Racial Disparities in Mobility Device Use in Late-Life

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Jennifer C. Cornman,
University of Medicine and Dentistry of New Jersey

Vicki A. Freedman,
University of Medicine and Dentistry of New Jersey

Abstract

This study investigates whether there is a difference by race in mobility device use; whether this difference is due to racial differences in rates of adoption and abandonment of devices; and to what extent racial and ethnic differences in need factors (functioning and chronic conditions) and enabling factors (income, assets, health insurance, and health care utilization) account for racial differences in mobility device use. We use the 2002 and 2004 waves of the Health and Retirement Study. Results indicate that minority elders are more likely than White elders to use mobility devices and that this difference is largely due to the fact that minorities are more likely to start using devices between 2002-2004 and are no different than Whites in rates of abandonment. Controlling for need and enabling factors explains some of the racial differences in mobility device use, but much of the racial difference in use remains unexplained.

Technology is playing an increasingly important role in facilitating independence among older Americans (Pew & Van Hernel 2004), particularly those at risk for long-term care, and a growing number of studies suggest that devices have efficacy in improving functioning and quality of life even in late-life (e.g. Verbrugge et al. 1997; Mann et al. 1999). Despite evidence that minorities experience more disability throughout late life (Schoeni et al. 2002; Mendes de Leon 1995), the continuing debate on racial disparities in health care (e.g., AHRQ 2003) has not explicitly recognized technology as a type of care with which to be concerned. Yet the use of devices to address gaps in functioning, particularly mobility, is hardly uncommon. Mobility is one of the most important functions to maintain independence. In 2000, 2.6 million older Americans reported difficulty walking and 2.1 million reported using some sort of device (most often wheelchair, cane, or walker) to accommodate that difficulty (Cornman et al. 2005).

Research on the use of mobility devices among older adults generally has not focused explicitly on racial and ethnic disparities, although a few studies have included race and/or ethnicity as predictors of use, generally contrasting Blacks and Whites. Results from these studies are inconsistent. Some studies find that use of devices does not significantly differ by race (Mathieson et al. 2002; Norburn et al. 1995). Two other studies report that, after controlling for health status and socioeconomic status, minorities were less likely than Whites to use devices (Hartke et al. 1998; Tomita et al. 1997). Agree (1994) and Rubin and White-Means (2001), however, find that Blacks are more likely than Whites to use devices.

Given the limited investigation into this issue, a number of important questions remain. Of particular interest is whether minorities use mobility devices in proportion to their underlying need and whether they are more likely than others to experience access-related barriers to use. Moreover, with the exception of several small, clinical studies that have lacked racial and ethnic diversity (Phillips and Zhao 1993; Cushman & Scherer 1996; Mann et al. 2002; Smith et al. 2002), previous research has ignored the processes underlying rates of mobility device use. Hence, it remains unclear whether differences by race and ethnicity in rates of use are due to differential rates of uptake or abandonment of devices.

The purpose of this research is to disentangle the effects of race/ethnicity, socioeconomic status, health, and functioning on the use of mobility devices (wheelchairs, walkers, canes, or crutches used for walking or for transferring in or out of bed or a chair) by older Americans. We investigate two questions: 1) Are differences by race in mobility device use due to differences in the adoption or abandonment of mobility devices? and 2) to what extent do racial and ethnic differences in need (e.g., chronic conditions and functioning) and enabling factors (e.g., income, assets, insurance, and use of other health services) account for differences in mobility device use?

Framework

We draw upon the Andersen behavioral framework (Andersen & Newman 1973), which although developed to study patterns of acute care utilization has been widely used in the study of long-term care, including nursing home stays (e.g Mui & Burnette 1994), home health care (e.g. Mui & Burnett 1994; White-Means & Rubin 2004) and assistive device use (Gitlin et al. 1996; Hartke et al. 1998; Mathieson et al. 2002; Zimmer and Chappell 1994). As applied to mobility device use, the framework suggests that the use of devices is a function of three sets of competing factors: predisposing, enabling and need. Predisposing characteristics are factors that are exogenous to the onset of illness or mobility problems that contribute to an individual's inclination to use devices. These factors - including age, sex, race/ethnicity, education, and knowledge and beliefs about health, service utilization and device use - are not directly responsible for the use of devices, but make some individuals more likely to use devices than others. Although some individuals may be predisposed to using assistive devices, these individuals must also have the means to obtain them. Such enabling factors include income and health insurance as well as contact with providers who may prescribe and/or recommend devices. Finally, and most importantly, need factors refer to an individual's chronic conditions and functioning. Those with greater need will be more likely to use devices

Building on the Andersen approach, we view need and enabling factors as factors that mediate the relationship between predisposing factors and the use of devices and/or personal care, providing potential

explanations for differences in device use by predisposing factors, particularly race (see Figure 1). In addition, the framework recognizes that decisions about devices are dynamic and are made within a broader caregiving context (Agree, et al. 2004). Hence, we explicitly specify in Figure 1 that use, adoption and abandonment are distinct dimensions of the care arrangement.

Previous research has well documented racial differences in need and enabling. Studies have shown that functional limitations are more prevalent among older Hispanics and Blacks than older Whites (Clark et al. 1997; Mendes de Leon 1995; Stump et al. 1997; Schoen et al. 2002), that the prevalence of chronic conditions differs by race (Kington & Smith 1997), and that minorities tend to have more home environmental barriers (Gitlin et al. 2001; Newman 2003; Tomita et al. 1997). Previous research also suggests that older minority adults may be less likely than White elders to experience functional or health improvements, although these patterns may not be consistent across all ages (Bryant et al. 2002; Mendes de Leon et al. 1997; Rankin 2002; Young et al. 1991). Because of their greater need and lower probability of recovery, we expect that older minorities will be more likely to use and adopt and less likely to abandon mobility devices.

