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Trends in Assistance with Daily Activities:

Socioeconomic Disparities in the U.S. Older Population

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ABSTRACT

Assistive technology has become increasingly important in facilitating independence among older Americans, and fewer older people are relying on personal care to assist with daily activities. It remains unclear, however, whether these trends have been experienced broadly. Using the 1992 to 2001 Medicare Current Beneficiary Survey, we provide evidence that among older people who have difficulty with daily activities, there has been: substantial increases in the independent use of assistive technology (without help), no significant changes in the proportion receiving any help, and declines in the proportion using neither help nor technology. Differentials in help by race/ethnicity, education, and income quartiles remain unchanged over this period. Increases in assistive technology use appear to be widespread; however, in one case—the use of only equipment for bathing—we find increases only for the most-educated. We discuss implications of findings for the study of late-life disability trends and in disparities therein.

INTRODUCTION

Assistive technology (AT) is playing an increasingly important role in facilitating independence among older Americans (Pew et al., 2004), particularly those at risk for long-term care, and a growing number of studies suggest devices have distinct efficacy in improving functioning and quality of life even in late life (Agree and Freedman, 2003; Verbrugge et al., 1997). Current estimates suggest that approximately 14 to 18 percent of the U.S. population age 65 or older uses assistive devices—most often devices for mobility (canes, walkers) and bathing (grab bars, bath seats, railings) (Cornman, Freedman, and Agree, 2004). Among older people reporting difficulty with daily personal care activities, nearly two-thirds report using a device to meet their needs (Agree and Freedman, 2000).

As first reported by Manton and colleagues a decade ago (Manton et al., 1993), shifts have been occurring in the forms of assistance to cope with disability in late life. In that study, between 1982 and 1989, equipment use increased for older persons with mild chronic impairment and for older people with severe chronic disability as a supplement to personal assistance. During the same time period, reliance on personal care without any supplemental equipment declined. The trend toward using equipment as a sole form of assistance with daily activities has continued through the 1990s (Spillman, 2004). In particular, the literature has drawn attention to large increases in assistive technology for two common tasks—mobility and bathing. Russell and colleagues (1997) report increases of over 19 percentage points in the use of mobility equipment among adults from 1980 to 1994 and a recent consensus report demonstrated agreement in two out of three national surveys that notable increases have occurred in the use of equipment

without personal help for bathing (Freedman, Crimmins, Schoeni et al., 2004). Reliance on such devices is likely to rise further as the number and types of devices available increase. In the last twenty years alone, the number of assistive devices has expanded from 6,000 products to over 29,000 (NIDDR, 2004; U.S. Congress Office of Technology Assessment, 1985).

Recently, based on analysis of the 1992 to 2001 Medicare Current Beneficiary Survey (MCBS), Freedman and colleagues (2004) identified several potentially important aggregate-level trends related to forms of assistance in the older population: 1) increases in the use of assistive technology without personal assistance for daily activities, particularly for walking; 2) increases in the use of assistive technology in combination with personal care for bathing; 3) declines in the use of personal assistance for daily activities, for walking, and among the oldest old, for bathing, and 4) declines in the use of neither assistive technology or personal care. Whether these shifts can be explained by the changing demographic and socioeconomic composition of the older population has not been explored. Moreover, the continuing debate on disparities in health care utilization (e.g., AHRQ, 2003) has not yet explicitly recognized assistive technology as a type of care with which to be concerned, and the literature on racial and socioeconomic differences in forms of assistance remains small, with mixed results. Hence, it remains unclear whether forms of assistance vary by race and socioeconomic status and whether the aforementioned trends have been experienced broadly, or only by some segments of the older population. To the extent that we can identify reasons for and disparities in these phenomena, such analyses may provide insights into explanations for recent declines in late-life disability.

BACKGROUND AND FRAMEWORK

As shown in Figure 1, disability is defined at the intersection of an individual's underlying functional capacity, his or her physical and social environment, and the demands of a given task. Most often late-life disability is discussed in terms of the ability to carry out routine tasks necessary to live independently such as shopping, cooking, and cleaning (instrumental activities of daily living [IADLs]) and personal care tasks such as bathing and walking (activities of daily living [ADLs]). The latter form of disability is associated with formidable costs, particularly when an individual requires daily assistance for an ongoing, chronic condition. Figure 1 also emphasizes the important distinction between disability in the absence of accommodations (that is, *underlying* disability, generally measured as difficulty without help or equipment) and *residual* disability (that is, the level of difficulty with help or equipment if used) (Verbrugge, 1990).

Accommodations to age-related changes in functional capacity take various forms. Older individuals may change their behavior, for example, by doing a task less frequently or in a different way (e.g., walking across the room by holding on to furniture, see Fried et al., 2000, 2001). Accommodations may also take the form of assistance in two distinct forms: the use of help from another person, whether paid or unpaid, and technological assistance designed to facilitate a specific task or set of tasks (Agree, 1999). In this context, assistive devices include both portable pieces of equipment (canes, walkers) as well as changes to the environment (railings, ramps). Although not explicitly shown in the figure, changes in behavior may change the nature of the task at hand,

whereas assistive technologies may either extend an individual's functional capacity or if in the form of environmental modifications may shift the environmental demands.

Although others have demonstrated that behavior changes may be potentially important clinical indicators of subsequent disability onset (Fried et al., 2000, 2001), here we focus on policy relevant forms of assistance—the use of assistive technology and the receipt of help with daily activities. Moreover, although we recognize that the use of personal and technological assistance in combination may confer benefits beyond those conveyed by either in isolation, three conceptually distinct groups are particularly germane for our purposes—those who carry out tasks with help from another person, those who use *only* technology in the performance of a task (i.e., use AT only to carry out a task independently), and those who report difficulty but use neither AT nor human assistance in the performance of the task. The latter group is likely heterogeneous in that it consists of individuals whose level of difficulty is mild enough that they do not need to accommodate it as well as those who need such accommodations but who are unable to make them (i.e., those with "unmet" needs).

The experience of disability and forms of assistance to cope with functional declines differ by task (Agree and Freedman, 2000). Mobility is unique in the sense that it is a component of and facilitates many other activities. Consequently, mobility may take place throughout the course of the day, is idiosyncratic in timing and length, and may involve short distances (across a room) or longer ones (walking to the bathroom, or going down stairs, or outside). The ability to walk even short distances involves multiple body systems (including lower body strength, balance, visual acuity, and respiratory, cardiovascular, and cognitive functioning) and for longer distances greater endurance is

required. Because mobility takes place in public as well as private spaces, social stigmas may be important in influencing choice of accommodation. Environmental barriers such as stairs, inclines, slippery floors, or inadequate lighting may impede walking. Assistive devices most often used to bridge difficulty with walking are common and include relatively inexpensive canes and walkers, and more expensive wheelchairs and modifications to the home such as the installation of ramps, railings, and widening of halls and doorways to accommodate wheelchairs.

In contrast, a task such as bathing can be scheduled at regular intervals, generally involves one specific room in the home (the bathroom), and a relatively consistent amount of time to carry out. Depending on the environment the task may require different physical and cognitive skills. For example, bathing in a traditional tub (with no environmental modifications) may require climbing over the side whereas using a traditional shower (with no equipment or modifications) may require standing and balancing. Most of the technologies designed to facilitate bathing involve a change to the physical environment and include relatively inexpensive tub and shower chairs (for sitting while bathing), grab bars that provide security in the tub or shower, transfer benches (placed in a tub to ease entering and exiting the tub) and relatively more expensive barrier-free showers with accessible features, and automatic bathtub lifts that facilitate transferring. In contrast to walking, concerns about privacy may be more salient than social stigma in choosing forms of assistance for bathing.

Each of the components of disability–functioning, the environment, and the nature of the task—arguably may vary by socioeconomic status. With respect to functioning, previous research has shown that functional limitations tend to be more prevalent among

older Hispanics and blacks than older whites, those with fewer years of education, and those with lower incomes (Freedman and Martin, 1998; Mendes de Leon et al.,1995; Stump et al., 1997; Schoeni et al., 2002) and that the prevalence of chronic conditions differs by race and socioeconomic status (Kington and Smith, 1997). The physical environment in the home also varies by race and socioeconomic status, with less advantaged groups facing more environmental barriers (Gitlin et al., 2001; Tomita et al., 1997; Newman, 2003). At the same time, more advantaged groups are more likely to live in places that may come equipped with features designed to facilitate aging in place (e.g., retirement communities built with wide hallways, railings, and accessible bathrooms). Finally, social norms and expectations about the nature of daily tasks and how often they should be carried out and resources to carry them out more efficiently may also vary by socioeconomic status. For example, it may be that more advantaged groups have access to more flexible, private transportation that would reduce their need for assistive technology to get to and from places outside the home.

