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Abstract

This report describes preparation of data from the National Long-Term Care Survey (NLTCS) for use in a dynamic multiple-indicator model of dependency in Activities of Daily Living (ADLs). The data set described makes use of all functional status information available across four NLTCS waves for six ADLs, including information from screening interviews, detailed interviews in the community, and institutional interviews. Importantly, it also captures all available information elicited from respondents about the *duration* of any impairment in these ADLS. The data was prepared as described in this report to enable the calculation of improved estimates of the probabilities that an older individual will transition from one functional status state to another in any of six ADLS. These probabilities can then be used to improve estimates of active life expectancy.

Background

Longitudinal survey data used to estimate parameters underlying active life expectancy calculations commonly feature data collection points spaced widely in time. As the interval between data collection points widens the probability that one or more functional status transitions occur unrecorded within the interval increases. Loss of unrecorded transitions challenges the accuracy of parameters estimating the probability of functional status transitions calculated from such data. Wolf, Freedman, Marcotte, and Ploutz-Snyder (2000), using data from the Medicare Current Beneficiary Survey (MCBS), demonstrate that as between-measure intervals widen, differentials in death rates according to functional status are understated. In addition to its theoretical interest, this understatement has public policy implications. For when the relative risks of death for individuals in various functional status states are biased downward, the implied benefits of reducing the incidence of disability, in terms of added life expectancy, are understated. To the extent that functional status can be influenced by public policies promoting education, public health measures, workplace safety, or individuals' healthy lifestyles, therefore, estimates that reduce this downward bias would offer stronger arguments favoring such policies.

A second considerable limitation of most active life expectancy calculations is the unidimensional state space used to discriminate between those who can and those who cannot live independently. Laditka and Wolf (1998), for example, judge individuals to be "unimpaired," "moderately impaired," "severely impaired," or "dead," depending upon the values of several functional status indicators. Laditka and Laditka (2001) and Wolf, Laditka, and Laditka (2002) similarly judge individuals to be “unimpaired,” “impaired,” or “dead.” Crimmins, Hayward, and Saito (1994) group individuals by those with no or some functioning problems, those unable to live independently, those unable to provide personal care, and those who are dead. Researchers commonly combine six or more ADL measures for an individual, in some instances also incorporating IADL information, producing a simple binary or single multiple-category indicator of functional limitation.[1] Combining difficulty measures as widely disparate as using the toilet or feeding oneself, this approach to analyzing impairment may obscure differences across individuals that contribute importantly to quality of life—indeed, to the ability to live independently. By discarding information, when combining categories in these ways, researchers also introduce increasing unmeasured heterogeneity into the data. Wolf, et al. (2000) discusses several potential effects of this unmeasured heterogeneity. In models of disability dynamics, the mean probability estimated from grouped data of transitioning from one disability state to another over a particular finite time interval can mask within-group differences in the transition risk. For multivariate models in which transition probabilities are the dependent variable, a considerable portion of the estimated effects of included covariates can be attributable to systematic differences in the specific items from which the generalized disability scale was constructed. Moreover, conflated data may lose much of the variability in the timing of transitions present in the underlying more specific data—so the more generalized data may gloss subtle (and not so subtle) differences in disability dynamics for various activity areas.[2]

Verbrugge and Jette (1994) note that disability in later life tends initially to be restricted to a few activity domains. It then gradually expands to restrict more types of activities. Health "shocks," or trauma, can produce immediate impairments. At other times, the development of impairments can be gradual, delayed, or cumulative. Recovery from impairments can similarly occur with some degree of relative rapidity, as when surgical repair of a bone fracture restores function after a relatively short period of convalescence and retraining. At other times, recovery may occur only slowly, extending over a period of many months or years, introducing the possibility of feedback mechanisms from one type of activity impairment to others. Widely spaced data collection points in surveys used for active life expectancy research miss much of this dynamic. This shortcoming works synergistically with unidimensional state space impairment definitions to challenge the accuracy of active life expectancy estimates.

Survey attrition poses a third challenge to the calculation of active life expectancy using survey data. Attrition may be correlated with health status or other factors associated with active life expectancy. So accurate analyses of active life expectancy must account for heterogeneity within a cohort that bears on attrition and other unmeasured factors associated with life course functional status dynamics.

Wolf (2000) described these challenges, and proposed methods to address them. First, the "Laditka-Wolf" method would be applied to data from the National Long-term Care Survey (NLTCS). A cohort of individuals from the initial (1982) sample, with possible follow-up interviews taken in 1984, 1989, and 1994, would be selected for analysis. Rich with detailed functional status information for a large representative sample of older Americans, the NLTCS is an important data set for studies of functional impairment prevalence, functional status change, and active life expectancy (Manton, 1988, 1989; Manton, Corder, & Stallard, 1993). Because long time intervals separate the second, third, and fourth interviews, however, the problem of possibly overlooked functional status transitions is particularly present in the NLTCS. In addition to the point-of-interview functional status information most commonly used by researchers, the research proposed by Wolf (2000) would utilize information elicited by the NLTCS about the *duration* of any of six ADL impairments. NLTCS respondents indicating receipt of help in an ADL, or that someone stood by in case help was needed, or (for selected tasks) that special equipment was used to perform the task, or that the task could not be performed at all, were asked how long that situation had lasted. Response categories were: "less than 3 months," "3 months to less than 6 months," "6 months to less than 1 year," "1 year to less than 5 years," and "5 years or over." In each survey wave, this duration information was asked for each of six ADL tasks. As Wolf (2000) notes, it appears that these response codes have not been used in past research. The total elapsed time from the 1982 baseline interview to the 1994 follow-up interview spans about 150 months. Yet measures utilized in research to date have been limited to, at most, four of those months—one from each of the four NLTCS survey waves. Making use of the impairment duration information provided by respondents provides a means, at least in principle, of relaxing the strong (first-order) Markov assumption that has characterized virtually all past work on active life expectancy.

Also proposed by Wolf (2000) is a multiple-indicator model of activity/independence. Instead of a single matrix of transition probabilities for input into a multistate life table, this research would model six separate 2x2 transition matrices for each of six ADL dimensions, with the states in each instance representing "independence" or "dependence." A seventh equation representing the transition to the absorbing state, "death," would also be included. With the availability of the multiple-indicator model, active life expectancy could be flexibly modeled with dependency defined using any one of, or any combination of, the six individual ADL indicators.

Third, the proposed research would extend the modeling of functional status transition probabilities to include unmeasured heterogeneity, using random effect logistic regressions, extending the method used successfully in an analysis of three formal long-term care service use variables measured by the British Household Panel Survey (Wolf, Grundy, and Laditka, 2000). Additional details of the research to be conducted using the data described in this report appear in Wolf, Freedman, Marcotte, and Ploutz-Snyder (2000).

Sample Selection

The sample selection process, along with broadly-categorized functional status information for several sub-samples, is illustrated by Figure 1. From the full NLTCS sample, we initially selected a sample of all individuals at ages 65-69 who participated in the 1982 survey (*n* = 5523). Individuals in the NLTCS survey frame who were institutionalized in 1982 participated only in abbreviated screening surveys, which did not elicit specific ADL information. We therefore eliminated from our sample those individuals who were institutionalized in 1982 (*n* = 144), a 2.6 percent sample loss resulting in a sample of *n* = 5379. Arrays were then created representing each of six ADLS: eating, dressing, getting in or out of bed, getting around inside (hereafter referred to as "mobility"), dressing, bathing, and getting to the bathroom or using the toilet (hereafter referred to as "toileting"). Each cell in each array represented a single month, with the leftmost cell in each array corresponding to the month of the individual's 65th birthday. Information for screening interviews, community interviews, and institutional interviews (including the 1989 institutional follow-up) was then obtained from the data representing each wave in which remaining individuals participated. Specific ADL status information (impaired/unimpaired) for each of the six ADLS was assigned to the array cells corresponding to the months in which the information was obtained, in the arrays corresponding to the relevant ADLs. The individual's age in years during the month in which any ADL information was obtained could be readily calculated in each instance.[3]

Because the proposed research relies on estimates derived from functional status *transitions*, we imposed the further requirement on remaining observations of at least two months, including the 1982 survey month, of non-missing status information. In addition to the 1982 information, this information could be a non-missing date of interview after 1982, or non-missing status information for at least one ADL from a survey later than 1982 (where a later date of interview was unavailable), or a date of death recorded for a month following the 1982 survey month. This requirement did not reduce the sample. We further required the availability of at least two non-missing cells for ADL status, or at least one month of ADL status and a month of death, for each of the six ADL arrays. This requirement reduced the sample by 0.35 percent, to *n* = 5360.[4]

Analysis of longitudinal survey participation revealed that a sizable group of individuals in our sample were not included in the 1989 survey, despite their presence in earlier waves and in the 1994 survey.[5] Long time intervals between surveys challenge any estimates of active life expectancy, and the ten year interval without ADL information between the 1984 NLTCS and the 1994 wave for these individuals was especially likely to contain unrecorded functional status changes, the omission of which could bias transition probabilities computed from this data. We therefore eliminated observations on individuals who were systematically excluded from the 1989 survey frame. This reduced our sample size by 35.6 percent, resulting in a sample of *n* = 3451. Finally, to facilitate the modeling of functional status transition probabilities accounting for heterogeneity with the use of any combination of the six ADL dependency indicators, we censored the six arrays for each observation at the rightmost location where all six arrays contained non-missing status information. This requirement removed 11 observations (0.32 percent of the previous sample) in which no complete set of ADL status cells was available in the same location across the six arrays. The resulting final retained sample consisted of *n* = 3440 observations, each with at least one transition from a known functional status in 1982 to either a known functional status in another wave, or to death, and each with a full set of known status information in the same (for that observation) rightmost non-missing cell location across six arrays.

How does the sample selection process just described affect the composition of the sample? Table 1 provides summary demographic information about the final retained sample and its differences from the initial sample of those at ages 65-69 in 1982 who responded to the 1982 survey, were not institutionalized, and had at least two waves of non-missing ADL or death information. As Table 1 illustrates, the retained sample has an older age profile than the initial sample, which, given the differential mortality between samples, is expected. For example, the rightmost columns of Table 1 indicate that 20.2 percent of the initial sample were age 69, while 27.0 percent of the final retained sample were age 69. The retained sample has a larger proportion of men (46.5 percent) than the initial sample (43.7 percent), and modestly more non-whites (9.8 percent in the retained sample, compared with 8.9 percent in the initial sample). Broadly-categorized functional status information for the various samples is included in Figure 1.[6] Removing the relatively small percentage of individuals institutionalized in 1982 yields a modestly less impaired sample. The step in the sample selection process with the greatest impact on the proportions of the sample in each of the disability groups presented is the removal from the sample of those individuals who were "Not in Survey Year" in 1989, most of whom were reintroduced in the survey frame in 1994. Since all individuals in this group were alive to 1989, and many to 1994, they constitute a generally healthier group than those in our final retained sample, 31.3 percent (*n* = 1076) of whom died prior to the first day of screening in 1989. We address this differential sample selection by re-weighting the sample, as described later in this report, in a section headed "Weighting."

Defining ADL Impairment

Much literature on functional impairment discusses ADLs as simple dichotomous states with easily identifiable definitions. In fact, the definition of ADL impairment is itself a complex matter (Deyo 1984; Hedrick, Katz, and Stroud 1981; Kane 1993; Kane and Kane 1981; Spector 1990), having potentially significant effects on estimates of disability prevalence (Wiener, et al., 1990). Judgments about the criteria used to define impairment have significant implications for individual's lives—in terms of service availability, for example. These judgments can also have important impacts on costs of services for governments, insurers, and individuals. They may also be used to determine case-mix adjusted reimbursements to health facilities or home health care agencies. Finally, they can significantly affect estimates of functional status impairment in a population, and therefore estimates of active life expectancy that derive from transition probabilities produced from such estimates. In the work of Manton (1988, 1989) and Manton, Corder, and Stallard (1993), chronic disability is defined as "an inability, lasting (or expected to last) 90+ days, to perform and ADL, without personal assistance or equipment, or an IADL because of a disability or health problem (including 'old age')" (Manton, Corder, and Stallard, 1993, p. S154). This definition establishes disability for the summary variables of the NLTCS Analytic File, which is often used by researchers to identify disability in the NLTCS sample. We did not use the Analytic File status variables, except as final checks of the reasonableness of our data. All ADL assignments were based on variables in the NLTCS individual wave data. Individuals were coded as impaired only in instances where the relevant variables were positively coded impaired (i.e., missing fields were in no instance taken to define impairment). Since the data developed through the processes described in this report are to be used to model *receipt of help*, or *resource utilization* in response to impairment, our definition of impairment included a respondent's reliance on people and reliance on equipment.

The ADL questions of the screening interviews differ from those of the detailed community and institutional interviews. The latter ask whether the respondent can perform the activity at all, whether she or he *receives* help, and whether special equipment is used to perform the activity. Screening interview questions ask whether the respondent is able to perform the activity "without help," where help has been defined by the interviewer to include "the help of another person, including people who live with you, or the help of special equipment." Thus the screening interviews do not ask whether or not help is actually *received.*[7] Nonetheless, we use this measure from the screening interviews as a proxy for help received, and include ADL impairments identified in response to screening interview questions in our data. We also include screening interview responses indicating no impairment. Screening interviews ask about several IADLs as well, adding questions about the respondent's ability to get in and out of chairs, and to go outside. However, we restrict our analysis to the six ADLs referenced throughout this text.[8]

Questions in the community and institutional detailed interviews for the six ADLs used throughout this research all ask respondents if they have received help to perform the ADL, and whether any special equipment was used (utensils or special dishes for eating; a wheelchair, railing, walker, or cane to help getting in and out of bed; and so forth). When a respondent responds positively to either of these questions, we code impairment in the ADL.[9] Those who report not being able to perform the ADL activity at all (individuals who cannot eat, get in or out of bed, and so forth), are not asked if they received help or used special equipment. ADLs measure basic activities one must either perform oneself, or for which one must receive assistance, even to survive for any extended period. We therefore judged that those indicating they could not perform an ADL were likely to have received assistance with the activity, or to have utilized special equipment. Individuals who do not get in or out of bed, for example, generally receive considerable personal care—regular turning, backrubs, and so forth—that utilizes resources to replace the ADL function. Therefore, those who could not perform an ADL at all were also defined as impaired for this research.

Finally, it is important also to note some potential ADL limitation information in the NLTCS data that we did *not* include in our definition of impairment. Respondents were asked, for each ADL, if someone "usually" stayed nearby "just in case you might need help" with that activity. We did not include responses to this question in our ADL definition, again since these data were developed to model resource utilization and dependency. It could be argued that those for whom someone "usually" stayed nearby were utilizing a resource. It is likely that many caregivers who "stay nearby" under such circumstances will consider this a part of their care work, for example. This question illustrates the difficulty of defining functional impairment, and the potential for multiple differing definitions, each of which might be reasonable within its conceptual frame. The distinguishing criterion in this instance is the lack of a clear measure of *dependency*, since respondents could respond affirmatively to this question for any or all ADLs when the standby help is not actually needed—when, for example the individual can and does perform the ADL when others are not present. With similar reasoning we did not use the detailed community question asking, "For which of those things do you need help," where "those things" are the six ADLs under study in this research. Although respondents' perceptions of needing help are of interest in the study of functional limitation, this need, in the absence of resource utilization, does not fall within the focus of this research.

Coding ADL Impairment and Death

This section describes in greater detail the information obtained from the individual NLTCS surveys, criteria for including that information in the ADL arrays, and limitations imposed on that information. Results of the coding strategy described in this section are summarized in Table 2, Descriptive Statistics of Monthly Status Assignments.

Individuals who were known from their responses to a detailed community interview to be impaired or unimpaired in a given ADL were assigned the relevant status in the array cell corresponding to the year and month of interview. Table 2 shows that the mean number of unimpaired months assigned from community interviews to the Mobility arrays for the final retained sample of $n = 3440$ is 0.584 and that the mean number of impaired months for the same array is 0.268. Similarly, array cells were assigned known impaired or unimpaired status based on screening interviews, again with the assignment made to the array cell corresponding to the year and month of interview. Table 2 shows a mean of 1.869 unimpaired months assigned from screening interviews to the Mobility arrays across all observations, and 0.101 mean impaired months. Institutional interviews (including the 1989 follow-up institutional interview) likewise generally provided months of known status for all six ADLs. Relatively few sample members were institutionalized in any given survey wave, and the maximum number of institutional interview months across the NLTCS surveys is 4 (institutional interviews were not conducted in 1982; 1 each was conducted in 1984 and 1994, and 2 in 1989).[10] So the mean number of unimpaired and impaired months associated with institutional interviews in the Mobility arrays, 0.013 and 0.048, respectively, is smaller than the mean number of months from screening or community interviews. These three data sources provide all information generally utilized in research using the NLTCS, with information from at most four detailed interview waves (and the possible addition of the second institutional interview in 1989, the institutional follow-up interview).

When the goal of the analysis is population impairment prevalence, results from screening interviews are included for those waves in which detailed community or institutional interviews are unavailable. This generally occurs when an individual has "screened out" of the detailed interviews. One can "screen out" when there is no disability in the month of screening, or when the disability has not lasted (or is not expected to last) 90 or more days.[11] Including "screen outs" in the analysis ensures that resulting prevalence estimates include proportional representation of the majority of persons in all population groups but the oldest old, those who do not have impairments. Thus the arrays described so far already incorporate information in addition to that generally included in analyses of disability based on the NLTCS. For waves in which an individual participates in both the screening survey and a community or institutional detailed survey, the arrays capture his or her status in each of the ADLS in the months of *both* the screening survey and the detailed survey.[12] The screening survey provides additional information for the calculation of transition probabilities. The status cells representing screening surveys include ADL limitations in the month of screening that may *not* have lasted (or have been expected to last) 90 or more days at the time of the screening survey; since they do not meet the 90+ day criterion for chronic impairments, these impairments are not included in data generally reported from the NLTCS.[13] They nonetheless are reported impairments experienced by survey respondents, and retaining the screening interview values captures this information that is otherwise lost to the analysis.

