Racial Disparities in Quality-Adjusted Life-Years Associated With Diabetes and Visual Impairment

Kathryn E. McCollister, phd[1]
D. Diane Zheng, ms[1]
Cristina A. Fernandez, msed[1]
David J. Lee, phd[1]
Byron L. Lam, md[2]
Kristopher L. Arheart, edd[1]
Anat Galor, md, msph[2]
Manuel Ocasio, ba[1]
Peter Muennig, md, mph[3]

OBJECTIVE—Compare differences in health-related quality of life among blacks and whites to examine if race, diabetes, and visual impairment (VI) present a triple disadvantage in terms of quality-adjusted life expectancy.

RESEARCH DESIGN AND METHODS—Data were analyzed from the 2000–2003 Medical Expenditure Panel Survey, a nationally representative survey that contains the EuroQol 5D (EQ-5D). The EQ-5D generates health utility values that provide a measure of the morbidity associated with various health states, such as having moderate or severe problems with mobility. The EQ-5D score can be linked with life expectancy data to calculate quality-adjusted life-years (QALYs), the number of years of optimal health an individual is expected to live. Multivariate analyses were conducted to estimate and compare differences in QALYs by diabetes status, VI status, and race.

RESULTS—Whites had a higher quality-adjusted life expectancy across all diabetes/VI comparisons. Overall, blacks with diabetes and VI had the fewest number of QALYs remaining (19.6 years), and whites with no impairment had the greatest number of QALYs remaining (31.6 years). Blacks with diabetes only had 1.7 fewer years of optimal health (fewer QALYs) than whites with diabetes. Within individuals with both diabetes and VI, however, this gap more than doubled, with blacks experiencing 3.5 fewer QALYs than whites.

CONCLUSIONS—Although efforts to target and reduce racial health disparities associated with diabetes appear to be effective, black communities may be contributing to a greater overall burden of illness given poorer infrastructure and less accommodation for disabilities such as VI.

Diabetes Care 35:1692–1694, 2012

Compared with the general population, blacks are disproportionately affected by diabetes and visual impairment (VI). Blacks over the age of 20 years are 1.8 times more likely to have diabetes compared with non-Hispanic whites (1), and the overall age-adjusted rates of VI among African Americans are twice that of whites (2). Some evidence suggests that diabetes prevention and disease-management protocols may be helping to reduce the gap in mortality rates between blacks and whites (3). There is very limited evidence, however, examining whether persistent community factors, such as a lack of assistive infrastructure for the visually impaired, limit the gains that can be made by medicine alone. Such factors are more of a concern in black communities and may contribute to a relatively lower quality of life among those with chronic illness and disabilities (4,5). The current study examines racial disparities and the burden of diabetes in those with and without VI using quality-adjusted life-years (QALYs) as a comprehensive measure of health and longevity. We explore how race, diabetes, and VI combine to create a triple disadvantage among blacks.

RESEARCH DESIGN AND METHODS

Data were obtained from the 2000–2003 Medical Expenditure Panel Survey (MEPS), a nationally representative subsample of the National Health Interview Survey. The MEPS is an annual survey of families and individuals, their medical providers, and employers across the U.S. (6). In order to have an adequate number of persons in certain population subgroups, the MEPS oversampled blacks and Hispanics in all years and began oversampling of Asians in 2002 (7). The sample for the current analysis is comprised of 40,215 adults, with 2,397 (~6%) reporting having only diabetes and 427 (~1%) reporting both diabetes and VI.

Participants were classified as having diabetes if they reported being told by a healthcare provider that they had diabetes. To determine VI status, participants were asked a set of visual impairment questions. Their answers were summarized into a five-category VI status variable: 1, no difficulty seeing; 2, some difficulty seeing, can read newsprint; 3, some difficulty seeing, cannot read newsprint, can recognize familiar people; 4, some difficulty seeing, cannot read newsprint, cannot recognize familiar people, but is not blind; and 5, blind. In order to preserve a large enough sample for comparing individuals with both diabetes and VI, participants falling into categories 2–5 were combined into one single category designated as "any VI." Sampling weights were applied in order to ensure that the resulting sample was nationally representative of the U.S. population and include adjustment for oversampling of race/ethnic groups and survey nonresponse.

