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Bridging the Communication Divide: A Role for Health Psychology in the Genomic Era

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Abstract

The application of genomics to population health has the potential to revolutionize the practice of medicine. Indeed, discoveries into the genomic basis of cancer and other common chronic diseases have resulted in new and improved predictive tests for identifying individuals at increased risk for these conditions and long before their onset occurs. When used properly, information gained from predictive genomic tests can be combined with other leading indicators (e.g., environmental and behavioral risk factors) to inform medical management decisions, preventive health practices, and risk-reducing strategies. However, genomics remains an emerging science and the translation of genomic discoveries into improved population health management remains elusive. There are divides in the translational science continuum at several junctures, and many of these divides could be narrowed or closed with additional data. For example, we know relatively little about how to effectively communicate with the public about the complex interplay among genomics, behavior, and health. Moreover, there is a need to develop better methods of counseling and educating the public in light of newly emerging knowledge about the genomic basis of health and disease. We assert that the discipline of psychology, and health psychology in particular, is well-poised to continue to make significant contributions to this growing area of science and practice. Through a focus on health-related social and behavioral research, psychology can lead the way in overcoming divides in communication, understanding, and action about genomics for the betterment of both individual and public health practices.

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Keywords

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Mary, a college-age woman, recently learned that her father (like her grandfather) was diagnosed with Type 2 diabetes. Concerned about her family history of the disease, Mary turns to the Internet in search of information. She finds out about the risk factors for diabetes, including genetic and lifestyle influences. Later that night, Mary posts the information on her blog and soon makes an online acquaintance who shares the URL of a company offering at-home genomic testing for multiple common health conditions, including Type 2 diabetes. The acquaintance suggests that Mary take the test to find out her own diabetes risk, and she agrees. For a modest fee, the test kit comes by mail and Mary sends her DNA sample to a laboratory for analysis. In a few weeks, Mary learns her results online. In addition to finding out that she is at increased risk for Type 2 diabetes, Mary also learns that her genetic profile places her at increased risk for cardiovascular disease, breast cancer, osteoarthritis, stroke, and many other conditions that Mary knows little about. Feeling confused, overwhelmed, and anxious, Mary ultimately turns to her primary care doctor for advice. Together, they discuss the genomic test results and Mary's desire to know more about her future health risks. Although the physician is unfamiliar with the genomic test offered by the company and is skeptical of the results, he decides to use this as an opportunity to begin a conversation with Mary about disease prevention. To facilitate their discussion, the physician consults with a health psychologist employed by the medical practice. Together, they develop a plan for educating and counseling Mary about genetic and environmental disease risks, risk-reduction strategies, and stress management. The psychologist also develops a plan to assist Mary in making changes to her lifestyle that could reduce her chances of developing diabetes.

The advent of Direct-to-Consumer (DTC) predictive genomic testing technology is expected to rapidly usher in a new era of personalized risk identification and management surrounding chronic disease prevention and control (Khoury et al., 2011). As illustrated in the example above, individuals with access to the Internet can now learn if their genetic code places them at increased risk for serious health conditions such as cancer, diabetes, heart problems, and a host of other medical threats (Borry, Cornel, & Howard, 2010). Historically, physicians and genetics professionals were the gatekeepers of this type of personalized health information, and these types of medical tests were usually offered in conjunction with patient education and genetic counseling efforts to address the potential risks and benefits of testing, and to assist in the interpretation of test results (Wade & Wilfond, 2006).