In addition to impairment status at the month of screening or detailed interview, the arrays capture information about the duration of impairment. In instances where a respondent to a screening interview indicated that any listed ADL impairments did not last 3 months or longer, we infer that the impairment in the listed ADL(s) existed in the month prior to screening, although not before, and assign an impairment code to the corresponding array cell.[14] We also know from such responses that, subject to recall error, the impairment in the given ADL did not exist in the third month prior to interview (inclusive of the interview month). We therefore assign such month's unimpaired status. Table 2 indicates a mean impaired value for the Mobility array of 0.013 for the first of these assignments, and a mean unimpaired value of 0.013 for the second. In all instances across the six arrays, these unimpaired and impaired value means are equal within a given ADL array, as expected, since both assignments are consistently made together.

Impairment duration is also elicited from respondents in the detailed community interviews.[15] Summary data describing array duration assignments from the detailed community interviews appears in the Table 2 column headed, "Conservative Application of Comm. Interview Duration." With the exception of the Eating ADL, this data provides more months of known status information than any other source—indeed, in most cases, more months of status information than the combined total months from all other sources (with the trivial exception of death, the absorbing state, for which only the initial assignment, the month of death, is to be used in the analysis). We assign impairment duration from this source conservatively, as the floor of the range of months reported, inclusive of the month of interview. For example, where a respondent indicates that a given ADL impairment has existed "6 months to less than 1 year," we assign impairment to the month of interview and the preceding 5 months. Table 2 shows a mean number of such impairment duration months for the Mobility array of 6.170 months, with a minimum of 0 and a maximum of 194.

Additional details about duration assignments from the detailed community interviews appear in Table 3. For each ADL, Table 3 shows the number of times each duration interval appears across all individuals, sorted by the number of times that the interval is reported by the same individual across four NLTCS waves. In the Mobility ADL, for example, 328 individuals reported one instance each of an impairment duration of "1 year to less than 5 years" across the 12 years spanned by the NLTCS surveys. In the same duration category, 64 individuals reported 2 such duration intervals across four waves, 13 reported 3, and none reported this duration category in all four waves. The larger frequencies in the columns corresponding to the longest impairment intervals, combined with the notably larger number of individuals who report multiple instances of these longer duration impairments across waves, suggest that impaired individuals in our sample are more likely to have experienced extended impairments across the period spanned by the surveys than to have experienced relatively brief periods of impairment followed by recovery. Also of interest in Table 3 are the relatively few instances in which individuals report multiple shorter impairment durations across waves. Several dynamics could account for this pattern. Those who become impaired for short durations in our sample may do so at later waves, with less opportunity for repeated durations. Or, if they experience these shorter intervals of impairment in earlier waves, they recover, either to experience no later chronic impairment, or to later experience only relatively extended impairment. A third possibility is that individuals tend to experience one of the shorter intervals in one wave, followed by increasingly lengthy intervals in later waves—as when a permanent chronic impairment occurs in the few months prior to one interview, to be followed by permanent impairment through later waves.[16]

The same responses that provide impairment durations also provide known months of unimpairment, at the duration ceiling, or end-point. For example, where the respondent indicates an ADL impairment duration of "6 months to less than 1 year," we know that in the 12th month prior to the month of interview (again, for conservative assignment of the impairment duration, inclusive), the respondent was unimpaired in that ADL. These single months of unimpairment at the duration end-point are assigned to the relevant array only when the respondent's duration estimate places them later in time than the next prior known ADL information, from a prior community or institutional interview, or, in their absence, from a prior screening interview. In instances where the duration end-point would precede prior known information, we permit that earlier information to govern all ADL status assignments further leftward in the array, under the assumption that contemporaneous responses have more validity than recollections from a later interview. The Table 2 column headed "Community Interview Duration Endpoint" indicates that, across all observations, such assignments amount to a mean of 0.098 months in the Mobility array, with a minimum of 0 and a maximum of 3.

Although this is known information directly attributable to respondents, we also recognize that these duration end-point assignments create transitions that will affect the modeling of transition probabilities.[17] Given the significance of these pivotal array cells, we present further details about their contributions to the arrays in Table 4. These duration end-point cells invariably identify months without impairment. Where a next previous month (array cell) with non-missing ADL status information exists (as is generally the case for waves after 1982), the assigned duration end-point month creates a transition. The first data column of Table 4 presents data on these transition intervals. Across the Mobility arrays, for example, there are a total of 354 transitions of this type, with a mean number of months between the next previous month with a known ADL status and the duration endpoint of 25.86, a minimum of zero, and a maximum of 108. Although a little over 60 months is the maximum interval between waves, the latter instance could occur when a respondent is not interviewed in the immediately preceding wave. It could also occur when missing data appears in one ADL variable in the immediately preceding wave, though not in others. Since the maximum value for all other arrays is consistent with the presence of an immediately preceding wave, it is likely that the maximum value for the Mobility array is a result of a missing value in that ADL in an immediately preceding wave when all other

ADLs for the same observation contained non-missing information. Despite this greater maximum value, the mean Mobility value appears to be consistent with the means from the other arrays.

The second data column of Table 4 describes the interval to the right of duration end-points, from the end-point to the month of the community interview that establishes its value. As expected, the number of such intervals in each ADL equals the number of intervals from the duration end-points to the next prior known status. The mean number of months between ADL duration endpoints and the community interview months in which they are determined is 23.61 in the Mobility array, with a minimum of 2 and a maximum of 59. The minimum size of these intervals is 2 across all six ADL arrays, as expected. This indicates the conservative interval assigned when a respondent identifies an ADL impairment duration of "less than 3 months." In this instance, it is known that the respondent was unimpaired in the ADL in the third month prior to interview (inclusive), and the assigned duration includes the month of interview and the previous month.

The third data column of Table 4 describes the intervals between duration end-points and the leftmost month of ADL impairment assigned by the conservative duration rule. In the Mobility array, there are 268 such intervals across all observations. The number of such intervals is smaller in every instance, across the ADLs, than the corresponding number of the intervals described in data columns 1 and 2. This is an expected result, since durations of “less than 3 months" are assigned an end-point at month *t*-2, and an impairment duration month at *t*-1, with no intervening interval. The minimum interval size in this instance is 3, across all six ADL arrays, indicating instances where the respondent's duration estimate is "3 months to less than 6 months." Here, month *t*-6 is the duration endpoint, the month of know unimpairment, months *t*-2 and *t*-1 are months of known impairment from the duration response, and assignment in the month of interview completes the 3 month impairment duration. The maximum size for this interval, again the same across the 6 ADL arrays, is 48. This instance occurs when the respondent identifies an interval of "1 year to less than 5 years." Here the duration end-point, a month of known unimpairment, is the 60th month prior to the month of interview. The month of interview and 11 prior months are assigned impairment, totaling the conservative duration assignment of 1 year. Thus the interval between the duration endpoint and the leftmost month of assigned ADL duration is 48 months.

The availability of the duration responses also permits an evaluation of the consistency of respondents' ADL information and duration estimates, both within and across waves. Table 5 provides counts of within-wave contradictions, instances where an impairment duration response conflicts with a reported unimpaired ADL status from the screening interview of the same wave.[18] There were few such contradictions in the second through fourth NLTCS waves. In the 1982 wave, however, their number was substantial.[19] Table 6 reports cross-wave contradictions, where an impairment duration reported in one wave extended leftward to the month of, or prior to, a previous wave's interview, in which no impairment was reported in the same ADL. There were relatively few such instances, though their number is not inconsequential for an understanding of response validity. The third column of Table 6 reports the percentage reduction in the number of duration months actually assigned from the number reported by respondents, when the conservative assignment of duration months is left-censored at the month following the previous wave's month of interview. In this case, note, the previous wave need not represent a contradiction of the impairment duration from the current wave; left-censoring at a cell of known ADL status from a previous wave occurs regardless of that status. Since interviews are spaced widely in time, the impact on the final arrays of this censoring is minimal, less than 2 percent for any of the six ADL arrays.

The longest duration category that could be identified by respondents impaired in an ADL was "5 years or over." Here the conservative duration assignment rule assigned a total of 60 months of impairment, the month of interview and the 59 preceding months. Additionally in these instances of long-term disability, we examined the individual's status in the ADL in the previous wave. When the individual was impaired in the same ADL in the previous wave, we judged that it was reasonable to assume that the long-term impairment had lasted at least from the month of the preceding wave when the respondent last noted the disability. In these instances, therefore, we also assigned months of impairment from the month following the month of known impairment in the previous wave through the *t*-60th month from the current wave. Thus the entire interval from the month of known impairment in the preceding wave through the month of the community detailed interview in the current wave would be assigned impairment in these instances. The month following the month of known impairment from the previous interview through month *t*-60 of the current interview were assigned the inferred impairment, and month *t*-59 through the month of interview in the current wave were assigned known impairment from current wave duration information.

An analogous procedure was applied to duration intervals of "1 year to less than 5 years." In these instances, it was known from the conservative application of the duration rule that the respondent had been impaired in the ADL at least in the month of community interview in the current wave and in the preceding 11 months. However, the wide interval provided by the respondent included the possibility of impairment throughout the 5 preceding years. When a preceding interview wave included a month of impairment and the month of that impairment fell within the duration interval identified by the respondent in the current interview (i.e., within the preceding 5 years), we judged that it was reasonable to assume the long-term impairment had existed at least from the month of the preceding interview in which it was last identified. Thus, we assigned months of impairment from the month following the month of known impairment in the preceding wave, through month *t*-12 in the current wave. As with the "5 years or more" duration instance described above, the entire interval between the preceding wave's month of known impairment and the current wave's month of interview would be assigned impairment in these instances. These inferred impairment assignments are summarized in the rightmost column of the "Impaired Months" section of Table 2, in a column headed "Months between Duration Assignments and Preceding Wave Impairment." In the Mobility array, for example, the mean number of months so assigned is 0.840, the minimum is zero, and the maximum is 61. Months of inferred impairment were assigned only in intervals between the leftmost duration end-point of a current interview and a month of known impairment in the immediately preceding wave.[20] Thus the maximum values reported cannot occur in a single interval between two adjacent waves. The few observations contributing the maximum values have ADL durations of "5 years or over" in 1994, and either "5 years or over" or "1 year to less than 5 years" in both 1989 and 1984, with interview dates in 1984 and 1989 separated by less than 60 months, and additional impairment durations of varying lengths in 1982. Thus, the lifecourse of individuals represented by these observations not only enable our decision rules to assign many months of known and inferred impairment, they also support the likelihood that these are individuals who, at least in the ADLs involved, have long-term impairments with few or no months of recovery in the years spanned by our data. This appears to support our assignment of inferred impairments, even in those instances where the assignments sum to a substantial number of months across an array representing an individual's ADL status.

Throughout this report, we describe array assignments as months of impairment or unimpairment, sometimes distinguishing between months of known impairment and months of inferred impairment. It should be noted that the array assignments described in Table 2 were made with a variety of codes, separately identifying the source of any information coded in an array cell (by wave, type of interview, and so forth), and also separately identifying each type of impairment assignment. Thus, while in the majority of instances the data will be recoded with simple dichotomous values representing impaired and unimpaired status for each month represented, the ADL arrays described in this report can be flexibly used to test specific effects of, for example, the inferred impairment assignments just described, on calculations of transition probabilities and active life expectancy.

Summary data for the six ADL arrays is presented in the rightmost large data column of Table 2, headed "Total Months." Across all observations, for example, the Mobility array has 2.58 mean unimpaired months and 7.44 mean impaired months. The minimum number of unimpaired months is the same across the six ADL arrays, at zero. Observations with this minimum represent individuals who report impairment in the given ADL at every interview, together with substantial impairment durations. Alternatively, these individuals may report any number of impairment months combined with death—possibly death in the early years of NLTCS sampling. The maximum number of unimpaired months, again consistent across the six ADLs, is 5. This occurs when an individual is unimpaired in four interview waves, and also reports being unimpaired in the given ADL in a second interview conducted with some respondents in 1989, the institutional follow-up. It can also occur with a combination of interview months with no impairment and duration end-point assignments. The maximum number of impaired months (201, for example, in the Mobility array), represents the maximum of total impaired months, including months identified in screening interviews, or community or institutional detailed interviews, or assigned through the conservative duration rule, or inferred. Individuals with these maximum impaired months would have indicated the longest available duration for the same ADL in all four NLTCS waves, "5 years or over," or the maximum in later waves and shorter but still considerable durations in earlier waves. As expected, all data for the absorbing state, death are the same across the six arrays. Data for cells with missing values, presented in the column headed "No Data," vary slightly across the six ADLS, due to random missing variable values in the NLTCS database.

Finally, the NLTCS includes data on deaths.[21] In the final retained sample described here, these data include death dates for 1871 individuals. After the 1994 interview date, 106 of these deaths occurred, with the latest recorded date of January 17, 1996. When a date of death is available, codes representing death are entered in the corresponding month across the six ADL arrays. In a small number of instances, death months correspond to months of interview (when, presumably, death occurred later in the month than the interview).[22] In these instances, the month of death was assigned to the month following the month of interview. In one instance each in 1982 and 1984, and in five instances in 1989, death dates predate later interview ADL assignments. In these instances, death is assigned to the array month corresponding to the death date, and the arrays are right-censored at this month.

Weighting

The final retained sample (n = 3440) includes a large proportion of generally more impaired individuals who died prior to the 1989 survey. It also excludes 1909 individuals who were systematically removed from the 1989 survey frame, all of whom were alive when the 1989 surveys began. Thus decedents by 1989 are represented disproportionately in our sample, and the sample is unrepresentative of all individuals surveyed in 1982. We addressed this by re-weighting the sample. The goal of this re-weighting was to create a new weighted sample, with decedents contributing the same proportions of the same characteristics as the proportions contributed by those who survived to 1989 and were included in the 1989 interviews. We adopted the procedure used by Aykan (1999) to re-weight the Second Supplement on Aging to the 1994 National Health Interview Survey. The procedure used logistic analysis to identify factors associated with the probability that a surviving respondent would be included the 1989 wave of the NLTCS. Sample weights distributed with the NLTCS were then adjusted, for those included in the final retained sample that died before the 1989 wave, using the probabilities estimated by the logistic analysis.

Although there is no generally available documentation associated with the NLTCS that would illuminate the selection process governing inclusion or exclusion from the 1989 wave, we did obtain information suggesting that age may have been among the selection criteria (Corder, 2000). Aside from age, however, our goal was to identify variables that may have been among those used explicitly in any algorithm defining the excluded sample, or to identify variables that may have been associated with the selection results, regardless of their explicit inclusion or exclusion in the sample identification process. In other words, the purpose of developing the model for obtaining weight adjustments was to identify variables that differentiated the group of surviving individuals included in the 1989 survey from the group excluded. This process is unique to the data set under study (Mihelic and Crimmins, 1997), and is not performed with the expectation that the results of the analysis will be applicable to other populations. Generalizing the results is not of interest, so retaining statistically indiscernible covariates (or, for that matter, any that might be questioned on theoretical grounds), does not challenge the validity of the procedure. We therefore included a rich set of potentially relevant covariates. A succession of nested logit models were estimated, to facilitate an understanding of those variables that may have been associated with an individual's inclusion or exclusion in 1989.

Table 7 provides means and standard deviations for variables used in the logistic analysis, including omitted category variable values, and with the addition of a continuous age variable not included in the analysis. Variable values shown represent individuals' status in 1982. As shown in the first two data columns of Table 7, those included in the 1989 wave were slightly older than those omitted (67.34 years old, compared with 66.81 years). A considerably smaller percentage of women were included in the 1989 sample (58.7 percent) than were excluded (61.3 percent). Blacks constituted 7.5 percent of those excluded from the 1989 wave, but only 5.9 percent of those included. Data for marital status presented in Table 7, based on the 1982 NLTCS wave, includes a substantial proportion of missing information, particularly for those excluded from the 1989 wave. These data should be interpreted with caution. Of those for whom marital status was identified in 1982, 5 times as many were married among those included in the 1989 survey than among those excluded. As expected, the proportions of the samples from each of the regional offices of the Census Bureau, which conducts the NLTCS survey field work, is consistently similar across samples, with the greatest difference between samples in New York. Of those included in the 1989 survey, 5.9 percent were from New York. Of those excluded, 8.4 percent were from New York. Disability status in 1982 appears in the uncontrolled descriptive data of Table 7 to be associated with inclusion or exclusion from the 1989 survey, with about 79 percent of those included having been unimpaired in 1982, compared with about 96 percent of those excluded. For comparison purposes only, the rightmost two columns of Table 7 provide the same information for the portion of the final retained sample that had died by the first day of screening in 1989, and also for the full retained sample. These columns illustrate, for example, that the percentage of the decedent sample that was unimpaired in 1982 was considerably smaller than the corresponding percentage of either surviving sample, and that the decedent sample's proportions of impaired status exceeded those of the surviving samples.

Table 8 reports results of a nested logistic analysis of factors contributing to the probability that a participant in the NLTCS who survived to 1989 would be included in the 1989 survey. Here the probability that an individual would be included, $P_i(r)$ takes the general form:

$$P_i(r) = \frac{e^{\alpha + \beta x_i}}{1 + e^{\alpha + \beta x_i}}$$

where $P_i(r)$ is the estimated probability of inclusion as a respondent in the 1989 NLTCS for the i^{th} respondent, α is the intercept (the logit value where all dummy variable values equal zero), β is the vector of estimated coefficients, and X_i is that respondent's array of auxiliary variables in the model. In *logits* 2-4, which include age dummies, all age dummies are statistically significant in every instance. Odds ratios on the age dummies included in the model range in *logit* 4 from

0.19, for Age 65, to 0.21 for Age 67, indicating that individuals at age 69 in 1982 (the omitted category) were substantially more likely to be included in the 1989 survey than individuals in all younger categories. Men were about 20 percent more likely to be included in the 1989 sample than women. Any difference in the selection probabilities by race is minor, with only marginal statistical significance on the covariate representing blacks in only *logit* 2; since the covariate on black is not statistically significant in *logit* 3, which provides a statistically significantly better model fit than *logit* 2, there is little evidence that being black played a role in selection for the 1989 survey. Interestingly, being a resident of the New York Census region in 1982 is statistically significantly associated with an individual's probability of being included in the 1989 survey; 1982 residents of the New York region were only about 65.5 percent as likely to be selected for inclusion in the survey as residents of the Los Angeles region, the omitted category. Surprisingly, in this sample of individuals who were participants in the 1982 survey and survived to 1989, being severely impaired in 1982 (with 5-6 ADLs), is statistically significantly associated with a *lower* probability of inclusion in the 1989 survey than the probability for nondisabled individuals, who constitute the omitted category (odds ratio 0.339). This suggests that 1982 disability status did not play an explicit role among any selection criteria that may have been employed to identify the 1989 sample (since, given the purpose of the surveys, it would have been desirable to include such individuals when they survived). Nonetheless, perhaps as a function of random processes within the NLTCS population, severe 1982 disability does appear to have been negatively associated with inclusion in the 1989 wave.

