical evidence does not clearly support [a single] treatment option” and for which the appropriate course of treatment “depends on the values . . . or preferences of the patient . . . regarding the benefits, harms and scientific evidence of each treatment option.”⁷¹ Deciding whether one would want to learn about different categories of genomic information falls precisely within the meaning of preference sensitive care.

⁶⁹ See *Bunnik*, *supra* note 51. This doesn’t answer a trickier question about where to draw the line and whether the same approach should be applied to the risk of learning about heightened risks of cancer, for which there may be some preventive measures that may not be uniformly beneficial. Nor does it address whether we can distinguish between the need for discussions about this kind of risk and the risk of learning about a heightened risk for heart disease, which, in areas of medicine outside of genetics, has not been part of the informed consent process. *Id.*

⁷⁰ The ACA reflects this trend in a provision intended to develop and assess “methods for enhancing patient participation in their own care . . . for facilitating shared patient-physician decision making,” 42 U.S.C.A. § 299(b)(1)(A) (West 2015), and for incorporating “patient preferences and values into the medical plan,” *id.* at § 299(b)-36(a).

⁷¹ *Id.* at § 299b-36(b)(2).

Further, patients may actually find discussions about the psychosocial risks of general categories of genomic information more helpful in the decision making process than a full-blown, detailed discussion about the nature of each disease, the pattern of inheritance, etc. In other words, describing the *categories* of information and the general risks and benefits associated with each category, rather than the particulars of each disease, may get to the crux of what is material to most patients in deciding whether to undergo genomic analysis and what information they want to receive. And it may be most consistent with how patients actually go about decision making in general.

Of course, one of the challenges of informed consent is that patients differ not only in their taste for learning about genetic risk (or any other medical information), but also in their intelligence, education, and interest in information generally. As a result, it is difficult to conclude that this kind of general informed consent, on the one hand, or more specific informed consent (if it were even logistically possible), on the other hand, would be more desirable or beneficial to all patients. To the extent that autonomy is a primary goal of informed consent, starting with more general information that focuses on the key risks of obtaining genomic information would provide a baseline amount of information. It would also avoid overwhelming patients with information that many may not want, understand, or be able to process. For those with a particular thirst for genetic information and curiosity about the details of the kind of information available, professionals could offer additional venues for more detailed information. Advances in technology may help with this. Interactive decision aids that allow patients to decide how much information they want beyond the basic disclosure for general consent may provide just the kind of personalized tailoring of information that is logistically impossible through the kind of physician/genetic counselor-patient discussion that has shaped the informed consent process in classical genetics.⁷²

⁷² David Artenburg, et al., *Introducing Decision Aids at Group Health Was Linked to Sharply Lower Hip and Knee Surgery Rates and Costs*, 31 HEALTH AFF. 2094 (2012); PRESIDENTIAL COMMISSION, *supra* note 26, at 90. In short, I am proposing what Cass Sunstein calls “simplified active choosing,” where patients have the option to choose between a default rule for information disclosed in the informed consent process (the general categories of genomic information) and their own preference for more detailed information. Cass R.

III. THE INEVITABLE EXPANSION OF GENOMIC ANALYSIS

As we have seen, one of the greatest challenges presented by broader genomic analysis is the difficulty of obtaining adequate informed consent. This is only one of the many reasons, as Section A will describe, that some scholars are wary about genomic analysis becoming widespread too soon. And yet, as Section B argues, numerous cultural, economic, and legal factors may nevertheless move us toward an expansion of genomic analysis more rapidly and broadly than is desirable.

A. Concerns and Dilemmas Surrounding the Expansion of Genomic Analysis

One concern surrounding broader genomic analysis is that as we discover more associations between genes and disease, the number of incidental findings will only increase.⁷³ As people undergo broader genetic testing or genomic analysis they will inevitably be found to have abnormal findings. Given that the science is not yet advanced enough for scientists or clinicians to understand the significance of much of those results, however, many of these findings will offer limited clinical utility.⁷⁴ Not only will this present informed consent challenges, as noted in Part II, but it may also result in negative psychological or social consequences.⁷⁵

As genomic analysis becomes more widespread it presents another related dilemma: which variants should laboratories report to clinicians, how much information should clinicians share with patients, and who should decide these questions?⁷⁶ A rich discussion has developed regarding the disclosure of incidental findings in the research context, with several different viewpoints about the appropriate scope of disclosure.⁷⁷ But as genomic analysis expands in

Sunstein, *Behaviorally Informed Health Policy? Patient Autonomy, Active Choose, and Paternalism*, in *NUDGING HEALTH: HEALTH LAW AND BEHAVIORAL ECONOMICS* (2015), at 4.

⁷³ See Ellen W. Clayton et al., *Managing Incidental Genomic Findings: Legal Obligations of Clinicians*, 15 *GENETICS MED.* 624 (2013).

⁷⁴ Rothstein, *supra* note 47, at 682; Clayton et al., *supra* note 73, at 624.

⁷⁵ Rothstein, *supra* note 47, at 682-83.

⁷⁶ Clayton et al., *supra* note 73, at 624.

⁷⁷ *Id.* (citing RR Fabsitz et al., *Ethical and Practical Guidelines for Reporting Genetic Research Results to Study Participants: Updated Guidelines from a National Heart, Lung, and Blood Institute*

the *clinical* context, this issue is just emerging for clinicians,⁷⁸ and it potentially challenges many of the norms about information disclosure in classical clinical genetics.

One guide for disclosure of such incidental findings might be whether the information is medically actionable or whether it has any clinical utility.⁷⁹ But this approach begs the question, what constitutes medically actionable and what benefits should count? Is a variant associated with stomach cancer in certain families medically actionable for patients with no family history of stomach cancer?⁸⁰ Is long-term surveillance sufficient to constitute medical action ability? And is an incidental finding actionable if it affects reproductive risks?⁸¹

Resolving these questions requires consideration of both the relative harms of not disclosing the information and the harms of disclosing the information. It also raises another issue: whose potential benefit or harm from disclosure should we consider in assessing whether information should be disclosed – those of the patient and/or those of biological relatives? And finally, who should decide which benefits and harms count and whose benefits and harms should be evaluated – the genetics profession, clinicians, or patients?

Even situations that seem on their face to be fairly straightforward prove complex. Imagine a situation where the incidental finding would reveal an increased risk of a preventable cancer. One might conclude that the balance of risks and benefits seems to justify and possibly compel disclosure as an ethical matter. But while most people would choose to learn of avertable cancer risks, there may be some who would choose to avoid the knowledge for fear of the potentially stigmatizing effects of such information.⁸² That there some people would not want such

Working Group, 3 CIRC. CARDIOVASC. GENETICS, Dec. 2010, at 574–80; Susan M. Wolf et al., *Managing Incidental Findings in Human Subjects Research: Analysis and Recommendations*, 36 J. LAW MED. ETHICS 219-48 (2008)).

⁷⁸ Clayton et al., *supra* note 73, at 624.

⁷⁹ See *infra* text accompanying notes 114-16.

⁸⁰ See *supra* text accompanying notes 54-57.

⁸¹ Clayton et al., *supra* note 73 at 628.

⁸² See Geller et al., *supra* note 13, at 1472.

information raises the question of whether the decision about disclosure should be based on patient preferences or more global risk-benefit analyses. In other words, how much should the patient, as opposed to the medical profession (or just the physician), determine the scope of disclosure?

B. Pressures to Expand Genomic Analysis

As Part IV will suggest, the resolution of these thorny questions about disclosure may well be influenced not only by professional norms, but also by other factors such as financial incentives and liability concerns. But before we turn to those pressures, and in spite of the many concerns about the expansive genomic analysis discussed above, Section III.B. argues that whatever we conclude about the appropriate scope and availability of genomic analysis, various factors—cultural, economic, technological, medical, and legal—push toward ever more expansive genomic analysis.