In addition, the relative out-of-pocket costs of assistance are likely to vary in part by socioeconomic status. The out-of-pocket costs faced by an older individual will vary depending on the nature and forms of assistance for a given task. In addition, costs will vary depending on the availability and opportunity costs of informal caregivers and on insurance coverage for personal care and equipment, both of which in turn are linked to socioeconomic status. Medicare, the primary health insurance program for people ages 65 and older, covers personal care assistance only for individuals who are home bound 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. For example, Medicare generally covers medically necessary walkers and wheelchairs used in the home, but the program does not cover stair glides, tub rails, or wheelchair ramps. Medicaid, the insurance program for poor elderly, blind, and disabled individuals, has a home health benefit similar to Medicare's, which covers nursing, home health aides, and medical equipment suitable for use in the home. In addition, half the states have a personal care benefit and almost all states now have a home and community-based waiver program, which has the flexibility of covering a wider range of assistive technologies. To our knowledge there is no systematic information currently available on which assistive technologies are covered through the Medicaid waiver programs.

Given these complexities, it is not surprising that findings about cross-sectional relationships between socioeconomic status and forms of assistance have been mixed. For example, with respect to race, two studies (Agree et al., 2004; Verbrugge and Sevak, 2002) both find that non-whites are more likely than whites to use assistive technology without help compared to using neither forms of assistance. And Agree and colleagues (2004) also find minorities and persons of Hispanic origin are more likely than others to combine equipment and informal care. Other studies, however, have found that minorities are less likely to use equipment (Hartke et al., 1998; Tomita et al., 1997) or that there are no significant racial differences (Norburn et al., 1995). With respect to education, higher levels of education are associated with increased odds of using equipment and/or personal care (Agree et al., 2004; Burton et al., 1995; Hartke et al., 1998). Other studies, however, either find a negative relationship between education and informal care (Kemper, 1992) or fail to find any relationship between education and the

use of assistive technology (Agree, 1999; Norburn et al., 1995; Zimmer and Chappell, 1994; Verbrugge and Sevak, 2002). Several studies have examined aspects of economic status, including percent of poverty in categories, above/below median income, family income and assets, household income, sources of income in addition to Social Security, and subjective measures of economic resources (Agree et al., 2004; Hartke et al., 1998; Verbrugge and Sevak, 2002; Norburn et al., 1995; and Mathieson et al., 2002). Results from these studies have been mixed, with most studies showing no income effects, one showing non-linear effects of percent of poverty on the use of mobility devices (Norburn et al., 1995) and another showing income in additional to Social Security increases the chances of using 1, 2, or 3 mobility devices but the amount of household income inversely related to the chances of using three or more devices (Mathieson et al., 2002).

There is reason to hypothesize that the relationship between socioeconomic status and forms of assistance may be shifting over time, with more advantaged groups benefiting disproportionately from newer technologies. Newer technologies may be more expensive relative to older ones, may require learning new ways of performing routine tasks, and may involve adherence to complex instructions. At the same time, newer technologies are not routinely covered by existing and widely held insurance, and those that are may require navigation of the increasingly complex health care system. In addition, the expansion of retirement communities, which often come equipped with environmental features, may disproportionately favor advantaged seniors. Yet studies to date are based on data that is often at least a decade old and none have attempted to trace changes over time in forms of assistance for various racial and socioeconomic groups.

In this paper we explore trends and disparities in trends by racial and socioeconomic status in forms of assistance with daily tasks (ADLs). Building on Agree and colleagues (2004), we integrate our analysis of predictors of assistance into a cohesive framework with three distinct, non-overlapping outcomes: use of only assistive technology, any help, and neither forms of assistance. In doing so, we focus on individuals reporting difficulty with any ADL, and also investigate these trends for two activities for which AT is commonly used, mobility, and bathing. Unlike previous studies, we explicitly test for differences by race, education, and income groups in trends in these forms of assistance.

DATA AND METHODS

Sample

The analysis is based on data from the Medicare Current Beneficiaries Survey (MCBS). Conducted annually, the MCBS is a continuous survey of a representative national sample drawn from Center for Medicare and Medicaid Service's Medicare enrollment file. The sample is selected by systematic random sampling with different sampling rates by age (0-44, 45-64, 65-69,70-74, 75-79, 80-84, and 85 or over) to over-represent persons with disability who are under 65 years of age and people who are 85 or older. Newly eligible beneficiaries are added to the sample once a year. Interviews are conducted wherever respondents reside, including long-term care facilities. We focus on

those age 65 or older living in the community and use data for each year from 1992 to 2001, resulting in a sample of 126,481 men and women.[1]

Variables

Respondents were asked whether because of a health or physical problem whether they have difficulty by themselves and without special equipment with each of the following activities of daily living (ADL): bathing, dressing, eating, transferring, walking, and toileting. If they report difficulty with or not doing an activity for health reasons, respondents were asked whether they receive help doing that activity. All respondents reporting difficulty also were asked if they use special equipment or aids to do the activity. Thus, whether a respondent reports either getting help with or using assistive technology for an activity depends on whether the respondent reports having difficulty with that activity.

Here we focus on accommodation of difficulty with bathing and walking, as well as difficulty with any of the six ADLs altogether. We highlight bathing and walking because personal help and AT are commonly used for these activities and because prior research has emphasized the growing role of technology for these activities.

We examine disparities in trends in ADL difficulty and the use of accommodations by three dimensions of socioeconomic status (SES): race/ethnicity, education, and income groups. Sample characteristics for these SES and other control variables used in the analysis are shown in Table 1 for all years combined.

For race/ethnicity, we contrast non-Hispanic whites and all other races or ethnicities. Education is classified into three categories: 0-8 years, 9-12 years (including

[1]Our analytic sample excludes 1,970 respondents living in Puerto Rico (80 percent of whom identify themselves as Hispanic), 56 cases missing both race and Hispanic origin, and 61 cases missing marital status.

high school graduates), and more than 12 years. For 909 cases (0.7% of the sample) that are missing data on education, we determined the modal education category for six age-sex groups (females age 65-74, 75-84 and 85 and over and males of the same age groups) and assigned this modal value to the cases with missing data by age and sex. Changes across survey years in the response categories for education do not permit finer categories. Unlike the other SES and control variables, the distribution of the sample across the categories of education changes considerably from 1992 to 2001. For example, the lowest group is 26.2 percent of the sample in 1992 but only 15.3 percent of the sample in 2001. This dramatic change reflects the rapid increase in educational attainment among young people in the first half of the 20th century. Thus, it may be that the composition of the lowest educational category has been shifting so that over this period the group has become relatively more disadvantaged.

For our analysis of income differentials and trends, we created a relative rather than absolute measure of income. In the MCBS for 1992 to 2001, couple income was collected in 14 categories, including a group for missing (n = 4,240 or 3.4% of the sample). To create a continuous income amount within categories, we implemented a three-step procedure. First, for each year 1992 to 2001, we used data on the 65 and older population from the March Current Population Survey (CPS), which is the U.S. Census Bureau's source for official estimates of income and poverty, to estimate couple income as a function of socio-demographic variables (age, sex, marital status, education, race/ethnicity, region) and the MCBS couple income categories. Second, we used the CPS-based coefficients from this model to estimate an exact couple income within

category for each MCBS respondent.[2] Finally, we grouped individuals in the MCBS into income quartiles based on the weighted distribution of the estimated income measure for each year. We evaluated the process by comparing the March CPS and estimated MCBS income distributions and trends and found they were substantially similar (see Figure 2).

In multivariate models we control for several additional demographic variables previously demonstrated to be related to forms of assistance in this population, including age, sex, marital status, and region (see Table 1 for categories). We include two additional variables in models predicting forms of assistance. To control for severity of disability, we include an indicator of the number of ADLs (total for models predicting assistance with any ADL and total minus one for models predicting assistance with walking or bathing). To control for potentially greater access to personal care in particular we include an indicator of Medicaid participation for at least part of the year.