Although *logit* 4 provides only a marginally better fit to the data than *logit* 3 (indeed, an improvement of questionable statistical significance), we reasoned from the arguments presented above, and from the theoretical significance of disability status in our modeling, that *logit* 4 provides the most appropriate basis for weighting adjustments. The sum of the intercept and an individual's summed vector of estimated coefficients provided the adjustment value for that individual. The 1982 basic prevalence weight for individuals in the final retained sample who died prior to the 1989 survey was multiplied by this adjustment value to obtain final adjusted weights for those individuals. Because, invariably, $0 < P_i(r) < 1$, this re-weighting procedure effectively down-weighted the contribution of the decedent sample. Their contributions to calculations such as weighted ADL prevalence thus became roughly comparable, in terms of sample proportions, to those of individuals included in the 1989 sample as a proportion of those who survived to 1989. Weights for individuals who survived beyond the first day of screening in the 1989 wave were unaffected by this adjustment.

The effectiveness of this weighing procedure is illustrated in Figures 2a, 2b, 3a, and 3b. All NLTCS data represented in these figures is weighted using the adjusted weights just described. Figure 2a shows mortality rates for the full NLTCS sample of noninstitutionalized individuals of any age who participated in the 1982 survey, n = 17,658, from ages 66 through 94, compared with mortality rates from the 1979-1981 Decennial Life Tables from the National Center for Health Statistics. The sample mortality rate progression illustrated in Figure 2a is less than satisfactory. However, like the final retained sample, the sample illustrated in Figure 2a excludes those who were institutionalized in 1982. Including these individuals, Figure 2b shows a close approximation to the national data by the NLTCS sample, with some fluctuation at older ages attributable to limited sample size (eventually to single digits) brought by death.

To illustrate the effects of weighting on sub-groups of relatively small size, Figures 3a and 3b illustrate analogous mortality rates for blacks, who represent only 8.6 percent of the final retained sample. Figure 3a represents all blacks. Figure 3b is limited to black men.. Again, despite considerable variability due to small sample sizes at each age, it appears that the weighting procedure appropriately adjusts sample weights. The effect of weighting on the final retained sample (n = 3440) is shown in Figure 4, which presents mortality rates pooled by age across the years from 1983 through 1994, when sample members were at ages 66 through 80.

(Although death information is available through 1996, small sample sizes yield unreliable mortality rates at the highest ages, which are not shown.) The weighted death rate at age 66 is 0.031. By age 80, it has risen to 0.059. A comparison of the weighted death rates illustrated in Figure 4 with the full-sample rates of Figure 2b suggest that weighted rates of the age-pooled final retained sample reasonably approximate those of both the larger sample and the NCHS. The NCHS death rates are depicted by the doted line in Figure 4. As expected, since those institutionalized in 1982 are omitted from our final sample, death rates from our age-pooled sample are below those of the NCHS. These comparisons suggest that the weighting procedure functions appropriately.

Sample Characteristics

After the sample weights were adjusted, weighted characteristics of the final retained sample and the arrays representing this sample's ADL experience could be developed and evaluated. Tables 9 through 11 present summary data from the arrays, including information from community detailed interviews (Table 9), institutional detailed interviews (Table 10), and screening interviews (Table 11).

Table 9 presents data on detailed community interviews represented in the arrays. This information is limited to the array cells representing months of community interviews, and does not include array cells with duration assignments, institutional interview values, screening interview values, and so forth. The first large data column, headed "Impairment," shows the unweighted number of impairments across all observations for each of six ADLs identified in community detailed interviews, both for the uncensored and censored arrays. We required a full set of non-missing status values across the six arrays in the rightmost non-missing cells of each observation. The small number of observations in which a full set of six non-missing status values was not available in the rightmost position with available data were right-censored at the next prior full set of six non-missing status values. A comparison of the first two data columns in the Impaired category, columns for the uncensored and censored arrays, reveals that censoring reduces the total number of individuals with impairments by only 1 each in the I/O Bed and Bathing ADL arrays in the 1989 wave. As expected, censoring has a greater impact in the 1994 wave. The loss of impaired observations in the 1994 wave to censoring is greatest in the Mobility array, a loss of 11.26 percent. The third data column in the impairment category of Table 9 presents the unweighted number of community interview impairments across ADLs represented in the NLTCS summary "Analytic File." In every instance by wave and ADL, this number exceeds the unweighted uncensored array value. One reason why the Analytic File counts exceed the uncensored array counts is that impairments are defined differently in the summations represented in the Analytic File. Standby help accounts for the largest difference in impairment definition.[23] The column headed "Analytic Impaired Only by Standby" reports the number of individuals in the final retained sample who are identified as impaired in the Analytic File only because they received standby help. These individuals did not report the other forms of impairment used to assign impaired status in the respective ADLs in this research, and are therefore not included among those with impairments in the arrays. In the mobility ADL, for example, 36 individuals in 1982 reported use of standby help but no other impairment in mobility. The final data column in the impairment category indicates the amount by which the Analytic File unweighted *n* for a given wave and ADL is greater (or less) than the unweighted *n* from the corresponding uncensored array. In most instances, the differences are slight. Larger differences in the Bathing and Toileting ADLs are accounted for by other minor differences in the definitions of impairment used in constructing the arrays and the Analytic File community impairment variables.

The second large data category of Table 9 shows unweighted exposure data, again from both the arrays and the Analytic File. Exposure is the total number of impaired and unimpaired responses. This data category also includes a summary column, showing the difference in total unweighted exposure between the uncensored arrays and the community ADL variables of the Analytic File. Of course, these difference figures include instances of both impairment and unimpairment.

Prevalence, both weighted and unweighted, appears as the rightmost large category of Table 9. Prevalence is the ratio of impairment to exposure. Two characteristics of the weighted prevalence data deserve special attention. First, across waves and ADLs, the weighted prevalence of the uncensored and censored arrays is quite similar, indicating that the impact of censoring is largely inconsequential. It should be noted, however, that in the Mobility array, censoring reduces the weighted prevalence in the final wave by 5.59 percent. In the I/O Bed array, censoring reduces weighted prevalence by 4.97 percent. In the Toileting array, censoring reduces weighted prevalence in the final wave by 3.49 percent. However, none of these impacts substantively alters the understanding of impairment prevalence obtained from these data. Importantly, the result of censoring is not an entirely systematic prevalence reduction: it effects no change to prevalence in the community Eating ADL values, and results in a small rise in the community Dressing prevalence.

Analogous information from institutional detailed interviews appears in Table 10. This data is taken only from array cells representing results of institutional interviews. In this instance, however, the 1989 follow-up interview is *not* included, for individuals who completed the initial 1989 institutional detailed interview, to avoid multiple observations on the same individuals in the computations of impairment prevalence. The Analytic File information is provided only as a check on the reasonableness of the magnitudes of data from the arrays. Again, differences between unweighted counts of impairment and exposure are expected between the arrays and the Analytic file, due to differing definitions of impairment. For example, in the Analytic File, an individual responding to an institutional interview is defined as able to perform an ADL task if she or he is not disabled, but the definition of the *un*impaired also includes those "who require assistance or equipment to perform the ADL."[24] The definition in this research counts those who use special equipment as impaired, a difference that may account for the larger weighted prevalence in the Toileting array than in the Analytic File. Nonetheless, across waves and ADLs, differences between the unweighted *n*'s of the uncensored arrays and the Analytic File are small. Differences between weighted prevalence levels for the uncensored and censored arrays are inconsequential in the institutional data. Differences between the weighted institutional prevalence from the arrays and the weighted institutional prevalence from the Analytic File are also small, with the expected exceptions already noted, suggesting that the arrays are a valid representation of NLTCS survey results.

Screening interviews represented in the arrays are summarized by Table 11. Across waves and ADLs, the largest uncensored exposure *n* for screening interviews is 3027, in the Eating array. This is smaller than the total final retained sample, *n* = 3440. This difference is accounted for by that fact that individuals with the same month of screening and detailed interview in a given wave have results of the detailed interview assigned to that month, eliminating results of the screening interview from the arrays. In later waves, such differences are also accounted for by the fact that individuals who received detailed community or institutional interviews in earlier waves were automatically included in the sample frame for detailed interviews in later waves, and generally did not participate in later screening. Table 11 again presents unweighted impairment and exposure data, along with weighted prevalence. Also included in Table 11 is an analysis of the contribution of screening interviews to the combined prevalence, which, separately for each ADL, estimates the total population prevalence using detailed community interviews in waves where they are available. When the detailed community interview is not available, the combined prevalence uses results of institutional interviews, where available. When neither a detailed community interview nor a detailed institutional interview is available, the combined prevalence uses any available information from a screening interview.

The impairment section of Table 11 shows that a relatively small number of observations contribute instances of impairment from screening interviews to the combined prevalence at any given wave and ADL. Also reported, in the fourth data column, is the percentage of impaired observations in the combined prevalence contributed by screening information. For example, in 1982, the Mobility array contributes 12 observations with impairment in the screening interview to the combined prevalence, accounting for 3.49 percent of the impaired individuals represented in the combined prevalence calculation. Since most individuals who report impairments on screening interviews also receive detailed community or institutional interviews, that the contributions of screening interviews to the combined prevalence are small is an expected result. The exposure section of Table 11 illustrates the much larger contribution of screening interviews to the combined prevalence. Those who have no ADL impairments having lasted (or expected to last) 90+ days when screened are generally not included in the detailed interviews, so a large percentage of the combined prevalence is accounted for by screening interview (unimpaired) results. The smaller percentage of combined prevalence accounted for by screening results across ADLs in the 1994 wave (Exposure data column 4) may largely result from a decision by the NLTCS to complete a larger percentage of detailed interviews with unimpaired individuals in that wave, providing additional detailed information about the unimpaired older population for later research. A second contributing factor may be the relatively large number of observations for which 1994 screening dates were unavailable; our procedure for assigning months of screening may in this instance have assigned a larger proportion of the sample without screening dates to dates of detailed interviews (where they would be overwritten by detailed interview information), thus reducing the impact of screening information.

The third data category of Table 11 presents weighted prevalence computations. The first column shows the ADL impairment prevalence of the primarily disabled population (those completing detailed community and institutional interviews).[25] In most ADLs, this prevalence rises consistently across most waves. This rise is expected, given the increasing ages of these individuals across waves. The decline in prevalence from 1982 to 1984 in the arrays representing the I/O Bed, Mobility, and Dressing ADLs is consistent with an analogous decline reported from the community interview data in Table 9, both for the arrays and for the Analytic File. It is also consistent with declining prevalence rates for several ADLs depicted in Table 10, which presented data on institutionalized individuals. This decline is consistent with the significant decline in chronic disability among disabled community and institutional residents in the 1980s, identified by Manton, Corder, and Stallard (1993), using data from the 1982, 1984, and 1989 NLTCS. The array data presented in Tables 9-11 includes information only for individuals who provided known ADL impaired/unimpaired status information, and does not otherwise include or adjust for decedents. Thus this result may also be attributable, in part, to selective loss to the sample between the 1982 and 1984 waves of more impaired individuals. Table 12 illustrates this process. Those who died prior to a 1984 interview were substantially more impaired than those who survived to the dates of 1984 interviews. Only 52.8 percent of the unweighted sample of decedents were unimpaired in 1982 (57.3 percent weighted), and fully 14.3 percent (12.7 percent weighted) were in the most impaired category, with 5 to 6 ADL impairments. Of survivors, 76.2 percent of the unweighted sample were unimpaired in 1982 (85.4 percent weighted), and only 2.9 percent were in the most severely impaired category (1.7 percent weighted). Thus "the deviant dynamics of death" appear to have contributed to the ADL impairment prevalence decline among disabled community and institutional residents from 1982 to 1984.

The next column of the weighted prevalence section of Table 11 shows the weighted ADL impairment prevalence for screening interviews that contribute to the combined prevalence. As expected, the screening prevalence values for this group are considerably smaller than those of the disabled community and institutional population in the preceding column, since screening interviews generally contribute to the combined prevalence only when an individual has "screened out," having no chronic ADL disabilities. Nonetheless, it should be noted that the screening prevalence is non-zero in every instance, since the arrays capture instances of impairment in the month of screening interview regardless of whether or not the impairment duration meets the 90+ day criterion that signals a "screen in" for the community or institutional interview.

The rightmost column of Table 11 shows the weighted combined prevalence for each ADL across four waves. The combined prevalence uses the ADL impairment status of the community detailed interview, where it is available. When it is not available, the institutional detailed interview information is used, where available.[26] In the absence of non-missing information from either the community or institutional detailed interviews for a given ADL array, the screening interview value for that ADL is used. As expected, within each ADL the combined prevalence rises across waves. Figure 5 illustrates the final combined prevalence rates graphically. Although, as expected, they rise monotonically for all six ADLs across waves, the slight "dip" in this rising rate at the 1984 data points is likely attributable to the differential impairment status of those who died before the 1984 wave, described above.

Another way to understand this prevalence data is to pool respondents by age, eliminating the distinction of which wave may have contributed the data for a given individual of a given age. Pooling actually affects only a few ages (ages 67, 68, and 69 appear in both 1982 and 1984, for example), but the resulting prevalence graph nonetheless illuminates dynamics of prevalence with advancing age, and provides another check on the reasonableness of our data. Figure 6 shows weighted prevalence for the 6 ADLs in a sample pooled by age, from the final censored arrays. The trend line depicting the scatter of data points (in this instance a 2nd order polynomial trend line) demonstrates an expected and reasonable pattern for this data.

Finally, the effect of right-censoring to obtain full sets of six non-missing status information in the rightmost non-missing array cells is illustrated in Figure 7. The effect appears to be small in each instance. Note, however, that in individual arrays the effect appears to reduce impairment prevalence in most instances. Analyses of active life expectancy based on the arrays will, therefore, need to account for this apparently non-random effect. The planned controls for unmeasured heterogeneity should capture this effect, among other unmeasured factors contributing to the probabilities associated with active life expectancy.

Duration Intervals and Transitions

How does capturing additional impairment information from otherwise unused screening interview information and duration responses affect the number and length of impairment duration intervals? How does this data recovery process affect the number of identifiable transitions from one state to another? Table 13 addresses the first of these questions. The first two data columns of Table 13 provide summary data describing both the mean length of duration intervals and the number of duration intervals, for each ADL, for simple arrays. These simple arrays include the data used to calculate combined population prevalence statistics described earlier in this report, using: in each wave, community detailed interview data, when they are available; in their absence, institutional interview data; in their absence, screening interview data.[27]

A transition is here defined as any set of two successive months with non-missing ADL status values, or a succession of a single month with a non-missing ADL status value and the month of death. In any succession, a series of one or months with missing values can intervene between the two months with non-missing values that frame a duration interval and establish the transition. In no instance, however, do intervening months contain non-missing values. A succession of two immediately adjacent months with non-missing status values constitutes a single transition with length = 1, and length is incremented by 1 for each intervening month with a missing value. Transition intervals are established by any 0/1 combination of status values, since the modeling of transition probabilities includes the probabilities of transitioning from any given 0/1 state to another. For each ADL, array transition counts are accumulated through the cell at which the array is right censored, either as described above, by the requirement of a full set of non-missing values across the six arrays, or by the month of death.

In the first column of Table 13, the Mobility ADL array, for example, shows a mean duration interval length with the simple array data of 38.31 months, a minimum length of 1, and a maximum of 145. The minimum length in this instance is attributable to a screening or detailed interview result in the first month of interview, followed immediately by the month of death. The mean number of duration intervals for the Mobility ADL across the four NLTCS waves is 2.59, with a minimum of 1 and a maximum of 5. The maximum is attained when an individual participates in all four waves (either in detailed community or institutional surveys), responds to the 1989 institutional follow-up interview, and also has a reported month of death.

The third and fourth data columns of Table 13 show the analogous results for the full arrays described in this report, including all available detailed community and institutional survey data, including duration information from the community surveys, screening data, and so forth. Here the mean duration interval length for the Mobility ADL is 29.95. As expected, this is considerably less (21.8 percent) than the mean 38.31 of the simple arrays. Also as expected, the mean number of duration intervals for the full arrays, 10.15, is substantially larger (392 percent) than the mean from the simple arrays, 2.59. The minimum number of duration intervals, 1, is obtained when only 2 non-missing ADL status cells appear across an array, or when one non-missing status cell is followed, at any later month, by a month of death. Also of interest is a comparison of the maximum values for the number of duration intervals for the simple and full arrays. Clearly, the full arrays offer substantial advantages over the restricted simple array data most commonly used for computing functional status transition probabilities.

Another way to understand the impact of the full arrays is illustrated by Figure 8, which presents frequency distributions of grouped means from the simple and full arrays, using data pooled across the 6 ADLs. For example, for the simple array, the number of instances across the 6 ADLs in which the mean transition interval length falls into the 40-50 month range is about 7,139. The corresponding number from the full arrays is 11,000. The full arrays are responsible for fewer interval means in the 50-145 month group, and for more in each of the remaining groups, all of which span ranges of smaller transition interval lengths. Thus, over a wide range of potential mean duration interval months, the full arrays produce notably shortened intervals. In other words, the temporal distance between any two months of known impairment status, represented by array duration intervals, is notably reduced in the full arrays.

A final graphical illustration of the difference between the simple and full arrays appears in Figures 9A, 9B, and 10. Figure 9A represents the number of observations with each number of transitions, with the total number available being 5. The number of pooled observations represented is 20,640 (3440 x 6). Only 20 observations pooled across 6 ADLs (representing fewer than 4 individuals) have non-missing data for all 5 of the potentially available data collection points, plus a month of death. These 20 observations thus accumulate 5 transitions. This result is, in part, due to the relatively small percentage of the sample institutionalized during the month of any detailed institutional interview. 896 pooled observations (representing about 150 individuals) have available data for either 5 interviews, or 4 interviews and death. The status of a much larger sub-sample, n = 12,392 (representing approximately 2,065 individuals) is known at 4 points of the years 1982 through 1996.[28] The remaining individuals have 2 or 3 available months of known status, constituting 1 or 2 transitions, respectively.