One of the more straightforward factors is simply that we can.⁸³ While the ability to do something does not mean that we should, both providers and patients are often eager to avail themselves of new technologies, particularly when they come with the promise or hope of preventive and personalized medicine. Patients, for example, have strong desires for information. Many are eager to learn all they can about genetic risks under the view that knowledge is power.⁸⁴ With all of the hype and media attention given to the near possibility of the \$1,000 genome sequence,⁸⁵ as well as strong advocacy for personalized medicine,⁸⁶ patients may request genomic analysis with increasing frequency, putting pressure on physicians to offer it.

⁸³ Grady & Pollack, *supra* note 19 (quoting Dr. Kenneth Offit who describes the inclusion of some genes in panels of genetic tests for several different genes “because they could be tested, not necessarily because they should be”); Cf. Kathryn Schleckser, *Physician Participation in Direct-to-Consumer Genetic Testing: Pragmatism or Paternalism?*, 26 HARV. J.L. & TECH. 695, 714 (2013) (noting the prevalence of DTC genetic testing exemplifies the ability to perform expansive genomic analysis).

⁸⁴ Wylie Burke et al., *Seeking Genomic Knowledge: The Case for Clinical Restraint*, 64 HASTINGS L.J. 1649, 1661 (2013).

⁸⁵ Bunnik, *supra* note 51 at 596.

⁸⁶ Christopher Bergin, *Take Off Your Genes and Let the Doctor Have a Look: Why the Mayo and Myriad Decisions Have Invalidated Method Claims for Genetic Diagnostic Testing*, 63 AM. U. L. REV. 173, 176 (2013); Juengst et al., *supra* note 15, at 34; Pear, *supra* note 28.

Indeed much of the advocacy for personalized medicine centers on the notion of patient empowerment and autonomy in having access to greater amounts of information through these new technologies.⁸⁷ The interest in DTC is further evidence that a segment of the society is already interested in learning as much as they can about genomic variations, even without the usual medical indications for genetic analysis.⁸⁸ It may be that one of the greatest pressures toward expansion of genomic analysis comes from the patient population itself.

The commercialization of technologies that allow for more comprehensive genetic and genomic analysis also increases the pressure to expand the scope of testing. When the Supreme Court invalidated some of the patents on the BRCA genes in 2013,⁸⁹ several companies began to offer not only the BRCA testing on which Myriad previously had a monopoly, but also multigene panels.⁹⁰ Even Myriad followed suit, offering its own multigene panel, instead of just the BRCA test, for nearly the same amount of money.⁹¹ Commercial incentives to market tests heavily to providers will put real pressure on physicians to adopt genomic technologies as they come to market.

Insurance provides another financial incentive that potentially moves us toward more expansive genomic analysis. The more willing insurers are to cover such testing, the more likely consumers will seek it and physicians will offer it. Some have argued, for example, that the United States Preventive Services Task Force should treat WGS as a preventive service so that it can be offered under the Affordable Care Act (“ACA”) without cost sharing.⁹² Of

⁸⁷ Juengst et al., *supra* note 15, at 36.

⁸⁸ *Id.*

⁸⁹ Ass’n for Molecular Pathology v. Myriad Genetics, Inc., 133 S. Ct. 2107, 2109, 2120 (2013).

⁹⁰ Turner Ray, *With New BRCA Testing Options, Patient Groups Advise Women to Speak to Genetics Expert, Share Reports*, GENOMEWEB (JUN. 19, 2013), <https://www.genomeweb.com/clinical-genomics/new-brca-testing-options-patient-groups-advise-women-speak-genetics-expert-share>.

⁹¹ Grady & Pollack, *supra* note 19 (describing companies like GeneDx, Ambry Genetics, Invitae and Quest Diagnostics).

⁹² Payne Jr., *supra* note 14, at 239. While there have been efforts to increase insurance coverage of genetic testing for preventive services, Anya E.R. Prince, *Prevention for Those Who Can Pay: Insurance Reimbursement of Genetic-Based Prevention Interventions in the Liminal State Between Health and Disease*, J. L. & BIOSCIENCES, May 17, 2015, at 14-20, “[o]verall the

course, whether insurers will choose to cover WGS widely, or whether it should be treated as a preventive service under the ACA, begs the question whether its widespread availability is actually desirable.⁹³

Although many are skeptical about the value of expansive genomic analysis, especially for the wider population,⁹⁴ many providers are eager to see this become a part of mainstream medicine under the theory that patients who have more information about themselves are both more responsible and empowered.⁹⁵ The fact that we have already seen some expansion of genetic cancer screening beyond what may be clinically recommended, simply because it is possible to do so,⁹⁶ is evidence that the same trend may continue with respect to broader genomic analysis. We have witnessed similar openness to the adoption of new technologies that analyze an ever-growing number of conditions in other areas, such as newborn screening and prenatal testing, even in the face of uncertainty and concerns about the benefits and risks of such expansions.⁹⁷ These trends regarding other new technologies suggest the adoption of genomic analysis may follow a similar path.

Indeed, it is not hard to imagine the incorporation of genomic

uptake of insurance coverage for genetic testing [let alone genomic analysis] has been relatively slow," *id.* at 8. Whether genetic testing is covered by insurance, however, is only the first factor influencing an interest in genetic analysis. Without coverage for preventive measures, such as surveillance or prophylactic surgery, the interest in accessing such testing may be less. In such cases, genetic testing may actually cause more harm than good, creating anxiety and stress, without offering any of the benefits of preventive treatments. *Id.* at 23.

⁹³ Pilar N. Ossorio & J. Paul Kelleher, *Why We Should Not Use the Affordable Care Act to Encourage Widespread Whole Genome Sequencing*, 39 J. HEALTH POL., POL'Y & L. 249, 249-50 (2014).

⁹⁴ Timothy Caulfield et al., *Reflections on the Cost of "Low-Cost" Whole Genome Sequencing: Framing the Health Policy Debate*, 11 PLOS BIO 1, 4 (2013); Rothstein, *supra* note 47, at 684; Pilar N. Ossorio, *The Human Genome As Common Heritage: Common Sense or Legal Nonsense?*, 35 J.L. MED. & ETHICS 425, 425-26 (2007).

⁹⁵ COLLINS, *supra* note 28; Wylie Burke et al., *Seeking Genomic Knowledge: The Case for Clinical Restraint*, 64 HASTINGS L.J. 1650 (2013); Sonia M. Suter, *Did You Give the Government Your Baby's DNA? Rethinking Consent in Newborn Screening*, 15 MINN. J. L. SCI & TECH. 729, 733 (2014) [hereinafter Suter, *Did You Give the Government*].

⁹⁶ Grady & Pollack, *supra* note 19.

⁹⁷ Suter, *Did You Give the Government*, *supra* note 95, at 732; Suter, *Brave New World*, *supra* note 1, at 929.

analysis in areas like newborn screening and prenatal testing in the near future, which would inevitably push toward more general expansion of genomic analysis. In the newborn screening context, technological advances – such as tandem mass spectrometry, which allows for the identification of a wide range of metabolic variants – coupled with parent advocacy groups, has led to an enormous expansion of the scope of newborn screening.⁹⁸ WGS will likely become part of this trend. In fact, studies are currently underway to “explore the promise – and ethical challenges – of sequencing every newborn’s genome.”⁹⁹

In the prenatal context, testing has expanded both in terms of the scope of analysis and who gets tested. Technologies, such as genome-wide arrays, are beginning to broaden the panel of conditions that can be identified through prenatal testing,¹⁰⁰ just as it has expanded the scope of testing in adult genetics.¹⁰¹ But the pool of patients availing themselves of prenatal testing generally has also expanded with the routinization of prenatal screening and testing.¹⁰² The factors that have contributed to this routinization – parents’ desires to learn as much as possible about their future child; the medical profession’s interest in more, not less information; and the threat of liability¹⁰³ – may lead us toward a similar expansion and routinization of genomic analysis in this context.

