Published in final edited form as:
J Am Geriatr Soc. 2008 March ; 56(3): 444–453. doi:10.1111/j.1532-5415.2007.01570.x.

Minority Disparities in Disability Between Medicare Beneficiaries

Marcia A. Ciol, PhD[*], **Anne Shumway-Cook, PhD**[*], **Jeanne M. Hoffman, PhD**[*], **Kathryn M. Yorkston, PhD**[*], **Brian J. Dudgeon, PhD**[*], and **Leighton Chan, MD**[†]

[*]Department of Rehabilitation Medicine, University of Washington School of Medicine, Seattle, Washington [†]Rehabilitation Medicine Department, National Institutes of Health Clinical Research Center, Bethesda, Maryland

Abstract

OBJECTIVES—To examine racial and ethnic disparities in mobility limitation, activities of daily living (ADLs), and instrumental activities of daily living (IADLs) in older adults enrolled in Medicare.

DESIGN—Longitudinal national survey.

PARTICIPANTS—Community-dwelling respondents in the Medicare Current Beneficiaries Survey from 1992 to 2004 (10,180–16,788 respondents per year).

MEASUREMENTS—Disability-related outcomes included mobility limitation, difficulty in six ADLs and six IADLs. Explanatory variables included age, sex, racial or ethnic group, living situation, and income level.

RESULTS—From 1992 to 2004, proportions of Medicare beneficiaries with mobility limitations were stable across racial and ethnic groups, improving slightly for ADLs and IADLs. Blacks reported more limitations in all three disability-related measures. In a longitudinal analysis, the probability of developing mobility limitation was consistently higher for blacks, followed by white Hispanics, white non-Hispanics, and Asians, after adjusting for age, sex, socioeconomic status, and living situation. For ADL and IADL difficulties, the number of reported difficulties increased with age for all ethnic and racial groups. At approximately age 75, Asians and white Hispanics reported difficulties with much higher numbers of ADLs and IADLs than the other groups.

CONCLUSION—Across all ethnic and racial groups, self-reported disability has declined in the past decade, but even after adjusting for age, sex, socioeconomic status, and living situation, racial and ethnic disparities in disability outcomes persist. Race and ethnicity may influence the reporting of disability, potentially affecting measures of prevalence. Further research is needed to understand whether these differences are a result of perceptions related to disablement or true differences in disability between racial and ethnic groups.

Address correspondence to Marcia A. Ciol, PhD, Department of Rehabilitation Medicine, University of Washington, Box 356490, Seattle, WA 98195. marciac@u.washington.edu.

Author Contributions: Marcia Ciol: study concept, design, data analysis, interpretation of results, and preparation of manuscript. Anne Shumway-Cook and Leighton Chan: study concept, design, interpretation of results, and preparation of manuscript. Jeanne Hoffman, Kathyrn Yorkston, and Brian Dudgeon: interpretation of results, and preparation of manuscript.

Conflict of Interest: This study was supported with funding from the Centers for Disease Control and Prevention (MM-0625-04/04) through an Extramural Project Grant with the Association of Academic Medical Centers. Additional resources were provided by the Centers for Medicare and Medicaid Services.

Keywords

minority disparities; disability; Medicare

The National Institutes of Health (NIH) strategic plan addressing health disparities (fiscal years 2000–2006)[1] defines health disparities as "a difference in the incidence, prevalence, mortality, and burden of disease and other adverse health conditions that exist among specific population groups in the United States." Considerable evidence exists demonstrating the prevalence of racial disparities in health and disability. Studies have substantiated a higher prevalence of disability in blacks than in non-Hispanic whites[2–6] and in Hispanics than in whites.[7–9] For these reasons, Healthy People 2010 lists the elimination of racial disparities in health as a top priority.[10] Achieving this goal requires longitudinal monitoring of health and disability status in subgroups of the population based on age, sex, race, and socioeconomic status.[5]

A number of studies have reported improvements in age-specific disability over the past 20 years.[4,11–14] Several authors have reported a reduction in disability disparities between racial groups,[4,13,15] whereas others did not find such a reduction.[2,5,16–18] One study[4] examined prevalence in chronic disability in activities of daily living (ADLs) and instrumental activities of daily living (IADLs) in black and white adults aged 65 and older (years 1982–1999) and reported that disability prevalence was declining over time, with faster declines in blacks than in whites. Another study[5] followed 6,158 non-Hispanic blacks and whites (aged ≥65) for approximately 6 years (study duration: 1993–2002) and found no clear evidence that there was a decrease in disability disparities between blacks and whites as the cohort aged. These researchers primarily compared racial disparities between blacks, Hispanics, or both and whites. Thus, gaps exist in understanding of racial and ethnic disparities in health and disability because of limited research examining disability between various racial and ethnic groups in a single study. The purpose of this study was to examine racial and ethnic disparities in mobility limitation, ADLs, and IADLs in older adults enrolled in Medicare from 1992 to 2004 by addressing the following questions:

1. Have self-reported disability-related outcomes changed over time, and is the pattern of change consistent across racial and ethnic groups?
2. Do self-reported disability-related outcomes measured longitudinally in Medicare beneficiaries vary according to race or ethnicity after adjusting for age, sex, living status, and socioeconomic status?