Older minorities also report having fewer economic resources than older Whites (Crystal & Shea 1990; Shea, Miles and Hayward 1996) and more older minorities are less likely to have health insurance that supplements Medicare coverage (Crystal et al. 2000). In addition, minorities are less likely to use formal healthcare services, such as physician visits (White-Means 2000). At the same time, White-Means and Rubin (2004) report that Blacks are more likely to use home health care, an important source for introducing assistive devices or information about assistive devices. In addition, minority elders are more likely to be dually eligible for both Medicare and Medicaid (Medicare Current Beneficiary Survey: http://www.cdc.gov/nchs/agingact.htm). Although assistive technology is often not covered by insurance, wheelchairs and walkers, two of the most prevalent forms of assistive devices for mobility, are durable medical equipment that is covered by both Medicare and Medicaid. Thus, although minorities have fewer economic resources, they may have access to assistive devices through these sources. As such, enabling factors may also favor minorities and contribute to their higher rates of mobility device use.

DATA AND METHODS

Data

We use the Health and Retirement Study (HRS), a longitudinal study of older adults that collects data regarding decisions that affect retirement, health insurance, saving and economic well-being, and the interplay of resources and late-life health transitions. Our analyses are based on the sample of respondents who were age 65 and over in 2004. Some respondents have been interviewed since 1992 or 1993 and others were first interviewed in 1998[1]. While baseline interviews were in-home, face-to-face interviews, follow-ups (done every two years) are administered by telephone. Health questions were answered by each respondent, although proxy interviews were also allowed. We focus on cross-sectional use in 2004 and the transitions in device use between 2002 and 2004. We concentrate on this time period rather than using additional waves of data because the availability and variety of assistive devices as well as home health policy have changed significantly over time and it is, therefore, important to use the most recent time period available. Although our main analyses will focus on the 2002-2004 period, additional analyses will also explore how results are affected if additional time periods (e.g.1998 – 2000 and 2000-2002) are included.

Analytic Samples

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[1] In 1998, the HRS and AHEAD surveys merged and a cohort of respondents was added to fill the gap in ages between the original HRS sample (age 57 to 67 in 1998) and the original AHEAD sample (age 75 and over in 1998). Therefore, the sample of respondents age 65 and over in 2002 have been in the study for different periods of time.

For analyses of cross-sectional use of mobility devices, we first select all 10,612 community dwelling adults age 65 and over in 2004 who were eligible to be interviewed in the 2004 wave and who completed an interview. We exclude an additional 13 respondents missing on race and 192 respondents who identified their race as "other". There are not enough cases classified as "other" to sustain a separate category nor could these respondents be combined with other race/ethnicity groups because they differ unsystematically from other race groups on a number of variables including, mobility device use, functioning, education, income, and wealth (analyses not shown). Since we are interested in understanding how racial differences in rates of cross-sectional use are influenced by racial differences in adopting and abandoning mobility devices over time, we further drop 319 cases that were interviewed only in the 2004 wave. To check for potential bias in excluding these cases, we reran all analyses of cross-sectional use in 2004 using a sample that included these 319 cases. The results were nearly identical to those that excluded these cases. Our final sample size for analyses of cross-sectional use, then, is 10,088.

For analyses of adoption and abandonment, we start with the 2004 sample used for analyses of cross-sectional use and follow them back to assess their device use status in 2002 and examine rates of adoption and abandonment between 2002 and 2004. Analysis of adoption is limited to the subset of the 2004 respondents who are not using devices in 2002 (N=8,816); analysis of abandonment is limited to the remaining respondents who are using devices in 2002 (N=1,240)[2].

By drawing our sample in this way, conclusions about racial disparities may be biased because we exclude respondents who died or were lost to follow-up (LFU) between 2002 and 2004. To assess the direction of this bias, we examined whether there were race differences in mortality and being lost to follow-up among those *not using* mobility devices in 2002 and among those *using* mobility devices in 2002. Among those using devices in 2002, Blacks were significantly more likely to die or be lost to follow-up than Whites (7.9 percent of whites, 10.3 percent of blacks and 7.4 percent of Hispanics died or were LFU). As such, we are likely underestimating the amount of adoption among blacks to a greater extent than among Whites, and, therefore, underestimating the difference between Blacks and Whites. There were no significant race differences in mortality or LFU among those *using* in 2002. Excluding those who died or were LFU, therefore, is not likely to affect abandonment analyses.

Measures

Mobility devices and personal care: We examine racial differences in the use, adoption, and abandonment of mobility devices in the context of personal care arrangements. Respondents are asked whether they use mobility devices, such as a cane, walker, or wheelchair when a) crossing a room or b) when getting in or out of a chair. Respondents also report which devices they use. If respondents use devices for either of the listed activities, they are classified as using a mobility device.[3] Respondents are also asked to report whether anyone ever helps with these activities and are classified as using personal care for mobility if they report receiving help with these activities.

The outcomes vary depending on whether the cross-sectional use, adoption or abandonment of devices is the focus of the analysis. We analyze two measures of use: 1) a dichotomous measure that indicates whether a respondent uses mobility devices in 2004 and 2) a 4-category variable that indicates whether a respondent uses in 2004 a) no assistance (omitted category), b) devices only, c) personal care only, or d) both personal care and devices. For adoption, we analyze the following two outcomes among respondents *not using* devices in 2002: 1) a dichotomous measure of those using devices in 2004 and 2) a three-category outcome a) uses no devices (omitted category), b) uses devices only, and c) uses both devices and personal care, all measured in 2004. For abandonment, we will analyze the following two

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[2] Note that we had to drop an additional 26 respondents from the 2004 sample because their 2002 weight is 0. These respondents were either living in a nursing home or were not cohort eligible in 2002.)

[3] . Note these measures are worded in such a way that they may be capturing the use of devices for indoor mobility and may omit devices used solely outdoors.

outcomes among respondents *using* devices in 2002: 1) a dichotomous measure of those not using devices in 2004 and 2) a three-category outcome, a) uses devices (omitted category), b) uses personal care only, and c) uses neither devices nor personal care, all measured in 2004.

Data can be missing on device use and personal care for two reasons: 1) the survey design skipped a respondent around these questions; and 2) a respondent did not provide an answer. For the respondents who were skipped around the device use and personal care questions and for item non-response (don't knows or refusals), we assume that the respondents do not use any mobility devices or personal care. This strategy for item non-response affects less than 0.7 % of cases included in the sample.

Race and ethnicity: The primary variable of interest is race/ethnicity. Analyses examine differences by a combined race/ethnicity variable: non-Hispanic Black (Black), non-Hispanic White (White), and Hispanic.