Figure 9B presents the analogous information from the full arrays. In the full arrays, many more potential transitions exist than the 5 shown in Figure 9B. Figure 9B represents n = 17,932 pooled observations, roughly the lower 87 percent of the distribution of the number of transitions.

Notable in a comparison of Figures 9A and 9B is the considerable shift in proportions, from a preponderance of observations with fewer transitions in the simple arrays, to a preponderance of observations with more transitions in the full arrays.

The remaining 13 percent at the right of the transition distribution from the full arrays is represented in Figure 10. Here the large number of observations for the categories representing 1 through 5 transitions (illustrated in Figure 9B) is omitted from the graph, and two transition length groups are truncated at 150 observations, so the remaining distribution can be discerned clearly. In Figure 10, we can observe considerable heterogeneity, a result of widely varying patterns of impairment duration. In the data constituting Figure 9A, data that provides a much more sparse representation of the lived experience of the same individuals through a period of about 14 years (from 1982 through the latest available death dates, in 1996), this heterogeneity is largely unobserved. The availability of the heterogeneity represented in Figure 10, combined with the separate availability of the 6 ADL arrays described in this report, provide a basis for improved estimates of functional status transition probabilities and active life expectancy.

Conclusion

This report has described the preparation of data from the National Long-Term Care Survey for research on active life expectancy with a dynamic multiple-indicator model of dependency in Activities of Daily Living (ADLs). The report also described the resulting data. Importantly, the resulting data set makes use of all functional status information available across four NLTCS waves for six ADLs, including information from screening interviews, detailed interviews in the community, and institutional interviews. It also captures all available information elicited from respondents about the *duration* of any impairment in these ADLS. The data were prepared as described in this report to enable the calculation of improved estimates of the probabilities that an older individual will transition from one functional status state to another in any of six ADLS. These probabilities can then be used to improve estimates of active life expectancy.

Endnotes

1. Nagi (1965, 1991) and Verbrugge and Jette (1994) developed theoretical frameworks for conceptualizing disability and the disablement process. In their frameworks, "pathology" first interrupts normal processes. "Impairment" may result, specifically defined as an anatomical, physical, mental, or emotional abnormality or loss involving tissues, organs, or systems. Impairments may or may not produce "functional limitations," which limit performance of physical actions or mental tasks at the organism level. Depending upon the social structures in which impairments develop, "disability" may then occur, the social definition of the inability to carry out specific roles or activities. While recognizing these distinctions, this report generally uses a more broadly defined concept of "impairment," as defined in the text. Our use of the term "impairment" generally encompasses both the pathology (or its results) and the impairment defined by Nagi, as well as functional limitations. To the extent that individuals who receive help in an ADL may not actually require that help, our use of "impairment" may also refer to Nagi's "disability," even in the absence of either pathology, impairment, or functional limitation in the sense defined by Nagi. Further relevant analysis of these definitions and their interrelationships appears in Burkhauser (1997).

2. Manton, Woodbury, Stallard, and Corder (1992) address this challenge using fuzzy logic categorization, which they call "Grade of Membership" (GoM). This approach preserves all unmeasured heterogeneity, but entails other limitations described by Wolf, Freedman, Marcotte, and Ploutz-Snyder (2000).

3. In some instances, non-missing information was available for individuals across the six ADLs for screening or full interviews for which dates of interview were unavailable in the NLTCS. In the 1982 interview wave, for example, 24 observations had complete sets of non-missing ADL information from the screening interview but missing values for the dates of screening, and 18 observations had complete sets of non-missing ADL information for the community or institutional interviews, but missing values for the dates of interview. In such instances, frequencies of the dates of screening or full interview were examined as a basis for assigning the ADL information to months of interview. 1984 screening interviews were conducted from June through October, for example, but 75 percent of the initial sample (n = 5523) were screened in June. Thus observations with available ADL information but missing screen month information in 1984 were assigned screen month 6. 1984 detailed community or institutional interviews for this sample were also conducted from June through October, with approximately 50 percent of those interviews conducted in August. Thus the ADL information for observations with available ADL information but missing months of detailed interview in 1984 were assigned to the array cells corresponding to month 8 of 1984.

4. In six observations of the sample n = 5379, the date of death preceded an NLTCS month of interview. In these instances, either the date of interview or the date of death is erroneous. However, we have no information that would enable us to identify which date is in error. We therefore removed these observations from the data at this point, as well.

5. Personal communications with a researcher at the Center for Demographic Studies, Duke University, which conducts the NLTCS, confirmed that financial constraints prevented the inclusion in the 1989 wave of a sizable number of individuals who had participated in the 1982 and 1984 waves, although those among these individuals who remained alive and agreed to participate were interviewed again in 1994 (Corder, 2000).

6. Obtained from the 1982 disability group variable of the "Analytic File" distributed with the NLTCS.

7. The screening interview question for using the toilet differs in this regard from those for other ADLs, asking simply, "Do you have a problem getting to the bathroom or using the toilet?"

8. One screening interview IADL question (labeled an ADL in the screening instrument) asks about "going outside without the help of another person or special equipment." In the detailed community interview, an analogous question is included among the Instrumental Activities of Daily Living (IADLS): "Do you get around outside at all, either with help or without help?" Further questions elicit details of help received or special equipment used. We restrict our data and the initial planned analyses to the six ADLs described throughout the text, although the addition of these questions for getting around outside suggests a potential extension of this research. Katz, et al. (1963) established a commonly accepted standard list of ADLs, which includes bathing, feeding, dressing, toileting, and indoor transfer; Katz included outdoor mobility among IADLs.

9. The ADL pattern of questions for "getting to the bathroom or using the toilet" differs from that for other ADLs, owing to the inclusion of additional detailed questions about incontinence, and use of urinary catheters or colostomy bags. Respondents are also asked about help received cleaning up after incontinence, or with the management of catheters or colostomy bags. We assigned ADL impairments when the respondent reported receiving help cleaning up after incontinence, or when help was received with a catheter or colostomy bag. Respondents who reported cleaning up after incontinence without assistance were not judged to be impaired for the purposes of this research. By definition, those with a urinary catheter or colostomy bag utilize resources, the criterion upon which we base impairment. But many individuals survive for many years with a urinary catheter or a colostomy bag with little outside assistance, and the ongoing cost of equipment in such instances (after any medical or surgical procedures associated with the initiation of their use) is often trivial. When respondents with a catheter or colostomy bag indicated they cared for it themselves, therefore, we judged these individuals to be unimpaired in the toileting ADL.

10. The institutional definition included those in registered nursing homes, persons in convalescent or rest homes with 3 or more elderly residents and medical care available 24 hours per day, as well as persons in hospital beds designated as "chronic care" beds (Manton, et. al, 1993).

11. An individual can also "screen in" if she or he has a chronic IADL disability, defined as an inability to perform the task, because of a disability or health problem (including "old age"), again having lasted, or expected to last, 90 or more days.

12. Where the screening survey and either the detailed community or institutional interview are conducted in the same month, values from the detailed interview are entered in the array cell representing that month. Detailed community or institutional interviews are conducted under more controlled circumstances than screening interviews, are more likely to be conducted in person (only about 20 percent of screening interviews are conducted in person), and are likely to produce results with greater validity than screening interviews. For our sample, there are also instances where the recorded date of screening interview represents a month that follows the month of a detailed interview for the same wave. There are 6 such instances in 1982, 1 each in 1984 and 1989, and 5 in 1994. In these instances, we assigned the month of screening to the month of interview. Since detailed interview information overwrites screening information in the arrays, ADL status information from these screening interviews remains in the data only in instances where an individual ADL variable from the detailed interview for the given wave contains missing data.

13. Manton, et al. (1994) report that impairment values from screening interviews were used to make sample weight adjustments in instances where deaths occurred between screening interviews and scheduled detailed interviews.

14. We recognize that this inference is of uncertain validity. As the third data column of the Table 2 Impaired Months section reveals, the impact of this coding strategy on the resulting arrays is minimal, with a maximum of 1 instance across most ADL arrays (maximum=2 for Mobility), and a small mean number of such assignments in each ADL. All other assignments described are known results from respondents' responses. It should also be noted that the conservative duration assignment rule for community interview durations, which has much greater impact on the final arrays, is likely to assign considerably fewer than the actual number of impaired months reported by respondents, since we include the month of impairment (in all instances a fractional month) in the number of months assigned impairment. In sum effect, our conservative duration assignment rule is also likely to assign considerably fewer than the actual number of duration months experienced by respondents; it is reasonable to expect that the variation of responses to duration questions is a random process, with the mean actual number of impairment months for any given interval approaching the interval mid-point as the sample grows large. Thus our conservative assignment rule, assigning in every instance the floor of the reported duration interval, is likely to under-represent actual impairment duration in the sample.

15. Duration questions are asked of all respondents in the detailed community interview for ADL tasks the respondent cannot perform, and for those with which the respondent receives help or uses special equipment. Although these questions are asked of all such respondents, not all observations with impairment in a given ADL have non-missing duration information for that ADL. The table below summarizes missing duration information in the final retained sample:

Observations with ADL Impairments in Detailed Community Interviews With Missing Duration Information n = 3440		
	Receives Help or Uses Special Equipment	Cannot Do the Activity
Eating	4	1
I/O Bed	12	0
Mobility	9	0
Dressing	18	1
Bathing	8	2
Toileting	7	7

16. Manton (1988) notes that recovery was a significant factor in the NLTCS sample between 1982 and 1984. The descriptive information of Table 3 illustrates in crude form how the duration information of the data set described in this report may be used to provide a more refined understanding of disability trends across the NLTCS surveys. In addition to the development of transition probabilities and improved estimates of active life expectancy, these data can be used to gain a more detailed understanding of impairment episodes and their duration, recovery, and subsequent impairment.

17. Impairment duration end-points are identified by respondents. It should be noted, therefore, that to the extent that respondent recall is valid, assigning impairment duration end-points do not "create" transitions. Transitions thus "created" are not merely artifacts of data processing. Transitions reflected in the arrays, including those represented by relationships between impairment duration end-points and the ADL status represented in other cells of the same array, capture the reported experience of the individuals represented by the arrays.

18. Table 5 may underestimate within-wave contradictions. The data in Table 5 were calculated from the final arrays. While most respondents who completed both a screening interview and a community detailed interview or an institutional detailed interview for a given wave did so in different months, some completed both the screen and the detailed interview in the same month. In these instances, the array cell representing the month of interview contains data from the detailed interview only. Thus, the arrays do not provide a basis for evaluating response consistency for these individuals.

19. This difference may be accounted for, in part, by the fact that in 1982 all sample members completed a screening interview as well as a detailed interview, while in later waves a substantial number of respondents were "automatic screen-ins," who completed only the detailed interview, and thus had no opportunity to report contradictory information. It would also not be surprising if the initial wave involved a higher rate of interview or coding errors.

20. Inferred impairment months were in no instance assigned based on information from a wave earlier than the immediately preceding wave. Thus, where an individual did not participate in the immediately preceding wave, or where there were no months of impairment identified for a given ADL in the immediately preceding wave, no months of impairment were inferred or assigned.

21. Death dates are available in both the Analytic File and, in some instances, in the data associated with individual waves. In one instance the dates of death differ for the same individual. Dates used in this research are from the Analytic File.

22. In the final retained sample, there are 8 instances in 1982, 3 in 1984, 2 in 1989, and 1 in 1994.

23. The community questionnaire asks, "Did someone usually stay nearby just in case ... might need help?"

24. Source: NLTCS Analytic File documentation, 11/10/97 Release. Filename: An111097.cat.

25. Those completing detailed community interviews in 1982 had already been identified through a screening interview as having at least one chronic ADL impairment. In 1984, however, those who had completed a detailed community interview in 1982 were automatically included in the survey frame for either a detailed community or institutional interview. Thus the 1984 community sample may include individuals without impairments, those who recovered from impairments existing in 1982. The same selection criterion included those who had been institutionalized or who completed the detailed community survey in 1984 in the frame for 1989 detailed surveys. So, again, the 1989 detailed community survey includes individuals who are not impaired. The 1994 detailed community survey similarly included unimpaired individuals through an analogous selection criterion, and also included additional unimpaired individuals. Included among them are 78 individuals in our final retained sample who are designated as "abbreviated type-H" individuals in the NLTCS 1994 interview status variable of the Analytic File. These individuals received both screening interviews and detailed community interviews in 1994, but ADL questions in the community interviews were not asked. These individuals were known from the screening interview to be unimpaired in all 6 ADLs, and unimpaired status was assigned to all 6 community detailed ADL variables. We follow the NLTCS judgment, and assign unimpaired status to the months of community interview, despite the fact that the ADL questions were not in all cases actually asked of these individuals during the month of interview. An additional 10 individuals in our sample are designated as having received "non-H abbreviated" interviews. As with the type-H individuals, these

respondents were not asked the ADL questions when they participated in the detailed community interview, and all 10 were assigned unimpaired values in the ADL variables associated with the community interview. Only 5 of these observations have non-missing values for ADL status in the relevant 1994 screening interview variables, however. Since we have not identified a data source that would confirm the appropriateness of assigning an ADL status to the months of detailed community interviews for these 5 individuals, we do not assign impaired or unimpaired status for their ADLs in 1994.

26. Where the 1989 institutional detailed interview is available, it is used. If an individual array has missing values for both the 1989 community detailed interview and the 1989 institutional interview, the 1989 institutional follow-up is used, where available, in preference to the 1989 screening interview.

27. Mean impairment interval duration and the number of duration intervals were also calculated for a chronically impaired sample, using only detailed community and institutional interviews. Using the arrays developed for this research, however, the number of observations with at least one transition with this more restrictive criterion is only n = 1494, considerably less than the n = 3440 used throughout this report for the larger population of individuals at ages 65-69 in 1982. As expected, the mean number of intervals declines with this data, since fewer observation points gathered data in the field and exist in the arrays, to 2.14 in the pooled arrays. However, the pooled array mean interval length is 36.32, unexpectedly smaller than that presented in the first column of Table 13 for the Simple Arrays. This effect is likely due to considerably different sample characteristics for the notably smaller sample limited to chronically impaired individuals. The mean interval length of only about 3 years also suggests that a large proportion of this sample died early in the period spanned by the surveys, since the interval between later waves is about 5 years. The 2-year interval between the first and second waves, combined with the possibility of relatively short intervals between interviews and death months, as well as the known number of more impaired individuals in our retained sample who died before the 1989 interviews, all suggest that the 3 year mean interval for this sample is reasonable.

28. Although the latest NLTCS survey was conducted in 1994, death dates are available through 1996.

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Table 1
Demographic Characteristics of Initial Sample Age 65-69 in 1982 (Sample 1, *n*= 5379)[a]
and Final Array Sample (Sample 2, *n*=3440)
NLTCS, Percent Distribution of Samples

	Male				Female				Total	
	White		Non-White		White		Non-White			
Sample:	1	2	1	2	1	2	1	2	1	2
1982 Age										
65	5.9	5.8	0.5	0.4	6.9	5.5	0.7	0.6	14.0	12.4
66	8.9	8.5	0.8	0.7	11.5	9.6	1.1	1.1	22.2	19.9
67	8.8	8.9	0.8	0.9	11.1	9.7	1.2	1.2	22.0	20.6
68	8.4	8.3	0.8	0.8	11.2	9.6	1.2	1.3	21.6	20.1
69	8.0	10.9	0.8	1.2	10.3	13.4	1.1	1.5	20.2	27.0
Total	40.0	42.4	3.6	4.0	51.1	47.8	5.3	5.8	100	100
Male									43.7	46.5
Female									56.3	53.5
White									91.1	90.2
Non-White									8.9	9.8

[a]Sample of all NLTCS observations ages 65-69 in 1982 in which a non-institutionalized respondent participated in the survey. Includes 74 observations for which both 1982 Screener and Community Interview dates are missing, but for which the wave 1982 Basic Prevalence Weight is non-zero. 70 of these observations have non-missing ADL information from the 1982 Screener, and 4 include non-missing ADL information from the 1982 Community Interview. 1982 Screen months are months 6-10; ages reported are computed to the month of 1982 Screener and/or Community Interview; for the 74 observations with missing Screener or Interview dates, age in years is computed and assigned as of 1982 month 8, and the available ADL values are assigned to month 8 as well.

