

# Genetic Research and Health Disparities

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**D**ISPARITIES IN HEALTH STATUS have increased in the United States in the last 50 years despite remarkable advances in our ability to prevent, diagnose, and treat disease.<sup>1</sup> The poor are the least likely to have benefited from progress in medicine, but economic status does not account completely for these disparities. Even when income and related variables are controlled for, the health status of racial and nonwhite ethnic minorities ranks lower than that of whites on numerous measures.<sup>1</sup> The reasons for this pattern include unequal quality of health care, education, employment, housing, and nutrition. Despite numerous studies that demonstrate the overriding importance of racial discrimination and poverty as the major contributors to health disparities,<sup>2</sup> several recent statements have suggested that genetic research holds considerable promise in the campaign against health disparities.<sup>3-7</sup> Although genetics broadly influences nearly all aspects of health, extensive research suggests that its direct contribution to the current pattern of health disparities in the United States is secondary to social and environmental influences.<sup>1</sup> Furthermore, overemphasis on genetics as a major explanatory factor in health disparities could lead researchers to miss factors that

Alleviating health disparities in the United States is a goal with broad support. Medical research undertaken to achieve this goal typically adopts the well-established perspective that racial discrimination and poverty are the major contributors to unequal health status. However, the suggestion is increasingly made that genetic research also has a significant role to play in alleviating this problem, which likely overstates the importance of genetics as a factor in health disparities. Overemphasis on genetics as a major explanatory factor in health disparities could lead researchers to miss factors that contribute to disparities more substantially and may also reinforce racial stereotyping, which may contribute to disparities in the first place. Arguments that promote genetics research as a way to help alleviate health disparities are augmented by several factors, including research funding initiatives and the distinct demographic patterns of health disparities in the United States.

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contribute to disparities more substantially and may also tend to reinforce racial stereotyping, which may contribute to disparities in the first place.<sup>8</sup>

## Health Disparities and Race in the United States

Substantial evidence indicates that disparities in health status in the United States result largely from longstanding, pervasive racial and ethnic discrimination.<sup>1</sup> Minorities are more likely to live in housing made hazardous by lead paint-coated walls and defective, fire-prone heating systems and to be exposed to allergens produced by cockroach and rat infestations and the indoor pesticides used to control them.<sup>9-12</sup> Neighborhoods where housing is most available to the minority poor are often less likely to meet Environmental Protection Agency ambient air quality standards and more likely to be located near hazardous waste sites.<sup>13,14</sup> Jobs open to minorities often pose serious health risks through exposure to toxic chemicals used in manufacturing or agricul-

ture.<sup>15,16</sup> Psychologic stress caused by perceived racial discrimination produces higher rates of depression and a greater risk of high blood pressure among some minority populations.<sup>17-19</sup>

Treatment of resulting health problems and even routine preventive care can be impossible for many because of inadequate health insurance.<sup>20</sup> Health insurance costs pose problems to many people in the United States, particularly the elderly. However, minorities

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are less likely to have health insurance than whites, and among Hispanics, the number of uninsured is almost twice that of whites.<sup>20</sup> Much of this disparity derives from discriminatory employment practices in that minorities are less likely to have jobs that offer employer-based health coverage.<sup>20</sup>

American Indians and Alaskan Natives are at particular disadvantage because funds for health care in these tribes, adjusted for medical inflation and population growth, have steadily declined since the 1990s.<sup>21</sup> Thus, American Indian and Alaskan Native tribes have increasingly insufficient funds for even the most basic health care needs. Funding for nonreservation health care has fared even worse, with just over 1% of the Indian Health Service budget appropriated by Congress to care for urban American Indians and Alaskan Natives.<sup>22</sup>

Unequal treatment of minority patients extends also to inpatient services. A 1997 study that reviewed 1.7 million hospital discharge abstracts and that controlled for diagnosis, severity, age, and insurance status showed that in nearly half of the 77 disease categories, "blacks were significantly less likely than whites to receive a major therapeutic procedure."<sup>23</sup> Several smaller, condition-specific studies have replicated the finding that blacks are less likely to be offered and, if offered, less likely to undergo diagnostic and therapeutic procedures for heart disease and cancer.<sup>24,25</sup> Similar findings have been reported recently for major diagnostic categories for Hispanics<sup>26</sup> and for Asians for certain cardiac procedures.<sup>27</sup>