Need Factors: Need is reflected in indicators of functioning and chronic conditions. Functioning is assessed using two scale indicators of the number of upper body and lower body activities with which a respondent has difficulty (Freedman et al. 2003). Upper body limitations include having difficulty (yes, no, can't do) with: pulling or pushing large objects; lifting or carrying weights more than 10 pounds; getting up from a chair after sitting for long periods; sitting for about two hours; and reaching or extending arms above shoulder level. Lower body limitations include having difficulty with: stooping, kneeling, or crouching; walking several blocks; walking one block; climbing several flights of stairs without resting; and climbing one flight of stairs without resting. We also included measures of change in functioning between 2002 and 2004. Changes in functioning are entered as a difference between time 1 and 2 measures in the number of upper and lower body limitations. These functional limitations measures, however, have both floor and ceiling effects in that those with zero functional limitations at time 1 can not experience improvements in functioning and those with the maximum number of limitations can not experience a decline. To overcome this aspect of the measures, a variable indicating whether a respondent's time 1 functional limitation measures are at the floor or ceiling is included.

Because research has shown that the severity of difficulty, not just presence of difficulty, with activities can affect the choice of care arrangements, we also examined a severity scale that summed the scores across the range of difficulty (none, some, can't do) for each upper and lower body task. Results (not shown) were nearly identical. We, therefore, retained the measures of number of upper and lower body functional limitations.

The effects of chronic conditions are measured using indicators of whether a respondent has ever been told by a doctor that he or she has ever had the following conditions: hypertension, diabetes, heart disease (including heart attack, angina, congestive heart failure or other heart problems), stroke (indicating cerebrovascular disease), arthritis, and obesity (bmi>=30). Change in chronic conditions will be indicated by incidence of each condition.

Enabling Factors: Enabling factors include three indicators of economic status (income, assets, and health insurance) and health care utilization. We will use the RAND derived measures of income and assets (http://hrsonline.isr.umich.edu/meta/rand/randhrsf/randhrsf.pdf). Income is a measure of total couple income from earnings, capital, pensions/annuities, social security, unemployment/workman's compensation, and other government transfers. Total assets include the values of real estate (both primary home and other), vehicles, businesses, IRAs, keogh accounts, stocks, bonds, mutual funds, savings/money market accounts and other savings. For both income and assets, we use a quartile specification. Additional analyses will explore whether tertiles or more refined categories fit better and influence racial disparities more. For assets, additional analyses will also test measures that separate out housing wealth.

The second indicator of economic access is a measure of health insurance.   While Medicare covers personal care assistance only for individuals who cannot leave the home and who also require skilled nursing care, coverage for durable medical equipment is limited to medically necessary, reusable medical items that are ordered by a physician for use in the home. Medicaid has a home health benefit

that covers nursing, home health aides, and medical equipment suitable for use in the home. Half the states also have a personal care benefit and almost all states have a home and community-based waiver program, which has the option of covering a wider range of assistive technologies. Many long-term care insurance policies allow assistive technology to be purchased under an alternative care plan. Health insurance is, therefore, coded as follows: 1) Medicare alone, 2) Medicare & Medicaid, 3) Medicare and Supplemental Insurance (private, VA, and/or long-term care) and 4) other. Additional analyses will also examine a specification that breaks out long-term care insurance from other forms of supplemental insurance.

Finally, we use three indicators of health care utilization: any overnight hospitalizations, number of visits with medical professionals, and any stays at a nursing home or other long-term care facility. The HRS asks about the use of these services in the last 2 years or since the respondent's last interview.

Predisposing Factors: Although not the primary interest of this research, previous research has shown that choice of care arrangement can vary by other predisposing factors including, age, sex, education, and kin availability. To ensure that results are not confounded, analyses will control for these variables. Measures of kin availability include marital status (married vs not married) and number of living children (0 children, 1 child, 2-3 children and 4 or more children). Analyses involving education examine contrasts between those with less than a high school education, a high school education, and more than high school education.

Analysis

We first tested for racial differences in need, enabling, and predisposing factors and use of mobility devices, both alone and in combination with personal care, in 2004, using t-tests for differences in means of continuous variables and chi-square tests for categorical variables.

We then fit a series of five logistic regression models to predict use. The first includes race and ethnicity only. The second adds the other predisposing (control) variables. Next we add need-related factors to determine whether the relationship between race and ethnicity and device use changes when need is controlled. We also run a model that includes race, predisposing and enabling characteristics to examine the effect of race and ethnicity when enabling factors are controlled. Finally, we run a model that contains all the variables of interest. All analyses are weighted and adjusted for sample design.

Previous research has shown that devices are often used in combination with personal care and our framework suggests that we model outcomes of device use and personal care. However, our data will not support these analyses. (See discussion of Table 2 below). We, therefore, analyze only the dichotomous measure of use.

Additional analyses will include a Oaxaca decomposition to determine how much of the racial differences in mobility device use are explained by the predisposing, need and enabling factors together and separately.

PRELIMINARY RESULTS
Racial differences in need, enabling and control factors
 Table 1 shows that, in general, Non-Hispanic Black (Blacks) and Hispanic elders have more need than non-Hispanic Whites (Whites). Both Blacks and Hispanics have more upper and lower body functional limitations than Whites and are more likely to have ever had hypertension and diabetes. While Blacks are more likely than Whites to have ever had a stroke or arthritis, Hispanics are less likely than Whites to have had these two conditions. One exception is heart disease, where Blacks and Hispanics are less likely than Whites to have ever had heart disease.

Minorities also have fewer available resources (enabling factors) than their White counterparts. The average couple income for Blacks is a little more than half the income of Whites and Hispanics have less than half the income of Whites. The gap in total assets, including the value of ones home, is even larger. Whites have assets that value 4 to 6 times the value of the assets of Hispanics and Blacks,

respectively. Although overnight hospitalizations and number of visits with medical professionals do not vary by race, both Blacks and Hispanics are significantly less likely to have had contact with a nursing home, a likely important source for procuring mobility devices.

Finally, Blacks and Hispanics differ from Whites with respect to the predisposing variables. Minorities are slightly younger, have less education, are less likely to be currently married and have more living children than Whites.