Table 2: Descriptive Statistics of Monthly Status Assignments
n=3440

	Unimpaired Months					Impaired Months						Total Months			
	Screen	Community Interview	Screen Month - 2 (Screen ADL, Dur. < 3 mos.)	Community Int. Duration Endpoint	Institutional Interview	Screen	Community Interview	Month Preceding Screen, When Duration < 3 Mos.	Conservative Application of Comm. Interview Duration	Institutional Interview Duration	Months between Duration Assignments and Preceding Wave	Unimpaired	Impaired	Dead	No Data
Eating															
Mean	1.965	0.817	0.002	0.016	0.032	0.017	0.039	0.002	0.603	0.032	0.037	2.83	0.73	61.69	134.48
Std. Dev.	1.126	1.131	0.042	0.127	0.224	0.128	0.227	0.042	5.291	0.223	0.932	0.91	5.76	67.56	52.03
Min.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Max.	4	4	1	1	3	1	3	1	129	3	45	5	133	216	217
I/O Bed															
Mean	1.913	0.674	0.007	0.071	0.015	0.055	0.184	0.007	3.877	0.049	0.299	2.68	4.47	61.69	130.89
Std. Dev.	1.175	1.029	0.082	0.271	0.144	0.227	0.521	0.082	15.208	0.288	2.929	1.00	16.75	67.56	53.62
Min.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Max.	4	4	1	3	2	1	4	1	186	3	61	5	193	216	217
Mobility															
Mean	1.869	0.584	0.013	0.098	0.013	0.101	0.268	0.013	6.170	0.048	0.840	2.58	7.44	61.69	128.03
Std. Dev.	1.203	0.966	0.116	0.319	0.143	0.302	0.656	0.115	20.087	0.284	5.560	1.07	23.37	67.56	55.06
Min.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Max.	4	4	2	3	3	1	4	2	194	3	61	5	201	216	217
Dressing															
Mean	1.921	0.710	0.006	0.049	0.015	0.053	0.136	0.006	2.631	0.044	0.230	2.70	3.10	61.69	132.24
Std. Dev.	1.161	1.059	0.078	0.225	0.151	0.225	0.450	0.078	12.361	0.271	2.494	1.00	13.66	67.56	53.14
Min.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Max.	4	4	1	2	3	1	3	1	186	3	59	5	193	216	217
Bathing															
Mean	1.882	0.555	0.010	0.103	0.004	0.079	0.293	0.010	6.855	0.060	0.994	2.55	8.29	61.69	127.20
Std. Dev.	1.191	0.941	0.097	0.326	0.078	0.271	0.673	0.097	20.577	0.330	6.061	1.08	23.85	67.56	54.87
Min.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Max.	4	4	1	2	2	2	4	1	195	3	62	5	201	216	217
Toileting															
Mean	1.931	0.705	0.006	0.061	0.017	0.040	0.149	0.006	3.267	0.046	0.299	2.72	3.81	61.69	131.52
Std. Dev.	1.155	1.053	0.080	0.249	0.162	0.196	0.470	0.080	14.125	0.280	2.851	0.99	15.56	67.56	53.13
Min.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Max.	4	4	1	2	2	1	4	1	176	3	50	5	182	216	217

Table 3
Impairment Duration Frequencies[a]
n=3440

ADL	Frequency Across 4 Waves for the Same Individual	Months of Impairment 1-2	3-5	6-11	12-59	60+
Eating	1	23	13	19	48	26
	2	1	0	0	5	2
	3	0	0	0	0	1
	4	0	0	0	0	0
I/O Bed	1	85	38	83	222	138
	2	3	0	0	36	36
	3	0	0	0	1	6
	4	0	0	0	0	4
Mobility	1	82	55	112	328	183
	2	3	1	1	64	46
	3	0	0	0	13	25
	4	0	0	0	0	8
Dressing	1	59	34	59	159	87
	2	1	0	0	30	19
	3	0	0	0	1	8
	4	0	0	0	0	2
Bathing	1	87	73	90	350	204
	2	1	2	2	84	66
	3	0	0	0	11	24
	4	0	0	0	0	2
Toileting	1	70	34	65	206	95
	2	1	0	1	35	28
	3	0	0	0	1	8
	4	0	0	0	0	3

[a]Duration lengths and frequencies as reported by respondents to NLTCS community interviews (not from arrays). Array duration assignments are assigned conservatively, as the floor of a respondent's impairment duration response (e.g., "Six months to less than a year" is assigned 6 month of duration only, including the month of interview). Array durations are censored at previous waves, and do not extend in all instances to the duration lengths reported by respondents. Some duration segments may be shortened or removed by right-censoring, where a full set of six ADL values is not available at the rightmost wave assignment. In these instances, arrays are censored at the month corresponding to the rightmost full set of six non-missing ADL values.

Table 4
Transition Intervals Created by Impairment Duration Interval Endpoints[a]
n=3440

ADL		Next Prior Information to Current Wave Duration Endpoint[b]	Duration Endpoint to Current Wave Community Interview	Duration Endpoint to Leftmost ADL Duration Assignment
Eating	*n*	56	56	35
	Mean	28.57	10.52	10.89
	S.D.	19.08	15.77	15.44
	Min.	0	2	3
	Max.	61	59	48
I/O Bed	*n*	257	257	173
	Mean	26.74	19.11	20.72
	S.D.	20.39	23.05	20.73
	Min.	0	2	3
	Max.	63	59	48
Mobility	*n*	354	354	268
	Mean	25.86	23.61	23.35
	S.D.	21.72	24.64	21.27
	Min.	0	2	3
	Max.	108	59	48
Dressing	*n*	172	172	114
	Mean	28.52	15.97	17.07
	S.D.	15.97	20.94	19.47
	Min.	0	2	3
	Max.	63	59	48
Bathing	*n*	362	362	275
	Mean	24.65	24.32	24.23
	S.D.	24.32	25.26	21.61
	Min.	0	2	3
	Max.	63	59	48
Toileting	*n*	219	219	154
	Mean	26.47	22.59	24.00
	S.D.	21.28	24.72	21.44
	Min.	0	2	3
	Max.	63	59	48

[a]Respondents identifying impairment durations implicitly also identify a prior month during which the ADL impairment did not exist. For example, an impairment duration of "Six months to less than one year" suggests that the impairment did not exist in the twelfth month prior to the month of interview. Such months are assigned unimpaired status. In instances where the next previous interview information identifies an impairment in the same ADL, the assigned months of unimpairment create a transition. The column headed "Next Prior Information to Current Wave Duration Endpoint" provides data on intervals between the next previous impairment information for the given ADL and the month assigned as the impairment duration endpoint. The column headed "Duration Endpoint to Current Wave Community Interview" provides data on intervals between the assigned duration endpoints and the months of community interviews which determine them. Between community interview months and duration endpoints are assigned months of impairment, conservatively assigned leftward from the month of community interview to the floor of the respondent's reported impairment duration. The column headed "Duration Endpoint to Leftmost ADL Duration Assignment" reports information about the transition interval created by the assignment of the impairment duration endpoint, the interval between the endpoint and the leftmost conservatively assigned month of impairment duration.
[b]Minimum equals zero in 1982 assignments.

Table 5
Within-wave Contradictions
Between Impairment Duration Statements of Community Interview and Screener ADL Status[a]
n = 3440

	Wave			
ADL	1982	1984	1989	1994
Eating	15	0	2	0
I/O Bed	63	3	6	7
Mobility	57	5	4	6
Dressing	43	2	1	0
Bathing	82	11	7	5
Toileting	70	2	3	4

[a]Counts of instances in which, within a given wave, respondents to the community interview identified an ADL duration that extended backward in time to include or extend beyond the same wave's month of screening, in instances where the respondent identified no ADL impairment in the given ADL in the month of screening. In these instances, the duration from the community interview is assigned to its leftward extent, including the month of screening, under the assumption that the community interview response, elicited under more controlled circumstances, has greater validity. Leftward duration assignments are nonetheless governed by other assignment criteria, e.g., a previous wave's non-missing ADL status censors this assignment at the previous wave's t+1.

Table 6
Cross-wave Contradictions
Between Respondents' Impairment Duration Statements and Previous Wave ADL Status
and
Duration Reduction from Left-Censoring at Prior Wave Known Status
n = 3440

	Number of Contradictions by Wave[a]		Percent Reduction in Number of Duration Months Assigned from Number of Respondent Duration Months[b]
ADL	1984	1989	
Eating	2	1	1.10
I/O Bed	14	10	1.97
Mobility	27	32	1.68
Dressing	10	14	1.93
Bathing	30	40	1.96
Toileting	17	18	1.53

[a]Counts of instances where the respondent's impairment duration report in the current wave extends leftward beyond the rightmost month indicating a previous wave's unimpaired ADL status. In these instances, the contemporaneous ADL status of the previous wave is assumed to have greater validity than retrospective impairment duration recollections at the current wave, and remains unchanged; the leftward duration assignment from the current wave is censored at the month following the previous wave's rightmost month with an unimpaired ADL value (from community or institutional interview, where available, else screener). Duration responses from waves 1982 and 1994 have no contradictions with previous waves, and are not shown.
[b]All impairment assignments in an interval between waves are governed by the interview wave ending the interval. Thus, in instances where a respondent reports an ADL impairment duration in a given interview that extends leftward to or beyond the month of a prior interview, the array duration assignment is left-censored at the month following in time the month of prior interview; any impairment assignments for the month of prior interview, or for months preceding the prior interview, are made exclusively in response to the respondent's ADL status and duration reports in the prior interview. Reported here are the percentage reductions in the number of impairment months assigned produced by left-censoring at prior interviews. Mean number of assigned duration impairment months are reported in Table 2.

Table 7: Means and Standard Deviations of Variables Used In the Logistic Analysis to Determine Adjustments to Weighting for Samples Used in the Analysis, and for Samples to which Weights are Applied

	Used for Logistic Analysis to Determine Weight Adjustments *n* = 4294				Sample to which Resulting Weights Are Applied			
	(a) Included 1989 Wave *n* = 2364		(b) Excluded 1989 Wave[a] *n* = 1928		(c) Decedents by 1989[b] *n* = 1076		(a + c) Combined Final Sample *n* = 3440	
Age								
65	0.120	0.325	0.167	0.373	0.134	0.341	0.124	0.330
66	0.199	0.400	0.263	0.440	0.199	0.399	0.199	0.400
67	0.199	0.399	0.245	0.430	0.221	0.415	0.206	0.404
68	0.189	0.392	0.243	0.429	0.227	0.419	0.201	0.401
69	0.293	0.455	0.081	0.274	0.219	0.414	0.270	0.444
all ages, 65-69	67.34	1.39	66.81	1.21	67.20	1.34	67.29	1.38
Sex								
Female	0.587	0.493	0.613	0.487	0.424	0.494	0.535	0.499
Male	0.413	0.493	0.387	0.487	0.576	0.494	0.465	0.499
Race								
White	0.914	0.280	0.929	0.257	0.875	0.331	0.902	0.298
Black	0.075	0.263	0.059	0.235	0.111	0.314	0.086	0.280
Other	0.011	0.104	0.012	0.111	0.015	0.121	0.012	0.110
Marital Status								
Married	0.159	0.366	0.031	0.174	0.250	0.433	0.187	0.390
Widowed	0.071	0.258	0.013	0.115	0.099	0.299	0.080	0.272
Divorced	0.013	0.114	0.001	0.032	0.028	0.165	0.018	0.132
Separated	0.004	0.062	0.000	0.000	0.007	0.086	0.005	0.070
Never Married	0.015	0.121	0.002	0.039	0.018	0.132	0.016	0.124
Unknown	0.738	0.440	0.953	0.212	0.598	0.491	0.694	0.461
Regional Office								
Boston	0.083	0.276	0.093	0.290	0.079	0.270	0.082	0.274
New York	0.059	0.236	0.084	0.277	0.071	0.256	0.063	0.243
Philadelphia	0.082	0.275	0.083	0.276	0.096	0.294	0.087	0.281
Detroit	0.091	0.288	0.088	0.284	0.100	0.301	0.094	0.292
Chicago	0.057	0.232	0.068	0.252	0.068	0.252	0.060	0.238
Kansas City	0.092	0.289	0.093	0.291	0.088	0.284	0.091	0.288
Seattle	0.074	0.262	0.086	0.281	0.070	0.255	0.073	0.260
Charlotte	0.091	0.288	0.070	0.255	0.088	0.284	0.090	0.286
Atlanta	0.131	0.338	0.107	0.309	0.122	0.327	0.128	0.335
Dallas	0.120	0.325	0.103	0.304	0.112	0.316	0.117	0.322
Denver	0.049	0.215	0.051	0.221	0.043	0.202	0.047	0.211
Los Angeles	0.070	0.255	0.074	0.261	0.063	0.243	0.068	0.252
Disability Group								
Not Disabled	0.787	0.410	0.959	0.198	0.628	0.483	0.738	0.440
IADLs only	0.086	0.280	0.018	0.132	0.112	0.316	0.094	0.292
1-2 ADLs	0.075	0.263	0.013	0.115	0.113	0.317	0.087	0.282
3-4 ADLs	0.034	0.182	0.004	0.060	0.054	0.226	0.040	0.197
5-6 ADLs	0.018	0.134	0.006	0.079	0.092	0.289	0.041	0.198

[a]Group excluded from the 1989 NLTCS.
[b]Decedents by first screening day of 1989 NLTCS.

Table 8: Logistic Analysis Coefficients for Auxiliary Variables Predicting Inclusion in the 1989 NLTCS among Survivors to 1989
N=4294[a]

	Logit 1	***Logit 2***	***Logit 3***	***Logit 4***
Intercept	0.205(0.031)**	1.422(0.093)**	3.158(0.211)**	3.639(0.353)**
AGE (*omitted group=Age 69*)				
65		-1.612(0.120)**	-1.654(0.125)**	-1.654(0.125)**
66		-1.555(0.109)**	-1.617(0.113)**	-1.617(0.113)**
67		-1.492(0.110)**	-1.557(0.114)**	-1.559(0.114)**
68		-1.531(0.110)**	-1.598(0.114)**	-1.599(0.114)**
SEX (*omitted group=Female*)				
Male		0.115(0.065)	0.188(0.069)**	0.186(0.069)**
RACE (*omitted group=White*)				
Black		0.260(0.129)*	0.036(0.141)	0.037(0.141)
Other		-0.091(0.296)	-0.149(0.323)	-0.154(0.324)
Marital Status (*omitted group=Married*)				
Widowed			0.068(0.258)	0.063(0.262)
Divorced/Separated			1.247(0.742)	1.196(0.746)
Never Married			0.645(0.625)	0.647(0.629)
Unknown			-1.926(0.146)**	-2.403(0.315)**
REGIONAL OFFICE (*omitted group=Los Angeles*)				
BOSTON			-0.164(0.170)	-0.170(0.170)
NEW YORK			-0.428(0.180)*	-0.423(0.180)*
PHILADELPHIA			-0.062(0.172)	-0.062(0.172)
DETROIT			0.064(0.168)	0.060(0.168)
CHICAGO			-0.081(0.183)	-0.083(0.183)
KANSAS CITY			-0.035(0.168)	-0.041(0.168)
SEATTLE			-0.086(0.171)	-0.094(0.171)
CHARLOTTE			0.199(0.174)	0.196(0.175)
ATLANTA			0.098(0.161)	0.100(0.161)
DALLAS			-0.009(0.164)	-0.006(0.164)
DENVER			-0.135(0.197)	-0.150(0.198)
DISABILITY GROUP (*omitted group=nondisabled*)				
IADLs only (disgrp82=2)				-0.593(0.360)
1-2 ADLs (disgrp82 eq 3)				-0.513(0.375)
3-4 ADLs (disgrp82 eq 4)				-0.134(0.505)
5-6 ADLs (disgrp82 eq 5)				-1.081(0.454)*
-2 Log Likelihood	5907.99	5576.35	5152.49	5145.64
Likelihood Ratio Chi-Square, d.f.		331.64, 7	755.50, 22	762.36, 26
Nested Chi-Square, d.f.		331.64, 7	423.86, 15	6.85, 4

* $p < 0.05$
** $p < 0.01$
[a]Ages 65-69 in 1982, alive to first day of first screen month in 1989. At least two waves of non-missing ADL or death information, at least two non-missing cells for ADL status or month of death for each of six ADL arrays. 1982 institutionalized not included. Standard errors in parentheses.

Table 9: NLTCS, Ages 65-69 in 1982
Community Interview Sample Meeting Final Array Criteria
Analysis of Differences between Arrays and Analytic File for the Same Sample
n= 3440

		Unweighted														Weighted			
		Impairment					Exposure				Prevalence								
Wave	ADL	Uncensored Array *n*	Censored Array *n*	Analytic File *n*	Analytic Impaired Only by Standby[a] *n*	Amount of Analytic File > (<) Array Not Accounted for by Analytic Use of Standby or *n*	Uncensored Array *n*	Censored Array *n*	Analytic File *n*	Amount of Analytic File > (<) Array Not Accounted for by Censoring *n*	Uncensored Array	Censored Array	Analytic File	Analytic File Without Standby Help	Uncensored Array	Censored Array	Analytic File	Analytic File Without Standby Help
1982	Eating	64	64	115	49	2	1050	1050	1054	4	0.061	0.061	0.109	0.063	0.051	0.051	0.091	0.052
1984	Eating	43	43	78	35	0	1061	1061	1066	5	0.041	0.041	0.073	0.040	0.034	0.034	0.064	0.034
1989	Eating	25	25	57	32	0	882	878	889	7	0.028	0.028	0.064	0.028	0.024	0.024	0.056	0.024
1994	Eating	15	14	33	18	0	724	674	737	13	0.021	0.021	0.045	0.020	0.019	0.019	0.043	0.019
1982	I/O Bed	253	253	300	46	1	1050	1050	1054	4	0.241	0.241	0.285	0.241	0.209	0.209	0.247	0.209
1984	I/O Bed	202	202	240	37	1	1063	1063	1066	3	0.190	0.190	0.225	0.190	0.163	0.163	0.196	0.163
1989	I/O Bed	169	168	190	21	0	882	880	889	7	0.192	0.191	0.214	0.190	0.172	0.171	0.192	0.170
1994	I/O Bed	127	113	139	12	0	723	676	737	14	0.176	0.167	0.189	0.172	0.161	0.153	0.173	0.158
1982	Mobility	332	332	377	36	9	1040	1040	1054	14	0.319	0.319	0.358	0.324	0.278	0.278	0.312	0.283
1984	Mobility	300	300	333	25	8	1058	1058	1066	8	0.284	0.284	0.312	0.289	0.248	0.248	0.274	0.253
1989	Mobility	279	279	301	16	6	874	872	889	15	0.319	0.320	0.339	0.321	0.285	0.286	0.305	0.287
1994	Mobility	222	197	225	2	1	722	675	737	15	0.307	0.292	0.305	0.303	0.286	0.270	0.283	0.281
1982	Dressing	198	198	238	30	10	1036	1036	1054	18	0.191	0.191	0.226	0.197	0.165	0.165	0.194	0.170
1984	Dressing	155	155	192	29	8	1049	1049	1066	17	0.148	0.148	0.180	0.153	0.127	0.127	0.157	0.132
1989	Dressing	108	108	132	17	7	873	870	889	16	0.124	0.124	0.148	0.129	0.110	0.110	0.133	0.115
1994	Dressing	70	66	87	15	2	725	675	737	12	0.097	0.098	0.118	0.098	0.088	0.089	0.106	0.089
1982	Bathing	359	359	418	49	10	1036	1036	1054	18	0.347	0.347	0.397	0.350	0.302	0.302	0.346	0.305
1984	Bathing	344	344	395	42	9	1054	1054	1066	12	0.326	0.326	0.371	0.331	0.291	0.291	0.330	0.295
1989	Bathing	303	302	333	21	9	873	870	889	16	0.347	0.347	0.375	0.351	0.321	0.321	0.347	0.324
1994	Bathing	218	208	262	7	37	689	666	737	48	0.316	0.312	0.355	0.346	0.298	0.295	0.338	0.328
1982	Toileting	181	181	218	59	(22)	1050	1050	1054	4	0.172	0.172	0.207	0.151	0.151	0.151	0.178	0.128
1984	Toileting	165	165	189	40	(16)	1057	1057	1066	9	0.156	0.156	0.177	0.140	0.134	0.134	0.151	0.117
1989	Toileting	161	161	163	24	(22)	875	872	889	14	0.184	0.185	0.183	0.156	0.167	0.167	0.167	0.140
1994	Toileting	131	119	143	9	3	716	672	737	21	0.183	0.177	0.194	0.174	0.172	0.166	0.180	0.163

[a]Individuals in this category are identified as impaired in the Analytic File if they have standby help. Some in this category also report needing help, but a report of needing help without a report of standby help does not assign an ADL impairment in the Analytic File. Arrays do not assign ADL impairment for standby help in the absence of other selection criteria.