METHODS

Sample

The sample consisted of individuals who participated in the Medicare Current Beneficiaries Survey (MCBS) from 1992 to 2004. The MCBS is an ongoing multistage survey that selects a representative sample from all Medicare beneficiaries enrolled during a calendar year. In the first stage, the United States is divided into 107 geographic primary sampling units (PSUs), each composed of a group of counties. Within each PSU, subareas are defined according to ZIP codes, and systematic random samples are collected, stratifying according to age. To ensure large-enough samples of certain strata, beneficiaries who qualify for Medicare because of disability (regardless of age) and beneficiaries aged 85 and older are oversampled, although in this study, only participants who were aged 65 and older at baseline were included in the analysis. For 4 years, survey participants were interviewed every 4 months regarding many aspects of their health status (once a year during the autumn quarter interview) and healthcare utilization (during the other two interviews in the year). By

using weighted estimation,[19,20] this sampling scheme permits generalization of the results to the Medicare population as a whole, and following each participant for 4 years allows for longitudinal analysis of some health indicators. Details of the MCBS interview content and design have been previously published[11] and can be found at the MCBS Website.[21]

Data Description

Data were drawn from responses of MCBS participants during 1992 to 2004. Yearly data from the Health Status and Functioning questionnaire were used to calculate annual proportions of three types of disability (mobility limitation, ADL, and IADL). Sample sizes for each year varied from 10,180 to 16,788, with most years between 12,000 and 13,000. Participants were likely to contribute to the calculations for more than 1 year, because they were followed for up to 4 years. Proxy respondents varied from 10% to 13% but were consistently approximately 10% in the last 7 years of the data.

While enrolled in the MCBS, participants answered questions about their health status during autumn interviews. Disability-related variables used for analyses were constructed as follows: mobility limitation was defined using four walking-related questions ("Do you have any difficulty walking one quarter of a mile?" "Do you have any difficulty walking?" "Do you need help from a person to walk?" and "Do you use equipment to walk?") according to an algorithm developed previously,[22] resulting in five limitation categories (none, mild, moderate, severe, does not walk). Participants were asked about whether they had difficulties (due to health or physical problems) with six ADLs (bathing, dressing, eating, getting in or out of bed and chairs, walking, and using the toilet). Similar questions were asked for six IADLs (using telephone, doing light housework, doing heavy housework, preparing meals, shopping, and managing money). The number of ADL and IADL items for which the participant reported having difficulty was calculated and categorized as follows: no difficulty in any ADL or IADL, difficulty in one or two ADLs or IADLs, difficulty in three or four ADLs or IADLs, and difficulty in five or six ADLs or IADLs. Prior research has demonstrated that using counts of ADL limitations accounts for the hierarchical nature of ADL dependencies.[23]

To estimate disability of beneficiaries as they grew older, the longitudinal data provided by the follow-up of the MCBS participants were used. For this analysis, participants who were in the MCBS from 1999 through 2004 with at least two consecutive years of observations were selected, for a total of 21,199 unique participants. Therefore, participants could have contributed two to four observations in the data analysis. It was decided to start the longitudinal data in 1999 in order to study only the most recent data that would allow for follow-up of individuals over a period of time.

Racial or ethnic group was defined based on two questions ("What is your race?" and "Are you of Hispanic origin?"). The classification had six categories: white non-Hispanic, white Hispanic, black (Hispanic or not), Asian (Hispanic or not), American or Alaskan Native, and other. For American or Alaskan Natives, there was a change in the coding system over the years, which was recoded to make it uniform through the period of the study. Additional variables used in the descriptive analysis and models included age, sex, education level (less than high school vs high school graduate or higher education), income level (<$25,000 vs ≥ $25,000 per year), marital status (married vs not married), living status (living alone vs not living alone), self-reported health status (fair or poor health vs good to excellent health), body mass index (BMI), number of comorbidities (self-reporting of presence or absence of 18 medical conditions such as high blood pressure and arthritis), and smoking status (current smoker vs nonsmoker).

Statistical Analysis

Weighted estimation[19,20] was used to estimate proportions of categories of mobility limitation and difficulties with ADLs and IADLs for each of the 13 years of MCBS data. Weighted estimation takes into account the sampling scheme, which was based on the age distribution of the Medicare population, and therefore, the estimates are adjusted for age. Visual displays were created for each of the disability-related variables according to racial and ethnic groups. Differences in racial and ethnic groups for each outcome variable were not tested, because it is likely that the results would be statistically significant simply because of the large sample sizes. Furthermore, many of these differences would be small and not important from a clinical point of view.

American and Alaskan Natives and participants aged 96 and older were excluded from the longitudinal analyses because of small sample sizes. The group denominated “other” was excluded from the longitudinal analysis because of its heterogeneity, including participants who reported more than one race. Consequently, the conclusions can be generalized to older adults (aged 65–95) who are Medicare beneficiaries and are of white (Hispanic or not), black, or Asian race or ethnicity. Characteristics of the participants at baseline were described according to race and ethnic groups, and differences in means for age, BMI, and number of comorbidities were tested using analysis of variance, whereas all other categorical variables were tested using chi-square tests.

Mobility limitation and number of ADLs and IADLs with difficulties over time were modeled using generalized estimation equations (GEEs). This method allows for analysis of correlated longitudinal data,[24,25] which were generated using the multiple measurements of disability of the MCBS participants. In this part of the data analysis, the sample weights were not used, because they were originally developed for the estimates of proportions of disability in the Medicare population in a certain year, but the GEE model had the objective of estimating the probability that one is in a certain category of disability given one’s age, sex, and racial or ethnic group over time. All participants with at least 2 years of follow-up were analyzed in the longitudinal model. The GEE allows for a person to change from one disability category to another over time, and because the person’s trajectories for mobility, ADL, and IADL disabilities were the major interest in the study, no person was excluded even if he or she already had a disability at baseline. For each disability-related outcome, the initial model included age, sex, racial or ethnic group, and all two-way interactions between the three variables. To account for the possibility that the effect of age is much larger as a participant grows older, the square of age was included in the model. The model was trimmed by eliminating interactions that were not statistically significant.

A second model was created by adding the variables income level and living status to the trimmed model above. These two variables have been shown to correlate with race and ethnic groups in other studies,[5,9] and they might explain the differences in disability. Although education level and marital status have been shown to be associated with disability,[22] they were not added to the model, because they are highly correlated with socioeconomic and living status, which were already included.