Another emerging technology in the prenatal context,

⁹⁸ Suter, *Did You Give the Government*, *supra* note 95, at 731.

⁹⁹ Jocelyn Kaiser, *NIH Studies Explore Promise of Sequencing Babies’ Genomes*, *SCI. MAG.* (Sept. 4, 2013), <http://news.sciencemag.org/biology/2013/09/nih-studies-explore-promise-sequencing-babies'-genomes>; Anna Nowogrodzki, *Should Babies Have Their Genomes Sequenced*, *MIT TECH. REV.*, July 2, 2015, <http://www.technologyreview.com/news/538931/should-babies-have-their-genomes-sequenced/> (describing the recent enrollment of four subjects (“three healthy babies and one baby from the neonatal ICU”) in the “first randomized controlled trial to measure the harms and benefits of newborn genomic sequencing”).

¹⁰⁰ WyboDondorp et al., *Arrays in Postnatal and Prenatal Diagnosis: An Exploration of Consent*, 33 *HUMAN MUTATION* 916, 916 (2012).

¹⁰¹ WyboDondorp, *The Thousand Dollar Genome: An Ethical exploration*, 21 *EUROPEAN JOURNAL OF HUMAN GENETICS* (2013) S6, S7, (2013), *available at* <http://www.nature.com/ejhg/journal/v21/n1s/full/ejhg201373a.html>.

¹⁰² Suter, *Routinization*, *supra* note 5, at 233.

¹⁰³ *Id.*

noninvasive prenatal screening tests (“NIPT”),¹⁰⁴ may also play a role in expanding genomic analysis. NIPT has the capacity to expand the pool of people undergoing prenatal testing generally because it removes what has been a significant impediment to prenatal testing – the threat of miscarriage from CVS or amniocentesis. When the only way to obtain detailed information about the fetus must be balanced against the risk of miscarriage, there are few incentives to obtain fetal information without a medical indication for prenatal testing. But prenatal analysis through noninvasive techniques removes these barriers, making prenatal analysis desirable to many, even to those without a medical indication. When one considers this technological change in light of the factors that have led to the routinization of prenatal testing, it is not hard to imagine the demand for and number of people interested in prenatal testing increasing greatly.¹⁰⁵ Given that a strong factor in the routinization of prenatal testing is the belief that good parents learn all they can about the pregnancy,¹⁰⁶ parental

¹⁰⁴ Jaime King, *Not this Child: Constitutional Questions in Regulating Non-Invasive Prenatal Genetic Diagnosis and Selective Abortion*, 60 UCLA L. REV. 2, 6 (2012).

¹⁰⁵ *Id.* at 36. Indeed, the “demand is sharply rising.” Virginia Hughes, *Pregnant Women Are Finding out They Have Cancer from a Genetic Test of Their Babies*, BUZZFEED (Mar. 5, 2015), <http://www.buzzfeed.com/virginiahughes/pregnant-women-are-finding-out-they-have-cancer-from-a-genet#.ieo4vDMYmY>. The tests have been “rapidly adopted by clinicians and patients,” with “more than 2 million tests . . . performed world-wide.” Ron Winslow, *Prenatal Blood Tests Could Detect Cancer in Mothers*, WSJ (July 13, 2015), <http://www.wsj.com/articles/prenatal-blood-tests-could-detect-cancer-in-mothers-1436818819>. And in the United States alone, 800,000 women have had an NIPT in the past year, which makes up “about 20% of the 4 million total babies born each year.” Hughes, *supra*. While this technology has been used primarily in high-risk populations, it is “poised to move from high-risk to average risk pregnancy populations.” Julia Karow, *NIPT Outperforms Standard Screening for T21 but False Positives Call for Caution*, NEJM Studies Find, GENOMEWEB (Apr. 2, 2015), <https://www.genomeweb.com/reproductive-health/nipt-outperforms-standard-screening-t21-false-positives-call-caution-nejm> (noting studies, however, that emphasize that, while better than prior screening tests with its higher sensitivity and specificity, NIPT still requires diagnostic confirmation of abnormal findings because it may yield false-positive results).

NIPT recently has raised interesting dilemmas concerning incidental and unexpected findings, when, in more than 40 cases, the tests “revealed an abnormal genetic profile suggestive of cancer in the mother,” 26 of which were confirmed to be cancer. Hughes, *supra*. These findings raise some of the same issues described in this piece about the propriety of disclosing these results, when they don’t have “clear-cut diagnostic value,” but when the failure to disclose the information could lead to preventable harm. *Id.*, see *infra* Part IV.A

¹⁰⁶ Suter, *Routinization*, *supra* note 5, at 247.

thirst for extensive prenatal information will always be great.¹⁰⁷ This will contribute to demands forever more comprehensive prenatal testing, such as full genomic analysis.

Finally, we must consider the contribution of liability concerns in expanding genomic analysis. Historically, and in most jurisdictions, the standard of care has been set by the medical profession based on its assessment as to which procedures are most effective and least risky for patients.¹⁰⁸ There are exceptions, however, in some jurisdictions where the standard of care is set instead by courts or by a reasonableness standard.¹⁰⁹ In addition, we have also seen instances in which decisions to introduce new technologies in clinical care were shaped by worries about potential liability. For example, in the 1980s, the American College of Obstetricians and Gynecologists (“ACOG”) was concerned that a particular prenatal screening test was “of uncertain value.” Nevertheless, a few years later, ACOG’s Department of Professional Liability issued an “Alert” declaring that it was “*imperative* that every prenatal patient be advised of the availability of this test.”¹¹⁰ Not surprisingly, the test soon became the standard of care, “not for medical reasons, but in response to liability concerns.”¹¹¹ Given that, so far, there is no consensus as to the appropriate availability of genomic analysis, and given that the standard of care in this context depends on a risk-benefit calculus that balances psychosocial harms of receiving information against

¹⁰⁷ In fact, a new company, GenePeeks, has built on this parental thirst by partnering with a fertility clinic to create digital models of the genetic makeup of 10,000 children that would result from the pairing of the gametes of potential donors and fertility patients. See Paul Rincon, *GenePeeks Firm to Offer “Digital Baby” Screen for Sperm Donors*, BBC (Oct. 2013), <http://www.bbc.com/news/science-environment-24398312>; Azeen Ghorayshi, *This Company is Trying to Make More Perfect Babies*, BUZZFEED (July 12, 2015), <http://www.buzzfeed.com/azeenghorayshi/more-perfect-babies>. For less than \$2,000, the company currently determines the risk of roughly 450 genetic conditions in the “virtual” babies created by the digital models. It plans to expand its analysis in the coming years to include about 1,000 diseases, including more complex conditions like diabetes and schizophrenia. In addition, it will eventually offer its services to fertile couples. *Id.*

¹⁰⁸ See *Sheeley v. Memorial Hosp.*, 710 A.2d 161, 166 (R.I. 1998).

¹⁰⁹ *Helling v. Carey*, 519 P.2d 981, 982 (Wash. 1974); Peters, *The Quiet Demise of Deference to Custom: Malpractice Law at the Millennium*, 57 WASH. & LEE L. REV. 163, 163 (2000).