Racial differences in use, adoption and abandonment of mobility devices:

In Table 2 we analyze racial differences in the use, adoption and abandonment of mobility devices. Black elders are the most likely to be using any mobility devices (25.3 %) followed by Hispanics (19.9 %) and Whites (15.7 %). This pattern also holds true for most individual pieces of equipment – walkers, canes, wheelchairs and "other" equipment. The one exception is crutches. Hispanics are slightly more likely than Blacks or Whites to use crutches, although less than 1 percent overall and of any race group uses this device.

Minorities also have slightly higher rates of using personal care for mobility, both alone and in combination with assistive devices (second panel, Table 2). Although less than 1 percent of all race/ethnicity groups use personal care alone for mobility, minorities are nearly twice as likely to be using mobility devices in combination with personal care.

Table 2 also shows that rates of adoption but not rates of abandonment differ by race. Among elders <u>not</u> using a mobility device in 2002, minorities, particularly Blacks, are significantly more likely than Whites to start using a mobility device by 2004, primarily using them alone rather than in combination with personal care. Overall, 12.4 percent of Blacks and 8.1 percent of Hispanics compared to 7.6 percent of whites adopted mobility devices (panel 3). However, there are no differences in rates of abandonment with approximately 20 percent of Whites, Blacks and Hispanics no longer using devices in 2004 that were used in 2002.

Although there are no racial differences in the abandonment of devices, Blacks and Hispanics have higher rates of abandoning devices but using personal care for mobility difficulty (last panel, Table 2). While 2.6% of Blacks and 2.2% of Hispanics who used a device in 2002 use only personal care in 2004, only 1.4% of Whites have this same care pattern.

Explaining racial differences in the use of mobility devices

Finally, we examine whether other predisposing factors and need and enabling factors explain racial differences in the use of mobility devices. Table 3 shows the odds ratios from logistic regression models that predict mobility device use in 2004. Results show that both Blacks and Hispanics are significantly more likely to use devices than Whites (OR=1.82, 1.34 respectively). Including the other predisposing factors reduces the size of the odds ratio for Blacks to 1.67, although the difference between Blacks and Whites is still significant. For Hispanics, the odds ratio is reduced to 1.19 and is insignificant. Controlling for both predisposing and need factors, the odds ratio for Blacks is further reduced to 1.51. The Black-White racial gap in device use becomes even smaller when adding enabling factors to the predisposing factors (OR=1.27). When all predisposing, need and enabling factors are included, the odds ratio bounces back up slightly to 1.41, suggesting that the effects of need factors are offsetting some of the effects of enabling factors. In all models, the difference between Blacks and Whites remains significant.

SUMMARY

In this study, we investigated a) whether there is a difference by race in mobility device use b) whether this difference is do to racial differences in rates of adoption and abandonment of devices and c) to what extent racial and ethnic differences in need and enabling factors account for differences in mobility device use. We found that minority elders were more likely than White elders to use mobility devices and that this difference is largely do to the fact that minorities, Blacks in particular, were more

likely to start using devices during the period of study and were no different than Whites in rates of abandonment.

That minority older adults use mobility devices more often than Whites is consistent with their higher rates of need for devices. Controlling for need reduced the difference between minorities, providing some evidence that differences in need accounts for some of the difference in device use. However, results also suggest that, although there were no significant racial differences in rates of abandonment of devices, minorities were more likely to be using personal care without devices at the end of the period, particularly Black elders. As such, minorities may be abandoning devices at rates that are higher than their rates of recovery. In other words, minorities may stop using mobility devices while there is still a need for the device. Although we did not have enough power to detect significant differences here, further investigation into the relationship between race, recovery and abandonment is warranted.

We also find that enabling factors - income, assets, health insurance and health care utilization – account for some of the racial difference in device use. With Whites having greater economic resources and better health care coverage, we might have expected that, controlling for other factors, White older adults would be more likely than minority older adults to use mobility devices. However, the types of devices most often used for mobility - specifically walkers, wheelchairs and canes - need to be considered. While canes are relatively inexpensive and readily available at local drug stores, wheelchairs and walkers may be covered to a great extent for those dually eligible for Medicare and Medicaid. In fact, the multivariate models show that those with more income and those with supplemental insurance are less likely to be using mobility devices. Had more expensive types of devices, such as home modifications, been involved, the effects of the enabling factors may have been different. This is consistent with findings from Rubin and White-Means (2001) who report that Black older adults were more likely to use portable assistive devices and White older adults were more likely to use home modifications to accommodate their disabilities.

Although our results suggest that predisposing, need and enabling factors account for some of the racial differences in device use, it is clear that not all of the difference is explained. The proposed decompositions will provide further insight into the relative importance of predisposing, need and enabling factors in explaining racial differences in mobility device use by race.

 Works Consulted

Agency for HealthCare Research and Quality. 2003. *National Health Care Disparities Report*. Accessed May 21, 2004: http://www.qualitytools.ahrq.gov/disparitiesreport/download_report.aspx

Agree, E.M. 1994. The role of technology in long-term care portfolios. Paper presented at the AHEAD Early Results Workshop, University of Michigan, September 1994.

Agree, E.M. 1999. The influence of personal care and assistive devices on the measurement of disability. *Social Science and Medicine*, 48, 427-443.

Agree, E.M. and Freedman, V.A. 2000. Incorporating assistive devices into community-based long-term care: An analysis of the potential for substitution and supplementation, *Journal of Aging and Health* 12(3):426-450.

Agree, E.M., Freedman, V.A., and Cornman, J.C. 2002. Reconsidering substitution in long term care: When does assistive technology take the place of personal care? Paper Presented at the Annual Meeting of the Gerontological Society of America, November 2002, Boston, MA.

Agree E.M., Freedman V.A., Sengupta, M. 2004. Factors influencing the use of mobility technology in community-based long-term care. *Journal of Aging Health*, 16(2), 267-307.

Allen, S.M., Foster, A., and Berg, K. 2001. Receiving help at home: the interplay of human and technological assistance. *Journals of Geronotology: SOCIAL SCIENCES*, 56B(6), S374-S382.

Andersen, R. 1995. Revisiting the behavioral model and access to medical care: Does it matter? *Journal of Health and Social Behavior*, 36, 1 – 10.

Andersen, R. and Newman, J.F. 1973. Societal and Individual Determinants of Medical Care Utilization in the United States. *Milbank Memorial Fund Quarterly*, 51, 95-124.