Traditionally, the benefits of genetic testing included quantifying or ending the uncertainty surrounding the chance of developing a health condition, allowing one time to plan for future health care needs, making more informed decisions about childbearing and family planning, and making choices about educational and vocational commitments. Importantly, if results conveying increased risk were learned, disease screening and treatment options may be availed, and these could be initiated early to prevent or delay disease onset. If results conveying lowered risk were learned, a weighty burden would be lifted as the prospect of a future health threat was abated. These benefits largely stem from the purview of *genetics* as the study of single genes and heredity. These benefits, however, have not yet been proven for many of the gene-health outcome associations included on DTC predictive genomic testing panels, which are derived from the purview of *genomics* and the study of multiple genes, their interactions, and functions (Feero, Guttmacher, & Collins, 2010). Many in the

scientific and clinical community remain skeptical that such benefits exist over and above what can be gleaned through family history and lifestyle information alone, highlighting the tension between traditional genetic medicine and the new genomic medicine. Moreover, there are concerns that the risks of genetic/genomic testing (e.g., misunderstanding, psychological burden, loss of privacy, stigmatization, and insurance and employment discrimination) could outweigh any potential benefits if patients and the public are not adequately informed about the limitations of testing (American College of Medicine Genetics Board of Directors, 2004).

Not surprisingly, DTC genomic testing has caused controversy over whether such tests represent access to personal information to which individuals have an innate right, or if the tests should be regulated by professionals (Myers, 2011). On the one hand, persons could seek-out this information simply because they are curious and want to know more about themselves. On the other hand, persons could seek-out this information because they want to know more about themselves and as a precursor to making changes to their health based on the results. For individual consumers, ‘knowing for the sake of knowing’ vs. ‘knowing for the sake of action’ may be a distinction without difference. In either case, the quality of the information obtained from the testing process must be sound and trustworthy.

At the center of this controversy is the patient/health care consumer, who may lack access to the knowledge and resources needed to make well-informed choices about pursuing personal genomic tests, interpreting results, and taking steps to protect one’s health. That is because, in most cases, individuals undergoing these tests receive ambiguous information about lifetime risks for common diseases, and this information can be scientifically complex (Samuel, Jordens, & Kerridge, 2010). Unlike in the above example, individuals often acquire this information without the benefit of personalized, evidence-based information for averting disease onset and managing risk through a trained health care provider (Howard & Borry, 2012). The professional community has expressed concern that this scenario places some persons in the line of unnecessary and regrettable psychological distress and misunderstandings about the propensity for disease, which could lead to unwarranted health actions (Caulfield, Ries, Ray, Shuman, & Wilson, 2010).

Our society currently stands at a crossroads in its preparedness to adopt DTC genomic testing, and other forms of predictive genomic testing, as a means to improve public health (Horn, Baxter, O’Leary, & Terry, 2011). Although genomic technology and knowledge are advancing, they are advancing more rapidly than is our understanding of how to apply these findings to better the human condition and to do so in a responsive and equitable manner (Khoury et al., 2011). Regarding the translation of genomic findings to individual health management, there is an urgent need to bridge the growing divide between what is possible to know about one’s self from a genomic perspective and what is desirable to know and can be acted upon (McBride et al., 2010). Ideally, translating genomic findings will occur in a manner that is both responsive to public health need and interest, while remaining mindful of the quality of our tools and resources for utilizing genomic information in a manner that improves health outcomes. As illustrated in the example above, the reality of DTC testing is teaching us how basic research in genomics can quickly lead to a wealth of data about personal health risks. Other examples include genomic advances in newborn screening, diagnostic and carrier testing, prenatal and preimplantation testing, predictive and presymptomatic testing, and forensics (see <http://ghr.nlm.nih.gov> for review). But like any medical test, personalized genomic tests will remain of little value if they are of poor quality with limited validity, and if health care providers, patients, and the public cannot use them and understand their meaning and implications for health.

We posit that as a field, behavioral science, and health psychology in particular, is well-poised to make valuable contributions to translational genomics--in both the health care and public health arenas. That is because much of the work that remains to be done in moving findings out of the realm of human genomics and into real-world clinical and public health practice is impeded by a lack of knowledge about how to accurately convey complex scientific data, especially data that involves social, behavioral, and genetic factors on health to the public (Institute of Medicine, 2006). This gap could be narrowed through health psychology's expertise in communication, and health psychology's core areas of strength in health behavior research and its application to clinical care and commitment to public interest. Moreover, there remains a need for high quality behavioral assessment methods, and the development and evaluation of communication interventions that improve the process and outcomes of genomic testing. Each of these points is highlighted below, beginning with an overview of the role of health psychology in genetic and genomic research and practice.