¹¹⁰ Sherman Elias et al., *Carrier Screening for Cystic Fibrosis: A Case Study in Setting Standards for Medical Practice*, in *GENE MAPPING: USING LAW AND ETHICS AS GUIDES* 196-97 (George J. Annas & Sherman Elias eds., 1992) (emphasis added).

¹¹¹ Suter, *Routinization*, *supra* note 5, at 253.

physical harms of not receiving it, one might imagine that similar liability concerns might ultimately shape professional norms.¹¹²

As consumer interest in this technology increases, and as physicians respond to consumer demands, the standard of care may move toward more widespread WG/ES. This may create a vicious cycle in which concerns about liability for failing to provide WGS to patients who ultimately develop a preventable condition may motivate physicians to offer genomic analysis more widely than they otherwise would. While the lack of a family history would clearly be a defense for failing to offer targeted testing with traditional genetic testing, in a world where genomic analysis is available and could potentially offer some valuable information, a physician may worry that about being sued for failing to offer the analysis, even for patients with no medical indication.

This outcome is especially likely in jurisdictions that base the standard of care on reasonableness rather than professional standards of care.¹¹³ A jury may find it unreasonable not to offer an existing test that could possibly identify risks for preventable illnesses regardless of the psychosocial concerns surrounding the test or the possibility of confusion regarding the results. Thus, even though WGS has not yet come close to the standard of care at this point, and even though many believe we are not yet ready for its widespread use, liability concerns may nevertheless push toward widespread adoption of the technology sooner than many believe is desirable. Ironically, these potential reactions to worries about liability might actually legitimize those very fears by influencing professional attitudes and behavior and hence shaping the standard of care.

IV. PRESSURES TO DISCLOSE MORE, RATHER THAN LESS, INFORMATION

As genomic analysis becomes more mainstream in health care, the health care system will increasingly confront a problem with

¹¹² As I shall discuss in Part IV.B, liability concerns may also play a significant role in providers' attitudes toward *disclosure* of information. See *infra* text accompanying notes 132-61.

¹¹³ See Peters, *supra* note 109, at 185.

which it is just beginning to grapple: which incidental findings obtained from multiplex panels or full-blown genomic analysis should be disclosed to patients and under what circumstances? Section IV.A. lays out in more detail the dilemma introduced in Part III.A, while Section IV. B. discusses how economic and legal pressures will likely create a bias in favor of more, rather than less, disclosure of incidental findings. As we shall see this outcome could challenge some long-held norms in genetics.

A. The Dilemma

Recently, an American College of Medical Genetics Working Group (“the ACMG/WG”) issued recommendations on this very issue in the context of WGS.¹¹⁴ Specifically, the ACMG/WG recommended laboratory analysis and clinician disclosure to patients of a non-exclusive list of disease variants associated with more than 20 inherited, monogenic conditions that are “amenable to medical intervention” and are inherited as autosomal dominant conditions (meaning the conditions can develop with only one copy of a mutation).¹¹⁵ The list included hereditary breast and ovarian cancer, inherited forms of colon cancer, familial medullary thyroid cancer, and conditions associated with aneurysms and serious heart disease.¹¹⁶

Given the complexity of this issue, the recommendations generated a fair amount of discussion and even controversy,¹¹⁷ in part, because they recommended the disclosure of these incidental findings regardless of whether the patient had requested or

¹¹⁴ ACMG Recommendations for Reporting of Incidental Findings in Clinical Exome and Genome Sequencing, 13 AM. C. MED. GENETICS & GENOMICS 565, 567 (2013) [hereinafter *ACMG Recommendations*].

¹¹⁵ *Id.* at 569. The list of conditions and associated genes has since been modified. Prince, *supra* note 92 at 22 n.115.

¹¹⁶ *Id.* at 570 (noting that many of the conditions develop in adulthood, although some can develop in childhood.).

¹¹⁷ See generally, ACMG Board of Directors, *ACMG Policy Statement: Updated Recommendations Regarding Analysis and Reporting of Secondary Findings in Clinical Genome-Scale Sequencing*, 17 GENETIC MED. 68 (2015) (updating ACMG policy statement to reflect discussion since the 2013 recommendations). See Maren T. Scheuner, *Reporting Genomic Secondary Findings: ACMG Members Weigh in*, 17 GENETIC MED. 27, 27-28 (2015) (noting that the question of how to deal with the analysis and reporting of these incidental findings has been “a matter of considerable debate” and that the response to the ACMG recommendations “was mixed”).

consented to the disclosure of such information.¹¹⁸ Rather than allow patients to decide selectively which variants they do or do not want to learn about, the ACMG/WG initially recommended that patients either choose WGS and be prepared to learn about all of the recommended incidental findings or decline WGS altogether “if they judge the risks of possible discovery of incidental findings to outweigh the benefits of testing.”¹¹⁹ More recently, however, the recommendations were updated to allow patients seeking WGS to opt out of having the listed actionable variants analyzed, although they did not recommend personal tailoring of the analysis and disclosure of variants.¹²⁰

The initial recommendations minimized the focus on patient preferences because of worries that, once WGS becomes more commonplace, clinicians ordering WGS will have “varying levels of ability and experience in genetic counseling” and it would be “unwieldy” to ask labs “to ignore findings of potential medical importance to honor [individual] preferences.”¹²¹ The Working Group acknowledged that not “offering the patient a preference as to whether or not . . . [to] receive . . . the minimum list of incidental findings described in these recommendations . . . may be seen to violate existing ethical norms regarding the patient’s autonomy and ‘right not to know’ genetic risk information.”¹²² Thus, the group’s initial position in many ways goes against deeply held norms in genetic counseling. Indeed, surveys of genetics professionals have shown that the majority of respondents believe strongly that patient preferences should be considered in the analysis and reporting of incidental findings.¹²³

¹¹⁸ ACMG Recommendations, *supra* note 114 at 566-67.

¹¹⁹ *Id.* at 568.

¹²⁰ ACMG Board of Directors, *supra* note 117, at 69.

¹²¹ ACMG Recommendations, *supra* note 114, at 568.

¹²² *Id.*

¹²³ Scheuner, *supra* note 117, at 33 (noting that the majority of ACMG members surveyed thought that patients should be able to “opt out of receiving a sequencing report with such findings”); J.H. Thu et al., *Attitudes of Genetics Professionals Toward the Return of Incidental Results from Exome and Whole-Genome Sequencing*, 95 AM. J. HUMAN GENETICS 77 (2014) (finding in another survey of genetics professionals, that “[t]he vast majority (81%) thought that individual preferences should guide the return [of secondary findings]”). Genetics professionals had different views, however, about how patient preferences should be

This issue is even more complex in the pediatric context. While not yet routine in pediatrics, WGS has been used to try to diagnose conditions in childhood that may have a genetic basis.¹²⁴ Pediatric WGS raises the possibility of identifying variants associated not only with childhood diseases, but also with those that develop in adulthood, such as some cancers and neurological conditions. Deciding what the scope of disclosure in this context should be raises the complicated question about whose benefit and risks should be considered.

The consensus in the genetics community has long been that testing for adult-onset conditions should generally be deferred until adulthood or until an adolescent interested in testing has developed mature decision-making capacities. Otherwise, parents may treat a child at risk of a late-onset condition differently and the child will be deprived of the opportunity to decide for herself whether and when to learn such information.¹²⁵ Under this theory, clinicians should not disclose such information to the child or the child's parents. The ACMG/WG, however, recommended disclosure of variants associated with conditions "amenable to medical intervention," even if they would only develop in adulthood.¹²⁶ As the Working Group argued, "to . . . withhold the incidental finding . . . is to state that the child's right not to know supersedes the parent's opportunity to discover a life-threatening risk factor."¹²⁷

The way these recommendations challenged widely shared

honored. A survey of ACMG members found that while "there was overwhelming agreement that patients should be able to opt out of receiving a report with secondary findings, there was no consensus regarding customization of a secondary findings list of genes according to patient preferences." Scheuner, *supra* note 117, at 34.