For the longitudinal analyses, the five categories of mobility limitation were recoded into a binary variable (no mobility limitation vs some limitation). The probability that a participant would have some mobility limitation was modeled assuming a single binomial trial, a logit link, and an autoregressive correlation matrix of order one (AR(1)).[24,25] The AR(1) model assumes that the mobility limitation status for a participant in a certain year is correlated with the mobility limitation status in the previous year. For each participant, a variable that counted the number of ADLs for which the participant had difficulties at each annual interview was also defined. The GEE model was set to use the binomial family with six

trials (one for each ADL), a logit link, and AR(1). A similar variable was defined for the number of IADLs with difficulties, and a GEE model was fitted using the same approach used for ADLs.

Statistical significance level was set to .05. SAS version 9.1 (SAS Institute, Inc., Cary, NC) was used for data management and weighted estimation, STATA version 8.0 for Windows (STATA Corp., College Station, TX) was used for GEE modeling, and SPLUS version 7.0 (Insightful, Inc., Seattle, WA) was used to create the figures.

RESULTS

Disability-Related Outcomes According to Racial and Ethnic Groups

The proportion of Medicare beneficiaries in each category of disability-related outcomes was estimated for the six racial and ethnic groups for each year of available data. Sample sizes varied from 8,597 to 13,853 for white non-Hispanic subjects, 347 to 956 for white Hispanic subjects, 929 to 1,347 for black subjects, 100 to 290 for Asian subjects, and 54 to 105 for American and Alaskan Native subjects. Participants who could not be classified into any of the main racial or ethnic groups were classified as other, with sample sizes varying from 120 to 342.

Table 1 presents the estimated population sizes and percentages of Medicare beneficiaries in each category of the disability-related outcomes according to racial or ethnic group for the most recent year of data (2004) followed by the 95% confidence intervals for those estimates. Results for years 1992 to 2003 were similar (available from the authors by request). Blacks had the lowest proportion of no mobility limitation and no difficulties with ADLs and IADLs (thus the highest proportions of some disability). Estimates for American and Alaskan Natives were also low for no mobility limitation and no difficulties with IADLs, but the confidence intervals were large because of the small sample size of that group. Asians, followed closely by white non-Hispanics, had the largest percentages of no disability in all three measures of function.

The effect of a disability in a certain racial or ethnic group can be estimated by multiplying the estimated size of the population in that group by the proportion of participants in each disability category. For example, in 2004, it was estimated that approximately 7.6 million white non-Hispanics Medicare beneficiaries had mild mobility limitations (25,305,000 × 0.30), and approximately 967,000 black Medicare beneficiaries were estimated to have mild mobility limitation (2,552,000 × 0.38).

For a view of trends of mobility limitation from 1992 to 2004, the first panel of Figure 1 shows the percentage of participants in each mobility limitation category according to racial or ethnic group (except American and Alaskan Natives and other). There were differences between racial and ethnic groups regarding the distribution of mobility limitation. White non-Hispanic and Asian subjects tended to have the highest proportions of people with no mobility limitation, followed by white Hispanic and Black subjects. Hispanic and non-Hispanic white subjects had similar overall proportions of people with and without mobility limitations, but blacks had a lower proportion than whites (Hispanic or not) of no mobility limitation, a similar proportion of mild mobility limitation, and a higher proportion of moderate limitation. It was also observed that the proportions for white non-Hispanics and blacks were fairly stable over time, whereas there was more variation in the white Hispanic and Asian groups, although this was possibly an effect of the smaller sample sizes available for those groups.

The second panel of Figure 1 shows the estimated proportions for the categories of ADL difficulties according to racial and ethnic groups. Asians had the highest proportion of participants with no difficulties in ADLs, followed by white non-Hispanics, white Hispanics, and blacks. White Hispanics presented stable proportions without ADL difficulties, whereas for blacks, there seemed to be a slight increase over time of participants with no ADL difficulties, with a correspondent decrease in the most severe category.

The third panel of Figure 1 shows the estimated proportions for the categories of IADL difficulties according to racial and ethnic groups. A slight, but steady, increase over time in the proportion of participants with no difficulties in IADLs was observed for blacks and Asians. For white Hispanics, there was a similar increase until 1999, at which point the estimated proportion decreased, followed by a steady increase again. The proportion of white non-Hispanics with no IADL difficulties increased from 1992 to 1996, followed by an almost constant value of that proportion. For most racial and ethnic groups, the increases in that proportion had a correspondent decrease in the proportion of groups with difficulties in one or two and three or four IADLs, except for white Hispanics, whose decline seemed to be concentrated in the group with one or two difficulties.

Differences in Disability-Related Outcomes According to Racial and Ethnic Groups

Table 2 shows the baseline characteristics of 21,199 participants who had at least two consecutive observations between 1999 and 2004 according to each of the four major racial and ethnic groups. Mean age was similar in all groups ($P = .27$), and there were larger percentages of females in the black and Asian groups ($P = .002$). White non-Hispanics and Asians had the highest percentages of high school or higher education ($P<.001$). Lower income was more prominent among white Hispanics and blacks, with white non-Hispanics having the lowest percentage ($P<.001$). Blacks had the lowest percentage of married individuals ($P<.001$) and the largest percentage of individuals living alone ($P<.001$), whereas Asians showed the opposite pattern. Blacks reported fair or poor health more often that the other groups, with white non-Hispanics reporting the least ($P<.001$). Fifteen percent of blacks, 10.5% of white non-Hispanics, 10.3% of white Hispanics, and 7% of Asians ($P<.001$) reported being a current smoker. Mean BMI was lowest for Asians, followed by white non-Hispanics, white Hispanics, and blacks ($P<.001$). The mean number of co-morbidities was statistically different for the four racial or ethnic groups ($P<.001$), although a close inspection of histograms (not shown here) showed that the statistical significance was most likely due to the large number of participants in each group instead of large differences in number of comorbidities. At baseline, the four groups differed in the distribution of mobility limitation and number of ADLs and IADLs with difficulties ($P<.001$ for all).