GENETIC AND GENOMIC APPLICATIONS OF HEALTH PSYCHOLOGY

Health psychology has played and will continue to play a critical role in the translation of genetic and genomic discoveries into clinical care. Perhaps the most notable examples stem from communication-related research on the psychological and behavioral impact of genetic testing for hereditary cancer risk. Since the inception of *BRCA1/2* genetic testing to identify individuals at increased personal risk for breast and ovarian cancer syndrome, health psychologists and colleagues working in allied fields have developed model communication and counseling protocols and assessed the potential outcomes of genetic testing (Botkin et al., 1996; Lerman, Rimer, & Engstrom, 1991; Lerman & Croyle, 1994). To date, this literature demonstrates that genetic counseling and testing for *BRCA1/2* mutations does not result in adverse psychological harms for the majority of individuals, with an absence of significant long-term negative impacts for the majority of individuals who are found to carry *BRCA1/2* mutations (Braithwaite, Emery, Walter, Prevost, & Sutton, 2006; Halbert et al., 2011). Certain subgroups of individuals who are tested, however, such as those with elevated levels of premorbid anxiety or stress, may be at risk for poorer outcomes during genetic testing, including prolonged distress reactions or delay in implementing risk-reduction measures (O'Neill et al., 2009; Rini et al., 2009). Novel, theory-based intervention methodologies have allowed greater numbers of at-risk individuals to benefit from testing (Schwartz et al., 2009; van Roosmalen et al., 2004) and interventions have sought to address differences in psychological and behavioral outcomes experienced (Halbert, Kessler, Troxel, Stopfer, & Domchek, 2010; Levy et al., 2011). Some of these interventions deeply attend to individualized aspects of the genetic testing decision-making process, including how to incorporate patient knowledge, preferences, values, and expectancies into their choices about testing, prevention, and treatment. However, we assert that more work is needed in understanding the potential contribution of alternate communication strategies, and that health psychologists are well-positioned to fill that gap. For example, health psychology researchers might explore how new and emerging channels of communication could be harnessed to deliver genetic and genomic information more efficiently and to standardize genetic education and counseling efforts with patients and the public. This might include the expanded use of telemedicine approaches for patient education purposes (e.g., videoconferencing), and the development of interactive Internet websites to deliver genetic education content and connect website users to experts and other users via web 2.0 technologies (e.g., podcasting, blogging, and social networking).

With this understanding about the personal experiences of genetic testing as a backdrop, emerging genomic applications will likely require the same integration of knowledge from both inside and outside of health psychology to maximize the potential benefits of genomic

testing while minimizing any potential harms (Patenaude, Guttmacher, & Collins, 2003). To do this, we must not only apply what we have learned from genetic testing research to date, but also consider the challenges presented by newer genomic discoveries (McBride et al., 2010). As mentioned, these discoveries include the identification of genes that confer relatively small changes in the magnitude of one's health risk, and the interaction of multiple genes combined with environmental exposures to accelerate disease risk processes: these are commonly encountered among DTC and personal genomic testing panels assessing multiple genetic risks simultaneously (e.g., multiplex genetic tests). The results of a recent study of the psychological impact of personal genomic testing did not signal demonstrable changes in adults' general psychological functioning or health behavior following such testing (Bloss, Schork, & Topol, 2011). However, changes in disease-specific psychological states (e.g., worry about heart disease risk, worry about cancer risk, etc.) were not examined but might have been more sensitive to change.

Thus, there remain significant opportunities for health psychologists, and social and behavioral scientists more broadly, to extend early findings on the outcomes of personal genomic testing, and to do so in different settings (e.g., clinical, community) and with an eye toward improving interpersonal communication about genomic risks to health. In the interest of promoting better clinical and public health translation in genomics, we posit that there are at least four areas where health psychologists can bring specific expertise in interpersonal communication to this translational effort, including: 1) risk communication, 2) health behavior and health communication theory, 3) communication assessment and outcomes measurement, and 4) communication coding and mapping.

