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Uncertainty and Moral Judgment: The Limits of Reason in Genetic Decision Making

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Since the inception of the Human Genome Project, the question of how genetic information should be used responsibly has generated a great deal of speculation and scholarship.[1] Although genetic testing offers unprecedented opportunities for choice and control in disease management and human reproduction, it has many critics who fear that over time, the indiscriminate use of genetic information may result in various kinds of harms to individuals and society. Responsible use of these new diagnostic technologies is therefore essential if genetic testing is to be successfully integrated into clinical medicine. But establishing normative standards of genetic responsibility has proved challenging.

A number of scenarios illustrate some common dilemmas individuals and couples may face today.

- Suppose a person is known to have a family history of disease. Does he or she have a responsibility to be tested for disease susceptibility?
- If a person tests positive, should he or she be expected to change behaviors or accept medical treatment to lower disease risks? Should a person be penalized or otherwise held accountable if she or he chooses not to do either?
- Suppose a person tests positive for a known disease-bearing mutation. Does the person have a responsibility to warn his or her relatives that they too may be at risk?
- If a woman or couple is thought to be at risk of having a child with a genetic abnormality, does the woman have a moral responsibility to undergo prenatal testing?
- If an abnormality is found, does the couple have a responsibility to continue or terminate the pregnancy?
- If both members of a couple are suspected carriers of genetic disease, do they have a responsibility to be tested prior to attempting reproduction? If they both test positive as carriers, does this information impose any new responsibilities on them?
- If a person is known to have a genetic predisposition for an occupational disease, does he or she have a moral obligation to seek other kinds of work?

Each of these scenarios suggests that genetic testing provides specific and clinically meaningful information that can be used in ways that can be considered morally responsible. However, in practice, genetic information is usually presented in terms of probabilities or risks, as uncertain rather than definitive informa-

tion. Moreover, studies in genetics and other disciplines have reported that decisions made under conditions of uncertainty may be influenced by a variety of nonrational factors, including heuristics and emotion. In this discussion, I explore whether and how genetic decisions that are influenced by nonrational factors can be considered responsible. I begin by summarizing some of the primary causes of genetic uncertainty followed by a discussion of how nonrational cognitive factors, specifically heuristics and emotion, may shape decision making. I then explore the implications of these nonrational factors for genetic decision making. I conclude with a number of questions regarding the nature of moral judgment when knowledge is uncertain.

SOURCES OF GENETIC UNCERTAINTY

The mapping and sequencing of the human genome has been more or less completed, but we are still far from understanding how our approximately 25,000 genes contribute to human development and behavior and how genetic activity is affected by factors external to the human organism. In addition, decisions of whether or not to test and what to do with test results often involve a range of psychosocial concerns, compounding uncertainty. Despite the many unknowns, several kinds of genetic testing have entered mainstream medical practice.

The most common form of genetic testing is amniocentesis, which is performed prenatally, and examines fetal cells for chromosomal abnormalities. Amniocentesis is usually recommended for couples who are considered to be at high risk of having a child with a genetic disorder, based primarily on the mother's age and medical history. Whether to accept the test is itself a question for many women. Because a slight risk of spontaneous abortion accompanies the test, the risk of a birth defect must be weighed against the risks imposed by the test. If a genetic abnormality is found, its significance may be unclear. Some chromosomal abnormalities are relatively benign, others are incompatible with life, and many have a wide range of expression. Diagnosis of a disorder also raises questions about what a child with a disability might require of prospective parents and their existing children, what the child's medical needs and prospects might be, whether the family will be able to provide adequate support for the child, and how others might respond to a decision to continue the pregnancy. None of these questions has clear or obvious answers.