Bryant L.L., Shetterly S.M., Baxter J., and Hamman R.F. 2002.Changing functional status in a biethnic rural population: the San Luis Valley. *American Journal of Epidemiology*, 155, 361-7.

Cagney, K., Cornman, J.C., Freedman, V.A., Agree, E.M., Cohen, M. and Williams, J. 2002. The impact of assistive device use on caregiver time and burden. Paper Presented at the Annual Meeting of the Gerontological Society of America, November 2002, Boston, MA.

Carmines, E.G. and Zeller, R.A. 1979. *Reliability and Validity Assessment*. Sage University Paper series on Quantitative Applications in the Social Sciences, series no.07-017. Beverly Hills and London: Sage Publications.

Clark D.O., Mungai S.M., Stump T.E., and Wolinsky, F.D. 1997. Prevalence and impact of risk factors for lower body difficulty among Mexican Americans, African Americans, and whites. *Journal of Gerontology: Medical Sciences*, 52, M97 – 105

Cornman, J.C., V.A. Freedman, and E.M. Agree. 2005. Measurement of assistive device use: Implications for estimates of device use and disability in late life. *Gerontologist*, 45(3), 347-58.

Crystal, S., Johnson, R.W., Harman, J., Sambamoorthi, U., and Kumar, R. 2000. Out-of-pocket health care costs among older Americans. *Journal of Gerontology: Social Sciences,* 55b, S51-S56.

Crystal, S. and Shea, D. 1990. Cumulative advantage, cumulative disadvantage, and inequality among elderly people. *The Gerontologist*, 30, 437-443.

Cushman, L.A. and Scherer, M.J. 1996. Measuring the relationship of assistive technology use, functional status over time, and consumer-therapist perceptions of ATs. *Assistive Technology*, 8(2):103-9.

De Klerk, M.M. and Huijsman, R. 1996. Effects of technical aids on the utilization of professional care: A study among unmarried 75-year olds, *Tijdschrift voor Gerontologie en Geriatrie*, 27(3):105-114.

Dunlop, D.D., Manheim, L.M., Song, J., Chang, R.W. 2002. Gender and ethinc/racial disparities in health care utilization among older adults. *Journal of Gerontology: SOCIAL SCIENCES,* 57B(3), S221-S233.

Ferguson WJ, Candib LM. 2002. Culture, language, and the doctor-patient relationship. *Family Medicine*, 34, 353-61

Freedman, V.A., Agree, E.M., Martin, L., and Cornman, J. 2004. Trends in disability and assistance: are they related? Paper presented at the National Bureau of Economic Research conference on Disability Trends, Charlotte, SC, February 2004.

Freedman, V.A., Aykan, and Kleban, M.H. 2003. Asking neutral versus leading questions: implications for functional limitation measurement. *Journal of Aging and Health*, 15(4), 661-687.

Freedman, V.A., Schoeni, R.F., Martin, L., Agree, E.M. and Cornman, J.C. 2004. Trends in late-life disability and assistance: are socioeconomic and racial gaps widening? Paper submitted for presentation at the annual meeting of the Gerontological Society of America, November 2004, Washtington, D.C.

Gitlin, L.N. and Levine, R. 1992. "Prescribing Adaptive Devices to the Elderly: Principles for Treatment in the Home", *International Journal of Technology and Aging*, 5(1):107-118.

Gitlin, L.N., Levine, R, and Geiger, C. 1993. Adaptive device use in the home by older adults with mixed disabilities. *Archives of Physcial Medicine and Rehabilitation*, 74, 149-152.

Gitlin, L.N., Schemm, R.L., Landsberg, L., Burgh. D. 1996. Factors predicting assistive device use in the home by older people following rehabilitation. *Journal of Aging and Health*, 8(4), 554-575.

Gitlin, L.N., Mann, W.C., Tomit, M., and Marcus, S.M. 2001. Factors associated with home environmental problems among community-living older people. *Disability and Rehabilitation*, 23(17), 777-787.

Hartke, R.J., Prohaska, T.R., and Furner, S.E. 1998. Older adults and assistive devices: Use, multiple-device use and need, *Journal of Aging and Health*, 10(1), 99-116.

Hoenig, H., Taylor, D.H., and Sloan, F.A. 2003. Does assistive technology substitute for personal assistance among the disabled," *American Journal of Public Health* 93(2): 330-337.

Kington, R.S. and Smith, J.P. 1997. Socioeconomic status and racial and ethnic differences in functional status associated with chronic diseases. *American Journal of Public Health*, 87, 805-810.

Mann, W.C., Goodall, S., Justiss, M.D., and Tomita, M. 2002. Dissatisfaction and nonuse of assistive devices among frail elders. *Assistive Technology*, 14(2), 130-9.

Mann, W.C., Hurren, D., and Tomita, M. 1993. Comparison of assistive device use and needs of home-based older persons with different impairments. *American Journal of Occupational Therapy*, 47, 980-87.

Mann, W.C., Ottenbacher, K.J., Fraas, L., Tomita, M., and Granger, C.V. 1999. Effectiveness of assistive technology and environmental interventions in maintaining independence and reducing home care costs for the frail elderly: A randomized control trial. *Archives of Family Medicine*, 8, 210 – 217.

Manton, K.G., Corder, L., & Stallard, E. 1993. Changes in the use of personal assistance and special equipment from 1982 to 1989: Results from the 1982 and 1989 NLTCS. *The Gerontologist*, 33, 168-176.

Mathieson, K.M., Jacobs Kronenfeld, J., and Kieth, V.M. 2002. Maintaining functional independence in elderly adults: The roles of health status and financial resources in predicting home modifications and use of mobility equipment. *The Gerontologist*, 42(1), 24-31.

Medicare Current Beneficary Survey (MCBS). National Center for Health Statistics, Trends in Health and Aging. http://www.cdc.gov/nchs/agingact.htm. Accessed on [September 22, 2006].

Mendes de Leon C.F., Beckett L.A., Fillenbaum G.G., Brock D.B., Branch L.G., Evans D.A., Berkman L.F. 1997. Black-white differences in risk of becoming disabled and recovering from disability in old age: a longitudinal analysis of two EPESE populations. *American Journal of Epidemiology*, 145, 488-97.