Risk Communication

New genomic technologies, such as whole-genome sequencing (Lander, 2011; Mardis, 2011) and the integration of genomics into larger and more comprehensive systems biology or personalized medicine efforts (Hood & Friend, 2011), bring a deluge of data to be integrated, translated, and communicated to both providers and patients. While these advances offer significant analytic and related concerns to epidemiology and biostatistics, bioinformatics, and computer science, they also present new issues for how to communicate these data in ways that are both meaningful and actionable to the average patient/health care consumer. Effectively communicating health risk information remains a challenge across medical disciplines, and there are some challenges that are common to genomics. Common challenges include the need to communicate small probabilities of risk (such as those associated with single genetic variants), as well as how small risk probabilities may combine (such as with other genetic variants and/or known sources of risk) and interact with an individual's behavior or his or her environment (Lipkus, 2007). The genetic and environmental combinations may lead to varying risks for both rare and common diseases across the population, requiring communicators to convey uncertainty around numerical risk estimates (Han et al., 2011).

Health psychologists are well-versed in navigating the nuances of complex medical information, and assisting providers in fostering more clear and actionable recommendations for those under their care. Thus, as part of an integrated team-based approach to personalized medicine, the role of the health psychologist is envisioned as being several-fold. First, facilitating the education and counseling efforts that take place with the geneticist, genetic counselor, or primary care provider and the patient and members of the patient's family. And second, facilitating the patient-provider dialog about what the test results may mean to the individual, and supporting persons in taking steps to improve their health profile. This latter role could include working to motivate individuals to make indicated changes their lifestyle and health behavior (e.g., smoking cessation and weight management), offering assistance with the cognitive and emotional aspects of coping with

genomic test results and making treatment decisions, and helping to establish proper adherence behaviors to a treatment regimen if one is prescribed. Each of these are anticipated to become expanded roles for health psychologists working within behavioral and preventive medicine settings, and for whom the integration of genomics into primary care can be anticipated.

Another risk communication challenge includes effectively communicating multiple sources of risk information that could conflict, as well as risk information that is unexpected based on an individual's personal or family history of disease (Marteau & Weinman, 2006). For instance, most psychological research on the communication of genetic risk information is derived from the hereditary cancer literature. Typically, patients seen in these venues are seeking to learn about their risk for a specific disease that is known to be present in their family (e.g., breast or ovarian cancer). But with the dawn of whole genome sequencing, clinically-relevant variants will be found that will be unexpected by patients and their providers (Biesecker, 2010). These "incidental findings" may not necessarily complement the patient's illness representations (Leventhal, Kelly, & Leventhal, 1999; O'Neill, McBride, Alford, & Kaphingst, 2010) and will demand new and more flexible styles of coping while assimilating the information into an identity. A role for health psychologists in this domain is to help providers understand the importance of preparing patients, families, and the public for the full range of findings that could result from testing (e.g., anticipatory guidance), as well as to help those who are tested to cope with the information after it is received (e.g., education and follow-up).

Health Behavior and Health Communication Theory

One means of determining the efficacy of the aforementioned communications of risk information is through theory-driven research and placing risk in a larger context that can help predict outcomes. Translational genomic research would benefit from more theory-driven work performed by health psychologists in real-world settings, either with patients already engaged with health care or healthy members of the general population. Analog studies using hypothetical scenarios can give us early glimpses into potential responses to genomic testing, but shed little light into how individuals will react to and apply genomic information under real (vs. simulated) conditions (Persky & McBride, 2009). Health psychologists could bring new methodologies to these questions, especially when asked in the context of genomic testing. For example, we might learn more from analog studies if they allow for experimental manipulation of variables in ways that are not logistically feasible under natural circumstances, with subsequent validation studies conducted with actual patient and provider populations when possible.