Shorter lives are the price that black, Hispanic, and American Indian and Alaskan Native populations pay for inadequate health care, unsafe living conditions, and high psychologic stress. The average life expectancy of white men is 74 years; of black men, 66 years.<sup>1</sup> Although this figure represents a gain for black men of several years since 1960, it is still lower than that reported for whites more than 40 years ago.<sup>1</sup> Among American Indian males, average life expectancy remains in the

mid-50s, exactly where it was in 1960.<sup>20</sup> These inequalities are mirrored in childhood mortality data. Despite notable improvements in neonatal outcomes generally, children younger than 1 year and born to black mothers have a greater mortality rate than infants born to white or Asian mothers, and neonates born at very low birth weights (<1500 g) are 3 times more likely to have black than white mothers.<sup>28</sup>

### Responses to the Health Disparities Campaign

Alleviation of disparities in health status is a primary goal of the US government, which in 2000 established the Healthy People 2010 program and earmarked substantial funds toward this effort. In 2003 alone, National Institutes of Health funding classified as supporting health disparities research was predicted to reach nearly \$3 billion.<sup>29</sup> Among the responses to this initiative are several to identify genetic contributions to health disparities.<sup>5-7,30</sup>

For example, the recent vision statement for the future of genomics by the National Human Genome Research Institute (NHGRI) named as a "grand challenge" the need to develop "genome-based tools" to address disparities in health status.<sup>3</sup> The statement acknowledges that social and economic factors contribute significantly to disparities but nevertheless asserts the need for extensive research to better understand the contribution of genetics. The statement also names genomics as an avenue to improve health in the third world and cites the recent mapping of the malarial parasite and malaria mosquito genome as examples of its application to third-world health problems.

NHGRI's genetically focused response to the federal health disparities initiative is consistent with its mission to promote genetics. Less predictable, however, were the responses from several other institutes that listed genetic research projects as examples of their support for the health disparities initiative. The National Institute of Arthritis and Musculoskeletal and Skin Diseases,<sup>5</sup> for example, highlights the importance of ge-

netic research in all 4 of its research areas, citing as a rationale that these conditions, including scleroderma, lupus, and osteoarthritis, cluster in populations targeted by health disparities initiative, including blacks and Native Americans. The strategic initiative from the National Eye Institute<sup>6</sup> includes genetic research for 3 of its 4 research areas, explaining, for example, that glaucoma disproportionately affects blacks and that blacks, Hispanics, Mexican Americans, Japanese Americans, and Native Americans are more likely to be diagnosed with diabetic retinopathy. Even the National Library of Medicine's list of research priorities for health disparities put genetic research at the top, above research on environment and socioeconomic status, mechanisms of disease, and epidemiologic and risk factors.<sup>7</sup>

Individual researchers have also characterized the importance of their work in its capacity to advance our understanding of health disparities.<sup>31-34</sup> Any research, including genetic research, that can help ameliorate health disparities is valuable. The problem is when researchers try to overstate the potential benefits of such research by proclaiming that it is going to significantly contribute to solving the health disparities problem. Although this research may well succeed in elucidating genetic factors that contribute to diseases associated with health disparities, the reporting of such studies all too often tends to downplay the fact that nongenetic factors are substantial contributors<sup>35</sup> or that the onset or severity of the disease results from a complex interaction of genetic and environmental factors.<sup>36-40</sup>

Most genetics researchers are, of course, presumably well aware of the importance of environmental causes of such disparities.<sup>29,41-43</sup> Few would seriously contend that genetic research alone is likely to be the key to the alleviation of disparities in health status. However, because this is the case, responses to the call to help alleviate health disparities that emphasize genetic research without better contextualizing their arguments about its importance require explanation.