¹²⁴ See PRESIDENTIAL COMMISSION, *supra* note 26 at 89.

¹²⁵ See *id.*; see also Jeffrey R. Botkin et al., *ASHG Position Statement: Points to Consider: Ethical, Legal and Psychological Implications of Genetic Testing in Children and Adolescents*, 97 AM. J. HUMAN GENETICS 6, 8 (2015) ("Unless there is a clinical intervention appropriate in childhood, parents should be encouraged to defer predictive or pre-dispositional testing for adult-onset conditions or at least until the child is an older adolescent who can participate in the decision making in a relatively mature manner.").

¹²⁶ ACMG Recommendations, *supra* note 114, at 569.

¹²⁷ *Id.* at 572. The Working Group explicitly noted, however, that its recommendations are limited to incidental findings obtained "during clinical sequencing for a specific clinical indication" and "do not address preconception sequencing, prenatal sequencing, newborn sequencing or sequencing of healthy children and adults." *Id.* at 569.

values in the genetics community illustrates how the move toward genomic analysis can shift attitudes toward the receipt and disclosure of genetic information. Before genomic analysis was possible, there would have been no reason to test a child for variants associated with late-onset conditions without a family history of such conditions. When there is a family history, in contrast, the parents already know about their risks, thus there is no need to learn the child's genetic status to give parents the opportunity to learn of their own risk.

In spite of the ACMG/WG recommendations, the genetics community is still grappling with these questions and has yet to reach a consensus as to how to balance the competing risks and benefits. As we shall see in the next section, however, the question of the scope of disclosure is not likely to be resolved alone by professionals and ethicists but may also be heavily influenced by financial incentives and concerns about liability.

B. Financial and Liability Concerns

Financial pressures do not clearly point in one direction regarding whether physicians are more or less likely to disclose incidental findings. Instead, whether financial incentives will encourage greater or less disclosure likely depends on the nature of the payment scheme. Imagine, for example, that a physician contemplates whether to disclose an incidental finding that may suggest a heightened risk for a preventable cancer. Under a system of capitated payments, she may be less inclined to disclose the information for fear the patient will demand costly surveillance or prophylactic treatments, especially if the risk is uncertain or fairly low. In contrast, under a fee-for-service system, the physician might be less reluctant to disclose information, even if the patient would insist upon further testing or medical procedures. While the question of disclosure should be based on what is medically appropriate treatment, evidence shows that physicians do not always disclose medically appropriate options because of concerns about cost.¹²⁸ Thus,

¹²⁸ *Id.* at 569. See also David Orentlicher, *Paying Physicians More to Do Less: Financial Incentives to Limit Care*, 30 U. RICH. L. REV. 155, 161 (1996) (“[I]f physicians have a personal economic interest in limiting the care they provide their patients, they may delay important tests and treatment or omit the tests and treatment entirely.”); Professor Stephen Peckham & Dr. Katerina Gousia, *GP Payment Schemes Review, Policy Research Unit in Commissioning and the Healthcare System*, (October 2014), available at <http://www.kent.ac.uk/chss/docs/GP->

in trying to predict how physicians will approach the problem of disclosure, we should be cognizant of how payment structures might play into this issue.

Another potential financial influence on decisions regarding the disclosure of genetic information may be the nature of insurance coverage that patients have. Insurance coverage of genetic testing for preventive purposes – such as testing for inherited forms of adult-onset cancer in asymptomatic individuals – is highly variable and depends on the type of test and insurance.¹²⁹ Coverage for the relevant preventive care – such as surveillance or prophylactic surgeries – however, is much more in question given that insurance covers treatment more often than prevention and given that “medical interventions for adult onset genetic conditions occupy a hazy space between these extremes.”¹³⁰ To the extent that physicians consider a patient’s ability to pay for treatment, they might worry about disclosing medically actionable incidental findings to patients without insurance coverage for the very treatment that would make the disclosure of this risk clinically valuable. Rather than benefit such patients, disclosure of these risk factors may only lead to “increased anxiety or other psychological concerns.”¹³¹

There is another kind of financial pressure, however, that may push fairly consistently toward disclosing incidental findings. Thus far, this piece has described the receipt of genetic information in the clinical context, where the physician acts as a gatekeeper of information. But the receipt of genomic information may, for many, move outside of the clinical realm, if and when more consumers move toward DTC genomic analysis. Given that the DTC consumers are generally thirsty for more information than they may be able to receive in the clinical context, the incentives for this industry are to provide more, rather than less, information. As a result, one could imagine that, in the DTC context, the approach would be to provide all incidental findings, irrespective of patient preference or taste for

[payment-schemes-review-Final.pdf](#) (“Since the money follows the patient independent of service utilization, capitation is thought to incentivize cost containment and underprovision of services (even below the clinically necessary levels.”).

¹²⁹ Prince, *supra* note 92, at 6.

¹³⁰ *Id.* at 2.

¹³¹ *Id.* at 23.

certain kinds of information. Economically, the incentives would be to disclose all results uniformly rather than to disclose them according to individual consumer preferences. The exception might be companies that offer higher cost options for personally tailored disclosure of information.

Finally, we turn to the legal incentives that also seem to cut in favor of greater, rather than less, disclosure. Clinicians currently have no legal guidance as to how to resolve these dilemmas given that courts have not addressed questions about legal obligations to disclose or not disclose such findings.¹³² The closest analogues are cases involving imaging procedures where physicians fail to recognize or act upon incidental findings. As one study has shown, the standard of care varies depending on the specialties of the physicians.¹³³ One thing that distinguishes the genomic context from many other medical fields is that physicians, even most geneticists, do not have the ability to evaluate the genomic results on their own. Therefore their liability will depend on what decisions they make with respect to the information the laboratory presents to them.¹³⁴ Not surprisingly, even though patients tend to be eager for disclosure of incidental findings, evidence suggests that physicians would prefer laboratories to limit the reporting of incidental findings,¹³⁵ probably in part because this would minimize the burdens of deciding what should and shouldn't be disclosed. Of course, this just raises issues about the reporting obligations for laboratories.

Were courts to confront questions about legal obligations in this context, they might be influenced by the fact that a group of genetics professionals has recommended the reporting of certain incidental findings.¹³⁶ Moreover, the reasoning of this report is consistent with

¹³² See Clayton et al., *supra* note 73, at 626.

¹³³ *Id.* at 627 (noting that ER physicians would be held to a different standard in evaluating an image than radiologists).

¹³⁴ *Id.*

¹³⁵ Townsend et al., "I Want to Know What's in Pandora's Box," 158(A) AM. J. MED. GENETICS 2519 (2012); Clayton et al., *supra* note 73, at 627.

¹³⁶ While the ACMG Working Group expressly noted that "these recommendations are designed primarily as an educational resource for medical geneticists and other health-care providers to help them provide quality medical services," *ACMG Recommendations*, *supra* note 114 at 565, commentators have noted that such recommendations might nevertheless become the standard of care, John Conley, *The ACMG Screening Recommendations*, GENOM. L.

how courts would likely balance the competing risks of disclosure and nondisclosure and the competing principles of autonomy and beneficence.