Several theories have been adapted or applied to specifically address the nature of genetic information. For instance, Baum and colleagues' (Baum, Friedman, & Zakowski, 1997) adaptation of the traditional Lazarus and Folkman's transactional model of stress and coping (Folkman & Lazarus, 1988) and Marteau and Weinman's (Marteau & Weinman, 2006) adaptation of the Common Sense Model (Cameron & Leventhal, 2003) each identify genetic risk information as a specific stressor to which individuals will have cognitive, emotional, and behavioral reactions. These models address medical and social-cognitive units that are unique to the context of genetic testing. For instance, Baum and colleagues' (Baum et al., 1997) model highlights the importance of the level of risk conferred, the degree of ambiguity associated with that risk, and whether the risk is associated with available disease management options (e.g., health behavior change, medical intervention).

Another important contribution from the health psychology literature that can bridge our understanding and communication of genetic risk to the public is the Family Systems Genetic Illness (FSGI) model (Rolland & Williams, 2005). This model is useful for

understanding family psychosocial processes surrounding the acquisition and management of personalized genetic risk information. Hereditary breast cancer risk and other forms of predictive genetic testing are fraught with uncertainty, making them unique in that they identify individuals at a predisease stage of illness, possibly when preventive intervention exists (although not always, such as in the case of Huntington's Disease). Uncertainty may be powerful, particularly if acquired prior to and during a time when key life decisions (e.g., post-secondary schooling, work, family) are still being made.

The FSGI model is a revision of Rolland's Family Systems Illness model of psychosocial aspects of medical illness (Rolland, 1990). The model is intended for genomic medicine, with emphases on the uncertain, preclinical phase of illness and preventive implications. Components of the FSGI model are: 1) the likelihood of developing a disease based on genetic mutation, 2) disease severity, 3) timing of disease onset within the lifecycle, and 4) the existence of preventive interventions. In the case of hereditary breast cancer, it has a high likelihood of development based on *BRCA1/2* genes, a high clinical severity (breast cancer can be fatal), it occurs during early/mid-adulthood (ages 20–60) or late life (age >60), and has preventive interventions available (e.g., prophylactic surgery) (Baumann, 2006). In the FSGI model, this constitutes the “psychosocial typology” of hereditary breast cancer. Once a typology can be correctly identified, psychological uncertainty, distress, and other outcomes may be better managed through education and counseling resources (Rolland & Williams, 2005).

We envision that one of the ongoing contributions of health psychology to genomic medicine and public health practice is the development of new theories of health behavior, such as the FSGI model, and theories of communication decision-making that take into account the contributions of multiple fields of investigation, including family science, psychology, sociology, and economics (Gaff et al., 2007; Tercyak, 2010).

Communication Assessment and Outcomes Measurement

A third important role that health psychologists can contribute to genomic research is to apply their extensive expertise in measurement and outcome assessment to these endeavors, including communication-related assessment. One of the primary and well-founded criticisms of the disclosure of genomic information related to common disease risk is the lack of precision and strength in these risk estimates and current understanding of how genetic and environmental risks interact (Ioannidis, Thomas, & Daly, 2009; Manolio et al., 2009). These risk estimates are improved through not only genomic research methods, but also through more rigorous assessments of individuals and their environments and refined definitions of disease and symptomatology (i.e., cornerstones of psychological research and practice). One of the many reasons for the lack of precision when characterizing risk associated with complex chronic disease and neuropsychiatric disorders is the multifactorial nature of the underlying conditions and the classification system used for neuropsychiatric disorders in particular. These may be fraught with poor and inconsistent measures of environmental exposures in existing datasets and conflicting taxonomies and definitions of behavioral variables.

One way for health psychology to improve upon the identification of these associations is to make the behavioral assessment of phenotypes more refined and precise. Rather than looking at genomic associations with diseases or complex traits, one could look at associations with a proximal marker of a particular disease (Acosta et al., 2008; Swanson et al., 2007) or a specific symptom. One example is the use of brain imaging to determine intermediate phenotypes closely tied to the action of genes throughout the course of brain development (Addington & Rapoport, 2012). This would allow for better associations between the timing and pattern of brain development seen in some neuropsychiatric

disorders and genetic functioning. Another example would be to understand how genes implicated in physical activity behavior activate pathways of physiologic reward, which are then related to changes in physical activity levels. Bryan and colleagues have shown a relationship between changes in positive affective states and exercise behavior. In that study, the *BDNF* gene moderated the effect of adults' exercise on their mood and heart rate. Physiological factors were then related to changes in mood, which was a significant correlate of exercise motivation and behavior (Bryan, Hutchison, Seals, & Allen, 2007).