Mendes de Leon, C.F., Fillenbaum, G.G., Williams, C.S., Brock, D.B., Beckett, L.A,, Berkman L.F. 1995. Functional disability among elderly blacks and whites in two diverse areas: the New Haven and North Carolina EPESE. Established Populations for the Epidemiologic Studies of the Elderly. *American Journal of Public Health*, 85(7), 994-8.

Mui, A. and Burnette, D. 1994. Long term care service use by frail elders: Is ethnicity a factor? *The Gerontologist*, 34, 190-198.

Newman S. 2003. The living conditions of elderly Americans. Gerontologist. Feb;43(1):99-109.

Norburn, J.E.K., Bernard, S., Konrad, T., Woomert, A., DeFriese, G., Kalsbeek, W., Koch, G.G., and Ory, M. 1995. Self-care and assistance from others in coping with functional status limitations among a national sample of older adults. *Journal of Gerontology: Social Sciences*, 50B(2), S101-S109.

Oaxaca, R. 1973. Male-Female wage differentials in urban labor markets. *International Economic Review*, 14, 693 – 709.

Phillips, B. and Zhao, H. 1993. Predictors of Assistive Technology Abandonment. *Assistive Technology*, 5, 36-45.

Pew, R.W. and Van Hemel, S.B. (*Editors*), *Technology for Adaptive Aging* Steering Committee for the Workshop on Technology for Adaptive Aging, National Research Council 2004.

RAND. 2004. *RAND HRS Data Documentation, Version F*. http://hrsonline.isr.umich.edu/meta/rand/randhrsd/randhrsd.pdf, accessed August 18, 2005

Rankin S.H. 2002. Women recovering from acute myocardial infarction: psychosocial and physical functioning outcomes for 12 months after acute myocardial infarction. *Heart and Lung*, 31, 399-410.

Resnick, L and Allen, S. 2006. Racial and Ethnic Differences in Use of Assistive Devices for Mobility Effect Modification by Age. Journal of Aging and Health, 18(1): 106-124

Rogers, J.C., Holm, M.B., Perkins, L. 2002. Trajectory of assistive device usage and user and non-user characteristics: long-handled bath sponge. *Arthritis Rheumatism*, 47(6):645-50.

Roelands, M., Van Oost, P.V., Depoorter, A.M., and Buysse, A. 2002. A social-cognitive model to predict the use of assistive devices for mobility and self-care in elderly people. *The Gerontologist*, 42(1), 39-50.

Rubin, R.M., and White-Means, S.I. 2001. Race, disability and assistive devices: sociodemographics or discrimination. *International Journal of Social Economics*, 28(10/11/12), 927-941.

Schoeni, R., Freedman, V.A. and Wallace, R. 2002. Late-life morbidity trajectories and socioeconomic status. *Annual Review of Gerontology and Geriatrics*, 22, 184-206.

Shea, D.G., Miles, T. and Haward, M. 1996. The health-wealth connection: Racial differences. *The Gerontologist*, 36, 342-249.

Smith, R, Quine, S., Anderson, J., Black K. 2002. Assistive devices: self-reported use by older people in Victoria. *Australian Health Review*, 25(4), 169-77.

Stump T.E., Clark D.O., Johnson R.J., and Wolinsky F.D. 1997. The structure of health status among Hispanic, African American, and white older adults. *Journals of Gerontology: Psychological Sciences*, 52, Spec No:49-60.

Tomita M.R., Mann W.C., Fraas L.F., and Burns LL. 1997. Racial differences of frail elders in assistive technology. *Assistive Technology*, 9, 140-51.

Verbrugge, L.M., Rennert, C., and Madans, J.H. 1997. The great efficacy of personal and equipment assistance in reducing disability. *American Journal of Public Health*, 87(3), 384 – 392.

Verbrugge, L.M. and Sevak, P. 2002. Use, Type and efficacy of assistance for disability. *Journals of Gerontology: SOCIAL SCIENCES*, 57B(6), S366-S379.

Weaver, F.M., Giobbie-Hurder, A.G., Hughs, S.L., Smith, G., Kubal, J.D., Ulasevich, A. 1999. Home medical equipment receipt in a home care appropriate population. *Journal of Aging and Health*, 11(4), 494-516.

White-Means, S.I. 2000. Racial patterns in disabled elderly persons' use of medical services. *Journal of Gerontology: SOCIAL SCIENCES,* 55B(2), S76 – S89.

White-Means, S.I. and Rubin, R.M. 2004. Is there equity in the home health care market? Understanding racial patterns in the use of formal home health care. *Journals of Gerontology: Social Sciences*, 59B, S220 – S229.

Wolinsky, F., Aguierre, B., Fann, L.-J., Keith, V., Arnold, C. Niederhauser, J., and Dietrich, K. 1989. Ethnic Differences in the demand for physician and hospital utilization among older adults in major American cities: Conspicuous evidence of considerable inequalities. *Milbank Quarterly*, 67, 412-448.

Wolinsky, F. and Johnson, R. 1991. The use of health services by older adults. *Journals of Gerontology: Social Sciences*, 46, S345-S357.

Young R.F., Waller J.B. Jr, and Kahana E. 1991. Racial and socioeconomic aspects of myocardial infarction recovery: studying confounds. *American Journal of Preventative Medicine*, 7, 438-44.

Zimmer, A. and Chappell, N. 1994. Mobility restrictions and the use of devices among seniors. *Journal of Aging and Health*, 6(2), 185-208.