Longitudinal Analyses

Mobility Limitation—Table 3 contains the estimated coefficients and *P*-values for the final logistic regression model. The only statistically significant interaction was age by sex. In addition, two other variables in the model, age squared and racial and ethnic groups, were statistically significant. The first panel in Figure 2 shows the curves for the probability of reporting some mobility limitation according to age, sex, and racial or ethnic groups, calculated from the logistic model. The probability of having some mobility limitation was greater with older age. Men had a lower probability of reporting mobility limitation for all ages. The different slopes of the curves reflected the interaction between age and sex. For men and women, Asians had a consistently lower probability of reporting mobility disability, followed closely by white non-Hispanics and white Hispanics, with blacks having the highest probabilities across all ages.

In the second GEE model (not shown here), income level and living status were added to the above model. Both variables were statistically significant ($P<.001$), but there were no substantial changes to the coefficients from the model shown in Table 3. The probability of reporting mobility limitation increased with lower income and when living with others.

Difficulties in ADL—Results of the modeling of ADL difficulties are shown in Table 3. Age- and sex-by-racial or ethnic group interactions were statistically significant, as well as age, age-squared, sex, and racial or ethnic group. The second panel of Figure 2 depicts the expected number of ADLs with difficulties according to age, sex, and racial or ethnic group, calculated from this model. Women tended to report having difficulties with more ADLs than men for every age. White non-Hispanics and blacks had parallel curves for the expected number of ADLs with difficulties, but blacks consistently had higher expected values. The age-by-racial or ethnic group interaction is seen in the steeper slope of the curves for white Hispanics and Asians. Between the ages of 70 and 75, Asians start reporting difficulties with greater numbers of ADLs than white non-Hispanics.

In the second GEE model (not shown here), income level and living status were added to the model. Both variables were statistically significant ($P<.001$), but there were no substantial changes to the coefficients from the model shown in Table 3. Number of ADLs that participants had difficulty with was greater with lower income and when living with others.

Difficulties in IADL—Results of modeling of IADL difficulties are shown in Table 3. Interactions between age and sex and between age and racial and ethnic groups were statistically significant. The third panel of Figure 2 shows the number of IADLs that subjects are expected to have difficulties with according to age, sex, and racial and ethnic group. Men tended to report fewer difficulties with IADLs than women, regardless of age or racial or ethnic group. The curve for blacks parallels the curve for white non-Hispanics but with an expected value of difficulty with approximately one more IADL. Similar to with ADLs, white Hispanics and Asians reported fewer difficulties with IADLs than blacks, but their curves had sharper slopes, and at approximately age 70 to 75, they start reporting difficulties with more IADLs than white non-Hispanics, surpassing blacks at approximately the age of 80 to 85.

In the second GEE model (not shown here), income level and living status were added to the model. Both variables were statistically significant ($P<.001$), but there were no substantial changes to the coefficients from the model shown in Table 3. Number of IADLs that participants had difficulty with was greater with lower income and when living with others.

DISCUSSION

This longitudinal study of Medicare beneficiaries determined that significant racial and ethnic disparities in disability outcomes persist despite an overall decline in disability across all groups in the past decade. The slight decrease over time in the proportion of ADL and IADL disability for Medicare beneficiaries is consistent with that found in other studies.[4,11–13] In spite of this positive finding, there continue to be differences between racial and ethnic groups that appear to be stable over time. Most studies in the literature examine differences between two groups, such as blacks and whites or whites and Hispanics,[2–5,7,13,16,17] for example. The current study compared the four groups for which we had enough data for reliable estimates over the years 1992 to 2004. The estimates for the Alaskan or Native American group were also presented for 2004, indicating that that group had larger proportions of mobility limitations and ADL or IADL difficulty, but when comparing less-frequent events, such as severe disability, between groups, disparities tend to look larger than when comparing more-frequent events (such as no disability).[26] One

study[27] suggested that health disparities be made relative to adverse events, but given the difficulty in interpretation, the least-adverse events should also be considered, as was done in the current study. The International Classification of Function, Disability and Health (ICF)[28] now emphasizes a person's level of health as opposed to impairment or disability. By studying degrees of disability-related outcomes instead of focusing solely on whether a person is disabled, the current study conforms to the ICF guidelines.

Although there are exceptions,[2,3,5,8,9] a common limitation of published studies is the assessment of racial or ethnic disparities using cross-sectional data instead of following the individuals longitudinally. Cross-sectional studies can assess the correlation between outcomes and race or ethnicity, but they cannot assess whether race or ethnicity is a risk factor for the observed disparities. By following Medicare beneficiaries over time (up to 4 years), the MCBS allows the participants' trajectories in mobility limitation and ADL and IADL difficulties to be studied. The models created using GEE can assess how much a person of a certain racial or ethnic group is more or less likely to report a disability than a person in the reference group (white non-Hispanic, in the current study) while controlling for other variables that are potentially important (e.g., age). These models use the longitudinal nature of the data to estimate the coefficients, allowing the expected trajectory of a person regarding disability-related outcomes to be studied. Thus, instead of examining the data on multiple points in time as if they were cross-sectional, the GEE analysis uses the information of each person's trajectory. The coefficients give information about the magnitude and direction of the effect of the variables in the reporting of disability-related outcomes, whereas the final equation allows curves to be created that depict the expected probabilities that one moves from category to another. In the current study, even after controlling for key variables such as age, sex, and socioeconomic and living status, race or ethnicity was an important factor in the probability of reporting mobility limitation, as well as the reported number of ADL and IADL difficulties. Blacks had a higher probability of reporting mobility limitations and difficulties in ADLs or IA-DLs than other racial or ethnic groups. Factors such as access to health care could explain this discrepancy, with poorer access resulting in a greater proportion of disability. Cultural differences in self-reporting of levels of disability could also explain the discrepancy. For example, Asians reported less mobility limitation at older ages but consistently reported more ADL and IADL difficulty. Thus, race and ethnicity may influence the way in which disability is reported. Consistent with this view is a study[29] that showed that self-reported drug use varied according to race and ethnicity when compared with confirmatory urine tests. It is also possible that social environments, including the available network of social support, may influence whether changes in physical functioning, such as walking, are viewed as a limitation that restricts participation in valued activities.