Assessments in many genomic studies will require a developmental focus. Here, parents may be the most likely source of information about a child's early environment, such as his or her diet, physical activity levels, exposure to toxins, and family or community stressors. As children mature into adolescence, they may become important co-reporters of their own environmental exposures, particularly when the focus of investigation is on risk behaviors (e.g., substance use, sexual activity). Likewise, as children mature, they become increasingly involved in the reporting of their symptomatology. This requires health psychologists and medical researchers to confront issues related to engaging minors in genomic research (Patenaude, 2011) and the ethical issues inherent in doing so (Tabor, Berkman, Hull, & Bamshad, 2011). Health psychologists may provide special contributions by applying expertise in diagnostic assessment and behavioral measurement, including assessments of children's capacities for mental understanding and competence at differing ages (Tarini, Tercyak, & Wilfond, 2011).

Communication Coding and Mapping

A fourth area where health psychology may contribute significantly to bridging the communication divide is to closely inspect the process and content of conversations taking place among patients and health care providers about genomic testing for common disease risk. Indeed, behavioral communication coding of such interactions has been suggested as a means to provide extensive information about genetic testing communication and its outcomes (Lerman, Croyle, Tercyak, & Hamann, 2002). The overarching goal of this line of work is to develop more effective ways for providers and patients to discuss genomics and its implications for health, and to extend these conversations well-beyond simply obtaining a family history of disease. This approach has successfully been used in genetic testing encounters, including prenatal (Benkendorf, Prince, Rose, De Fina, & Hamilton, 2001; Roter, Ellington, Erby, Larson, & Dudley, 2006) and cancer risk counseling (Ellington et al., 2006; Ellington et al., 2007; Pieterse, van Dulmen, Beemer, Bensing, & Ausems, 2007; Roter et al., 2006) with the advantage of reducing demand characteristics inherent in self-report. The findings from these and other studies indicate that adding basic behavioral research methods into understanding the ways in which persons perceive and understand their risk, communicate about risk, process risk information, and experience cognitive and affective responses to risk are fundamental to our understanding of health-promoting behavior (Miller, Shoda, & Hurley, 1996). Moreover, insights gained from this perspective can help create improved risk communication protocols enacted by genetic health care providers with patients surrounding common disease risk (Croyle & Lerman, 1999; Lerman & Croyle, 1995; Lerman, 1997). Cross-disciplinary research into these foundational elements of psychology and public health genomics has been heralded as a means to improve population health (Mabry, Olster, Morgan, & Abrams, 2008), and public health genomics is a high priority area of investigation at the federal level (Khoury et al., 2009).

Behavioral mapping of conversations in this manner requires sound research tools and methods, such as those encountered in the literature on patient-provider communication. Several assessment instruments exist for this purpose (see Boon & Stewart, 1998 for a review including observational coding systems and Eveleigh et al., 2012 for a review of questionnaires): the Roter Interaction Analysis System (RIAS) is among the most widely