Methods

We model trends and disparities in difficulty by fitting logistic regression models for any ADL, walking, and bathing, using all years of data combined. Among those who report difficulty with one of those three activities, we then fit for each activity multinomial regression models of trends and disparities in use of any help (with or without AT), AT only, or neither. Thus, sample sizes for the multinomial analyses vary as follows: 38,603 report difficulty with one or more ADL activities, 32,737 report

[2] For a small number of cases the imputation procedure estimated an income that was out of range. Imputed income for 31 cases missing on income was less than 0. These values were recoded to 0. For 14 cases that provided an original response of "$25,000 or more," imputed income was less than $25,000 and these values were recoded to $25,000.

difficulty walking, and 16,648 report difficulty bathing. Standard errors are adjusted for the complex sampling design of the MCBS.[3]

In both types of models, we included a linear trend variable that took the value of 1 in 1992 and increased by 1 in each subsequent year, with maximum value of 10 in 2001. Initially, we fit models including year, one of the three SES variables, and the control variables as previously discussed. To each of those models, we added an interaction between the SES variable and year to test if there were changes over time in SES differentials. The final models reported here include SES and year interactions that were found to be significant at the $p< 0.05$ level.

RESULTS

Difficulty

Figure 3 shows the unadjusted trends in difficulty with any of six ADLs by racial/ethnic and socioeconomic groups. The data are based on the weighted percentage of respondents reporting difficulty in each year from 1992 to 2001. For both non-Hispanic whites and the other racial/ethnic group, there has been a statistically significant decline in difficulty (tests based on linear trend not shown). In contrast, the percentage reporting difficulty is relatively flat for each of the education groups. However, this pattern does not necessarily imply that overall difficulty has remained constant since there have been substantial changes in the population composition by education during this period. Finally, in the bottom panel of Figure 3, the two lowest income groups

[3] Standard error adjustments do not take into account the additional gain in precision from overlapping samples and are thus conservative. For one model, standard error adjustments necessitated that 7 cases be deleted because they were single cases within a primary sampling unit (PSU).

(quartile 1 and 2) show statistically significant declines in difficulty over the ten-year period.

Table 2 presents the odds ratios from the logistic regressions of difficulty with any of six ADLs or not, difficulty with walking or not, and difficulty with bathing or not.[4] Interactions between year and the race/ethnicity and education variables were not statistically significant, indicating that the trends in difficulty were similar across the categories of these variables, so they were excluded from the final model. However, for any ADL and walking, the odds ratio for an interaction between year and the fourth (highest) income quartile was significant at the $p<.05$ level so income quartile*year interactions are included here.

The first row in each column therefore indicates the trend in difficulty for the lowest income quartile (<25th percentile). For any ADL, from 1992 to 2001, the odds of having difficulty have declined by 2.3 percent per year for the lowest income group (= (.977-1.000) x 100). The declines for difficulty walking and bathing are similar. For all three outcomes, the odds of reporting difficulty are lower for more educated and higher income groups. For bathing the odds are lower for non-Hispanic whites. The interaction between the highest income quartile and year is greater than one, indicating declines for the highest income group were smaller, on the order of 0.15 percent per year ((1.022*0.977)-1 x 100). Hence, some narrowing of the differential in difficulty by income over the ten-year period occurred.

[4] For categorical variables in the model, an odds ratio greater (less) than one indicates that in comparison to the omitted category for the variable, the subject category is more (less) likely to have difficulty. For example, for any ADL, those who are ages 75 to 84 have 1.694 times the odds of having difficulty than those ages 65 to 74, the omitted category.

Findings with respect to the effect of control variables on difficulty are in the expected direction, consistent with the voluminous literature on this topic (see, for example, Stuck et al. 1999). For example, not surprisingly, difficulty is greater for those who are older and female and least for those living in the northeast region. Being married reduced the odds of difficulty with any ADL and with walking (but not bathing).

Assistance

Figure 4 shows the unadjusted trends in the receipt of any help among those in each SES category who have difficulty with any of the six ADLs. The weighted percentages suggest relatively little change in the percentage receiving help over this period, except for the most highly educated and the for second income quartile for whom small but statistically significant declines occurred. In contrast, Figure 5 displays striking and statistically significant *increases* in the use of AT only for most groups, although the increases for minorities and the least educated are just beyond significance at the 0.05 level (p=<.06).

Table 3 presents the coefficients from the multinomial logit models predicting assistance among those with difficulty with any of six ADLs, walking, or bathing. The results for any ADL and walking tend to be similar, whereas those for bathing differ in some important aspects. Most importantly, perhaps, we found no significant interactions between year and race, income, or education for the model predicting any of six ADLs or walking. In contrast, for bathing, interactions between education and year were significant in predicting AT only versus neither help or AT (last model to the right in Table 3).

Predictors of Help. For all three activity outcomes, the statistically insignificant odds ratios for year indicate that, controlling for the demographic and socioeconomic indicators in the model, there is no trend among those reporting difficulty in receiving any help versus neither help or AT. Non-Hispanic whites and those with more education who report difficulty are also generally less likely to receive any help. There is a negative income gradient for receipt of help for those with difficulty with any ADL or walking. Interestingly, the income pattern is quite different for those with difficulty bathing, whereas the middle income quartiles (2^{nd} and 3^{rd}) have a higher odds than those in the lowest quartile of receiving help.

With respect to control variables, consistent with the literature, receiving any help is more likely among those who are older, female, and married and those who have difficulty with a greater number of ADLs overall. Midwesterners are less likely to receive any help versus neither in comparison to residents of the other regions. The odds of receiving any help are substantially raised for those who are Medicaid participants.

Predictors of AT only. Among those reporting difficulty, the trend for using only AT versus neither receiving help or using AT is substantial for all three activity outcomes. The annual increase is on the order of four to five percent a year over the ten-year period for any ADL and for walking. For bathing, a significant trend toward using only AT for bathing was found only for the highest educated group—on the order of 7.8 percent per year ((1.059*1.018 – 1) x 100) over the ten-year period.

There are no race/ethnicity or education differentials for only AT for any ADL or walking, but there is a negative income gradient for using only AT for those with difficulty with these two activities. The patterns associated with use of AT only for

bathing are quite different. Those who are non-Hispanic white and have higher income are more likely to use AT only versus neither help or AT. Note that once education and year are interacted, there are no statistically significant differences across education groups. One interpretation of this finding is that at the beginning of the observation period there were no differences across education groups in the use of AT only for bathing; however increases for the highest educated group have occurred over this period, resulting in a large gap by the end of the period. Thus, there appears to be a growing education differential in the use of AT only for bathing among those reporting difficulty with this activity.

Findings with respect to control variables are not surprising, with AT only more likely among those who are older, female, and unmarried. It is also more likely for those with a greater number of ADLs in the case of any ADL and walking. Medicaid participation does not influence AT use for any of the activities.

Predicted Probabilities for Assistance

To facilitate the interpretation of odds ratios across the various contrasts from multinomial logit models, we used the results from the final full SES models (without interactions for any ADL and walking and with education*year interactions for bathing) to calculate for each year the predicted probabilities of using each type of assistance. We calculated the probabilities of each outcome, varying characteristics of interest across the whole data set and averaging the predictions. In doing so, we held all other characteristics constant at the levels observed in the data set.[5]

[5] For more details on this methodology, known as "the method of recycled predictions," see StataCorp (1997 p. 548).

Figure 6 shows these probabilities of assistance over time for each of the three activity outcomes, conditional on having difficulty. For those having difficulty with any of the six ADLs, almost 40 percent have received help in each of the ten years observed. However, the plot shows the dramatic increase in the use of AT only and that there has been a concomitant decline in the probability of having neither help or AT. These two lines cross in 1997. The overall pattern for walking is similar though the level of any help is lower and the levels of AT only and neither are higher. The predicted probability of using AT only exceeded that of neither in 1994.

The picture for bathing is quite different. Here we present predicted probabilities separately for the lowest and highest education groups because we observed in Table 3 statistically significant odds ratio for this contrast for using AT only. As noted earlier, among those with difficulty bathing, the probability of receiving help is over 60 percent. For those with 0 to 8 years of education, the probability has been relatively stable at about 65 percent, whereas the probability for the highest educated group has consistently been just under 60 percent. The probability of using other forms of assistance is much lower, although there is a large upward trend in the use of AT only among those with 13 or more years of education. This increase has been offset by declines in the probability of using neither help nor AT among this group.

DISCUSSION

This paper has provided strong evidence that there has been a substantial increase in recent years in the use of assistive technology by members of the older U.S. population who have difficulty with ADLs. We found that among those reporting difficulty with

daily tasks there has been no significant change in the proportion receiving any help, but there has been an offsetting decline in the proportion who use neither help nor assistive technology. These findings are even stronger once we take into account shifts in the demographic and socioeconomic composition of the population.