In 2000, MEPS added the EuroQol 5D (EQ-5D), a preference-based health status classification scale that asks participants to report the degree of problems (none, mild, and severe) encountered across five domains: mobility, self-care, daily activities, pain, and anxiety/depression. EQ-5D generates a health-related quality

From the [1]Department of Epidemiology and Public Health, University of Miami Miller School of Medicine, Miami, Florida; the [2]Bascom Palmer Eye Institute, University of Miami, Miami, Florida; and the [3]Department of Health Policy and Management, Mailman School of Public Health, Columbia University, New York, New York.
Corresponding author: Kathryn E. McCollister, kmccolli@med.miami.edu.
Received 14 December 2011 and accepted 14 March 2012.
DOI: 10.2337/dc11-2433

of life (HRQL) score between 0 (death) and 1 (perfect health), using U.S. health utility preference weights (8). For the purposes of illustration, consider a person in otherwise perfect health who cannot walk because of diabetes-related complications and who has a HRQL score of 0.6. This indicates that for the average person who cannot walk but is in otherwise perfect health, each year of life lived is valued at 60% of that of a person who can fully walk (9). This HRQL score can be used to multiply the average life expectancy for an individual (based on age, sex, race, and disease status) to determine the adjusted number of remaining years of perfect health he/she is expected to have. Continuing with the example above, if this individual has an HRQL score of 0.6 at age 60 and is expected to live for 10 more years, the remaining quality-adjusted life expectancy at age 60 is $0.6 \times 10 = 6$ QALYs.

For this study, individual-level EQ-5D scores from the MEPS were summarized by race (black or white) and diabetes/VI status (no diabetes/no VI, diabetes only, VI only, and diabetes plus VI). Multivariate analyses were conducted to estimate differences in EQ-5D scores across the sample adjusting for age, sex, and race. To calculate life expectancy, life tables based on the general U.S. population were used by which the risk of mortality was adjusted by age, sex, race, diabetes, and VI status. Following the method outlined in Muennig and Gold (10), we multiplied the total number of person-years in each age category by the age-specific EQ-5D score to get quality-adjusted life expectancy. Differences in quality-adjusted life expectancy by race and diabetes/VI status represent the incremental QALYs (i.e., marginally greater years of optimal health) experienced by whites relative to blacks.

All statistical analyses were performed using SAS 9.2 (SAS Institute Inc., Cary, NC). To account for the complex survey design of the MEPS data, analyses were completed with adjustments for sample weights and design effects. The University of Miami institutional review board reviewed and approved this study.

RESULTS—Table 1 presents the QALYs and incremental QALYs among blacks and whites by VI and diabetes status. For all comparisons, whites were at an advantage relative to blacks in terms of health status and longevity ($P < 0.05$). In addition, whites with neither VI nor diabetes had the greatest number of years of optimal health (31.6), whereas blacks living with both conditions had the fewest years of optimal health (19.6). In terms of incremental differences in QALYs, whites without diabetes or VI had 3.4 more years of optimal health (more QALYs) than blacks without diabetes or VI (95% CI 3.19–3.69). Whites with diabetes only had 1.7 more QALYs than blacks with diabetes (only) (0.87–2.38), whereas whites with VI (only) had 4.3 more QALYs than blacks with VI (only) (3.19–5.55). Finally, whites with both diabetes and VI had 3.5 more QALYs than blacks with both diabetes and VI (1.26–5.97).

The relative advantage experienced by whites with no diabetes/no VI compared with whites with VI only was 0.9 QALYs ($4.3 - 3.4$). This relative advantage completely disappears when comparing differences in incremental QALYs between the no diabetes/no VI group to the diabetes only group ($1.7 - 3.4 = -1.7$). The relative advantage experienced by whites was the largest when comparing having diabetes only with having diabetes plus VI: 1.8 QALYs ($3.5 - 1.7$). These results are being driven by racial differences in life expectancy. A separate analysis of the mean EQ-5D scores alone showed that whites are at an advantage in terms of HRQL as they have higher EQ-5D scores than blacks across all diabetes/VI comparisons, but the difference in EQ-5D between blacks and whites is the same for diabetes only as it is for VI only (for both comparisons whites had a mean EQ-5D score of 0.77, whereas blacks had an EQ-5D score of 0.75).