used worldwide (Roter & Larson, 2002), with more than 200 published studies to date (see www.riasworks.org for annotated bibliography). The RIAS is a system of medical interaction assessment (e.g., patient-provider communication assessment). It is commonly employed in health care communication research and medical education settings where there is a desire to capture and analyze communication exchanges among two or more parties. Intended as a versatile system, the RIAS can be applied to any medical dialog, including dialog about genetics/genomics. In the RIAS, speakers are denoted and codes are applied to the smallest unit of expression (e.g., utterance), which could range from a single word to a complete thought, that he or she makes. Examples of coded dialog categories include: asking questions, giving information (medical, treatment-related, lifestyle-based, and otherwise), counseling, showing agreement, and showing concern. The coding process can be facilitated by the use of computer software. Once a coded record of patient-provider exchange has been created, it can be merged with other similarly coded records and conventional statistical analyses employed to test hypotheses. For example, a health psychology researcher might be interested in studying the relationship between primary care providers' genetic counseling education efforts with patient-reported outcomes of genetic testing (e.g., genetic health literacy, test results recall and understanding, psychological stress, patient satisfaction, and patient uptake of health behaviors that might reduce risk). It may also be of interest to investigate moderators of the relationship, for instance, patient sociodemographic and personality characteristics. If so, the researcher might use RIAS data to compare and contrast coded records with varying delivery styles of information and counseling (e.g., high vs. low patient-centered talk) stratified by patient characteristics to predict the outcomes described above. These results, in turn, could then help drive the development of patient-provider interventions to teach providers the skills that produce better outcomes (Portnoy, Roter, & Erby, 2010; Roter et al., 2008; Roter, Ellington, Erby, Larson, & Dudley, 2006; Roter, Erby, Larson, & Ellington, 2009).

There are advantages of observational coding over other methods: (1) coding is performed directly from an audio tape, eliminating the need for transcription, and allowing the coder to attend to voice tone and phrasing cues, and; (2) it is time efficient (Roter & Larson, 2002). Behavioral coding is also highly functional in the context of health communication exchanges, which are generally focused on: (1) gathering and giving information, (2) providing psychosocial support/counseling, (3) rapport building, and (4) facilitating decision-making and follow-up (Roter & Larson, 2002). To the extent that these information- and emotion-focused functions coexist within the health communication exchange, improved outcomes may result (Roter et al., 1995; Roter, Larson, Fischer, Arnold, & Tulsky, 2000; Zolnierak & Dimatteo, 2009). A recent study of interpersonal communication mapping in a genetic counseling context underscores the potential of this approach to improve health care providers' responses to patients and foster better patient education about genetics (Ellington, Kelly, Reblin, Latimer, & Roter, 2011).

CONCLUSION

To date, too little research has examined patient-provider communication surrounding genetic risk for common diseases, or the outcomes of communication. As a result, we do not know if such encounters appropriately raise and sufficiently attend to patients' informational and emotional needs and concerns, such as the implications of test results for one's self and family members. Moreover, we do not yet know the relative balance between information-talk and emotion-talk, and how these drive communication outcomes such as comprehension, risk perception, and affect. Until this is known, it is difficult to develop model education and counseling protocols that would be broadly applicable to genomic health care. Given the inherent uncertainties surrounding genomic test results, it is likely that both information- and emotion-based conversational exchange are called upon. If so,

educational and counseling approaches dually-emphasizing these parameters may be more effective at optimizing the outcomes of multiplex genetic testing, such as increasing patient knowledge and comprehension, facilitating informed decision-making, and supporting the adoption of preventive lifestyle changes without raising undue stress (Pagon, 2002)

Health psychology has a distinctive history of making essential contributions to the translation of genetic tests in ways that benefit human health while reducing potential harms (Lerman, Croyle, Tercyak, & Hamann, 2002). The new era of genomic medicine calls for innovative and forward-thinking clinical and research endeavors from the health psychology community to ensure effective translation of genomic technology. The results of genomic tests and their implications are vastly more complex than their predecessors, and they have the potential to reach greater proportions of the population through multiple delivery channels. These factors suggest that even greater effort will be required from health psychologists and colleagues in the medical, social, behavioral, and public health sciences.

In sum, we see a number of opportunities and challenges for the field of health psychology to work alongside other clinical and public health disciplines to bridge the communication divides that exist between patients/health care consumers and providers surrounding genomic medicine, and the public discourse surrounding genomic contributions to health more broadly. These include contributing expertise in behavioral research, risk communication, and theory, assessment, and behavioral conversation mapping. Such collaboration will increase the likelihood of successfully translating basic discoveries in the genomics laboratory into improved public health and health care.

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