Table 10: NLTCS, Ages 65-69 in 1982
Institutional Interviews
Sample Meeting Final Array Criteria
Analysis of Differences between Arrays and Analytic File for the Same Sample
n= 3440

		Unweighted										Weighted		
		Impairment				Exposure				Prevalence				
Wave	ADL	Uncensored Array *n*	Censored Array *n*	Analytic File *n*	Amount Analytic > (<) Uncensored Array	Uncensored Array *n*	Censored Array *n*	Analytic File *n*	Amount Analytic > (<) Uncensored Array	Uncensored Array Prevalence	Censored Array Prevalence	Uncensored Array Prevalence	Censored Array Prevalence	Analytic Prevalence
1982	Eating	na	na	na	na	na	na	na	na	na	na	na	na	na
1984	Eating	21	21	21	0	40	40	40	0	0.525	0.525	0.515	0.515	0.515
1989	Eating	36	36	36	0	83	83	83	0	0.434	0.434	0.433	0.433	0.433
1994	Eating	37	36	39	3	99	94	102	8	0.374	0.383	0.374	0.379	0.381
1982	I/O Bed	na	na	na	na	na	na	na	na	na	na	na	na	na
1984	I/O Bed	29	29	29	0	40	40	40	0	0.725	0.725	0.677	0.677	0.677
1989	I/O Bed	61	61	60	(1)	83	83	83	0	0.735	0.735	0.695	0.695	0.687
1994	I/O Bed	73	70	76	6	98	94	102	8	0.745	0.745	0.735	0.738	0.738
1982	Mobility	na	na	na	na	na	na	na	na	na	na	na	na	na
1984	Mobility	34	34	34	0	40	40	40	0	0.850	0.850	0.813	0.813	0.813
1989	Mobility	60	60	62	2	81	81	83	2	0.741	0.741	0.721	0.721	0.725
1994	Mobility	74	72	81	9	95	92	102	10	0.779	0.783	0.765	0.766	0.780
1982	Dressing	na	na	na	na	na	na	na	na	na	na	na	na	na
1984	Dressing	28	28	29	1	39	39	42	3	0.718	0.718	0.723	0.723	0.729
1989	Dressing	63	63	64	1	81	81	83	2	0.778	0.778	0.776	0.776	0.772
1994	Dressing	69	69	78	9	93	91	102	11	0.742	0.758	0.742	0.757	0.762
1982	Bathing	na	na	na	na	na	na	na	na	na	na	na	na	na
1984	Bathing	38	38	38	0	40	40	40	0	0.950	0.950	0.943	0.943	0.943
1989	Bathing	77	77	77	0	83	83	83	0	0.928	0.928	0.914	0.914	0.914
1994	Bathing	97	92	100	8	99	94	102	8	0.980	0.979	0.976	0.975	0.976
1982	Toileting	na	na	na	na	na	na	na	na	na	na	na	na	na
1984	Toileting	29	29	27	(2)	40	40	40	0	0.725	0.725	0.712	0.712	0.669
1989	Toileting	59	59	56	(3)	83	83	83	0	0.711	0.711	0.678	0.678	0.632
1994	Toileting	75	72	72	0	98	94	102	8	0.765	0.766	0.758	0.757	0.703

Table 11: NLTCS, Ages 65-69 in 1982

Screen Interviews and Combined Impairment Prevalence
Sample Meeting Final Array Criteria
n= 3440

		Unweighted								Weighted		
		Impairment				Exposure				Prevalence		
Wave	ADL	Uncensored Array	Censored Array	Censored Array Contribution to Combined Prevalence	Percentage of Combined Prevalence Contributed by Screens	Uncensored Array	Censored Array	Contribution to Combined Prevalence	Percentage of Combined Prevalence Contributed by Screens	Without Screens (Community Interviews, Else Institutional)	Screens Contributing to Combined Prevalence	Combined (Community Interview, Else Institutional, Else Screen)
		_n_	_n_	_n_		_n_	_n_	_n_				
1982	Eting	35	35	2	3.03	3027	3027	2389	69.47	0.051	0.0004	0.011
1984	Eating	14	14	2	3.03	2201	2201	1982	64.29	0.049	0.0008	0.014
1989	Eating	8	8	3	5.26	1519	1519	1382	62.73	0.065	0.0022	0.022
1994	Eating	4	3	3	3.85	855	853	778	50.58	0.071	0.0026	0.030
1982	I/O Bed	127	127	1	0.39	2978	2978	2389	69.47	0.209	0.0005	0.046
1984	I/O Bed	35	35	4	1.70	2201	2201	1984	64.27	0.179	0.0020	0.052
1989	I/O Bed	22	22	5	2.65	1519	1519	1382	62.68	0.207	0.0036	0.066
1994	I/O Bed	11	10	7	3.17	854	852	777	50.49	0.254	0.0077	0.106
1982	Mobility	235	235	12	3.49	2989	2989	2399	69.76	0.278	0.0028	0.063
1984	Mobility	56	56	6	1.76	2201	2201	1984	64.37	0.266	0.0021	0.077
1989	Mobility	44	44	7	2.46	1519	1519	1383	62.89	0.311	0.0051	0.101
1994	Mobility	29	29	15	5.94	854	853	777	50.62	0.374	0.0218	0.162
1982	Dressing	121	121	14	6.60	3005	3005	2403	69.87	0.165	0.0032	0.038
1984	Dressing	25	25	4	2.14	2200	2200	1986	64.61	0.146	0.0017	0.042
1989	Dressing	34	34	6	4.05	1519	1519	1381	62.89	0.166	0.0043	0.055
1994	Dressing	10	10	6	4.26	853	851	776	50.59	0.191	0.0077	0.081
1982	Bathing	175	175	13	3.49	2959	2959	2398	69.83	0.302	0.0038	0.069
1984	Bathing	45	45	4	1.04	2201	2201	1984	64.46	0.312	0.0017	0.089
1989	Bathing	41	41	8	2.52	1516	1516	1379	62.85	0.359	0.0058	0.116
1994	Bathing	22	21	12	3.54	860	858	787	51.01	0.431	0.0140	0.179
1982	Toileting	91	91	1	0.55	2993	2993	2387	69.45	0.151	0.0002	0.033
1984	Toileting	23	23	4	2.02	2201	2201	1985	64.41	0.152	0.0019	0.044
1989	Toileting	20	20	6	3.26	1516	1516	1379	62.77	0.208	0.0044	0.066
1994	Toileting	9	8	6	2.55	854	853	777	50.65	0.271	0.0064	0.112

Table 12
Disability Status of Final Retained Sample
Survivors and Decedents by 1984 Wave
n = 3440

	Deceased by 1984 Interview[a] *n* =356			Alive through 1984 Interview *n* = 3084		
Disability Group[b]	*n*	Unweighted percent	Weighted percent	*n*	Unweighted percent	Weighted percent
Not Disabled	188	52.8	57.3	23	76.2	85.4
IADL Only	42	11.8	10.6	282	9.1	5.6
1-2 ADLs	49	13.8	12.4	250	8.1	5.0
3-4 ADLs	26	7.3	6.9	113	3.7	2.3
5-6 ADLs	51	14.3	12.7	90	2.9	1.7

[a]Defined by a death date in the Analytic File prior to the first day of screening interviews in 1984, or a code associated with either the screening or detailed interview indicating the reason for non-interview being death prior to the date of interview.
[b]Disability groups from the Analytic File disability group variable.

Table 13: Impairment Duration Interval Comparison of Simple and Full Arrays[a]
NLTCS, Ages 65-69 in 1982, n = 3440

		Simple Arrays		Full Arrays	
ADL		Duration Interval Length, Grand Mean[b]	Number of Duration Intervals	Duration Interval Length, Grand Mean[b]	Number of Duration Intervals
Eating	Mean	38.22	2.60	34.39	3.60
	S.D.	13.41	0.74	14.26	5.75
	Min.	1	1	1	1
	Max.	145	5	145	133
I/O Bed	Mean	38.23	2.60	31.55	7.21
	S.D.	13.36	0.73	16.32	16.51
	Min.	1	1	1	1
	Max.	145	5	145	193
Mobility	Mean	38.31	2.59	29.95	10.15
	S.D.	13.38	0.73	17.29	23.11
	Min.	1	1	1	1
	Max.	145	5	145	201
Dressing	Mean	38.41	2.59	32.67	5.82
	S.D.	13.44	0.73	15.69	13.37
	Min.	1	1	1	1
	Max.	145	5	145	193
Bathing	Mean	38.42	2.58	29.44	10.93
	S.D.	13.44	0.72	17.64	23.52
	Min.	1	1	1	1
	Max.	145	5	145	201
Toileting	Mean	38.35	2.59	32.02	6.58
	S.D.	13.44	0.73	15.99	15.51
	Min.	1	1	1	1
	Max.	145	5	145	198
Pooled Arrays	Mean	38.32	2.59	31.67	7.38
	S.D.	13.41	0.73	16.32	17.56
	Min.	1	1	1	1
	Max.	145	5	145	201

[a]Simple arrays have only data used for combined impairment prevalence; at any given wave, this is the community interview, where available, otherwise one institutional interview, where available, otherwise the screening interview. Full arrays include all screening interviews not completed in the same month as a detailed community or institutional interview, all community and institutional interviews, and all duration and end-point information. Both array types include a transition to death, where available.
[b]The mean duration interval length for each observation was computed; reported here is the mean of those means, across observations.

Figure 1

Full NLTCS Sample
(non-missing 1982 disability group)

1982 Disability Groups	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Nondisabled	12106	33.8	12106	33.8
IADL Only	1729	4.8	13835	38.6
1-2 ADLs	1978	5.5	15813	44.1
3-4 ADLs	851	2.4	16664	46.5
5-6 ADLs	994	2.8	17658	49.3
Institutionalized	1992	5.6	19650	54.8
Nonresp.-Deceased	282	0.8	19932	55.6
Nonresp.- Other	553	1.5	20485	57.1

Ages 65-69 in 1982.
Screener or interview attempted in 1982, any disability group, any later status (includes interviewed in a later wave, attrited, or dead).

1982 Disability Groups	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Nondisabled	4391	77.8	4391	77.8
IADL Only	358	6.3	4749	84.2
1-2 ADLs	327	5.8	5076	90.0
3-4 ADLs	146	2.6	5222	92.5
5-6 ADLs	157	2.8	5379	95.3
Institutionalized	144	2.6	5523	97.9
Nonresp.-Deceased	31	0.5	5554	98.4
Nonresp.- Other	89	1.6	5643	100.0

Ages 65-69 in 1982.
Respondent to Screener or Interview in 1982, with **at least two waves of non-missing ADL or death information.** ADL information from screeners, community interviews, or institutional interviews. Death information from Analytic File.
Remove 1982 institutionalized.

1982 Disability Groups	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Nondisabled	4391	81.6	4391	81.6
IADL Only	358	6.7	4749	88.3
1-2 ADLs	327	6.1	5076	94.4
3-4 ADLs	146	2.7	5222	97.1
5-6 ADLs	157	2.9	5379	100.0

Loss from Respondents in Previous Sample: 2.6%
NOTE: Only loss here are 1982 nonrespondents. There is no sample loss due to the

Ages 65-69 in 1982.
Screener or interview in 1982, at least two waves of non-missing ADL or death information, **and at least two non-missing cells for ADL status or month of death for each of six ADL arrays. Remove 6 observations with erroneous 04 codes.***

1982 Disability Groups	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Nondisabled	4380	81.7	4380	81.7
IADL Only	358	6.7	4738	88.4
1-2 ADLs	324	6.0	5062	94.4
3-4 ADLs	146	2.7	5208	97.2
5-6 ADLs	152	2.8	5360	100.0

Loss from Previous Sample: 0.35%
*Requiring "at least 2 waves in all six arrays" removes 13 observations. Six observations

Ages 65-69 in 1982.
At least two waves of non-missing ADL or death information, at least two non-missing cells for ADL status or month of death for each of six ADL arrays. **Remove those randomly excluded from the 1989 survey.**

1982 Disability Groups	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Nondisabled	2542	73.7	2542	73.7
IADL Only	324	9.4	2866	83.0
1-2 ADLs	301	8.7	3167	91.8
3-4 ADLs	139	4.0	3306	95.8
5-6 ADLs	145	4.2	3451	100.0

Loss from Previous Sample: 35.6%

Ages 65-69 in 1982.
At least two waves of non-missing ADL or death information, at least two non-missing cells for ADL status or month of death for each of six ADL arrays. Remove those randomly excluded from the 1989 survey.
Require full complement of non-missing ADL status information across six arrays.

1982 Disability Groups	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Nondisabled	2537	73.8	2537	73.8
IADL Only	324	9.4	2861	83.2
1-2 ADLs	299	8.7	3160	91.9
3-4 ADLs	139	4.0	3299	95.9
5-6 ADLs	141	4.1	3440	100.0

Loss from Previous Sample: 0.32%

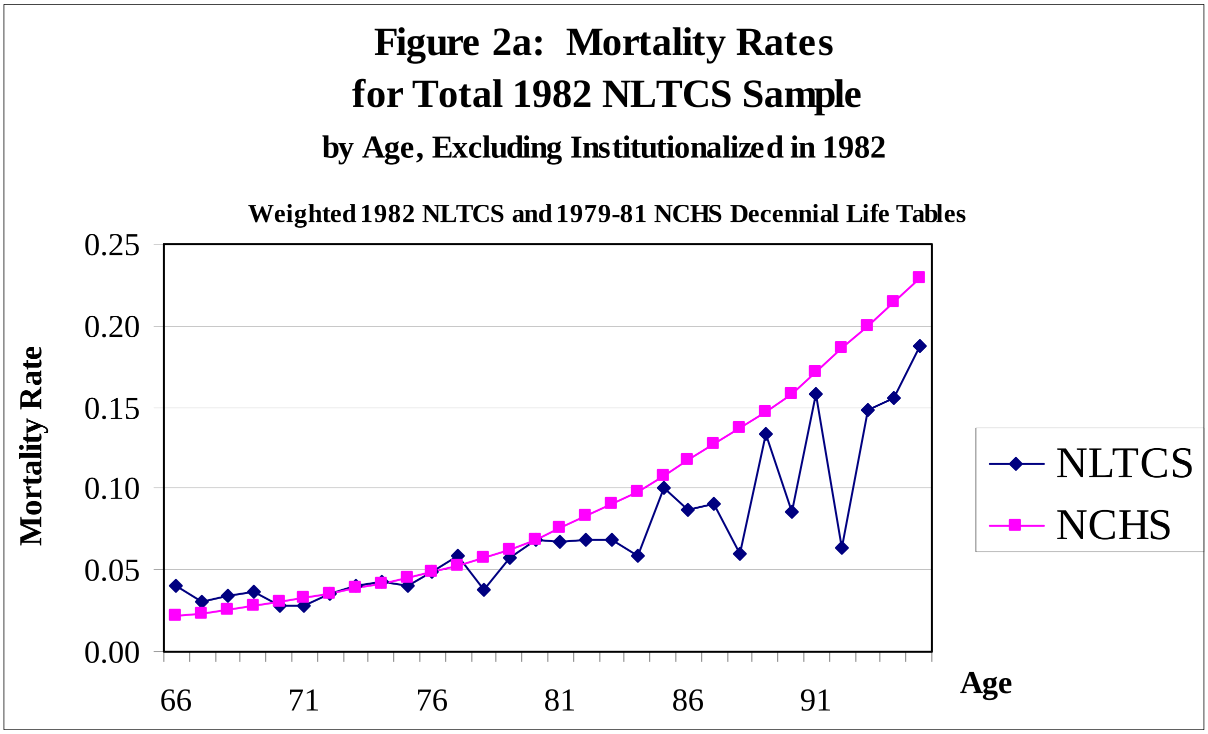


Figure 2a: Mortality Rates
for Total 1982 NLTCS Sample
by Age, Excluding Institutionalized in 1982
Weighted 1982 NLTCS and 1979-81 NCHS Decennial Life Tables
Mortality Rate
0.25
0.20
0.15
0.10
0.05
0.00
66
71
76
81
86
91
Age
NLTCS
NCHS