The current study has a number of limitations. First, the results can only be generalized to persons aged 65 and older covered under the Medicare system. Data were not available on younger adults in health maintenance organizations, people covered by Medicaid or private insurance, or Americans without health care. Second, the MCBS data were based on self-report of functional limitations and have not been checked against measures obtained from health-care professionals. Next, the fact that MCBS survey methods have changed slightly during the reporting period limited efforts to study long-term changes. For American or Alaskan Natives, there was a change in the coding system over the years, which coupled with the small sample sizes, limits confidence in the estimates. There appears to be a discontinuity in the estimates of proportions of people without disability around the 1996/97 period. A reason for this change that is present in all three disability-related variables (mobility, ADL and IADL) could not be identified. The questions in the interviews for all years were the same for the disability-related variables. One possibility is that the oversampling of subjects who belonged to health maintenance organizations, occurring

during 1996 to 2000[21] would overestimate the proportion of individuals with no disabilities. These participants cannot be identified as "oversampled" and are included in the analysis. Although this could explain the sudden jumps in 1997, it does not explain why the pattern continues after the oversampling was discontinued. Finally, despite interest in examining disability in individuals with many racial or ethnic backgrounds, some groups were so small and heterogeneous that, although they were included in the descriptive analysis, no generalizations could be made about them.

CONCLUSION

Across all studied ethnic and racial groups, self-reported disability has declined in the past decade, although even after adjusting for age, sex, and socioeconomic status, disparities in disability outcomes persisted between these racial and ethnic groups. One possible explanation is that race and ethnicity may influence how disability is self-reported, potentially affecting measures of prevalence, a possibility that was evidenced in certain racial and ethnic groups by self-reporting less mobility disability and higher ADL and IADL disability. Further research is needed to understand whether the observed differences are true or due to perceptions related to disablement.

Acknowledgments

Sponsor's Role: None.

References

1. [Accessed May 24, 2007.] NIH strategic plan to reduce and eliminate health disparities, fiscal year 2000–2006 [on-line]. Available at http://ncmhd.nih.gov/our_programs/strategic/pubs/VolumeI_031003EDrev.pdf
2. Clark DO. US trends in disability and institutionalization among older blacks and whites. Am J Public Health. 1997; 87:438–440. [PubMed: 9096549]
3. Ferraro KF, Kelley-Moore JA. Self-rated health and mortality among Black and White adults: Examining the dynamic evaluation thesis. J Gerontol B Psychol Sci Soc Sci. 2001; 56B:S195–S205. [PubMed: 11445612]
4. Manton KG, Gu X. Changes in the prevalence of chronic disability in the United States black and non-black population above age 65 from 1982 to 1999. Proc Natl Assoc Soc. 2001; 98:6354–6359.
5. Mendes de Leon CF, Barnes LL, Bienias JL, et al. Racial disparities in disability: Recent evidence from self-reported and performance-based disability measures in a population-based study of older adults. J Gerontol B Psychol Sci Soc Sci. 2005; 60B:S263–S271. [PubMed: 16131627]
6. Mendes de Leon CF, Beckett LA, Fillenbaum GG, et al. Black-white differences in risk of becoming disabled and recovering from disability in old age: A longitudinal analysis of two EPESE populations. Am J Epidemiol. 1997; 145:488–497. [PubMed: 9063338]
7. Hamman RF, Mulgrew CL, Baxter J, et al. Methods and prevalence of ADL limitations in Hispanic and non-Hispanic white subjects in rural Colorado: The San Luis Valley Health and Aging Study. Ann Epidemiol. 1999; 9:225–235. [PubMed: 10332928]
8. Herbert PL, Frick KD, Kane RL, et al. The causes of racial and ethnic differences in influenza vaccination rates among elderly medicare beneficiaries. Health Serv Res. 2005; 40:517–537. [PubMed: 15762905]
9. Shih VC, Song J, Chang RW, et al. Racial differences in activities of daily living limitation onset in older adults with arthritis: A national cohort study. Arch Phys Med Rehabil. 2005; 86:1521–1526. [PubMed: 16084802]
10. U.S. Department of Health and Human Services. Healthy People 2010. 2. Washington, DC: U.S. Government Printing Office; 2000.
11. Adler GS. A profile of the medicare current beneficiary survey. Health Care Financ Rev. 1994; 15:153–162. [PubMed: 10138483]