Figure 1: Framework for evaluating need and enabling factors as mediators of the race-care arrangement

PREDISPOSING FACTORS
Race and Ethnicity
Other (age, sex, marital status, kin availability, education, health beliefs)

NEED FACTORS
(chronic conditions, functioning, environmental barriers)

ENABLING FACTORS
(income, assets, health insurance, health care utilization)

CARE ARRANGEMENT
Use, adoption or abandonment of mobility devices

Personal care
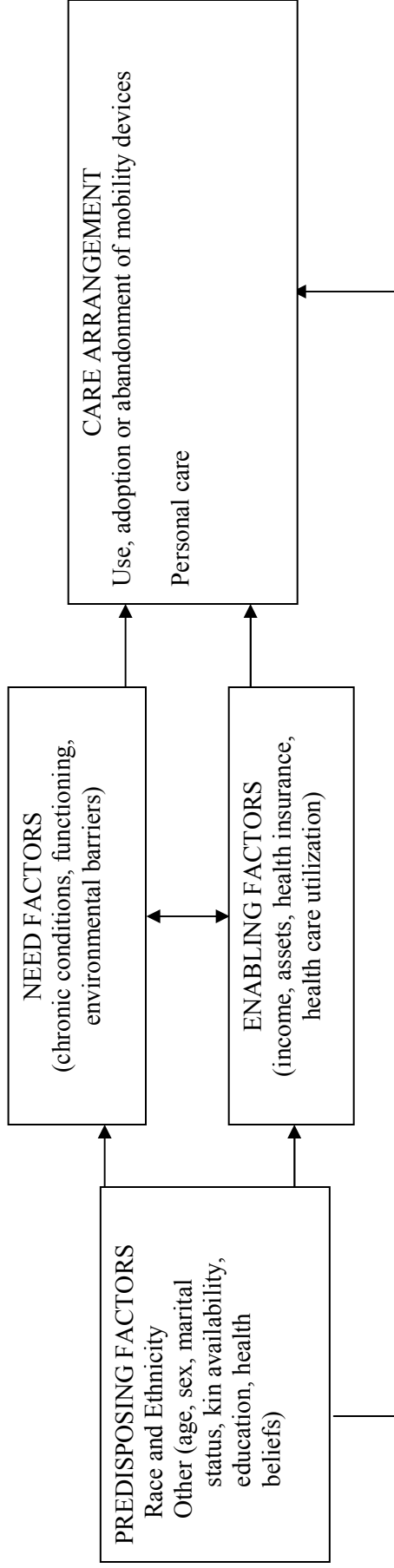
Table 1: Racial and Ethnic Differences in Need, Enabling and Control Factors in 2004: Weighted Means and Percents

	Total	White Non-Hispanic	Black Non-Hispanic		Hispanic	
Sample size	10,088	7,972	1,314		802	
NEED						
Functioning						
Mean number of upper body limitations	1.4	1.4	1.9	**	1.7	**
Mean number of lower body limitations	1.9	1.9	2.2	**	2.1	**
Chronic conditions (percent ever had)						
Hypertension	61.2	59.9	75.9		61.0	**
Diabetes	19.5	17.9	30.9		30.1	**
Heart disease	33.0	33.9	29.8		2.9	**
Stroke	11.0	10.8	14.4		8.7	**
Arthritis	69.0	69.0	72.9		64.7	**
Obesity	21.2	19.8	32.5		26.3	**
Missing obesity	1.1	1.0	1.2		2.3	
ENABLING						
Mean total couple income from earnings	47,984	51,389	27,550	**	21,347	**
Mean total assets (including home)	469,848	523,828	90,242	**	133,159	**
Health Insurance (percent)						
Medicare alone	29.1	27.7	37.0		41.3	**
Medicare and Medicaid	6.3	3.7	19.4		29.3	
Medicare and supplemental insurance	59.9	64.6	34.5		18.3	
other	4.8	4.0	9.2		11.1	
Health Care Utilization in previous 2 years (percent)						
Any overnight hospitalizations	30.4	30.3	27.5		30.3	
Mean number of visits with medical professionals	11.0	11.0	11.2		11.7	
Any nursing home stays	3.4	3.6	3.3		1.4	*
PREDISPOSING						
Age						
65-69	27.8	27.2	31.6		33.1	**
70-74	24.6	24.5	25.6		25.3	
75-79	21.3	21.2	22.1		21.3	
80-84	15.4	16.0	11.8		11.5	
85+	10.9	11.1	8.9		8.8	
Mean age						
Sex						
Male	42.8	43.4	38.0		41.1	
Female	57.2	56.7	62.0		58.9	

	Total	White Non-Hispanic	Black Non-Hispanic	Hispanic	
Education					
Less than high school	25.0	20.3	50.2	67.2	**
High school	38.1	39.9	29.1	20.3	
More than high school	36.9	39.8	20.7	12.5	
<u>Kin availability</u>					
Marital status					
Married	57.6	59.6	38.2	54.6	**
Number of living children					
0	1.7	1.6	2.2	1.7	
1	9.7	9.6	11.9	7.9	
2-3	45.6	47.9	28.9	32.5	
4+	36.2	34.1	49.6	51.2	
missing	6.8	6.8	7.3	6.8	

Note: The test for significant racial differences in categorical variables is a chi-square test. The test for significant racial differences in continuous variables is a t-test that compares Blacks to Whites and Hispanics to Whites. Both tests are adjusted for the HRS complex sample design.
* $p < 0.05$ ** $p < 0.01$

Table 2: Mobility Device Use in 2004 and Adoption and Abandonment of Mobility Devices 2002-2004 by Race and Ethnicity

	Total	White Non-Hispanic	Black Non-Hispanic	Hispanic	
Mobility device use					
Use any mobility device 2004	16.6	15.7	25.3	19.9	**
Use walker in 2004	7.5	7.2	9.7	9.4	**
Use cane in 2004	11.1	10.3	19.0	13.6	**
Use crutches in 2004	0.2	0.2	0.2	0.6	*
Use wheelchair in 2004	2.4	2.2	5.0	2.2	**
Use other equipment in 2004[a]	2.2	2.1	3.4	1.9	*
Mobility device use and personal care (2004)					
Uses neither mobility devices or personal care	82.9	83.9	73.8	79.2	**
Use only mobility devices	14.8	14.0	22.2	16.2	
Use only personal care	0.5	0.4	0.9	0.9	
Use mobility devices and personal care	1.9	1.7	3.1	3.7	
N	10,088	7,972	1,314	802	
Adopt mobility devices					
Among those not using mobility devices in 2002, percent using a mobility device in 2004	8.0	7.6	12.4	8.1	**
Adopt mobility devices and personal care					
Among those <u>not</u> using mobility devices in 2002…					
percent not using mobility devices in 2004	92.0	92.4	87.6	92.0	**
percent using mobility devices only in 2004	7.7	7.4	11.7	7.8	
percent using both mobility devices and personal care in 2004	0.3	0.2	0.7	0.3	
N	8,816	7,083	1,052	681	
Abandonment of mobility devices					
Among those using mobility devices in 2002, percent not using a mobility device in 2004	20.5	20.42	21.0	20.2	
Abandonment of mobility devices and personal care					
Among those using mobiity devices in 2002….					
percent using mobility devices in 2004	79.5	79.58	79.0	79.8	
percent using personal care only	1.6	1.38	2.6	2.2	
percent using neither mobility devices nor personal care in 2004	18.9	19.0	18.4	18.0	
N	1,240	864	260	116	