Other kinds of genetic tests look for mutations — abnormal patterns — in the nucleotide sequences that make up the functional "code" of the human genome. These tests may be used to confirm a suspected diagnosis in children, to diagnose late-onset disease susceptibility, or rarely, to diagnose disease-bearing mutations in embryos created through *in vitro* fertilization prior to implantation. Single-gene diseases are the easiest to detect, but if a disease has a wide range of expression, the severity of symptoms over a lifetime cannot be determined from the diagnosis and may be highly variable. But most genetic diseases are multifactorial, caused by a combination of genetic, environmental, and behavioral factors. Tests for these diseases vary in their predictive utility, depending on what is known about the frequency of the gene in the population at risk, the proportion of people with the mutation in whom symptoms will eventually develop, and variation in how those symptoms are expressed. Because the predictive values of genetic tests are derived from studies of high risk populations, they are subject to change with continued research. For multifactorial diseases, particularly those that manifest in adults, a positive diagnosis therefore only indicates an increased risk for disease over a patient's lifetime. But even when risk assessments are quite high, because multifactorial disease is not determined by genetics alone, there will always be some people who test positive who will never develop disease. A positive diagnosis is thus rarely conclusive evidence of disease. Testing also carries risks of employment or insurance discrimination, concerns for the health of family members, and possible social or psychological burdens, all of which may compound uncertainty for the decision maker.

NONRATIONAL FACTORS IN GENETIC DECISION MAKING

A person usually seeks genetic testing because he or she is concerned about a risk. A woman may become pregnant at an older age and worry about her risks of having a child with chromosomal defects. A

middle-aged man may have a family history of colon cancer and wonder how to minimize his risks. An employee in an industrial setting may be concerned about his or her susceptibility to occupational hazards. Whatever the situation, when faced with a genetic risk, an individual will first have to decide whether or not to seek genetic testing. This decision will be shaped by the state of genetic knowledge regarding the disorder, the way the person perceives his or her risks relative to other life stresses and values, and how the person's physician responds to his or her concerns. If testing is pursued, test results will likely be presented in terms of numerical risk factors or probabilities of developing disease, which must then be interpreted by the clinician and the patient prior to further action. In these ways, genetic testing almost always involves some interpretation of risks.

Risk assessments for genetic diseases are developed from correlations between family histories, genetic diagnoses, and the incidence of disease across large populations. But while these assessments provide meaningful indicators of disease risks in populations, it is often difficult for individuals to interpret numerical risks with respect to their own circumstances. Generally speaking, people experience risk as the possibility of a loss. The significance of the risk reflects the magnitude of the potential loss combined with the likelihood that the loss will occur. But individuals differ over what they consider a loss, the significance of that loss, and their perception of its likelihood. In this way, a risk has little or no objective value; it becomes meaningful only as it is interpreted by an individual.

Although perception of risk has been extensively studied across a range of disciplines, there is still much that remains unknown. What is clear, however, is that the interpretation of risk and probabilistic information is far from an exclusively rational process. Genetic counselors assume that the more accurately a risk is conveyed, the better prepared a client will be to make the right decision for him or her. They are aware that how a risk is "framed" contributes to how it is interpreted, and for this reason make an effort to present risks and probabilities in a number of ways: as a single figure or as part of a sequence, in comparison to other risks, and verbally as well as numerically expressed.[2] Differentiating between risks of different magnitude can be difficult. Whether one has a 50 percent risk or 85 percent risk of developing a disease over a lifetime may make very little difference to the person faced with the risk; instead, he or she may construe the risk simply as "high" or "low," or as something that either will or will not happen.[3] Moreover, risks are always understood relative to other goals and uncertainties. For this reason, some people may dismiss a long-term genetic risk when short-term demands of a job or family are pressing.[4]

Studies in social psychology and neuroscience have demonstrated that under conditions of uncertainty, a number of heuristics and emotional responses may strongly influence decision making.[5] Three such heuristics have been described as representativeness, availability, and anchoring.[6] *Representativeness* refers to the extent to which interpretations of risk may be narrowly based on limited or anecdotal experience, neglecting the range of variation across populations. For example, prospective parents whose fetus is diagnosed prenatally with Down syndrome may consider whether to continue or terminate the pregnancy. If they only know one person with Down syndrome, they may assume all people with Down syndrome exhibit characteristics similar to that person, and base their decision on how they feel about that individual. But the symptoms of Down syndrome range from mild to severe, and the likely form of expression cannot be inferred from the diagnosis. In this way, the couple may be misled by excessive reliance on their limited experience.