12. Freedman VA, Martin LG, Schoeni RF. Recent trends in disability and functioning among older adults in the United States. A systematic review. JAMA. 2002; 288:3137–3146. [PubMed: 12495394]
13. Margellos H, Silva A, Whitman S. Comparison of health status indicators in Chicago: Are black-white disparities worsening? Am J Public Health. 2004; 94:116–121. [PubMed: 14713708]
14. Manton KG, Gu X, Lamb VL. Change in chronic disability from 1982 to 2004/2005 as measured by long-term changes in function and health in the U.S. elderly population. Proc Natl Acad Sci U S A. 2006; 103:18374–18379. [PubMed: 17101963]
15. Woolf SH, Johnson RE, Fryer GE, et al. The health impact of resolving racial disparities: An analysis of US mortality data. Am J Public Health. 2004; 94:2078–2081. [PubMed: 15569956]
16. Schoeni RF, Martin LG, Andreski PM, et al. Persistent and growing socioeconomic disparities in disability among the elderly: 1982–2002. Am J Public Health. 2005; 95:2065–2070. [PubMed: 16254235]
17. Schoeni RF, Freedman VA, Wallace RB. Persistent, consistent, widespread, and robust? Another look at recent trends in old-age disability. J Gerontol B Psychol Sci Soc Sci. 2001; 56B:S206–S218. [PubMed: 11445613]
18. Liao Y, McGee DL, Cao G, et al. Recent changes in the health status of the older U.S. population: Findings from the 1984 and 1994 supplement on aging. J Am Geriatr Soc. 2001; 49:443–449. [PubMed: 11347789]
19. Kish, L. Survey Sampling, Wiley Classics Library Edition Published 1995. John Wiley and Sons; 1965.
20. Ciol MA, Hoffman JM, Dudgeon BJ, et al. Understanding the use of weights in the analysis of data from multistage surveys. Arch Phys Med Rehabil. 2006; 87:299–303. [PubMed: 16442990]
21. [Accessed May 18, 2007] Medicare Current Beneficiaries Survey [on-line]. Available at http://www.cms.hhs.gov/mcbs/
22. Shumway-Cook A, Ciol MA, Yorkston KM, et al. Mobility limitations in the Medicare population: Prevalence and sociodemographic and clinical correlates. J Am Geriatr Soc. 2005; 53:1217–1221. [PubMed: 16108942]
23. Travis SS, McAuley WJ. Simple counts of the number of basic ADL dependencies for long-term care research and practice. Health Serv Res. 1990; 25:349–360. [PubMed: 2113045]
24. Diggle, PJ.; Liang, K-Y.; Zeger, SL. Analysis of Longitudinal Data. Oxford Science Publications; 1994.
25. Hardin, JW.; Hilbe, JM. Generalized Estimating Equations. Chapman & Hall/CRC; 2003.
26. Scanlan JP. Can we actually measure health disparities? Chance. 2006; 19:47–51.
27. Keppel K, Pamuk E, Lynch J, et al. Methodological issues in measuring health disparities. Vital Health Stat. 2005; 2:1–16.
28. ICF. International Classification of Functioning, Disability and Health: ICF. Geneva: World Health Organization; 2001.
29. Fendrich M, Johnson TP. Race/ethnicity differences in the validity of self-reported drug use: Results from a household survey. J Urban Health. 2005; 82(2 Suppl 3):iii67–iii81. [PubMed: 15933333]

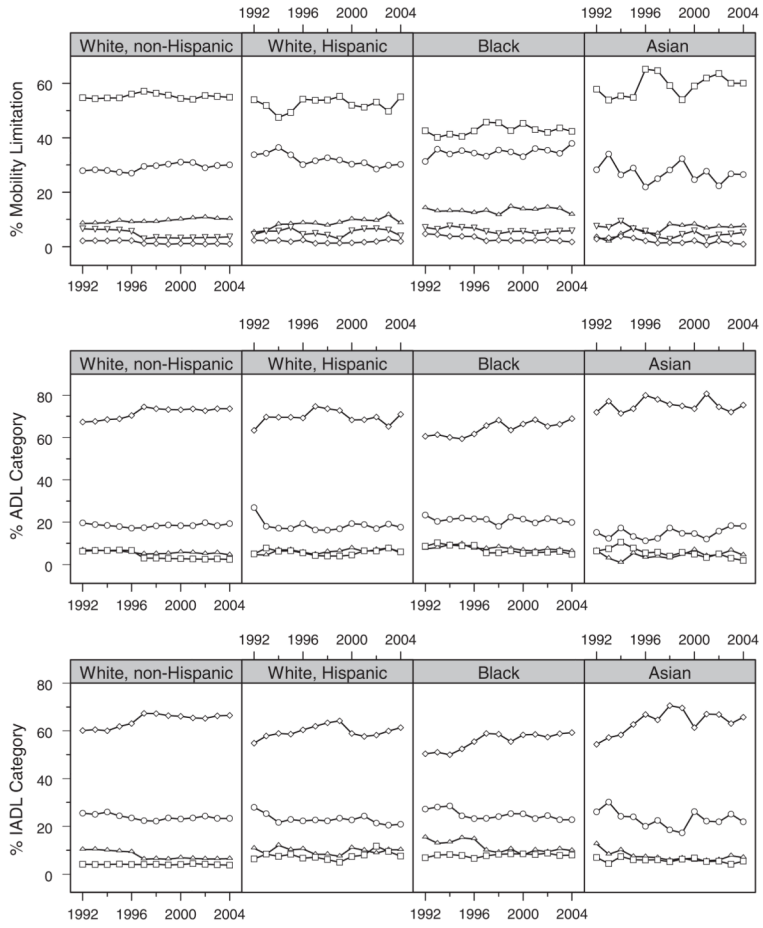

Figure 1.

Estimated proportions for each category of the disability-related outcomes according to racial or ethnic group from 1992 to 2004. □ = no mobility limitation, ○ = mild mobility limitation; △ = moderate mobility limitation; ▽ = severe mobility limitation; ◇ = do not walk. Symbols for categories of activity of daily living (ADL) and instrumental activity of daily living (IADL) difficulties: ◇ = no difficulties; ○ = difficulty in one to two ADLs or IADLs; △ = difficulty in three to four ADLs or IADLs; □ = difficulty in five to six ADLs or IADLs.