[a]Other equipment includes: railing, orthopedic shoes, brace, prosthesis, oxygen/resiprator, furniture/walls, and other unspecified

Note: The test for significant racial differences is a chi-square test. * $p < 0.05$ ** $p < 0.01$

Table 3: Odds Ratios for the Effects of Race and Ethnicity on the Use of Mobility Devices Controlling for Predisposing, Need and Enabling Factors

	Race	Race, Predispos.	Race, Predispos., Need	Race, Predispos., Enabling	Race, Predispos., Need, Enabling
RACE					
non-hispanic black	1.82**	1.67**	1.51**	1.27*	1.41**
	(0.14)	(0.15)	(0.18)	(0.12)	(0.17)
hispanic	1.34**	1.19	1.25	0.81	1.07
	(0.14)	(0.14)	(0.18)	(0.10)	(0.17)
PREDISPOSING FACTORS					
Age (65-69 omitted)					
70-74		1.46**	1.51**	1.38**	1.49**
		(0.15)	(0.19)	(0.14)	(0.19)
75-79		2.08**	1.91**	1.92**	1.89**
		(0.21)	(0.24)	(0.20)	(0.24)
80-84		3.10**	2.69**	2.88**	2.71**
		(0.32)	(0.35)	(0.31)	(0.36)
85+		6.95**	5.82**	6.21**	5.69**
		(0.73)	(0.80)	(0.69)	(0.79)
Sex (male omitted)					
female		1.23**	0.73**	1.18*	0.73**
		(0.08)	(0.06)	(0.08)	(0.06)
Education (less than high school omitted)					
GED/HS diploma		0.68**	1.03	0.85	1.11
		(0.05)	(0.10)	(0.07)	(0.11)
more than HS		0.60**	1.23*	0.91	1.35**
		(0.05)	(0.13)	(0.09)	(0.15)
Marital Status (not married omitted)					
married or cohabitating		0.75**	0.84*	1.09	0.95
		(0.05)	(0.07)	(0.09)	(0.09)
Number of Children (0 omitted)					
has 1 kid t2		0.85	0.69	0.83	0.69
		(0.20)	(0.21)	(0.20)	(0.21)
has 2-3 kids t2		0.76	0.78	0.71	0.74
		(0.17)	(0.22)	(0.16)	(0.21)
has 4+ kids t2		0.84	0.75	0.69	0.68
		(0.19)	(0.22)	(0.16)	(0.20)
missing on num kids t2		0.81	0.84	0.75	0.79
		(0.20)	(0.26)	(0.19)	(0.25)
NEED FACTORS					
Upper Body Functioning					
number of upper body functional limitations			1.42**		1.39**
			(0.07)		(0.07)
improved upper body functioning			0.72**		0.74**
			(0.07)		(0.08)
decline in upper body functioning			1.73**		1.64**

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	(0.17)	(0.16)
time 1 upper body measure was at floor	1.03	1.01
	(0.15)	(0.15)
time 1 upper body measure was at ceiling	0.99	1.00
	(0.17)	(0.18)
Lower Body Functioning		
number of lower body functional limitations	2.06**	2.00**
	(0.10)	(0.10)
improved lower body functioning	0.46**	0.46**
	(0.05)	(0.05)
decline in lower body functioning	3.23**	3.03**
	(0.31)	(0.30)
time 1 lower body measure was at floor	0.88	0.88
	(0.16)	(0.16)
time 1 lower body measure was at ceiling	1.60**	1.57**
	(0.24)	(0.23)
Chronic Conditions		
High Blood Pressure		
onset high blood pressure	0.95	0.93
	(0.17)	(0.16)
ever had high blood pressure	1.03	1.02
	(0.09)	(0.09)
Diabetes		
onset diabetes	0.92	0.90
	(0.22)	(0.22)
ever had diabetes	1.25*	1.16
	(0.12)	(0.12)
Heart Disease		
onset heart disease	1.00	0.82
	(0.17)	(0.14)
ever had heart disease	0.93	0.84
	(0.08)	(0.07)
Stroke		
onset stroke	1.89**	1.55
	(0.44)	(0.35)
ever had stroke	1.66**	1.55**
	(0.19)	(0.18)
Arthritis		
onset arthritis	1.37	1.35
	(0.27)	(0.27)
ever had arthritis	1.38**	1.38**
	(0.15)	(0.15)
Obesity		
lost weight	1.57**	1.56**
	(0.27)	(0.27)
onset obesity	0.79	0.76
	(0.18)	(0.18)
obese at time 1 and time 2	1.14	1.18
	(0.12)	(0.12)

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missing obese t1 and/or t2				1.07	1.14
				(0.26)	(0.28)

ENABLING FACTORS

Income (1st quartile omitted)

2nd quartile income				0.86	0.98
				(0.07)	(0.10)
3rd quartile income				0.60**	0.78
				(0.07)	(0.11)
4th quartile income				0.46**	0.72
				(0.08)	(0.14)

Assets (1st quartile omitted)

2nd quartile assets				0.74**	0.85
				(0.07)	(0.09)
3rd quartile assets				0.56**	0.84
				(0.06)	(0.11)
4th quartile assets				0.58**	0.99
				(0.07)	(0.14)

Health Insurance (Medicare only omitted)

has Medicare and Medicaid				1.78**	1.30
				(0.22)	(0.21)
has Medicare and supplemental insurance				0.84*	0.87
				(0.07)	(0.08)
other insurance				1.50**	1.36
				(0.22)	(0.25)

Health Care Utilization

any hospital stays in last 2 years (0 omitted)				2.15**	1.62**
				(0.15)	(0.14)
Number of doctor visits in last 2 years				1.01**	1.00
				0.00	0.00
Any nursing home stays in last 2 years (0 omitted)				3.57**	2.27**
				(0.52)	(0.40)
Observations	10,088	10,088	10,088	10,088	10,088

Standard errors in parentheses
* significant at 5%; ** significant at 1%