In general, the increases in assistive technology use appear to be widely experienced. However, in one case—the use of only equipment for bathing—we found increasing disparities in reports of technology use. Although there were no differences in 1992 across educational groups in the use of AT for bathing, over the decade only the most educated (those with more than a high school education) experienced increases. In other words, all else equal, by 2002 the gap between highest and lowest education groups reached nearly 10 percentage points (30 percent using AT for bathing among those with 13 or more years of education versus 20 percent among those with less than 8 years).

In contrast, differentials by income and race in forms of assistance remained essentially unchanged over this period. Such disparities do not consistently favor more advantaged groups. Less advantaged groups appear *more* likely to use assistance for difficulties with any ADL and with walking than more advantaged groups. This negative gradient is surprising if one assumes that the greater economic resources of the more advantaged would allow them to purchase more help and AT. There are several possible explanations. It could be that the more advantaged who have difficulty experience less severe disabilities and thus need less assistance, although we have tried to control for this possibility by including the total number of ADL difficulties for each person in our models of assistance. Similarly, they may have different underlying diseases and conditions. Or they may live in more accessible environments, for example, with built-in

railings, elevators, or ramps, which we have not accounted for in our analysis. The more advantaged also may have access to more flexible, private transportation that would reduce their need for assistance in walking. Or they may have modified their activities in ways that we have not measured or be more sensitive to social stigma associated with using mobility aids. One other possibility regarding the negative SES gradient for receipt of help with walking is that the opportunity costs of help from friends and family members may be greater for the more advantaged than the less.

The SES differentials in assistance for those who have difficulty bathing vary substantially from those for any ADL and walking. Older people in the second and third income quartiles are more likely to receive help bathing than are those with lower income, and non-Hispanic whites, better educated, and highest income people are more likely to use AT only for bathing than are their less advantaged peers. We also saw that the gains in the use of AT only for bathing have been limited to the most educated and that consequently there has been growing disparity by education level in the use of AT to bathe independently. However, these increases in independent use of technology appear to be offsetting declines in the group receiving neither help nor AT; the use of help by this group remains relatively flat over the period.

Our analysis is limited in several respects. First, questions about forms of assistance were limited to those individuals reporting that they experienced difficulty with a particular task. As Cornman and colleagues (2004) and others (Pine et al., 2002) have shown, there is a sizeable group that uses assistive technology, most often canes, but do not report difficulty, and this group appears to be increasing in size (Freedman, Agree, Martin et al., 2004). Hence, our findings likely underestimate the increases in assistive

technology that have taken place over the last decade. Second, in the data available to us we were not able to distinguish between paid and unpaid care. We have shown though that Medicaid participation has contributed to greater receipt of help, but not assistive technology. Others have found the distinctions between paid and unpaid care to be important in understanding the use of assistive technology, in part because many older people acquire devices through the formal care system (Gitlin and Levine, 1992; Agree et al., 2004). Future analyses should explore these distinctions. They might also probe patterns for tasks besides walking and bathing. In particular, declines in the prevalence of IADL limitations have been much larger than those observed for ADLs; hence understanding the role of technology in these other activities would be an important next step.

Despite these limitations, our analysis has implications for the study of late-life disability trends and in disparities therein. A recent consensus report (Freedman, Crimmins, Schoeni et al., 2004) found agreement across several national data sets (including the MCBS, which we drew upon here) that there have been declines during the 1990s in help with ADL activities. Among individuals reporting difficulty, however, we saw flat trends during this period in the use of help, both in descriptive analyses and in models controlling for shifts in other characteristics of the population. Together these findings suggest that the shifts in forms of assistance we report may be linked in part to changes in the composition of the older population reporting underlying difficulty. Previous studies have demonstrated that the severity of underlying difficulty is the overriding determinant of forms of assistance (Agree et al., 2004; Verbrugge and Sevak, 2002). Although we controlled for number of ADL limitations in our analyses, a useful

next step would be to explore additional measures of severity, particularly functional limitations, and their contribution to trends in difficulty and in forms of assistance.

With respect to disparities, increasing gaps in the need for help with personal activities have recently been reported (Schoeni et al., 2004), with lower income seniors and those with fewer years of education not gaining as much as other groups. Among those reporting difficulty we observed differential trends in forms of assistance in one case -- the technology gap increase between highest and lowest education groups for bathing technologies. However, such patterns were not mirrored by differential changes in help among those with difficulty. These findings raise the possibility that the widening gap in the need for help by socioeconomic status also may be tied to differential shifts in underlying difficulty. Further exploration of this possibility is warranted.

The task-specific findings also highlight the complex nature of disablement and the heterogeneity of the various daily tasks. Given the influences on disability of functioning, the physical environment, social roles, behavior change, as well as receipt of help and use of AT, it is not surprising that those engaged in trying to understand trends and differentials in disability have not found a single explanation for the patterns recently witnessed.

From a societal perspective the good new is that there have been declines in the proportion of the older population reporting difficulty with ADL activities, with disparities by income narrowing over the last decade. And, although disadvantaged groups continue to experience higher rates of underlying disability, they report receiving relatively more help and are more likely to use assistive technology for difficulty with any ADL and walking. As a result, the less advantaged may be less likely to have

unassisted disability for these activities than are the more advantaged. This finding as well as the evidence presented regarding the positive influence of Medicaid participation on receipt of help does not mean though that there is no room for additional effort to reduce the disproportionate disability burden on the less advantaged. Moreover, the growing educational disparity in use of assistive technology for bathing difficulty particularly suggests the need for greater effort in this area, perhaps through public education around access to and benefits of assistive technology.

Promoting independence through increased use of assistive technology has been a goal of federal programs and policies, beginning with the passage of the Americans with Disabilities Act over a decade ago, and continuing with the 1998 Assistive Technology Act, and President Bush's "New Freedom Initiative." These policies specifically target the removal of environmental barriers and increased access to assistive and universally designed technologies. Our analyses suggest that increases have indeed occurred, even among the older population. Whether shifts toward technological assistance are ultimately judged as beneficial remains to be seen. One of the only randomized trials of the benefits of assistive technology demonstrates cost-savings compared to personal home care in a Medicaid population (Mann et al., 1999). A recent study suggests that technology may enhance independence, but that AT users equally or more often report that tasks are tiring, time consuming, or painful even when they use assistance (Agree and Freedman, 2003). Better understanding of the costs and benefits of various forms of assistance for older persons who experience difficulty in their day-to-day tasks is needed for policymaking to keep pace with technological advancements.

Table 1
Sample characteristics, all years combined

	Unweighted N	Weighted %
Race		
Non-Hispanic white	105,619	84.7
Other race	20,862	15.3
Education		
0-8 years	27,912	20.3
9-12 years	59,836	47.8
More than 12 years	38,733	31.8
Income quartiles		
First	35,031	25.0
Second	32,482	25.0
Third	30,504	25.0
Fourth	28,464	25.0
Age		
65-74	56,300	53.9
75-79	51,240	36.1
85+	18,941	10.0
Sex		
Male	52,559	41.8
Female	73,922	58.2
Marital Status		
Married	67,167	56.5
Not married	59,314	43.5
Region		
Northeast	25,805	24.2
South	45,201	21.2
Midwest	29,279	35.4
West	26,196	19.2
Number of ADL Difficulties		
0	87,878	72.2
1	16,876	12.5
2	8,464	6.1
3	4,716	3.3
4	3,508	2.4
5	3,249	2.2
6	1,790	1.2
Medicaid participation	12,135	8.8

Year		
1992	9,278	9.8
1993	9,708	9.7
1994	12,076	9.7
1995	11,638	9.9
1996	13,891	10.0
1997	14,303	10.1
1998	16,472	10.1
1999	13,906	10.1
2000	12,654	10.2
2001	12,555	10.3
Total	126,481	

Table 2
Odds Ratios for Difficulty or Not with Any of Six ADLs, Walking, and Bathing