### Factors Promoting Genetic Research Proposals

There are several reasons why researchers might try to overstate the potential benefits of genetic research to alleviate and eventually eliminate health disparities. First, much genetic research depends on government funding. The US government has widely publicized the Healthy People 2010 campaign and directed billions of dollars of increasingly scarce scientific research monies to health disparities initiatives. As with many similar government initiatives, such as the 1970s “war on cancer,” these priorities are translated into messages that researchers should emphasize the possibility that their work will “solve” the featured health problem, even if this is an unlikely outcome.<sup>44</sup>

Second, characterizing genetic research as a way to help alleviate health disparities might seem more plausible in the United States because of the particular pattern of health disparities in this country. Poor health in the United States is concentrated among racial and ethnic minorities, whereas better or good health is concentrated among the majority white population. If a person’s racial or ethnic identity is considered to be associated with his or her real or putative genetic ancestry, then observations of the patterns of poor and good health restricted to the United States appear to support the inference that genetic ancestry strongly influences health status. However, if genetic ancestry strongly influences health status in the United States, it should be similarly influential elsewhere. In other words, if increased rates of hypertension, diabetes, and prostate and breast cancer among blacks in the United States are strongly influenced by genetics, then individuals of African descent living outside of the United States should also have elevated rates of these conditions. Research instead shows far lower rates of these conditions.<sup>45-50</sup>

One explanation proposed to explain the different rates of hypertension and diabetes in black Africans and black Americans<sup>51,52</sup> is that new environments encountered in the African diaspora triggered expression of certain ge-

netic variations quiescent in Africa. Even if this explanation is correct, the heterogeneity and variability of the environments encountered make it unlikely that the direction of this triggering was nearly always to confer on blacks ill health, especially considering the widely variable conditions, such as breast cancer, depression, and diabetes, that unequally affect them. Furthermore, health disparities, when examined globally rather than through an exclusively US lens, do not cluster in any particular population or region, and they do not fall along stable racial or ethnic lines. Rather, they are endemic wherever poverty prevails so that the average life expectancy among black Cubans is approximately 70 years at the same time that men in neighboring Haiti have an average life expectancy of 45 years.<sup>53-55</sup>

Third, the historical tendency by scientists and the press to overstate the successes and potential benefits of genetic research<sup>56,57</sup> may have distorted some researchers’ sense of how quickly this line of research is likely to produce practical applications. For example, predictions for finding a prostate cancer gene have been scaled back considerably, with a caution that the genetic mechanisms of prostate cancer “have turned out to be remarkably difficult to unravel.”<sup>58</sup> Recent research on asthma suggests that it results from a complex interaction of numerous genetic and environmental factors, some that protect individuals from disease and some that contribute to its development, and that each has only a small and often contingent effect in the overall disease process.<sup>59</sup> Even the much-heralded finding that angiotensin-converting enzyme inhibitors work less well in treating heart failure in blacks than in whites has been challenged by some scientists who have used the difficulty of determining why the finding is not as generally applicable as predicted to frame a new perspective on “therapy response” as a “complex rather than a simple phenotype.”<sup>40,60</sup> Thus, although considerable progress has been made in understanding how genes contribute to diseases associated with health disparities, for many, the molecular ge-

netics is still obscure and, for all, the complexity of how genes and the environment interact evades explanation.

Many geneticists recognize the need for long-term studies of gene-environment interactions and recently NHGRI has proposed a prospective US cohort study to accomplish this.<sup>61</sup> However, the emphasis of others on genetics as the dominant if not sole causative factor continues to require counterassertion. Some of the genetic optimism originates with media coverage of genetic findings, but recent research identifies the role played by scientists themselves in overstating the certainty and the implications of findings.<sup>42,56,57</sup> There continue to be far more publications that attend solely to genes than those attending to gene-environment interactions, and even the more straightforward studies often overgeneralize from findings that lack statistical significance.<sup>62</sup>

Thus, there exist several reasons that researchers might be inclined to overstate the potential benefits of genetic research, including the need to respond to funding initiatives, the distinctive pattern of health disparities in the United States, and the history of over-optimistic certainty in predicting the benefits of genetic research.

### Pitfalls of Overemphasizing the Alleviation of Health Disparities as a Rationale for Promoting Genetic Research

Recognizing that the genetic contribution to health disparities is likely to be relatively limited is not the only reason to question the wisdom of promoting genetic research under the aegis of health disparities. First, overfocusing on genetics might divert attention from what evidence already suggests are the central causes of health disparities and might lead scientists to overlook possible actual environmental contributors.