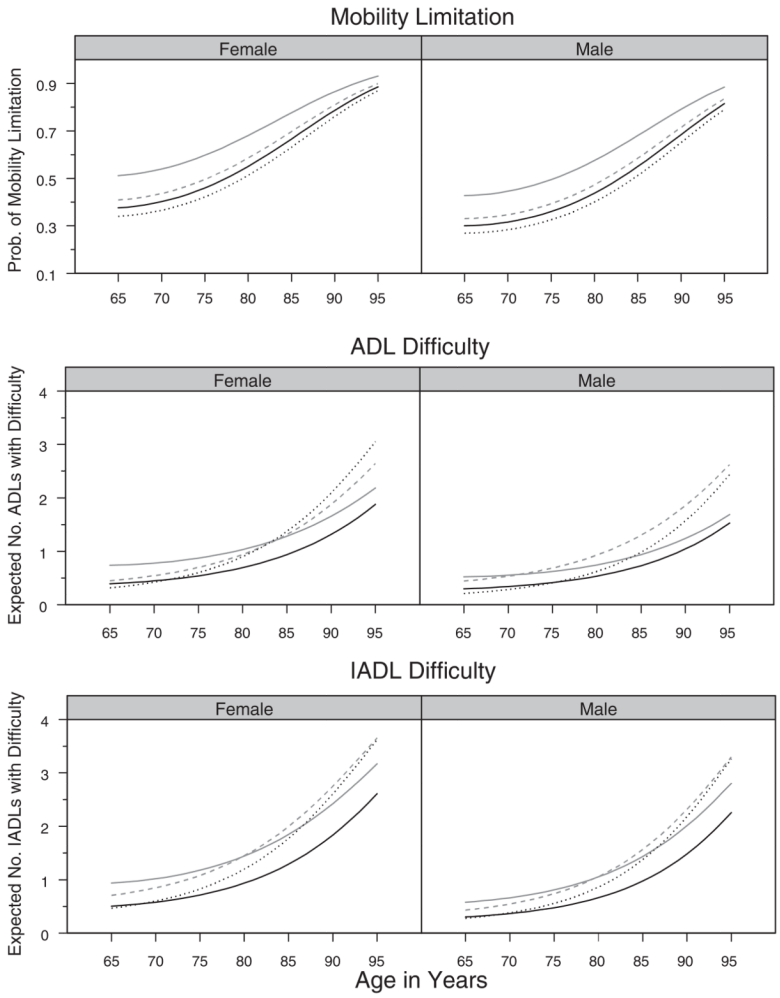

Figure 2.

Probability of developing any mobility limitation, and expected number of activities of daily living (ADLs) and instrumental activity of daily living (IADL) participant has difficulty with according to age, sex, and racial or ethnic group, from generalized estimation equations models. Solid black line = white non-Hispanic; dashed gray line = white Hispanic; solid gray line = black; dotted black line = Asian.

Table 1

Proportion of Individuals in Each Category of Mobility Limitation, Activities of Daily Living (ADLs), and Instrumental Activities of Daily Living (IADLs) According to Racial and Ethnic Groups in 2004

	Racial or Ethnic Group					
Disability-Related Outcomes	**White Non-Hispanic**	**White Hispanic**	**Black**	**Asian**	**American or Alaskan Native**	**Other**
Sample size, n	9,683	641	980	249	105	325
Estimated population in thousands, n *	25,305	1,662	2,552	735	256	873
Mobility limitation, weighted estimate (95% CI) †						
None	0.55 (0.53–0.57)	0.55 (0.51–0.59)	0.42 (0.39–0.46)	0.60 (0.53–0.67)	0.49 (0.40–0.58)	0.51 (0.46–0.57)
Mild	0.30 (0.28–0.32)	0.30 (0.27–0.34)	0.38 (0.35–0.41)	0.27 (0.21–0.33)	0.32 (0.24–0.39)	0.29 (0.23–0.34)
Moderate	0.10 (0.09–0.11)	0.09 (0.07–0.11)	0.12 (0.010–0.14)	0.07 (0.04–0.11)	0.10 (0.02–0.18)	0.11 (0.08–0.14)
Severe	0.04 (0.03–0.04)	0.04 (0.03–0.05)	0.06 (0.04–0.07)	0.05 (0.03–0.08)	0.04 (0.00–0.08)	0.06 (0.04–0.09)
Do not walk	0.01 (0.01–0.01)	0.02 (0.01–0.03)	0.02 (0.01–0.02)	0.01 (0.00–0.02)	0.04 (0.00–0.09)	0.03 (0.01–0.05)
Difficulty in ADLs, weighted estimate (95% CI)						
0	0.74 (0.72–0.75)	0.71 (0.68–0.74)	0.69 (0.65–0.73)	0.75 (0.70–0.81)	0.70 (0.61–0.80)	0.65 (0.59–0.70)
1–2	0.19 (0.18–0.20)	0.18 (0.14–0.21)	0.20 (0.17–0.23)	0.18 (0.13–0.23)	0.23 (0.13–0.33)	0.22 (0.17–0.27)
3–4	0.05 (0.04–0.05)	0.05 (0.04–0.07)	0.06 (0.05–0.08)	0.05 (0.02–0.07)	0.02 (0.00–0.04)	0.08 (0.05–0.11)
5–6	0.02 (0.02–0.03)	0.06 (0.04–0.09)	0.05 (0.03–0.06)	0.02 (0.01–0.03)	0.05 (0.01–0.09)	0.05 (0.02–0.08)
Difficulty in IADLs, weighted estimate (95% CI)						
0	0.67 (0.65–0.68)	0.61 (0.57–0.65)	0.59 (0.55–0.63)	0.66 (0.59–0.72)	0.60 (0.50–0.70)	0.58 (0.52–0.64)
1 or 2	0.23 (0.22–0.24)	0.21 (0.15–0.27)	0.23 (0.20–0.26)	0.22 (0.16–0.27)	0.24 (0.15–0.33)	0.29 (0.23–0.33)
3 or 4	0.07 (0.06–0.07)	0.10 (0.08–0.13)	0.10 (0.08–0.12)	0.07 (0.04–0.10)	0.08 (0.03–0.12)	0.07 (0.05–0.10)
5 or 6	0.04 (0.03–0.04)	0.07 (0.02–0.13)	0.08 (0.06–0.10)	0.05 (0.03–0.08)	0.08 (0.03–0.14)	0.06 (0.04–0.09)

Note: The weighted estimation uses the weight from the sample scheme and therefore takes into account the age distribution of the population.