	Any ADL		Walking		Bathing	
Year	0.977	**	0.979	**	0.984	*
	(0.008)		(0.008)		(0.008)	
Non-Hispanic white	0.976		0.957		0.921	*
	(0.031)		(0.029)		(0.038)	
Education 9-12 years	0.774	**	0.784	**	0.765	**
	(0.024)		(0.025)		(0.025)	
Education >12 years	0.689	**	0.691	**	0.653	**
	(0.026)		(0.027)		(0.031)	
2nd income quartile	0.772	**	0.775	**	0.841	**
	(0.042)		(0.043)		(0.051)	
3rd income quartile	0.635	**	0.634	**	0.681	**
	(0.036)		(0.037)		(0.050)	
4th income quartile	0.461	**	0.441	**	0.485	**
	(0.029)		(0.029)		(0.041)	
Year * 2nd income quartile	1.006		1.008		0.989	
	(0.008)		(0.009)		(0.010)	
Year * 3rd income quartile	1.012		1.014		0.996	
	(0.009)		(0.009)		(0.011)	
Year * 4th income quartile	1.022	*	1.028	**	0.999	
	(0.010)		(0.010)		(0.013)	
Control variables:						
Age 75-84	1.694	**	1.632	**	1.978	**
	(0.033)		(0.035)		(0.060)	
Age 85+	3.652	**	3.420	**	4.791	**
	(0.101)		(0.098)		(0.178)	
Female	1.241	**	1.201	**	1.456	**
	(0.026)		(0.025)		(0.045)	
Married	0.921	**	0.908	**	0.961	
	(0.020)		(0.021)		(0.030)	
Midwest	1.017		0.982		1.062	
	(0.060)		(0.049)		(0.070)	
Northeast	0.844	**	0.839	**	0.894	*
	(0.044)		(0.043)		(0.049)	
South	0.936		0.902	*	1.017	
	(0.050)		(0.045)		(0.057)	
Observations	126,481		126,481		126,481	

* $p < 0.05$ **$p < 0.01$

Table 3. Results from Multinomial Regressions for Using Assistive Technology Only, Receiving Any Help, or Neither Among Those with Difficulty with Any ADL, Walking, or Bathing

	Any ADL				Walking				Bathing				Bathing			
	Any help vs. neither		AT only vs. neither		Any help vs. neither		AT only vs. neither		Any help vs. neither		AT only vs. neither		Any help vs. neither		AT only vs. neither	
Year	1.016		1.041	**	1.017		1.040	**	1.023		1.056	**	0.994		1.018	
	(0.010)		(0.008)		(0.010)		(0.007)		(0.014)		(0.018)		(0.016)		(0.020)	
Non-Hispanic white	0.863	*	0.957		0.859	*	0.931		0.853		1.345	*	0.851	*	1.338	**
	(0.052)		(0.054)		(0.060)		(0.053)		(0.075)		(0.163)		(0.058)		(0.113)	
Educ. 9-12	0.838	**	0.954		0.865	*	0.965		0.901		1.109		0.745	*	0.886	
	(0.046)		(0.044)		(0.053)		(0.046)		(0.058)		(0.099)		(0.094)		(0.133)	
Educ. 13+	0.730	**	1.073		0.755	**	1.058		0.826	*	1.450	**	0.661	*	1.079	
	(0.049)		(0.060)		(0.055)		(0.059)		(0.078)		(0.163)		(0.106)		(0.199)	
Educ. 9-12 * year													1.040		1.047	
													(0.022)		(0.026)	
Educ. 13+ * year													1.045		1.059	*
													(0.026)		(0.030)	
2nd income quartile	0.969		1.022		0.919		0.997		1.181	*	1.199	*	1.179	*	1.196	*
	(0.051)		(0.048)		(0.048)		(0.042)		(0.092)		(0.102)		(0.081)		(0.091)	
3rd income quartile	0.936		0.928		0.893		0.893	*	1.247	*	1.331	**	1.246	*	1.329	*
	(0.060)		(0.046)		(0.058)		(0.045)		(0.128)		(0.144)		(0.106)		(0.125)	
4th income quartile (high)	0.807	**	0.824	**	0.855	*	0.803	**	1.059		1.181		1.061		1.184	
	(0.061)		(0.053)		(0.068)		(0.050)		(0.128)		(0.153)		(0.107)		(0.132)	
Control variables:																
Age 75-84	1.759	**	1.644	**	1.671	**	1.652	**	1.609	**	1.339	**	1.612	**	1.343	**
	(0.075)		(0.063)		(0.078)		(0.070)		0.104		(0.093)		(0.098)		(0.093)	
Age 85+	5.269	**	3.099	**	4.511	**	3.313	**	3.148	**	1.234	*	3.156	**	1.238	**
	0.309		0.157		(0.265)		(0.170)		0.239		(0.109)		(0.220)		(0.101)	

Female	1.293	**	1.083	*	1.314	**	1.004		1.011		1.295	**	1.010		1.293	**		
	(0.054)		(0.042)		(0.058)		(0.041)		(0.063)		(0.106)		(0.060)		(0.091)			
Married	2.028	**	0.702	**	1.913	**	0.722	**	1.884	**	0.701	**	1.884	**	0.701	**		
	0.100		(0.028)		(0.098)		(0.030)		(0.153)		(0.056)		(0.125)		(0.054)			
Midwest	0.783	**	0.983		0.699	**	1.000		0.737	**	0.788		0.735	**	0.786	**		
	(0.071)		(0.070)		(0.057)		(0.071)		(0.085)		(0.126)		(0.058)		(0.068)			
Northeast	1.139		0.952		0.964		0.948		1.325	*	0.793		1.325	**	0.793	*		
	(0.083)		(0.074)		(0.068)		(0.070)		(0.148)		(0.131)		(0.115)		(0.079)			
South	0.940		0.982		0.796	**	0.926		0.982		0.842		0.979		0.839	*		
	(0.075)		(0.066)		(0.061)		(0.067)		(0.109)		(0.121)		(0.073)		(0.070)			
Number of ADLs	3.434	**	1.904	**	2.012	**	1.304	**	1.513	**	1.006		1.513	**	1.006			
	(0.093)		(0.050)		(0.031)		(0.020)		(0.033)		(0.025)		(0.026)		(0.019)			
Medicaid participation	1.633	**	0.994		1.328	**	1.082		1.724	**	0.886		1.731	**	0.890			
	(0.098)		(0.057)		(0.093)		(0.059)		(0.166)		(0.102)		(0.129)		(0.080)			
Observations	38,603				32,737				16,648				16,648					

* p < 0.05 **p < 0.01

Figure 1. Framework for Understanding the Role of Accommodations in the Disablement Process