Availability has to do with the tendency to judge the likelihood of an event by the vividness with which an impression of the event comes to mind. Factors that contribute to availability include the magnitude of the consequences of the event, how recently the event occurred, and the frequency of the event. For example, a person exposed to a disease in family members, friends, or acquaintances is likely to have a heightened perception of his or her own risks for that disease.[7] Similarly, diseases that receive a lot of media attention, such as breast cancer or AIDS, also carry heightened availability. As a result, risks for these diseases are often overestimated relative to more common risks such as heart disease or car accidents.[8] Conversely, those with no prior experience with a disorder may find it difficult to imagine what the disorder might mean, or why they might want to pursue testing. Availability may therefore heighten or diminish perceptions of risk, depending on each person's experience.

Anchoring refers to a person's baseline knowledge about a risk. For some people, anchoring may be the most powerful influence on their perception of risks because long-held beliefs, even when mistaken, can be difficult to shake. This is illustrated in a study of genetic counseling in which approximately half of the patients' beliefs about their genetic risks before genetic counseling remained unchanged after counseling.[9] The strength of anchoring can be particularly distressing for people who are convinced that they either do or do not have a gene for a particular disease and who seek testing to confirm their hunches. Receiving news to the contrary can require a monumental reshaping of one's identity and prospects.[10]

In addition to these heuristics, emotional factors can contribute to decisions in a variety of ways. People faced with a genetic decisions have been found to use emotional feedback as information, exploring how they imagine they would feel — joyful, despondent, regretful, and so forth — by creating best- and worst-case scenarios.[11] This kind of "anticipated emotion" can be a powerful determinant of decisions.[12] The emotional foundation of personality may also make a difference — a person's general sense of optimism, confidence in "luck," belief that "it won't happen to me," or distaste for preventive measures, may diminish his or her perceptions of risks, while anxious individuals may overestimate their risks or underestimate their ability to cope with what they consider a "bad" outcome.[13] It is also noteworthy that genetic decisions are always stressful and often must be made quickly, which may result in efforts to avoid making a decision or a panic response that impairs judgment.[14]

Fear may be the most powerful emotional contributor to genetic decision making and is rarely avoidable, if only because so much of genetic testing is done for purposes of reassurance. The rational component of fear may be characterized as prudence — as reasonable precaution in the face of the unknown. The irrational dimensions of fear are potentially far more powerful. Some fears are experienced viscerally, as an "anticipatory emotion" that may overwhelm reason altogether.[15] Fear of public speaking, fear of heights, fear of snakes — for people who have these kinds of fears, no amount of intellectualizing can overcome them. Conceivably, some people may have this kind of fear response upon learning of their genetic risks and diagnoses.

Fear may also include anxiety over the unknown — the extent to which a hazard is considered novel, invisible, or delayed in producing harmful effects. Fear may also be experienced as "dread," referring to a person's perceived lack of control and the catastrophic potential of a situation.[16] Because genetic decisions are unfamiliar to most people, have sometimes invisible or delayed effects, and yet may have catastrophic consequences over which individuals have little or no control, these kinds of fear responses may strongly influence genetic decision making. Fears may include fear of the genetic risk, of the child who is different, the future that is not turning out as expected; fear for one's health, one's marriage, one's employment, one's life; fear of the judgment of others, of stigma, embarrassment, and rejection. And fear is subject to the same kinds of cognitive errors as perceptions of risks — it can be overblown or underestimated, depending on a person's experience, emotional makeup, and personality.