CONCLUSIONS—The relative advantage in QALYs experienced by whites with no diabetes/no VI (3.4 QALYs) diminishes to 1.7 QALYs when comparing whites with diabetes only to blacks with diabetes only. This finding contributes to existing evidence that the mortality gap between whites and blacks with diabetes has lessened and that more aggressive treatment strategies targeting health disparities among those with diabetes have reduced the morbidity gap as well (11).

Thus, for diabetes only, the disparity in disease burden between blacks and whites is minimized relative to the other diabetes/VI status comparisons. Once VI is included along with diabetes, the gap re-emerges, such that whites have 3.5 more QALYs than blacks (more than double the relative advantage experienced by whites within the diabetes only comparison). This is roughly the same as the relative advantage experienced by whites with no diabetes/no VI compared to blacks with no diabetes/no VI.

The fact that among those with both diabetes and VI the incremental QALYs are actually less than the incremental QALYs among those with VI only suggests that, from a health and longevity perspective, it is better to have both diabetes and VI as opposed to VI alone if you are black. This is likely the case given that black communities tend to have fewer resources, poorer infrastructure, and fewer accommodations for disabilities such as VI. These community factors would explain why the relative burden of diabetes plus VI is much greater in blacks than the burden of diabetes alone.

This study possesses a number of strengths, including the use of nationally representative data, large sample size ($N = 2{,}639$ visually impaired), and the opportunity to highlight subgroup analyses by diabetes and VI status across two race groups. But it is also limited by the use of cross-sectional data, self-reported diabetes, and VI status, and the onset and treatability of diabetes and VI are not known. In addition, we do not address the presence of other diseases like cancer or heart disease in our comparison groups. We adjusted analyses by age, sex, race, and diabetes/VI status, but not by other characteristics. This provides us with a sense of the overall burden of disease given the underlying

Table 1—*QALYs and incremental QALYs among blacks and whites by VI and diabetes status*

Race	No diabetes/no VI ($N = 35{,}226$)	Diabetes only ($N = 2{,}398$)	VI only ($N = 2{,}181$)	Diabetes plus VI ($N = 427$)
Black	28.19 (27.93–28.46)	24.12 (23.41–24.84)	22.64 (21.46–23.85)	19.63 (17.36–21.60)
White	31.63 (31.46–31.79)	25.77 (25.41–26.10)	26.94 (26.56–27.38)	23.09 (22.02–24.16)
Incremental QALYs	3.44* (3.19–3.69)	1.65* (0.87–2.38)	4.31* (3.19–5.55)	3.46* (1.26–5.97)

Values in parentheses are 95% CI. Sample sizes vary between $N = 106$ for blacks with both diabetes and VI and $N = 28{,}603$ for whites with no impairment. Incremental QALYs reflect the difference in QALYs between whites and blacks such that higher values reflect greater QALYs among whites. *Statistically significant ($P < 0.05$).

socioeconomic characteristics of the cohort and allows us to capture the race-associated variation in characteristics such as income and education within the pathway to triple disadvantage. Finally, in order to preserve sample size, we collapsed different categories of VI into one measure of any VI. Although this reduces the precision of our estimates (potentially underestimating the full impact of having VI), <1% of the sample reported having severe VI (i.e., blindness).