Consider a situation in which an incidental finding is clearly medically actionable – i.e., imagine there are known treatments for a cancer associated with a particular genetic variant.¹³⁷ Based on liability concerns, a laboratory would likely report, and a physician would likely disclose, the information. Were the physician not to report the risk, and were the patient ultimately to develop the cancer in question, the resulting damages could be physical, tangible, and probably considerable. While the information might cause confusion, anxiety, and even stigma or discrimination for the patient, a court would likely find these concerns outweighed by the interests in preventing tangible, preventable harms. In a jurisdiction in which the standard of care is based on a reasonableness evaluation, a jury would also likely conclude that the standard should require disclosure, given that most people would want information that could prevent physical harm, even at the risk of some negative psychosocial effects.

What about the situation where an individual patient would balance the risks and benefits differently? That is, imagine that the patient has specifically requested not to receive this kind of incidental finding, for whatever reason. Here the disclosure of a risk of preventable harm would come up against a patient's desire not to know. Recall that the ACMG/WG initially recommended disclosure in such instances irrespective of patient desires.¹³⁸ As the group noted, to disclose the risk would violate patient autonomy and the right not to know,¹³⁹ which goes very much against long-held values of the

REP. , July 30, 2013, <http://www.genomics-lawreport.com/index.php/2013/07/30/the-acmg-gene-screening-recommendations/>.

¹³⁷ This, however, is a big assumption. What may be medically actionable in someone with a family history might raise questions about the appropriate medical course for those without a family history.

¹³⁸ See *ACMG Recommendations*, *supra* note 114. However, it did emphasize the need to inform patients up front about the risks of such disclosure so that patients could decide whether or not to undergo WGS. *Id.* The updated recommendations would allow patients to opt out of having the listed actionable variants analyzed but do not recommend personal tailoring of the analysis and disclosure of variants. ACMG Board of Directors, *supra* note 117 at 69.

¹³⁹ *Id.*

genetics community.

In classical genetics, determinations about what genetic testing should be performed and what information should be disclosed has been largely based on informed patient choice (within the constraints of medically reasonable testing). In rare instances, however, beneficence, rather than autonomy— which is usually the driving force in genetics— guides decisions about the delivery of genetic information. For example, when there are concerns about the capacity of a patient to deal with information because of emotional instability, the norms have been not to perform genetic tests or disclose information, in spite of patients' wishes.¹⁴⁰ For the most part, it has been possible to promote both autonomy and beneficence in genetics through the informed consent process, under the theory that patients are in the best position to make the risk-benefit calculus and thereby make choices that are in their best interest. As a result, the profession has strongly protected the right “not to know” with respect to targeted genetic testing given that the informed consent discussion can focus on the risks and benefits of obtaining information regarding a specific gene. Thus, in classical genetics, a patient with a family history of breast cancer could think carefully about the risks and benefits of learning about a predisposition to breast cancer, including the emotional and socioeconomic costs, as well as the nature and effectiveness of preventive options. She could therefore conduct her own risk benefit analysis as to whether learning this information would be to her benefit.

With broader genomic analysis,¹⁴¹ any discussion about these kinds of risks and benefits would necessarily be more general. As a result, it might be more difficult for patients to grapple with the pros and cons of learning about the different types of incidental findings that might arise. With targeted testing, patients often have relevant family histories and therefore have a better understanding of a condition. As a result, they might more fully appreciate the implications of receiving or failing to receive information about a particular risk. With untargeted genomic analysis, patients simply

¹⁴⁰ See Bloch et al., *supra* note 12, at 505-506 (describing the “stringent protocol of pre-counseling and assessment . . . to assess the psychosocial status of each candidate” and to evaluate whether the candidates are suitable for genetic testing).

¹⁴¹ See *supra* text accompanying notes 83-113.

do not have background knowledge about the full range of possible incidental findings and their implications.

Even if we believe that a general discussion of the range of information one could receive from genomic analysis is sufficient to prepare one to make an informed choice about whether to be tested and whether to get information about incidental findings, liability concerns, including simply the worry about being sued, may still motivate physicians to disclose results, even if such disclosure would infringe a patient's right "not to know" about a particular risk. As we shall see, from a physician's perspective, the liability risks of infringing this right seem much lower than the risks of failing to disclose a risk. If a physician were to disclose incidental findings in spite of a patient's express desire not to know, a patient might point to the legally protected interest in refusing treatment, even life-saving medical treatment,¹⁴² to argue for the right not to be forced to learn about unwanted information. But, unlike the interest in refusing life-saving treatment, which is rooted in common law battery principles, the interest here merely involves unwanted information, not an unwanted procedure. The interest therefore cannot be rooted in common law battery claims because it does not involve unwanted touching. The harms of disclosure would be purely dignitary and emotional, but not physical. Given that the law strongly discourages recovery for nonphysical harms, except in rare cases,¹⁴³ courts might be reluctant to recognize this dignitary injury as a compensable harm, especially if it is the price of potentially saving a life.¹⁴⁴ And even were courts to recognize it, the damages for such intangible harms might not be great.¹⁴⁵

¹⁴² *Cruzan v. Missouri Dep't of Health*, 497 U.S. 261, 110 S. Ct. 2841, 2854-55 (1990).

¹⁴³ For example, courts initially refused to allow recovery for emotional distress alone, without accompanying physical injury. DAN B. DOBBS, *THE LAW OF TORTS* 836 (1st ed. 2008). Today, courts will allow recovery for pure emotional distress in some instances, although courts "remain deeply concerned to impose a limit." *Id.* Similarly, courts do not allow recovery for claims of failure to obtain consent if the patient merely suffers the dignitary harm of having made a medical decision without full information if there is no accompanying physical injury. See Schultz, *supra* note 4.

¹⁴⁴ See, e.g., *Tarasoff v. Regents of the University of California*, 551 P.2d 334(1976).

¹⁴⁵ Of course, whether such a claim would ultimately be viable is another story given the complex causation issues that such claims may raise. To succeed, the patient would need to show that her dignitary and emotional distress from learning unwanted information was the result of a violation of her desire not to know rather than simply the painful realization

A liability-wary physician might be further concerned that a patient who did not think she wanted this information before testing might have very different views about the value of the information were she to become seriously ill. If the physician failed to report the risk, and if the patient ultimately developed the cancer, the damages for the physical harm that might have been prevented had the patient learned of and acted upon the risk would likely be considerable.¹⁴⁶ A patient who did not think she wanted this information before testing might have very different views about the value of the information after becoming seriously ill. As a result, physicians might worry about 20/20 hindsight, where patients ultimately want information they had not initially desired. If given the choice of erring one way or another, one could imagine physicians' consciously deciding to err on the side of disclosing too much as opposed to too little.

Two additional factors cut in favor of the standard of care requiring disclosure even when patients do not want to know (whether the standard of care is set by the profession, the courts, or on the basis of a reasonableness assessment by juries). First, there are (not insignificant) concerns about the burdens on the health-care profession in tailoring the reporting and disclosure of information according to individual preferences.¹⁴⁷ Information management will only become more complex as we move toward more widespread genomic analysis, making this kind of personal tailoring of information delivery potentially more impractical and costly. As the ACMG/WG noted, such tailoring will be even more difficult when genomic analysis is performed by clinicians without broad training in genetics and genomics.¹⁴⁸ And even for those who are trained in genetics, tracking individual disclosure preferences for each patient would be a logistical challenge, at best, or nightmare, at worst.

that she harbors a mutation associated with disease.

¹⁴⁶ Causation questions arise here as well, *see supra* note 145, given that the patient would have to show that had she received the information, she would have acted accordingly to prevent the condition. Even if such claims were ultimately unsuccessful, however, the desire to avoid being sued may be enough to influence physicians' decisions.

¹⁴⁷ *See ACMG Recommendations, supra* note 115, at 568. This is consistent with the fact that "there was overwhelming agreement" in a survey of ACMG members "that patients should be able to opt out of receiving a report with secondary findings," whereas "there was no consensus regarding customization" of the analysis and disclosure of secondary findings. Scheuner, *supra* note 117, at 34.