To summarize, responses to uncertainty generally represent a balance between a person's desire for a particular outcome and desire for security. How this balance is struck will be a measure of how each risk is interpreted, which in turn reflects the decision maker's prior knowledge and experience, contextual circumstances, personality, and the extent to which cognitive biases and emotional responses govern choices. Due to the range and variability of the factors that contribute to risk assessment, the same genetic information will mean different things to different people and decisions will vary correspondingly. Remarkably, most people are highly confident of their ability to make the right decision, even when the facts are uncertain.[17]

GENETIC RESPONSIBILITY: A MATTER OF INTERPRETATION

Prior to genetic testing, most people meet with a healthcare professional who provides genetic counseling. Genetic counseling is primarily a process of sharing information, in which a counselor solicits information on a person's family and medical history, assesses his or her genetic risks, and discusses the risks and benefits of testing. When test results are received, the counselor then explains their significance as accu-

rately as possible and helps the counselee with any questions and concerns. The counselor's role in decision making is somewhat restrained. In the United States, the current policies and practices that surround genetic testing have been dominated by concern for the highly personal nature of genetic information coupled with the emphasis on individual liberty and rights that pervade American culture and law. Ensuring genetic privacy is therefore a paramount concern, as is a determination to avoid the coercive practices of the eugenics era a century ago. For these reasons, genetic counseling has evolved as a nondirective practice, meaning that counselors offer information and psychological support but rarely offer advice, respecting the right of their counselees to make their own decisions. Only when there is clear medical benefit to be derived from a particular choice are counselors likely to offer guidance or make recommendations. Decisions are thus driven primarily by how decision makers interpret their risks and alternatives in view of their unique circumstances, goals, and values. This approach minimizes the possibility of coercion and, it is widely believed, enables each counselee to make the decision that seems best for him or her.

A nondirective stance with regard to genetic decision making thus offers no normative guidelines or blueprints for responsible decisions. But if decision making is largely a matter of individual interpretation, which in turn may be shaped by nonrational factors, in what way can genetic decisions be considered morally responsible? At its core, moral judgment calls for the intentional use of reason to guide one's actions, reason typically being understood as the dispassionate and impartial exercise of one's intellect.[18] However, the burgeoning literature in cognitive science and decision making indicates that cognition calls on far more than rational processes,[19] including more than 30 different heuristics that are known to contribute to medical judgment.[20] How should these findings be incorporated into theories of morality and ethics? At issue is the perceived value of non-rational cognition — whether heuristics and emotional responses are believed to add useful insights that are not available by reason. If they are useful responses, how ought we to incorporate these insights in moral decision making? If not, how shall we minimize their influence? Can we even reliably distinguish between rational and nonrational modes of thought?

Cultural attitudes toward uncertainty and risk taking impose additional moral considerations. For example, in affluent industrialized societies, we are encouraged to try to minimize uncertainty and control risk as much as possible. In the United States, our massive insurance industry is predicated on these values; our laws, social conventions, and reliance on the accountability of individuals and institutions all speak to our distaste for the unpredictable. And because uncertainty is portrayed as something to be avoided, failure to avoid it carries moral weight. This is clearly evident in healthcare, in which both physicians and patients who take unnecessary risks may be seen as irresponsible. Sometimes risk taking is necessary, and when it is done on behalf of others, it is often praised, regardless of the outcome. However, if the risk is unnecessary, or seems to benefit only the risk taker or results in burdens to others, taking risks may be judged more harshly.

But for many people, uncertainty is a fact of daily life. Hunger, homelessness, illness, violence — when these are present, mere survival requires taking calculated risks. When uncertainty is unavoidable, constant, and potentially life-threatening, there may be less of a moral burden associated with taking inadequate precautions or failing to assess risks accurately. Religious beliefs may also help some people cope with risks by portraying uncertainty as something to be embraced or endured through faith in providence or the will of God. In such circumstances, religious beliefs may provide a source of guidance and strength, but may also diminish one's sense of responsibility for the consequences of a choice. Perceptions of uncertainty itself are therefore value-laden, depending on one's culture, circumstances, and whether opportunities to manage risk are available.