Future studies should identify other conditions that potentially synergize with visual impairment to produce greater overall disability and to determine how diabetes and VI fit into the cascade of comorbidities (12). Although some gains have been made in reducing racial disparities in morbidity and mortality due to diabetes, these gains may have done little to alleviate disadvantages within black communities. For instance, diabetes can lead to VI, and black communities may be less likely to accommodate those who suffer from this condition (4,5). Discriminatory policies of the past, such as redlining in black communities, have led to concentrations of poverty and higher than average levels of stress and social disorganization in these communities. This, in turn, has been linked to lower levels of social support and social capital (13). Healthcare reform in the U.S. seems poised to further address racial health disparities. The recently passed Affordable Care Act provides $11 billion to expand community health centers over the next 5 years. These centers will target medically underserved and disadvantaged neighborhoods throughout the U.S. to provide better access to preventive and primary care services, as well as to sustain and create jobs. Such efforts may improve the health and living conditions within black communities and may be the key to truly reducing racial disparities in health and longevity associated with a number of health conditions and disabilities. However, it is also important to consider the community context itself if health disparities are to be eliminated.

Acknowledgments—Funding for this study was provided by National Eye Institute Grant 1R21EY19096 (principal investigator D.J.L.).

No potential conflicts of interest relevant to this article were reported.

K.E.M. researched data and wrote the manuscript. D.D.Z. researched data, conducted statistical analyses, and contributed to the discussion. C.A.F. contributed to the discussion and reviewed and edited the manuscript. D.J.L. contributed to the discussion and helped to write the manuscript. B.L.L. contributed to the discussion. K.L.A. researched data and assisted with data analysis. A.G. and M.O. contributed to the discussion and reviewed the manuscript. P.M. researched data, guided statistical analyses, and contributed to writing the manuscript. K.E.M., D.D.Z., and P.M. are the guarantors of this work and, as such, had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

The authors thank the University of Miami's Ocular Epidemiology Research Group, which includes D.J.L., B.L.L., K.L.A., K.E.M., D.D.Z., A.G., C.A.F., M.O., Sharon Christ, and Vicki Biagi, for support and feedback. The authors also thank Derek Freitas and Jenelle Lin of the University of Miami and William Russell of the College of Charleston for editorial assistance.

References

1. American Diabetes Association. Living with Diabetes: African Americans and Complications [article online], 2011. Available from http://www.diabetes.org/living-with-diabetes/complications/african-americans-and-complications.html. Accessed 28 November 2011
2. Schmeidler E, Halfmann D. Race and ethnicity of persons with visual impairments; education of children with disabilities; and living arrangements of older Americans. J Vis Impair Blind 1998;92:539–540
3. Centers for Disease Control and Prevention NCfHS. Compressed Mortality File 1999–2007 [article online], 2010. Available from http://wonder.cdc.gov/cmf-icd10-archive2007.html. Accessed 3 April 2012
4. Williams DR, Jackson PB. Social sources of racial disparities in health. Health Aff (Millwood) 2005;24:325–334
5. Franks P, Muennig P, Lubetkin E, Jia H. The burden of disease associated with being African-American in the United States and the contribution of socio-economic status. Soc Sci Med 2006;62:2469–2478
6. U.S. Department of Health and Human Services. The Medical Expenditure Panel Survey (MPES) [article online], 2007. Available from http://www.meps.ahrq.gov. Accessed 28 April 2007
7. Data overview, Agency for Healthcare Research and Quality [article online], 2002. Available from http://www.meps.ahrq.gov/mepsweb/data_stats/data_overview.jsp. Accessed 16 February 2010
8. Williams A. EuroQol—a new facility for the measurement of health-related quality of life. The EuroQol Group. Health Policy 1990;16:199–208
9. Gold M, Siegel J, Russell L, Weinstein M. *Cost-effectiveness in health and medicine*. New York, Oxford University Press, 1996
10. Muennig PA, Gold MR. Using the years-of-healthy-life measure to calculate QALYs. Am J Prev Med 2001;20:35–39
11. Miech RA, Kim J, McConnell C, Hamman RF. A growing disparity in diabetes-related mortality U.S. trends, 1989-2005. Am J Prev Med 2009;36:126–132
12. Centers for Disease Control and Prevention. Improving the Nation's Vision Health. A coordinated Public Health Approach [article online], 2010. Available from http://www.cdc.gov/visionhealth/pdf/improving_nations_vision_health.pdf. Accessed 3 April 2012
13. Kawachi I. Social capital and community effects on population and individual health. Ann N Y Acad Sci 1999;896:120–130