MAYO CLINIC

Living at Risk: Factors That Affect the Experience of Direct-to-Consumer Genetic Testing

Serena Oliveri, PhD; Chiara Renzi, PhD; Marianna Masiero, PhD; and Gabriella Pravettoni, PhD

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From the Interdisciplinary Research Center on Decision Making Processes, Department of Health Sciences, University of Milan (S.O., M.M., G.P.), and Applied Research Unit for Cognitive and Psychological Science, European Institute of Oncology (S.O., C.R., M.M., G.P.), Milan, Italy.

In the past decades, genomic medicine has become a cornerstone of personalized medicine, which aims to tailor prevention and treatment to each patient's unique characteristics, including the makeup of one's tumor or infectious microbes. According to this perspective, identifying individual risk factors and predicting latent diseases may allow the development of personalized interventions and, together with personal and environmental factors, decrease the probability of disease development.[1] Within this framework, the increased accessibility of direct-to-consumer genetic testing (DTC-GT) leads to a situation whereby individuals find that they are asked to directly manage the available information without necessarily understanding its real meaning. Personal genomics companies provide DTC-GT that can be categorized across prediction (susceptibility testing), detection (disease-specific testing), and care selection (pharmacogenomics). Personal genome services include the testing of more than a million single-nucleotide polymorphisms and yield information for more than 250 health-related traits. The complexity of such information conveyed is related first of all to its 2-fold nature, which may be interpreted by consumers as both predictive and diagnostic.[2] This may imply that individuals should then be able to regulate their lifestyle according to the evidence derived from the DTC-GT.[3] However, the complexity resides in the variety of information that the consumers find themselves unable to interpret, which may well leave individuals defenseless in the face of their own genetic heritage.[4] In fact, complicated and potentially unreliable data outside the medical and counseling contexts may lead to inappropriate health decisions,[1] which in turn may result in increased health care costs without clear benefits.

Critically, studies focusing on the effect of DTC-GT are characterized by predominantly hypothetical contents, nonsignificant psychosocial variables, use of nonrepresentative samples of the population, and too little evidence from users, especially concerning effective lifestyle changes.[5] Therefore, such studies cannot be considered a good basis on which to study this phenomenon. We argue that the data available from the published literature does not capture the nature of the effect of DTC-GT on consumers and does not provide relevant information to stakeholders who are involved in the regulation of DTC-GT uptaking.[6] Crucial factors in determining the effect of DTC-GT may instead concern experiential components, such as the condition of uncertainty in regard to personal implications, as well as historical components, such as the family and personal history of disease. In fact, the psychological characteristics of the individual and a family history of disease have been indicated as the main factors that influence perceived risk and decision making.[3,5] Altogether, this may critically affect cognitive representations and biases, which, in turn, determine health-related decisions and behaviors.[7]

EXPERIENCE OF UNCERTAINTY IN DTC-GT

The spread of DTC-GT among the general population could arise from a 2-fold desire: that of increasing control over health-related dangers and that of reducing worry about possible disease occurrence; in other, words it could be viewed as a strategy to manage life uncertainty. Uncertainty in genetics may be closely intertwined with the nature of the information per se (genetic risk is related to genetic factors together with environmental factors) or it may be related to the implications of this information for the individual. This creates the impossibility of allocating definite numerical values for each future health outcome, according to the risk of occurrence and to the patient's belief system.[8] In this perspective, undertaking a genetic test represents a bet in which the probabilistic process and the uncertainty regarding personal implications

prevail over forecasts about disease development and consequent health decisions. Therefore, one must evaluate whether the choice to undergo a genetic test is worth the probability of being rewarded with useful health information.[9] It appears clear that in such conditions the presence of a certain degree of anxiety becomes an expected index, as a modulator of the health choice and as a temporary immediate reaction to a novel state. However, it does not explain all aspects involved in the psychoemotional effect of DTC-GT and consequent decisions, as some studies attempt to find.[5] The fundamental challenge to refine theories on the effect of DTC-GT is that of abandoning the assumption that uncertainty about personal implications produces clinical anxiety and causes harm in itself.

Uncertainty experienced in genetic risk can be about the self (eg, one's own beliefs, values, abilities, and behaviors), others (eg, others' beliefs, values, abilities, and behaviors), relationships (eg, the quality and durability of relationships), and other features of a context (eg, rules, social norms, and procedures). For instance, people with a genetic susceptibility for an illness may evaluate whether they may be able in the future to manage the illness or whether their physicians will be able to diagnose the disease or to choose the appropriate treatment.

Therefore, it appears clear that in DTC-GT there is not a unique experience of uncertainty but rather multiple sources of uncertainty at once, and these experiences are ongoing and subject to the changing of features throughout individuals' lives. For instance, the manipulation of one type of uncertainty can affect (eg, increase or decrease) uncertainties of other types. Uncertainty is thus multilayered, interconnected, and temporal in its nature, and the appropriateness or the effectiveness of responses used to cope with it are as various as the different contexts and situations.[10] These dimensions of the experience require that people develop responses that are sensitive to multiple goals and tasks.