As described above, fear may also exert a powerful effect on genetic decisions. Fear is not a virtue, and decisions based on fear are rarely praised. But some fears may be legitimate. For example, in the United States, financial support and services for children with disabilities is limited and dwindling. The rising costs of health insurance make it inaccessible to increasing numbers of people, which hinders their ability to use disease prevention strategies. Legal protection from genetic discrimination is still far from comprehensive and existing laws have not been adequately tested in the courts. Indeed, people have been known to refuse disease susceptibility testing because they fear losing a job or insurance discrimination following testing.[21]

Studies suggest discrimination in insurance and employment already occurs[22] and existing legal constraints may not prevent it in the future.[23] Given all this, how should fear be acknowledged in genetic decisions? Moreover, because the social policies and practices of a society affect how choices are perceived, do these also bear some responsibility for the kinds of decisions that are made? Western ethics places the locus of moral responsibility on individuals, but individual choices inevitably reflect the surrounding context. To what extent should society as a whole be considered accountable for how genetic technologies are used?

Lastly, if genetic decisions cannot be said to be fully rational, should genetic counseling remain nondirective? Genetic counselors have long been aware that heuristics and emotion affect perceptions of and responses to risk, but at present, they do not consciously or systematically attempt to limit or constrain the kinds of factors that their counselees bring to bear on their decisions or the kinds of decisions made. Should counselors intervene when they feel that a counselee's decision is inappropriately influenced by nonrational factors? How can a counselor judge this? If counselors attempt to redirect a decision, might they be seen as manipulative? As experts who know more than their counselees about the significance of genetic information, to what extent should genetic counselors have a role in the kinds of uses to which genetic technologies are put and the kinds of decisions that are made?

CONCLUSION

Genetic decisions must thus be seen as a balancing act in which each individual balances his or her hopes, beliefs, and values against uncertainties and fears. This balancing act is primarily an act of interpretation that involves a host of medical, psychosocial, and moral factors, many of which are subject to biases and distortion due to the strategies we use to make sense of uncertainty. Where the balance will fall depends on each individual and his or her life story. With rare exceptions, most people will believe their decisions are morally responsible.

But recognizing that decisions may even partially based on nonrational considerations raises a number of questions. First is the question of what it means to make a moral judgment. We speak of "moral reasoning" as a rational process that is based on an impartial analysis of facts and values. Can a decision be considered morally responsible if it is shaped, perhaps even primarily, by nonrational factors?

Second, how might or ought we to frame, articulate, and acknowledge uncertainty as a contributing factor in moral judgments? How do cultural values and expectations contribute to responses to uncertainty? What can we claim about the demands and expectations of moral responsibility in the genetics arena, where information is almost always uncertain?

Third, what do we need to know about how fear contributes to genetic decisions? What kinds of fear are morally legitimate? If fears significantly reflect persons' anticipated social consequences of testing, should the locus of responsibility rest solely on the individual? How do public policies influence perceptions of risk, and correspondingly, what role has society in promoting responsible genetic decisions?

Finally, and most immediately, how ought those who provide genetic counseling acknowledge and respond to those factors that contribute to nonrational decisions? What is (or ought to be) counselors' role in promoting responsible decisions, and how ought they best to go about fulfilling it?

My goal in this article has been to introduce some of the literature on the limits of rationality to broader discussions of genetic responsibility and bioethics. To date, discussions of genetic responsibility have focused primarily on legal rights and protections for individuals and groups, and have neglected the lived experience of people who make genetic decisions. There is ample evidence that these decisions are not based entirely on factors that are amenable to rational analysis. The successful integration of genetics in healthcare and society will require that we learn much more about how nonrational forms of cognition affect moral judgment. It is possible that a greater understanding of these relationships may even prove useful beyond the genetics arena.

NOTES

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