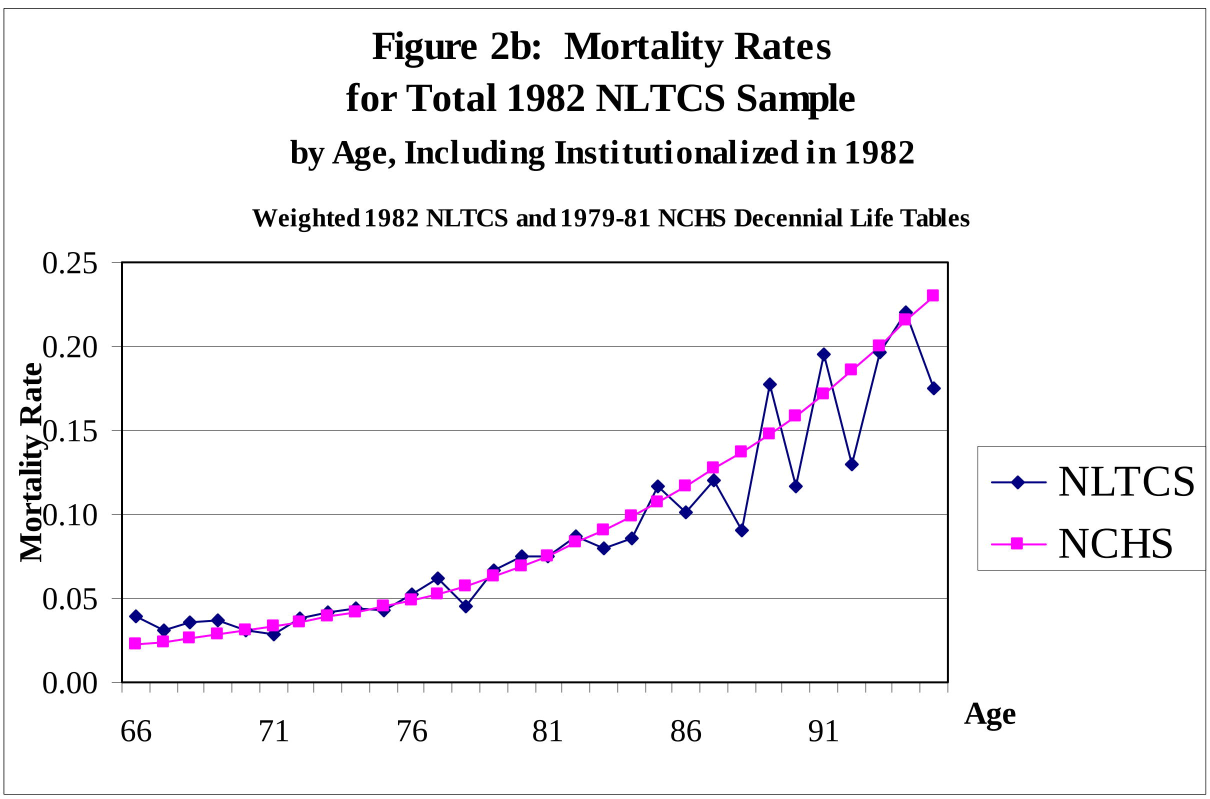


Figure 2b: Mortality Rates
for Total 1982 NLTCS Sample
by Age, Including Institutionalized in 1982
Weighted 1982 NLTCS and 1979-81 NCHS Decennial Life Tables
Mortality Rate
0.25
0.20
0.15
0.10
0.05
0.00
66
71
76
81
86
91
Age
NLTCS
NCHS

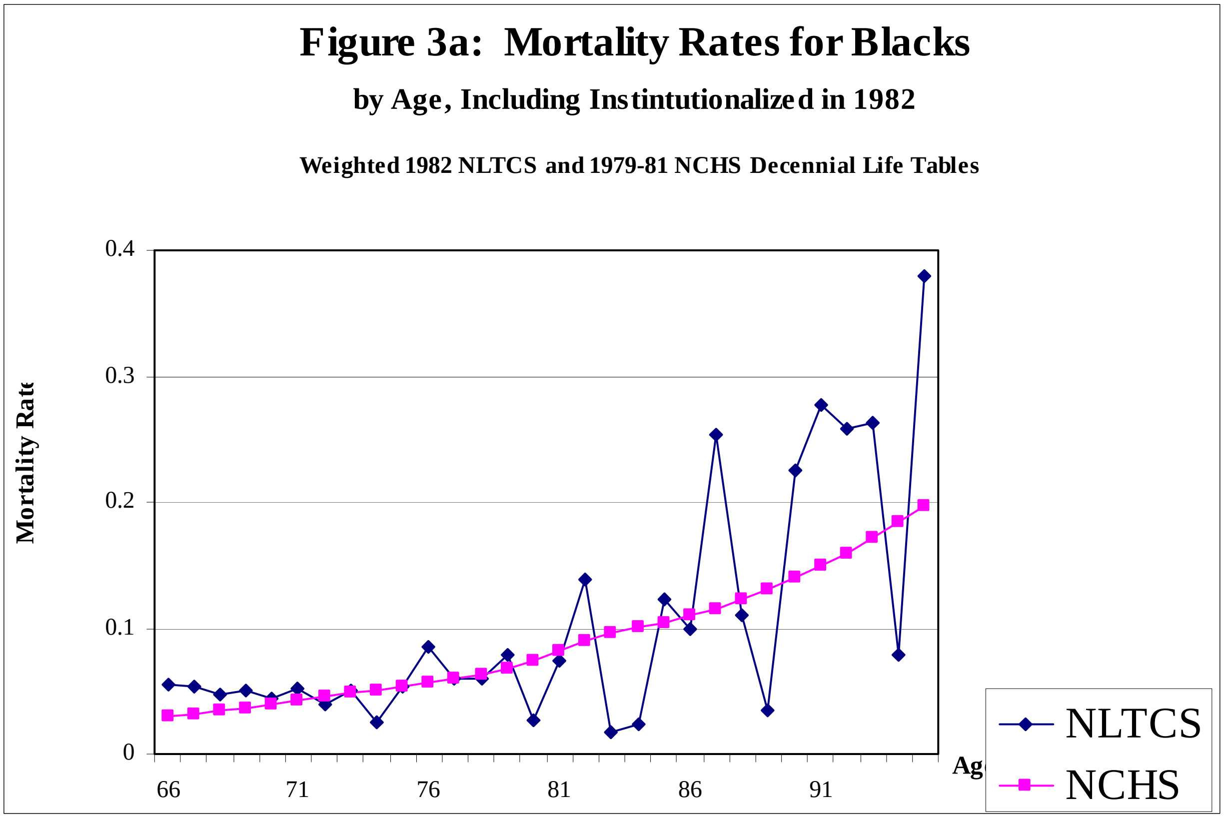


Figure 3a: Mortality Rates for Blacks
by Age, Including Instintutionalized in 1982
Weighted 1982 NLTCS and 1979-81 NCHS Decennial Life Tables
Mortality Rate
0.4
0.3
0.2
0.1
0
66
71
76
81
86
91
NLTCS
NCHS

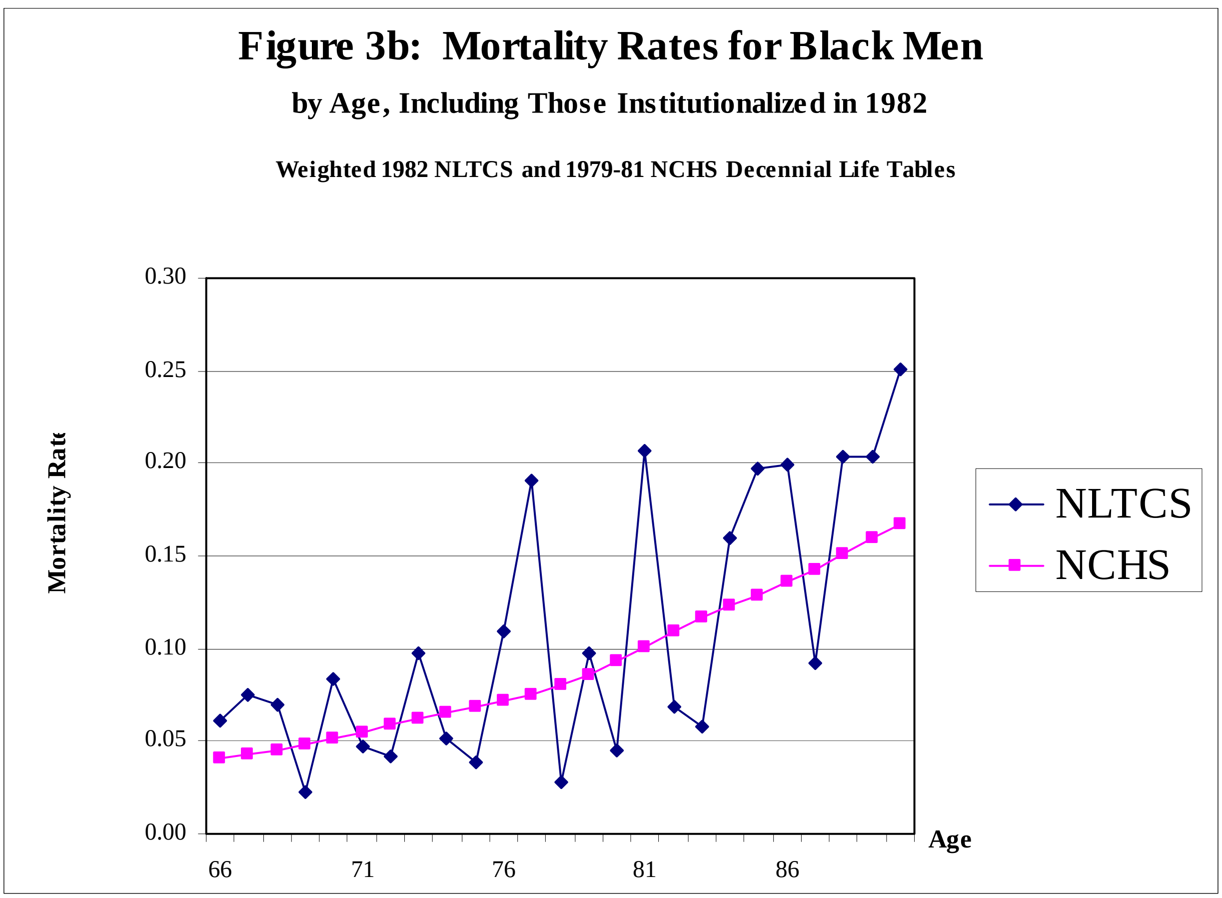


Figure 3b: Mortality Rates for Black Men
by Age, Including Those Institutionalized in 1982
Weighted 1982 NLTCS and 1979-81 NCHS Decennial Life Tables
Mortality Rate
0.30
0.25
0.20
0.15
0.10
0.05
0.00
66
71
76
81
86
Age
NLTCS
NCHS

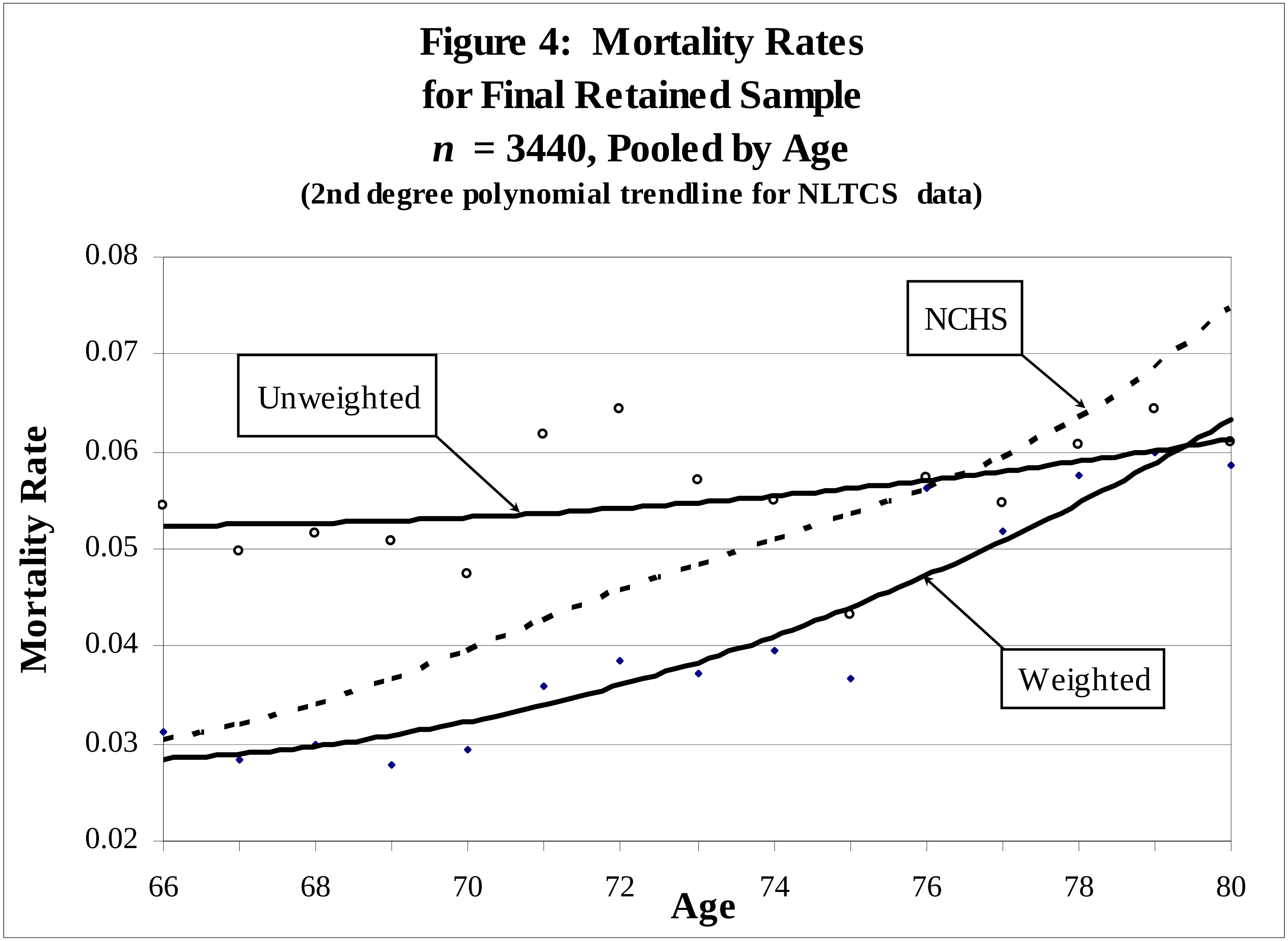
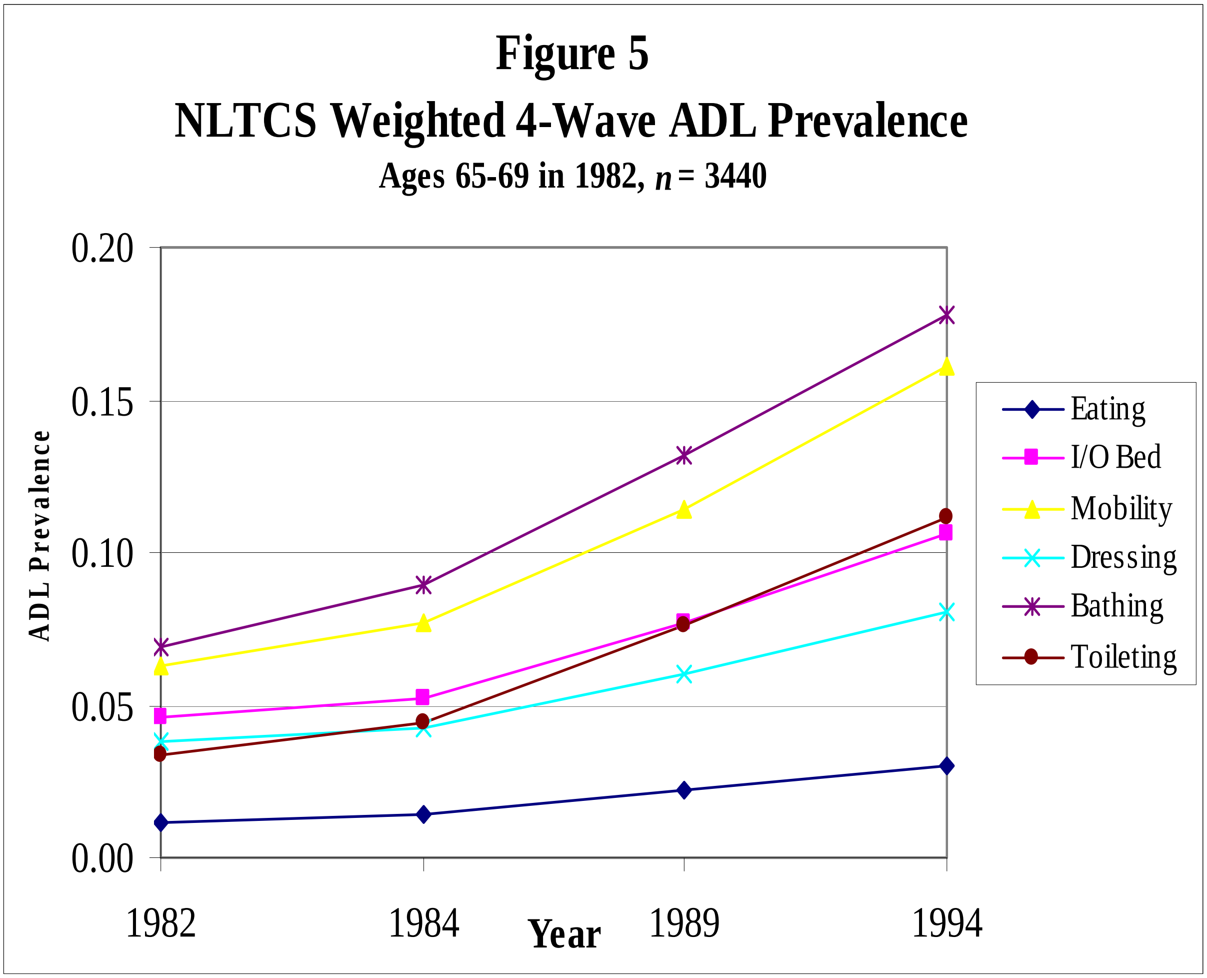


Figure 4: Mortality Rates
for Final Retained Sample
n = 3440, Pooled by Age
(2nd degree polynomial trendline for NLTCS data)
Mortality Rate
0.08
0.07
0.06
0.05
0.04
0.03
0.02
66
68
70
72
74
76
78
80
Age
Unweighted
NCHS
Weighted



Combined prevalence uses community interview values where they are available for a given wave. When the community interview is not available, that wave's institutional value is used. When neither is available, that wave's screening interview is used.