EXPERIENCE OF RISK PERCEPTION AND FAMILY AND PERSONAL HISTORY OF DISEASE

Which experiences modulate the link between judgments (eg, risk perceptions) and health-related behavior? The theory of planned behavior[11] suggests that the greater the perceived controllability of a health circumstance, the greater the intention to engage in a precautionary or preventive behavior and the greater the likelihood of adopting such behavior. However, in genetics, intentions do not necessarily translate into behavior.[5,12] It may be that the matter is not so much whether genetic risk information can motivate health behavior changes but rather under what conditions it might do so. Empirical evidence reveals that individual differences modulate motivational effects on risk perceptions. Boeldt et al[13] found that higher perceived seriousness related to a specific disease (such as myocardial infarction or Alzheimer disease) creates more psychological susceptibility to test results, with an increase in levels of anxiety and distress, but not a clinically significant increase. Instead, perceived control may protect against negative psychological consequences. However, these results cannot say anything more about if and how risk perception translates into health behaviors.

The binomial between the personal context and a family history of disease seems to be more likely to determine lifestyle changes[3,5] after receiving genetic information. Kaufman et al[3] reported that contextual factors of participants' lives, such as undergoing regular physical examinations and having a poorer self-perceived health, were significantly associated with the decision of sharing results with a physician and were associated with changes in diet and supplement regimen. Moreover, they found that having a chronic disease or a family history of at least one genetic condition, tested with DTC-GT services, induced changes in prescribed medication regimen, whereas a positive family history led to a declared availability for follow-up tests and increased focus on diet and exercise. Many studies found that people always contextualize genetic risk in their own family history,[14] and sometimes merely having a family history of a disease, without any symptom, could affect one's perception of risk and consequent lifestyle choices.[15]

Thus, there is a need to identify past experiences, environmental factors, lifestyle, stress and worry, physical resemblance to an affected relative, and genetic or family history factors to

Mayo Clin Proc. ■ October 2015;90(10):1323-1326 ■ http://dx.doi.org/10.1016/j.mayocp.2015.06.014
www.mayoclinicproceedings.org

understand decision-making architecture and behavioral changes in genetics.

SOUNDING OUT THE LIVED EXPERIENCE OF GENETIC RISK

In a blog in the journal *Nature*, Charles Warden argued that "having some information is better than having no information" to prevent and cope with future health problems.[16] So, is he right? The answer is that it depends, among other things, on experiential factors.

The scientific community[17] recognizes that it is a right of ordinary citizens to receive information about their genetic predisposition toward certain diseases and that regulatory constraints cannot suppress the development and delivery of emerging products that could help society to become "aware." Furthermore, they argue that the failure to fit the model of physician-driven health care is not an adequate and exhaustive reason to interrupt DTC-GT services.

We agree that dissemination of genetic information should not be banned. However, we do maintain that adequate disclosure should also be provided, recognizing the role that emotions and experiences play in assessing risk and deciding on behavioral actions. The Food and Drug Administration regulations should ensure that practitioners adequately disclose the limits of the information they provide, without restricting the availability of information to the public out of concern that it *might* be misused. Furthermore, we cannot expect to improve a health care model by adopting a paternalistic approach to the management of genetic issues, but it is nonetheless paramount to work for citizen empowerment.

We believe that the potential harm of DTC-GT goes beyond distress, anxiety, and inappropriate treatment. It becomes very easy to create people who "live at risk" because of genetic test results without really knowing yet what it means in individuals' lives. In fact, when individuals get to know that they are at increased risk, the effect of living with this risk in their daily lives is as yet undetermined, and there are no guidelines concerning what they should do with the risk in the form of treatments or changes in lifestyle. Therefore, the consumer is left with uncertainty not only about the health implications of the genetic information derived from DTC-GT but also about which actions they should or should not take to counteract a possible genetic risk.

Our challenge as researchers and health care professionals should not be restricted to simply finding more adequate ways to communicate with individuals about genetic risk. In fact, no matter how well the genetic risk is explained, the definition of (genetic) risk itself is intrinsically ambiguous. We do not cease to live and to experience life just because some medical or genetic risk was explained to us in a comprehensible way.

So how does life change when it becomes a life with genetic risk? This is the core question that we need to investigate. To achieve effective regulations, we should understand what the personal experience of being at genetic risk really is and shed light on certain psychological aspects of humanity that may be overlooked or taken for granted.

CONCLUSION

To grasp the efficacy of DTC-GT and translate genetic and genomic findings into practice that can be usefully applied in terms of health, the personal implications for the consumer and his or her experiences need to be understood and addressed. Regulations on how to provide genetic risk information should be tailored toward the personal experiences of the individual, taking into account the psychological factors and dynamics that determine decision making and behavior. Furthermore, communication should also entail disclosing the complexity of the information (eg, by reporting environmental factors and preventive behaviors modulating genetic risk), thus tackling the ambiguity related to the nature of the information per se.

ACKNOWLEDGMENTS

We thank William Russell-Edu, BSc, for his assistance in proofreading the manuscript.

Grant Support: This work is supported by a grant for the project Mind the Risk from The Swedish Foundation for Humanities and Social Sciences, which had no influence on the content of this article.

Correspondence: Address to Serena Oliveri, PhD, Applied Research Unit for Cognitive and Psychological Science,

European Institute of Oncology, Via Ripamonti 435, 20141 Milano, Italy (serena.oliveri@unimi.it).

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