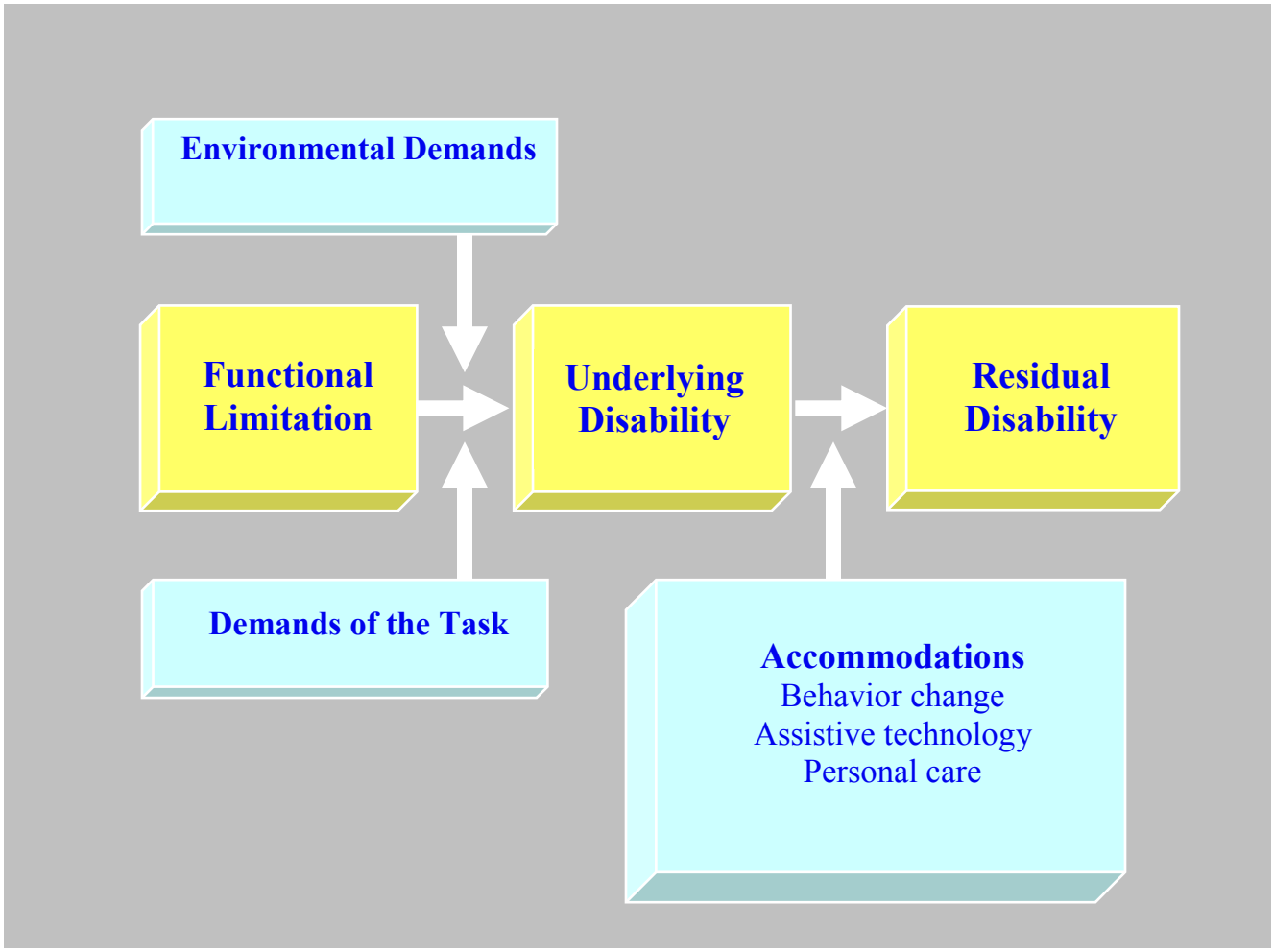


Figure 2. Income Quartiles: Current Population Survey Actual versus Medicare Beneficiaries Survey Estimated

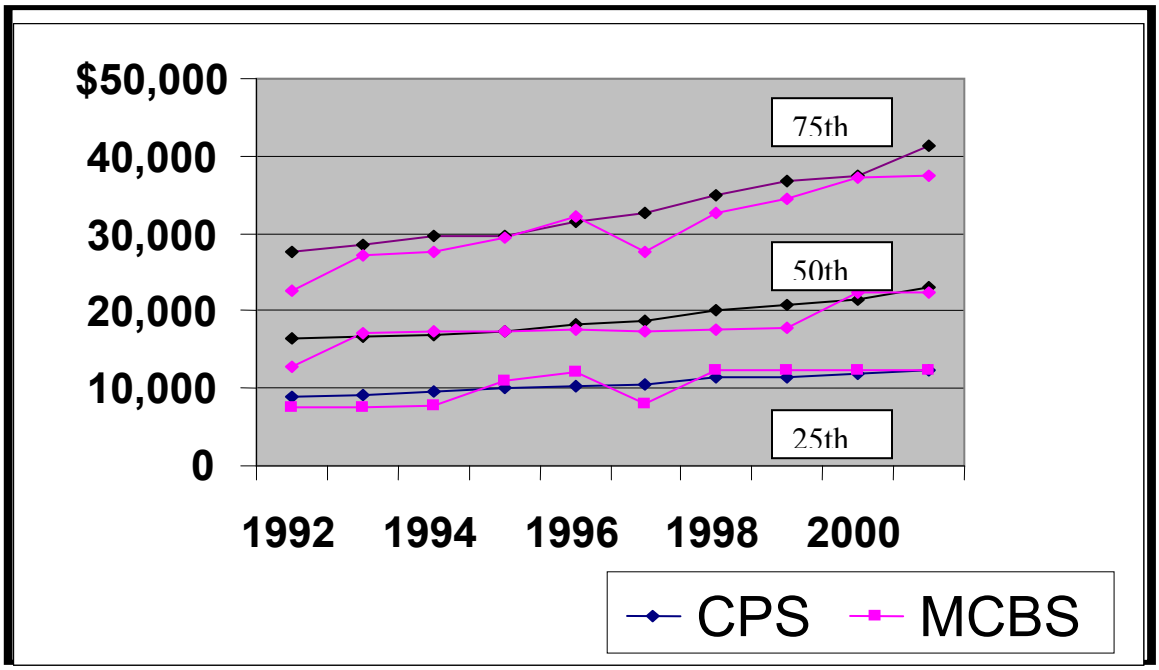


Figure 3. Trends in Difficulty with Any of Six ADLs
by Race/Ethnicity, Education, and Income

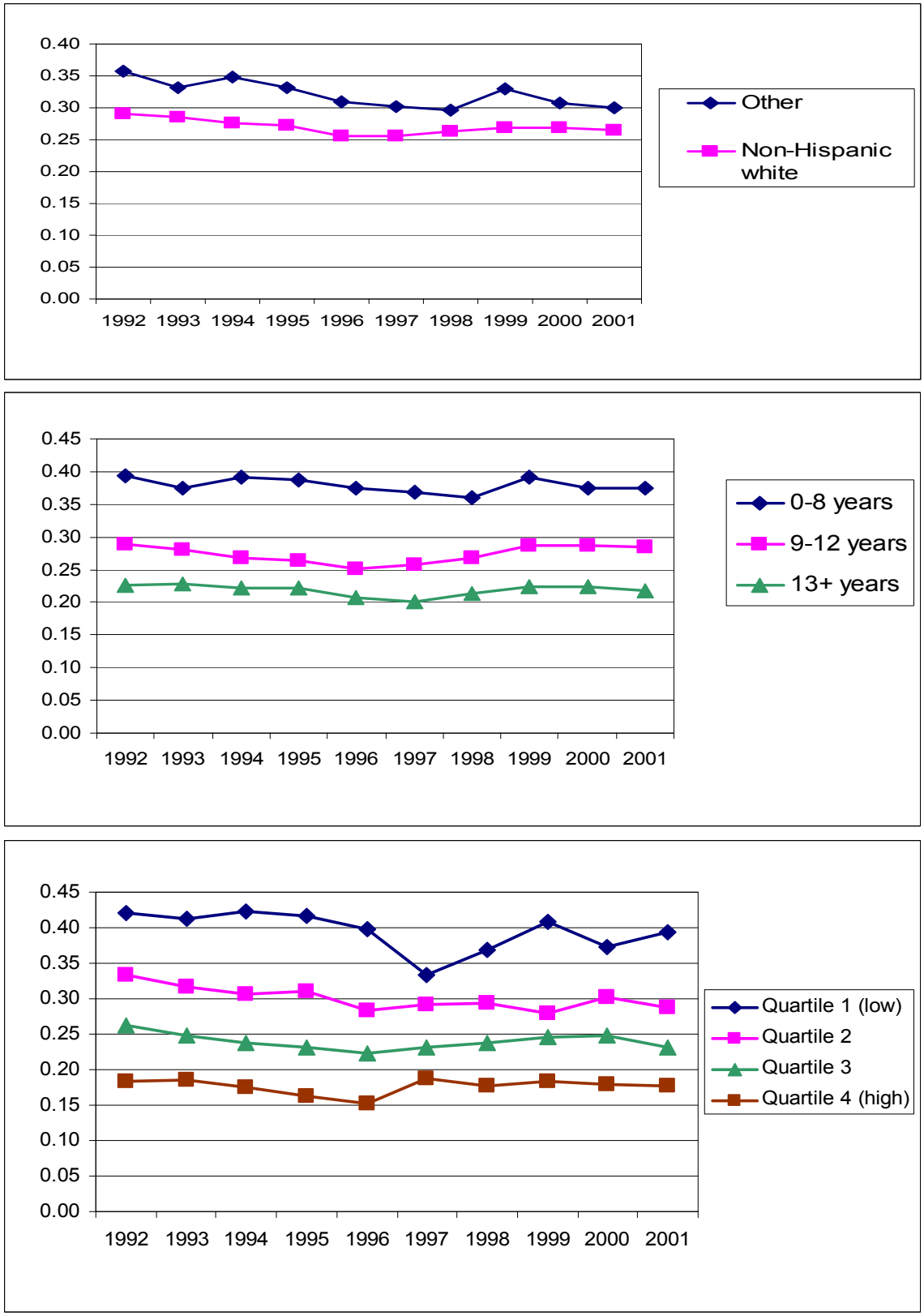
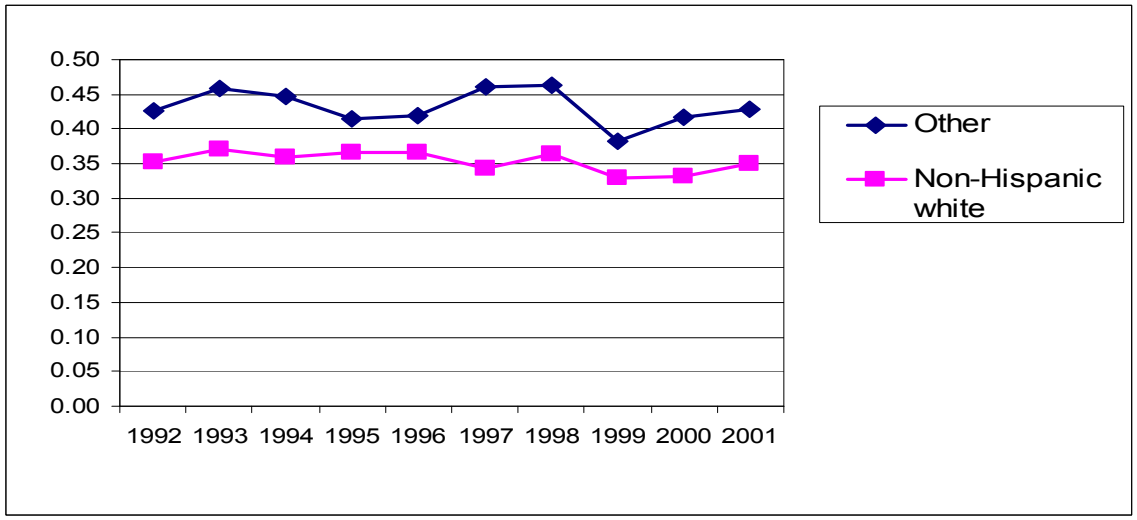
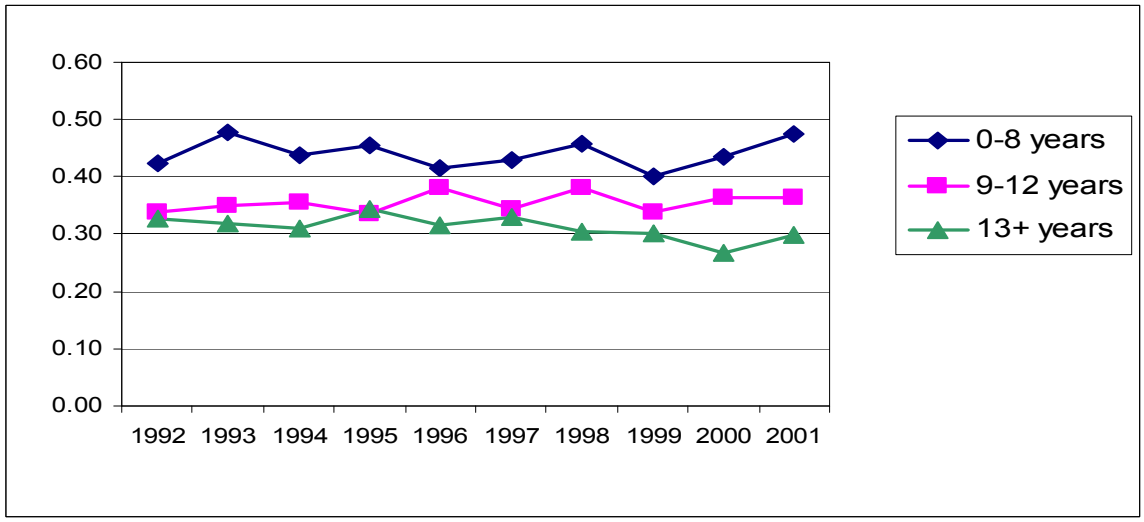