Second, overemphasizing the potential of genetic research to alleviate health disparities fosters the misconception that disparities in health status will be easy to solve. Standardizing access to health care and reforming attitudes toward minority patients poses a far

greater challenge than introducing new treatments facilitated by genetic research. Although the idea of underlying biological causes amenable to medical intervention might be appealing, characterizing the problem in this way could send the wrong message about what kind of changes are most needed. This concern is particularly salient in light of a recent government report that depicts “health disparities” as “differences” and that highlights the scant few instances in which minority rather than white populations experience better health outcomes.<sup>63,64</sup>

Third, given the particular pattern of health disparities in the United States, research or policy that emphasizes a population-based genetic predisposition to disease may foster a tendency to attribute the poor health of racial and ethnic groups primarily to their genetic makeup, running the risk that those groups will be seen as inherently biologically inferior to groups who enjoy better health. Popular press coverage has already moved in this direction. For example, a recent newspaper article stated that there is “a growing mountain of research” that shows that inheritance, rather than “social, environmental and economic stresses of lower income and minority status,” explains health disparities across US populations and that this acknowledgment calls for genetic research on health-disparity-related conditions such as heart disease, diabetes, and asthma.<sup>65</sup>

Racial labeling, even if done in an effort to better diagnose and treat patients, can reinforce racial stereotyping, and the recent Institute of Medicine report on health disparities has identified such stereotyping as a primary factor in unequal treatment of minority patients.<sup>1</sup> Racial stereotyping enters medical practice when conditions are linked to populations and then to the unexamined assumptions that practitioners might have about whether patients from some populations are more or less likely than those from other populations to comply with treatment regimens or to endanger the success of treatment through destructive behavior, such as

drug abuse.<sup>66</sup> These assumptions can lead to miscommunication between practitioner and patient and to inadequate treatment.<sup>67,68</sup> Thus, an overfocus on genetics in the effort to alleviate health disparities could have the paradoxical result of actually exacerbating disparities.

### The Genetic Contribution to Complex Diseases

Clear evidence of an easily discernible and well-understood genetic contribution to common diseases can provide valuable insights for health management, as in the cases of some breast and colon cancers. However, the question is not whether genetics has enhanced our understanding of the disease process in individuals. It clearly has. Rather the question is whether, all things considered, overfocus on genetic research is a particularly effective way to proceed with the effort to alleviate health disparities in the United States with regard to the more common, complex diseases that largely account for such disparities.

Genes undoubtedly make some contribution to disparities in aggregate group health status, but the potential genetic contribution is unknown. Geneticists recognize that the causes of most common, complex diseases consist of a complicated interaction between genes and the environment. Untangling this interaction will take a long time. For this reason, expectation for genetic research to explain health disparities must be calibrated appropriately, and those who conduct research and those who write about it should be encouraged not to overstate those expectations by promising more than genetics is likely to be able to offer. The reason to study prostate cancer genetics is not to address health disparities. It is to determine the genetics of prostate cancer.

The genetics of human health and disease and how best to alleviate disparities in health status among US citizens are 2 vitally important areas of research. Casual observation of the particular pattern of disparities in the United States might indicate that the 2 are related because there are clear differences among racially identified popu-

lations in the prevalence of many common, complex diseases. But more careful reflection on the pattern of disparities globally challenges this assumption and suggests that health disparities and genetics may have little to do with each other, short of both capturing public attention simultaneously. The irony is that if we do not recognize that these are distinct, if interrelated, topics, efforts that are meant to improve the health of racial and ethnic minorities instead might inadvertently harm them, which could happen if genetic research diverts attention from productive ideas about the effects of environment on health or if it reinforces racial and ethnic stereotypes that contribute to the very discrimination that health disparities initiatives are meant to ameliorate.

It is critical that research on the genetics of human health and disease continue and bring to clinical fruition the vast storehouse of basic research that the Human Genome Project has produced. The justification for this work, however, can and should be made on its own merits and need not be the inflated claim that it will solve problems of a specific disease when we know that genes are just a small part of the problem.

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