* Estimate of population size according to racial or ethnic group, using weighted estimation.

† Sample size for mobility limitation estimates is slightly smaller because 33 participants' mobility limitation could not be classified using the algorithm.

CI = confidence interval.

J Am Geriatr Soc. Author manuscript; available in PMC 2012 August 23.

Table 2

Characteristics at Baseline of Individuals Followed over a Period of 2 to 4 Years (Aged <95) from 1999 to 2004

Characteristic	White Non-Hispanic (n = 17,742)	White Hispanic (n = 1,162)	Black (n = 1,854)	Asian (n = 441)	*P*-Value*
Age, mean ± SD	75.8 ± 7.1	75.1 ± 7.2	75.0 ± 7.3	75.0 ± 7.0	.27
Female, %	57.1	56.2	61.6	59.0	.002
High school education or more, %	72.4	40.8	40.2	61.7	<.001
Income <25,000, %	56.9	82.1	83.6	71.2	<.001
Married, %	56.2	54.3	33.9	61.2	<.001
Living alone, %	33.3	26.6	36.9	19.1	<.001
Reporting fair or poor health, %	20.2	32.5	35.8	27.3	<.001
Current smoker, %	10.5	10.3	15.0	7.0	<.001
BMI, mean ± SD	26.3 ± 4.8	26.5 ± 4.7	27.7 ± 5.8	23.9 ± 4.0	<.001
Number of comorbidities, mean ± SD	2.3 ± 1.8	2.0 ± 1.7	2.1 ± 1.6	1.8 ± 1.7	<.001
Mobility limitation, %					<.001
None	55.1	51.6	43.1	56.5	
Mild	29.7	31.1	33.5	27.9	
Moderate	11.1	10.6	16.2	8.6	
Severe	3.2	4.9	5.4	5.2	
Does not walk	0.9	1.7	1.8	1.8	
Number of activities of daily living having difficulty with, %					<.001
0	72.1	68.8	63.4	72.6	
1	13.3	11.6	14.1	10.0	
2	6.4	7.3	8.8	4.1	
3	3.5	4.9	4.4	5.0	
4	2.2	2.5	3.2	3.2	
5	1.7	3.7	3.9	3.2	
6	0.7	1.9	2.1	2.0	
Number of instrumental activities of daily living having difficulty with, %					<.001
0	65.3	59.0	55.3	62.1	
1	18.1	17.3	17.6	15.0	

J Am Geriatr Soc. Author manuscript; available in PMC 2012 August 23.

Characteristic	White Non-Hispanic (n = 17,742)	White Hispanic (n = 1,162)	Black (n = 1,854)	Asian (n = 441)	*P*-Value*
2	6.5	7.0	7.0	7.5	
3	3.4	4.4	5.2	5.0	
4	1.9	5.3	5.7	4.1	
5	1.5	3.4	5.1	3.4	
6	1.5	3.6	4.0	2.9	

Note: Some descriptive values are based on slightly smaller number of individuals because of missing values.

**P*-value from one-way analysis of variance for age, body mass index (BMI), and number of comorbidities and from Pearson chi-square test for all other variables.

SD = standard deviation.

Table 3

Estimated Coefficients for the Final Models of Disability-Related Outcomes Using Generalized Estimating Equations

	Outcome Variable					
	Mobility Limitation*		Number of ADL Difficulties†		Number of IADL Difficulties†	
Explanatory Variables	**Coefficient**	***P*-value**	**Coefficient**	***P*-value**	**Coefficient**	***P*-value**
Age	−0.32	<.001	−0.16	<.001	−0.19	<.001
Age^2	0.00	<.001	0.00	<.001	0.00	<.001
Sex (reference: female)	0.17	.56	−0.28	<.001	−1.21	<.001
Racial or ethnic group (reference: white non-Hispanic)						
White Hispanic	0.14	.008	−0.71	.24	−0.33	.53
Black	0.55	<.001	1.70	<.001	1.41	.001
Asian	−0.15	.07	−2.52	.01	−1.75	.04
Interactions						
Age by sex	−0.01	.04	—	—	0.01	.004
Age by white Hispanic	—	—	0.01	.08	0.01	.10
Age by black	—	—	−0.01	.007	−0.01	.04
Age by Asian	—	—	0.03	.006	0.03	.02
Male by white Hispanic	—	—	0.27	.02		
Male by black	—	—	−0.094	.33		
Male by Asian	—	—	−0.127	.53		
Constant	9.49	<.001	1.83	.19	3.037	.019

Note: The initial model contained all the variables in the first column. Interactions that were not statistically significant at the .05 level in the initial model were removed and a new model constructed. The final model is shown in the table, where the symbol —denotes an interaction that was not included in the specific final model.

J Am Geriatr Soc. Author manuscript; available in PMC 2012 August 23.

P-values shown in table are for the coefficient of each category of an interaction, but the decision on statistical significance of that interaction was based on the *P*-value that tested all coefficients at once, whose *P*-values are not shown here.

Negative coefficients translate into smaller likelihood of reporting mobility disability or smaller likelihood of reporting higher (worse) categories of ADLs or IADLs, whereas positive coefficients translate into higher likelihoods. Interpretation of a coefficient is valid only when the other variables are held constant.

*Mobility limitation was modeled as a dichotomous variable (no mobility limitation vs some mobility limitation).

†Activities of daily living (ADLs) and instrumental activities of daily living (IADLs) were modeled using a binomial distribution, with the outcome being number of ADLs or IADLs with reported difficulty from among six ADLs or IADLs.