Figure 4. Trends in Receipt of Any Help Among Those with Difficulty with Any of Six ADLs by Race/Ethnicity, Education, and Income





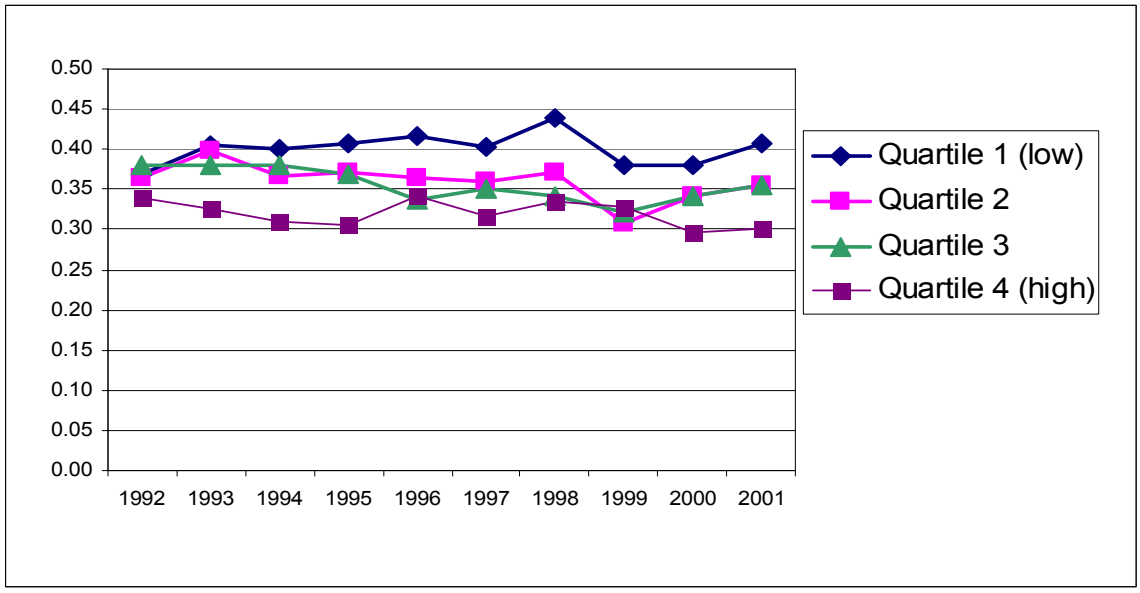


Figure 5. Trends in use of Assistive Technology Only Among Those with Difficulty with Any of Six ADLs by Race/Ethnicity, Education, and Income