¹⁴⁸ *See supra* text accompanying note 121.

Second, if courts examine how incidental findings are handled in other areas of medicine, they may be even more inclined to impose a standard of care requiring broad disclosure in the genetics context. Incidental findings are not new; they were a part of medicine long before the human genome was sequenced.¹⁴⁹ But the possibility of encountering such findings in other medical fields has not generated the same concerns about balancing autonomy and beneficence, probably because those fields have not had to contend with information that raises the kind of psychosocial issues that some forms of genetic information present. When one undergoes a CAT scan for one purpose, for example, the standard of care for a radiologist is generally to disclose incidental findings of clinical significance,¹⁵⁰ even though patients typically are not informed beforehand about the risks of learning about incidental information or about their right not to be told about such findings. The presumption is that clinically valuable information – whether incidental or not – must be disclosed. Indeed, failure to do so can be a basis of tort liability.¹⁵¹

Courts might evaluate disclosure dilemmas similarly in other contexts. Imagine a pediatric patient with a complex constellation of symptoms. If WGS were performed to try to diagnose the cause and if a variant associated with a late-onset colon cancer were incidentally found, the physician would face a dilemma. The norms against genetic testing of children for late-onset conditions might argue against disclosure. The liability risks of not disclosing the variant, however, would be greater than the liability risks of disclosing it.¹⁵² That is, the risks of harm to the child in disclosing the risk – which would violate his right not to know – would likely seem too intangible and speculative to courts as compared to the risk of harm to the parent in not learning about the risks of a tangible, physical, and preventable condition.

This situation is slightly different from the initial scenario in that it involves consideration of risks and benefits of disclosure not only to the patient (the child), to whom the physician clearly owes a duty,

¹⁴⁹ Botkin et al., *supra* note 125, at 9.

¹⁵⁰ See Clayton et al., *supra* note 73, at 627.

¹⁵¹ See *id.* at 2.

¹⁵² *Id.*

but also to a third party. This is not, however, just any third party. This is the kind of third party – a close genetic relative – to whom the law has found physicians owe a duty of care.¹⁵³ In cases addressing whether there is a duty to warn third-party relatives of genetic risks discovered in a patient, courts have held that physicians owe the close relatives a duty of care. Courts vary, however, as to the scope of that duty; some suggest that it is fulfilled merely by telling the patient about the risk,¹⁵⁴ others argue that it possibly requires warning the relative directly, even if that might breach patient confidentiality,¹⁵⁵ an interest that has been recognized and protected by the law.¹⁵⁶ Given that courts have not yet recognized a minor's right not to know, however, it is easy to imagine that a court's balancing of the conflicting obligations would come out in favor of a duty to disclose.¹⁵⁷

Similar issues arise with respect to prenatal testing where liability concerns might also push toward disclosure of more, not less, information. First, there is the capacity to learn about parental risks for late-onset conditions via prenatal screening, just as one can learn about parental risks via pediatric testing. In this context, the pressures to disclose this information may be even greater. Not only is there the risk of liability for failing to warn parents about potentially treatable conditions they face, but there is also the possibility of liability for a wrongful birth claim. Admittedly, the damages might not be significant for parents if courts were to recognize a wrongful birth claim for a late-onset condition. Typically the bulk of damages for wrongful birth claims covers the costs

¹⁵³ See *Pate v. Threlkel*, 661 So. 2d 278 (Fla. 1995); *Safer v. Pack*, 677 A. 2d 1188 (N.J. Super. Ct. App. Div. 1996); *Molloy v. Meier*, 679 N.W. 2d 711 (Minn. 2004).

¹⁵⁴ See *Pate*, 661 So. 2d at 282.

¹⁵⁵ See *Safer*, 677 A.2d at 1192.

¹⁵⁶ See, e.g., Health Information Portability and Accountability Act of 1996, Pub. L. No. 104-191.

¹⁵⁷ Similar debates have existed in the newborn screening context, where broader disclosure of newborn screening results has been justified based on the value of the information not only to the newborn's well-being, but also for the family's reproductive decision making. See Suter, *Did You Give the Government*, *supra* note 95. Setting aside the controversial issue of whether newborn screening should be done for the benefit of anyone other than the child, if WGS becomes part of NBS, one could imagine even stronger arguments in favor of reporting incidental findings about medically actionable variants associated with late-onset disorders, in spite of concerns about identifying these variants in children.

associated with the illness.¹⁵⁸With a late-onset condition, the child would usually reach the age of the majority before the illness would manifest. As a result, parents would not be burdened with the costs of the illness. At most, damages for a wrongful birth claim would include surveillance costs, although some courts might recognize the costs of the delivery for a pregnancy that would have been terminated had the parents learned of the risk.¹⁵⁹

All of these scenarios suggest courts or juries may conclude that providers should disclose incidental findings based on medical benefits not only to the immediate patient, but also to the family, regardless of patient preferences.¹⁶⁰In those scenarios, I have assumed away situations where the incidental findings are ambiguous or where the clinical utility is of questionable value. In these tougher cases, the risk benefit calculus is less straightforward because the harms of disclosure include not only the potential violation of autonomy, but also the risk of confusion, anxiety, and possibly a prolonged period of surveillance that may not be necessary or effective. A physician's defense might be that the standard of care should not be to disclose information when there is uncertainty about the value of information. Nevertheless, physicians might be troubled by how courts would evaluate the standard of care *ex post*, even in these scenarios, if, for example, a cancer associated with the variant were ultimately to develop. Adding to their worries would be the fact that this kind of uncertain information frequently *is* disclosed by physicians,¹⁶¹ and therefore some expert witnesses might argue that it is the standard of care. Given the current debates about what the standard of care should be and given the bias in favor of protecting against physical risks as opposed to emotional risks, a liability cautious physician might err on the side of over-disclosing information that could potentially minimize the risk of physical harm even if such over disclosure presents the risks of anxiety and confusion among patients.

¹⁵⁸ Cailin Harris, *Statutory Prohibitions on Wrongful Birth Claims & Their Dangerous Effects on Parents*, 34 B.C.J.L. & SOC. JUST. 365, 374 (2014).

¹⁵⁹ Some courts allow for recovery of emotional distress, but that seems difficult to establish for a parent who would be distressed about a child's future, not current, illness.

¹⁶⁰ See *supra* text accompanying notes 152-59.

¹⁶¹ See Grady & Pollack, *supra* note 19.

In short, if laboratories and physicians act solely to reduce the risks of liability or being sued, the choice seems clearly in favor of disclosing more rather than less information. Combining this dynamic with the tendency for patients to want more, rather than less, genetic information and companies commercializing and marketing their methods for increasingly broad scale genetic/genomic analysis, the trend will be toward even broader disclosure and ultimately toward standards of care that push in that direction as well.

V. THE DE-EXCEPTIONALIZATION OF GENETIC INFORMATION AND SHIFTING NORMS

As we have seen, the move toward an era of genomic medicine will not only generate more information about patients, but may also significantly change the way in which genetic information is obtained and shared. The pressures that challenge some of the norms of classical genetics – like detailed informed consent and the right not to know – suggest that as we move toward genomic medicine, the exceptionalization of genetic information that has shaped public policy and how the genetics profession deals with genetic information will be tested.¹⁶² The routinization of genomic analysis will probably motivate clinicians and the law to treat genomic information much like they have treated other kinds of medical information, like information that can be gleaned from a CBC or an x-ray. Not surprisingly, there is increasing discussion about whether genomic information really is different.¹⁶³ Ultimately, the almost rarified approach toward information in the genetics world will be difficult to sustain for the logistical and practical reasons described in this piece and because of the tension between autonomy and beneficence when it comes to disclosure of genomic information.