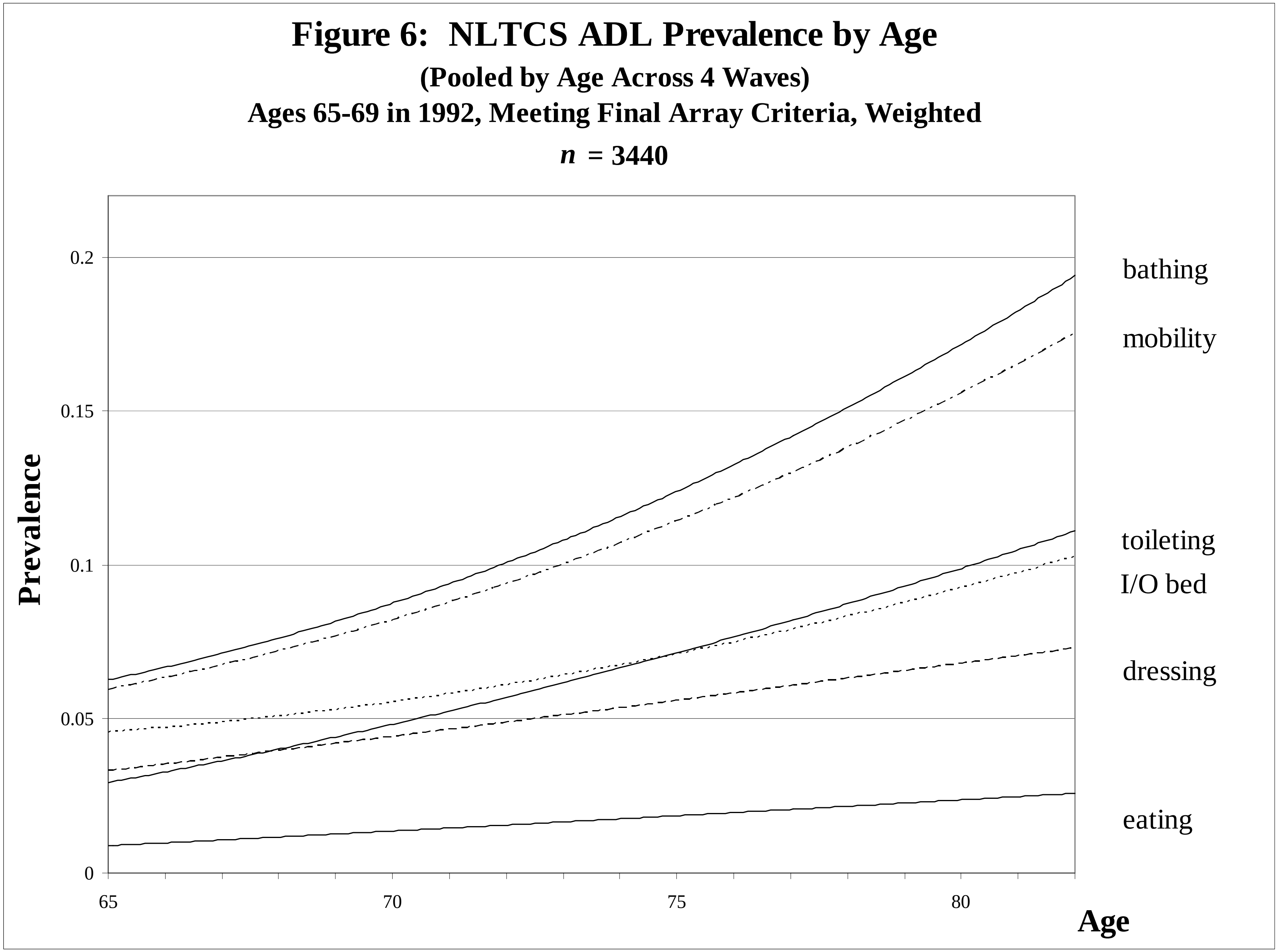
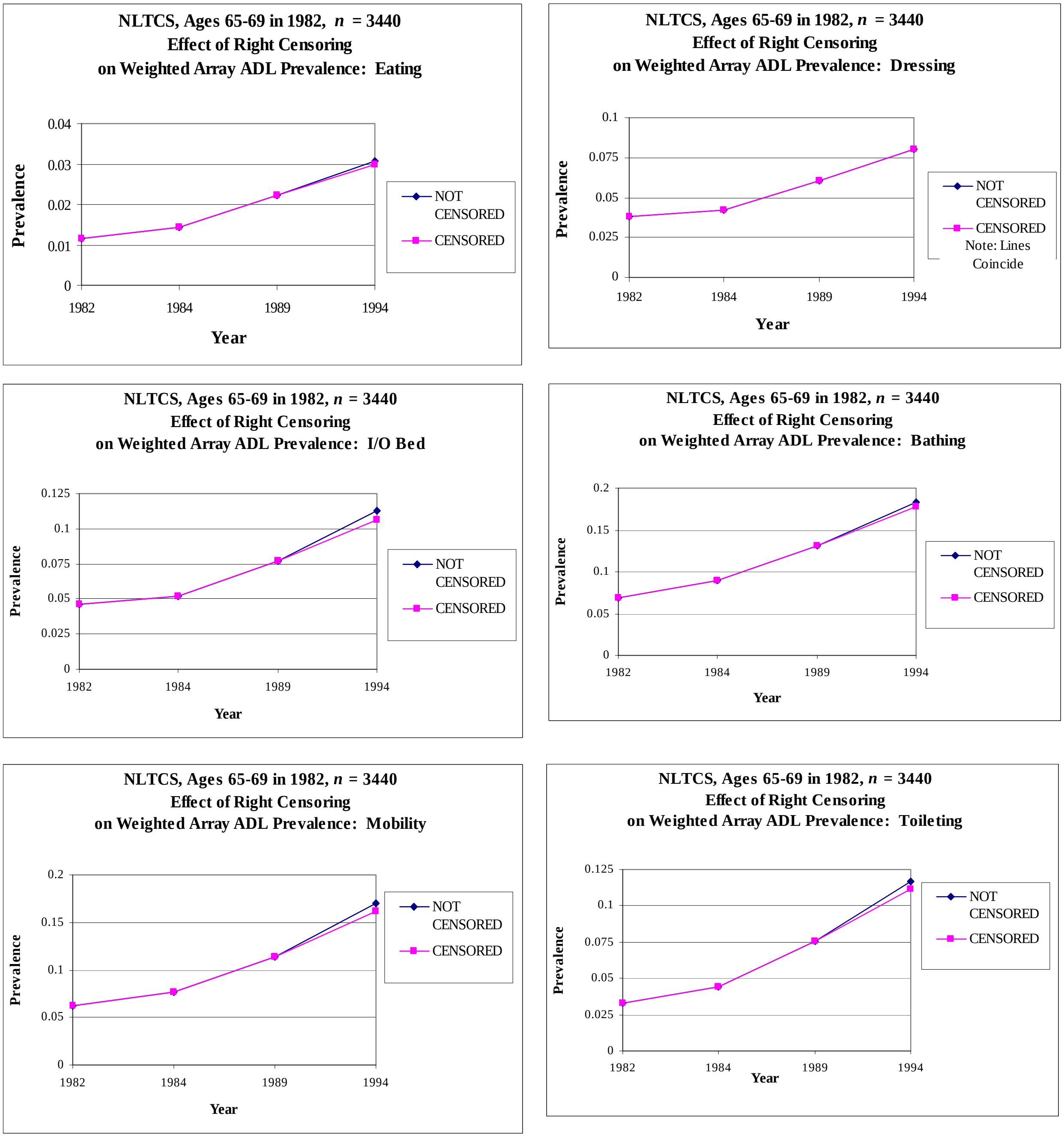


Figure 6: NLTCS ADL Prevalence by Age
(Pooled by Age Across 4 Waves)
Ages 65-69 in 1992, Meeting Final Array Criteria, Weighted
n = 3440
Prevalence
0.2
0.15
0.1
0.05
0
65
70
75
80
Age
bathing
mobility
toileting
I/O bed
dressing
eating

Figure 7
Effects of Right Censoring on ADL Prevalence in Arrays



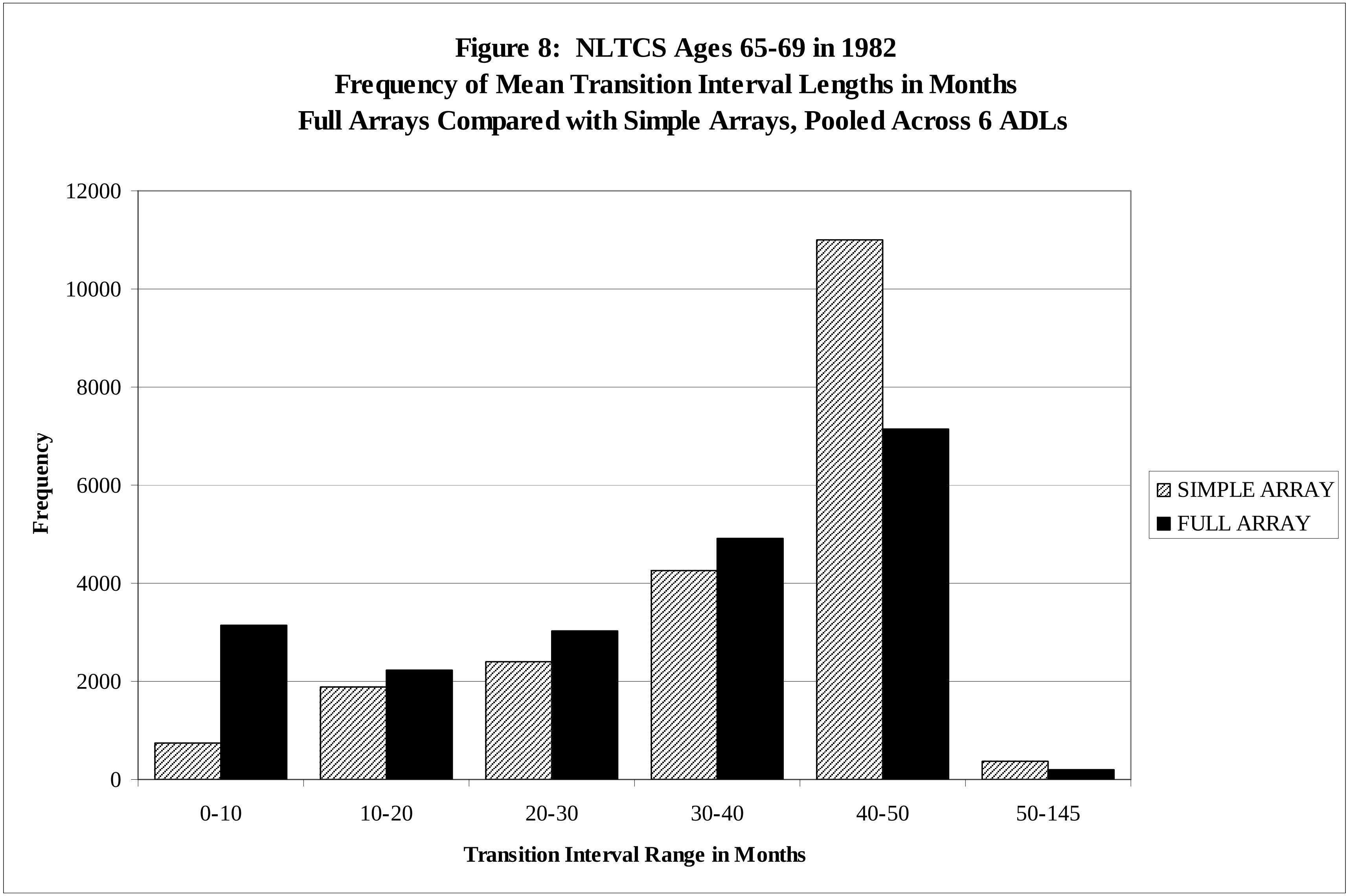


Figure 8: NLTCS Ages 65-69 in 1982
Frequency of Mean Transition Interval Lengths in Months
Full Arrays Compared with Simple Arrays, Pooled Across 6 ADLs
Frequency
12000
10000
8000
6000
4000
2000
0
0-10
10-20
20-30
30-40
40-50
50-145
Transition Interval Range in Months
SIMPLE ARRAY
FULL ARRAY

Figure 9A: NLTCS Ages 65-69 in 1982
Number of Observations with Each Number of Transitions
Pooled Across ADLs
Simple Arrays, Pooled *n* = 20,640

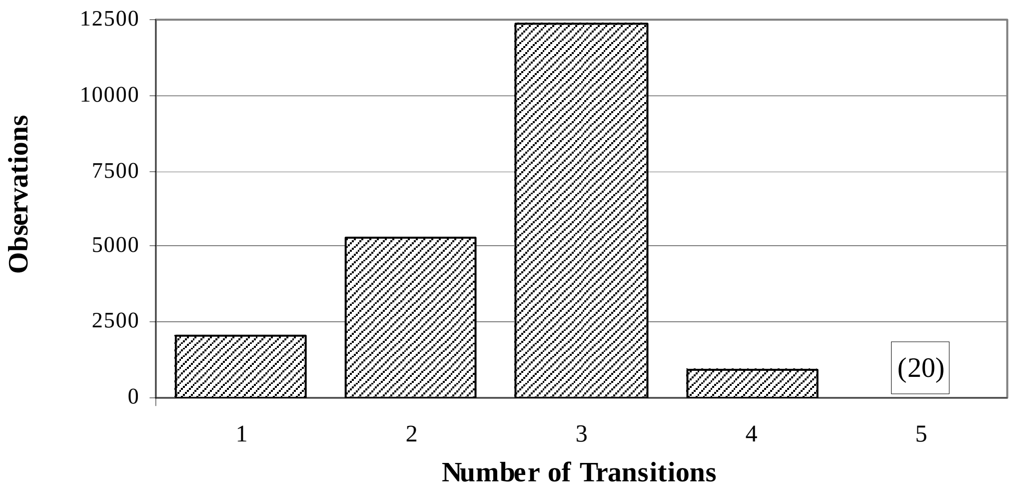


Figure 9B: NLTCS Ages 65-69 in 1982
Number of Observations with Each Number of Transitions
Pooled Across ADLs
Full Arrays, Pooled *n* = 17,932

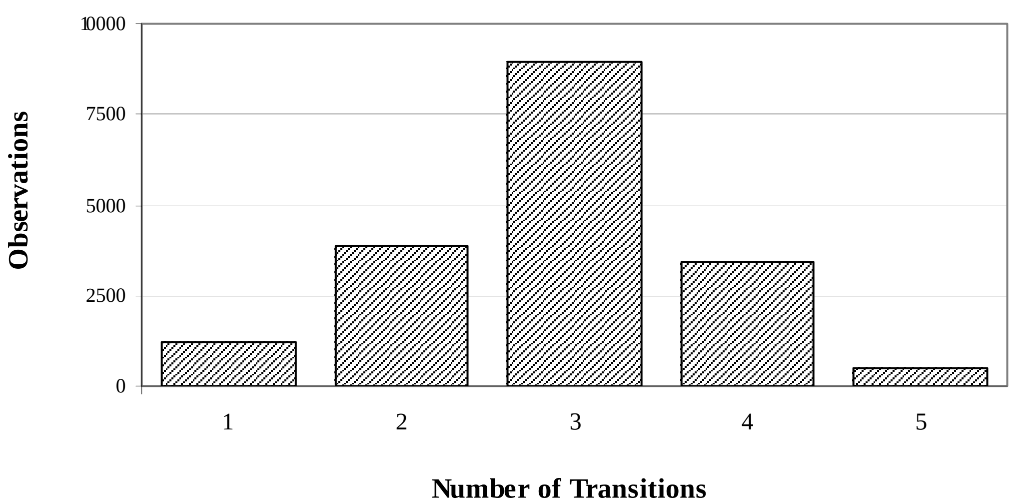
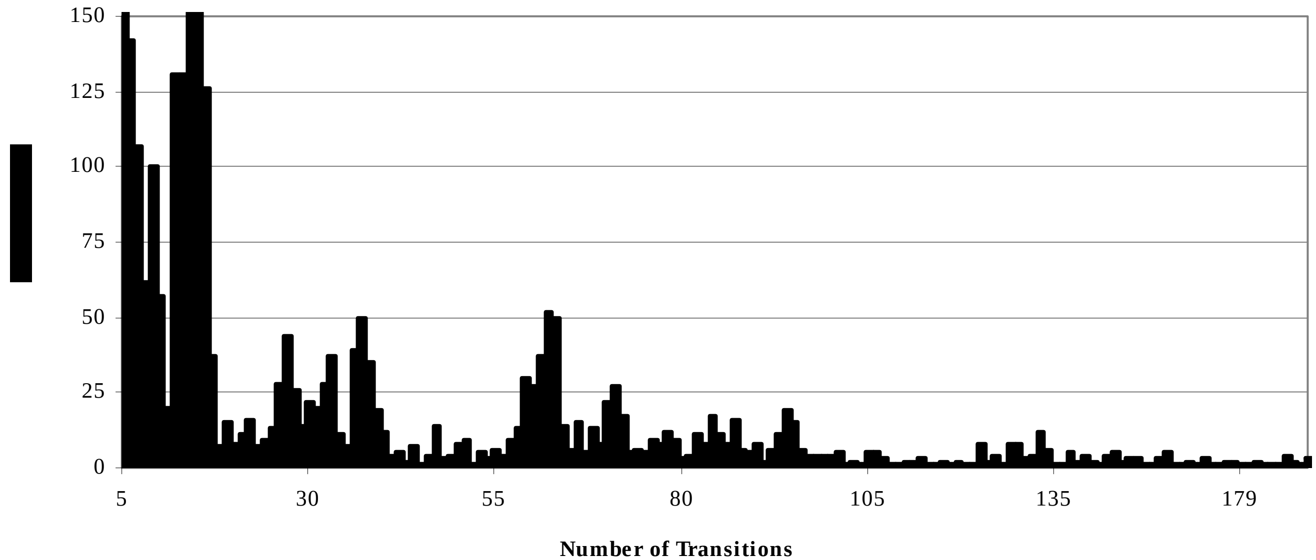


Figure 10: NLTCS Ages 65-69 in 1982
Number of Observations with Each Number of Transitions
Pooled Across ADLs
Full Arrays (Detail), Pooled *n* = 2,708*



*The detail truncates the number of observations with 14 transitions (n=211) and 15 transitions (n=284), and omits the following frequencies (Number of Transitions / Number of Observations): 1 / 1224, 2 / 3856, 3 / 8955, 4 / 3413, 5 / 484.