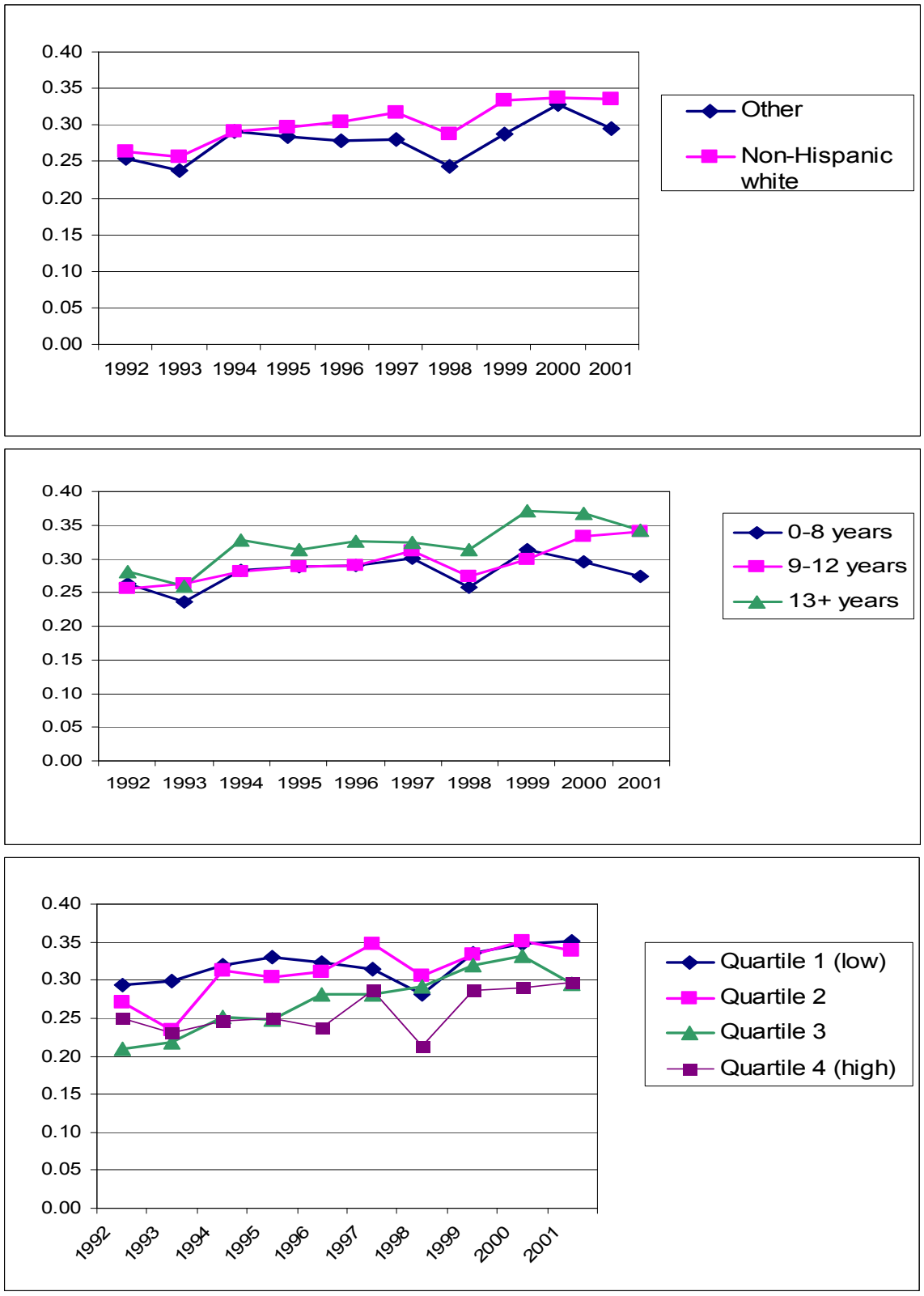
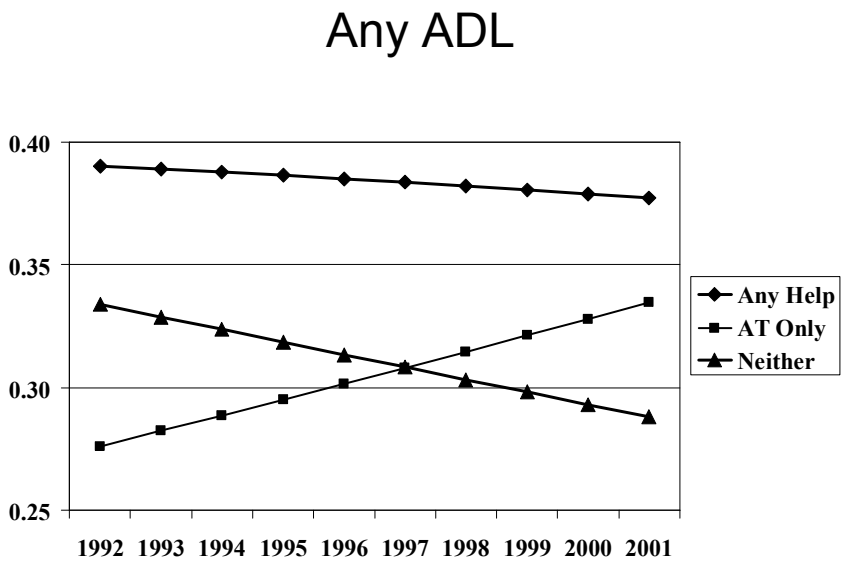
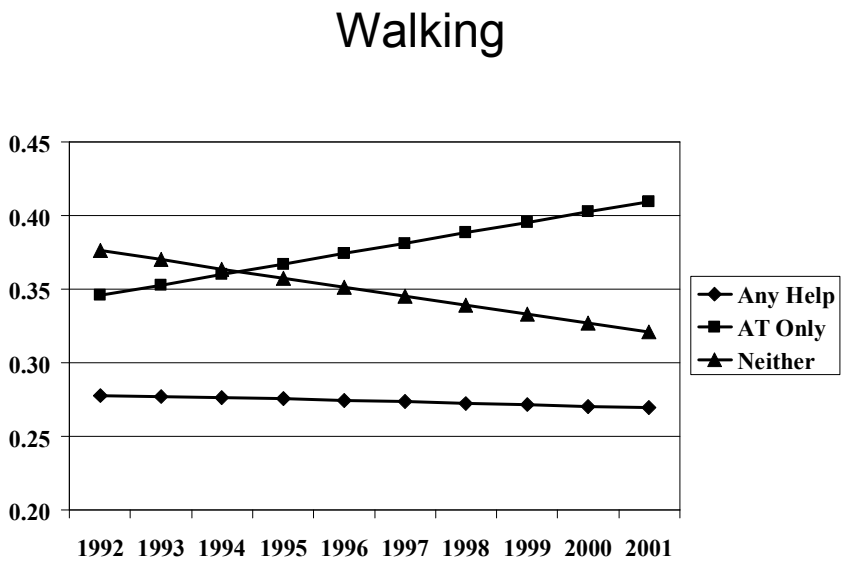
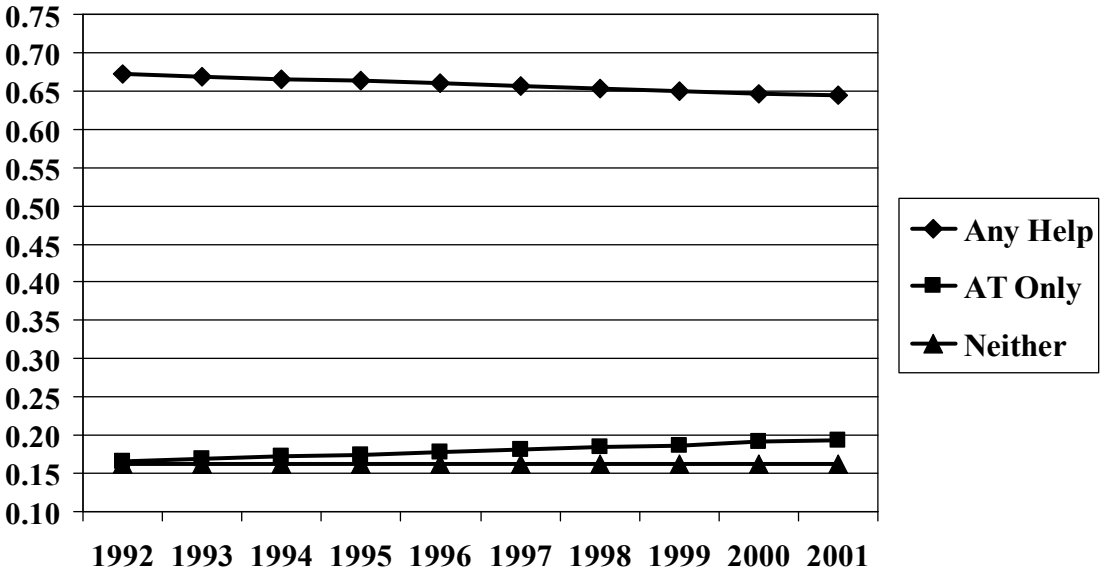


Figure 6. Predicted Probabilities of Any Help, AT Only, and Neither for Any ADL, Walking, and Bathing, Conditional on Difficulty

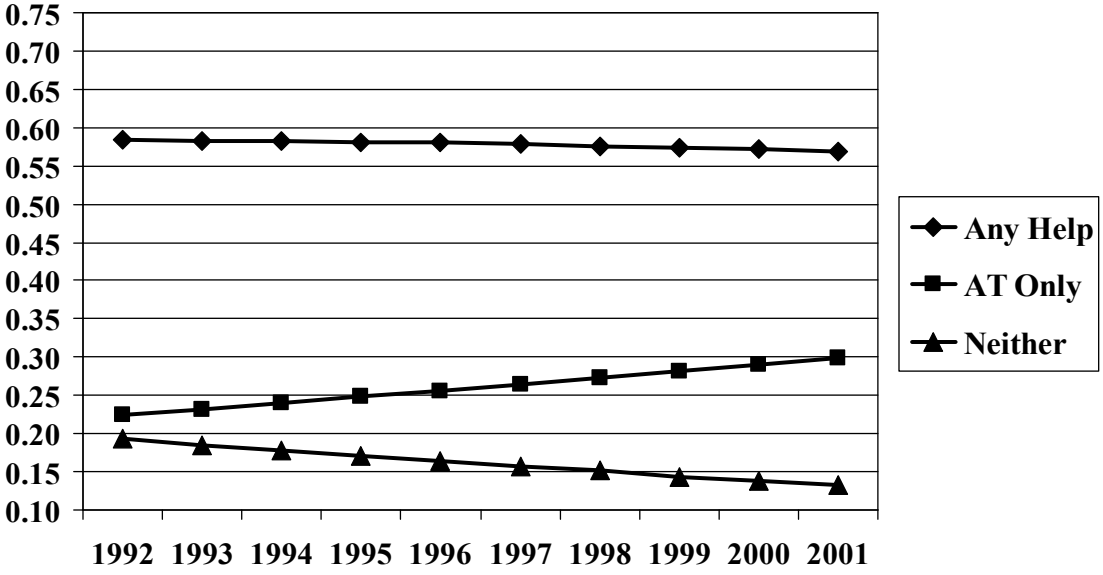




Bathing – 0-8 Years Education



Bathing – 13+ Years Education



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