One interesting normative shift we are beginning to see is the

¹⁶² Suter, *Genetics Exceptionalism*, *supra* note 45.

¹⁶³ See, e.g., Robert C. Green, Susan M. Wolf, Eric Green, *Is Genetic Information Different?*, UNLOCKING LIFE'S CODE (Feb. 6, 2014), <https://unlockinglifescode.org/connections/events/genetic-information-different> (Robert C. Green and Susan M. Wolf, both with extensive experience in genetics & genomics, debated this issue).

role that autonomy plays in debates about the delivery of and access to genomic information. This article noted earlier how much genetics has focused on autonomy in information delivery – both by promoting informed consent and protecting the right not to know. As technology allows for the ability to glean more information through SNP arrays or WGS, however, autonomy has been a frequent justification for expansion of genomic analysis, whether it be through DTC companies or otherwise. Indeed, the calls to limit or slow the expansion of genomic analysis or to keep it within clinics where health care professionals can explain the significance of results (so that patients are not confused or unduly anxious about results) have been criticized as paternalistic infringements of autonomy.¹⁶⁴

As some scholars have pointed out, however, the language of empowerment may actually undercut the goals of exercising meaningful autonomy.¹⁶⁵ Simply having access to more information cannot promote true autonomy if the information is not adequately understood. But even more, the emphasis on the right to as much information as possible, will potentially lead to the inability to make individual choices about whether or not to receive all of that information. The right to know everything may eliminate, to some extent, protection of the right *not* to know some things.

Personalized medicine is intended, in part, to empower patients by individualizing treatment according to individual needs, rather than employing a one size fits all approach.¹⁶⁶ But as genomic analysis inevitably expands, it will impose on patients something akin to an obligation to get information, to act, and to take responsibility for their health care. This will potentially remove obligations from other entities, such as the “social and political realms.”¹⁶⁷ Urging individual responsibility is not in itself bad, but the idea that obligations and limits on autonomy will not arise in other

¹⁶⁴ See generally Kathryn Schleckser, *Physician Participating in Direct-to-Consumer Genetic Testing: Pragmatism or Paternalism?*, 26 HARV. J. L. TECH. 696 (2013).

¹⁶⁵ Juengst et al., *supra* note 15 at 38.

¹⁶⁶ Kenneth Cornetta & Candy Gunther Brown, *Perspective: Balancing Personalized Medicine and Personalized Care*, ACAD. MED. 88(3) 1 (2013).

¹⁶⁷ See Juengst et al., *supra* note 15, at 36 (“[T]he emphasis on individual empowerment often disguises the fact that personal genomics is pushing the individualization of responsibility for health one step further.”) (quoting Prainsack et al., *Personal Genomes: Misdirected Precaution*, 456 NATURE 24, 34-35 (2008)).

ways in this context is naive. And if, indeed, we expand the creation and disclosure of genomic information to patients, we move more toward a world in which decisions are made in terms of objective standards of what is best for patients, rather than individualized assessments based on each patient's risk-benefit calculation.

One potential solution is to try to balance the factors cutting in favor of objective standards for disclosure against the desire to preserve some autonomy by setting a default rule for disclosure with the option to opt out. Such a rule would base disclosure on the kind of objective standards used by the ACMG or the kind of disclosure most individuals would choose and find useful. But it would allow individuals with different attitudes to opt out of the disclosure of certain categories of information. Such an approach offers several advantages. First, it removes some of the logistical challenges that a highly individualized approach to disclosure would present to clinicians.¹⁶⁸ Second, it offers some protection against physicians' responding to perceived liability threats or financial conflicts of interest that might push toward too little or too much disclosure.¹⁶⁹ And, finally, it allows for individuals with strong desires not to know particular kinds of information the ability to opt out, which protects the autonomy interests where infringement of the interest in not knowing would be greatest.

Granted, this approach would require affirmative acts on the part of the individuals who want to opt out. In addition, there may be limits to what kind of information we would find socially acceptable for people to opt out of, if that failure to learn information and respond to it poses risks to others or society as a whole. Further, without patients' full understanding of the issues surrounding disclosure of genomic information, there is a risk that the opt-out approach would not be a meaningful exercise of autonomy.¹⁷⁰ But, assuming that informed consent based on categories of information with supplemental decision aids can adequately educate patients about the relevant issues,¹⁷¹ this approach may be the most effective

¹⁶⁸ See *supra* text accompanying notes 119-21.

¹⁶⁹ See *supra* text accompanying notes 128-61.

¹⁷⁰ Ainsley Newson, *Should Parental Refusals of Newborn Screening Be Respected?*, 15 CAMBRIDGE Q. HEALTHCARE ETHICS 135, 140, 144 (2006).

¹⁷¹ See *supra* text accompanying notes 69-72.

compromise to address the competing interests.

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I conclude with some final points about autonomy and genomic analysis. Many of the autonomy arguments for access to genomic analysis and broad disclosure of information presume that all of this information will be empowering by offering us meaningful options once we learn our genomic information. But, our autonomy in the face of obtaining genomic information may actually often be fairly limited. The goal of personalized medicine is to learn about our *individualized* risks for various conditions. Ironically, however, this risk assessment will often not be individualized, but instead will be based on data about large groups.¹⁷² As some have argued, until we have significant treatment options for many of these risks, which may be a long time coming, this personalized and “individualized” risk assessment will, at best, place us into various risk categories, what some have called “stratified medicine.”¹⁷³ This classification of patients, without robust options to attend to these risks, will be disempowering in another way. It raises the risks of discrimination and stigma, as we develop even more refined methods to categorize people, which is a real threat to autonomy of a different kind.

Finally, there is another kind of threat to autonomy as genomic information becomes more widely available and potentially seeps into all realms of medicine, including the prenatal world. If genomic analysis becomes a routine part of prenatal diagnosis, especially if it can be done through noninvasive means, the possibility for prenatal testing for non-medical reasons increases. Whereas, until recently, prenatal testing has focused almost entirely on “medical,” as opposed to non-medical, information, like traits,¹⁷⁴ broader genomic analysis, coupled with a better understanding of the genome, may over time make it possible to obtain prenatal information about non-medical traits. This will raise difficult questions about whether such

¹⁷² Juengst et al., *supra* note 15, at 37.

¹⁷³ Trusheim et al, *Stratified Medicine: Strategic and Economic Implications of Combining Drugs and Clinical Biomarkers*, 6 NATURE REVIEW DRUG DISCOVERY 287 (2007).

¹⁷⁴ There are some exceptions, such as sex, which other than its relevance to X-linked diseases, is not health related.

information should be reported from laboratories to clinics and ultimately disclosed to patients. It is beyond the scope this paper to explore whether such analysis should be allowed and who should be the gatekeepers of this information. However, the capacity for such analysis is likely to encourage, for all of the reasons discussed earlier, broader acceptance of such prenatal analysis. If this kind of testing becomes routine, choice will begin to become limited in subtle ways as social pressures and other factors make it harder to resist finding out all one can about a future child. The "choice" not to know exists, but the norms, practices, and incentives all push toward knowing, which is yet another kind of infringement on autonomy.

For all of these reasons, we should be cautious about assuming that genomic medicine, with the wealth of information it can provide to us, will not create a new set of issues regarding autonomy and information delivery. We should hope that it can offer the possibility of improving health, but should recognize the many challenges it presents in the nature and complexity of information it provides. Information can be freeing, but in this context, it can also bind us in subtle and complex ways, a concern to which we should attend as the march toward genomic medicine moves relentlessly forward.