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Stroke-associated differences in rates of activity of daily living loss emerge years before stroke onset

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Abstract

Objectives—To compare typical age-related changes in activities of daily living (ADL) independence in stroke-free adults to long-term ADL trajectories before and after stroke.

Study Design, Setting, and Participants—Prospective, observational cohort of 18,441 Health and Retirement Study participants who were stroke-free in 1998 and followed through 2008 (average follow-up=7.9 years).

Measurements—Strokes were assessed with self- or proxy-report of a doctor's diagnosis and month/year of event. We used logistic regression to compare within-person changes in odds of self-reported independence in 5 ADLs among those who remained stroke free throughout follow-up (n=16,816); those who survived a stroke (n=1,208); and those who had a stroke and did not survive to participate in another interview (n=417). Models were adjusted for demographic and socioeconomic covariates.

Results—Even prior to stroke, those who later developed stroke had significantly lower ADL independence and were experiencing faster independence losses, compared to similar aged individuals who remained stroke free. Of those who developed a stroke, survivors experienced slower loss of ADL independence compared to those who died. ADL independence declined at the time of stroke and decline continued afterwards.

Conclusion—Among adults at risk of stroke, disproportionate ADL limitations emerge well before stroke onset. Excess disability among stroke survivors should not be entirely attributed to effects of acute stroke or quality of acute stroke care. Although there are many possible causal pathways between ADL and stroke, the association may alternatively be non-causal. For example,

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ADL limitations may be a consequence of stroke risk factors (e.g., diabetes) or early cerebrovascular ischemia.

Keywords

stroke; activities of daily living; older adults; disability; mortality; longitudinal

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Strokes are very common[1] and often result in substantial changes in cognitive and physical health for survivors. Limitations in functional ability post-stroke are very prevalent[2], as strokes often affect both the memory and physical capabilities required to carry out activities of daily living (ADLs) such as eating and walking across the room. Although prevalence of ADL limitations typically increases with age[3], the onset of limitations may be a harbinger of other future health changes over and above age.[4–7] Although disability is often conceptualized as a consequence of disease,[8] it is unclear whether major acute health events necessarily alter long-term ADL trajectories.

Important gaps remain in our understanding of the long-term trajectory of ADL limitations before and after stroke. New evidence from a prospective study showed that memory declined differentially among future stroke patients[9], yet to our knowledge the possibility of differential pre-stroke trajectories in ADLs has not been assessed. Pre-stroke trends may predict future health; thus, it is important to assess ADL trajectories prior to stroke separately for individuals who survive stroke versus those who die after stroke.

We used data from the U.S. Health and Retirement Study (HRS), a nationally representative sample of adults aged 50+, to assess trends in independence in 5 ADLs by stroke status over 10 years of follow-up. We describe ADL trends among respondents who did not have a stroke during follow-up compared to those who reported a stroke during follow-up. For individuals who developed a stroke during follow-up, we also distinguished trends by mortality status. We hypothesized that even before stroke, prevalence of ADL limitations would increase as the date of stroke approached, and that annual increases in disability would be faster than annual changes among individuals who remained stroke-free. Among those who survived a stroke, we anticipated much lower levels of independence after stroke compared to before stroke, and continued decline in subsequent years.

Methods

HRS is a longitudinal survey of a national sample of US adults aged 50+ years and their spouses. Details of the study are provided elsewhere.[10,11] Enrollments occurred in 1992, 1993, or 1998 (based on respondent's and spouse's birth years) with biennial interviews (or proxy interviews for decedent participants) through 2008. Retention rates through 2008 were above 80%, and "exit" interview participation for deceased respondents ranged between 85–92%.[12] HRS was approved by the University of Michigan Health Sciences Human Subjects Committee and these analyses were determined exempt by Harvard School of Public Health Office of Human Research Administration.

This study was conducted including HRS participants born between 1900 and 1947 and interviewed in 1998. The HRS sample included 19,992 respondents who were age eligible in

1998; 1,422 (7.1%) respondents were excluded because of prior diagnoses of stroke reported in 1998; 124 (0.6%) respondents were excluded because of missing covariate information. The final analysis therefore included 18,441 individuals contributing person time.

Assessment of Stroke

Onset of stroke between 1998 and 2008 was assessed biennially by respondent's self-report of a doctor's diagnosis ("Has a doctor ever told you that you had a stroke?"). For participants who had died and those unavailable for a direct interview, interviews were conducted with proxy informants, typically spouses. No information on stroke subtypes was available; voluntarily reported transient ischemic attacks were not coded as strokes. We used the information on the date of first stroke to characterize respondents with respect to time trajectories; we did not re-classify someone if they had a subsequent stroke (i.e., all person-time after the first stroke was considered "post-stroke" even if it was prior to a second stroke). We classed people into three groups: never stroke (no event recorded during follow-up), stroke survivors (stroke reported during follow-up and respondent survived to participate in a subsequent interview), and stroke decedents (stroke reported during follow-up but respondent did not survive to participate in a subsequent interview). Stroke decedents include people who died from any cause after their stroke, even if stroke was not the cause of death.

Respondents who reported stroke were asked the month and year of the stroke. For each biennial interview, we then calculated the months-until the stoke date and months-since the stroke date. We estimated the association between ADL independence and the months-until and months-since stroke variables. All coefficients are converted from months into years to facilitate comparison with rate of change in ADL independence among stroke-free participants per year of age.

Of the stroke date information, month of event was missing (but year was recorded) for 12.5% of events; an additional 4.4% of events were missing both month and year). We used the midpoint of the last known stroke-free date and the date when the stroke was first reported, based on all available biennial interviews and any date information provided, as the date of stroke for those missing stroke date information. The extent of missing information on the date of event was not significantly different between stroke survivors and decedents (χ^2,1 df=1.99, p=0.16). We repeated primary analyses excluding individuals with uncertain stroke dates; results were very similar in magnitude and significance (results available from authors).

Activities of Daily Living

Respondents were asked at each wave if they had any difficulty "because of a physical, mental, emotional, or memory problem" with each of 5 ADLs (getting across a room; dressing; bathing; eating; and getting in and out of bed); they were asked to exclude any difficulties expected to last less than three months. Response options for each ADL included yes, no, or did not do. For comparability with prior research, we used the RAND version of these variables, which set the "did not do" answer to missing. The frequency of the "did not do" response was very small—at baseline, it was 0.08% of the total—and thus, we suspect it would not exert sufficient influence on our estimates. These questions were asked consistently at each survey wave from 1998 to 2008.

Covariates

We considered demographic and socioeconomic covariates that potentially confound the relationship between ADLs and stroke. Demographic characteristics included age (centered at 75 years), race (white/black/other, white as reference), Hispanic ethnicity (non-Hispanics as reference), male sex (female as reference), marital status (married [reference], never married, divorced/separated, widowed), and Southern birthplace.[13] Socioeconomic variables included measures of both current (years of education and natural log of per capita household wealth) and childhood (height[14] and maternal education [unknown, <=8, or >8 years]) socioeconomic position (SEP). We set mother's education to the reference group (<8 years) for the 10.6% of respondents who did not report it and included an indicator of this imputation in regression models. All measures were assessed at baseline (1998) and were time-constant in the analyses. Continuous variables were centered at the group mean; for categorical variables, the most prevalent group was used as the reference value.

Methods of analysis

We used logistic regression to model independence trajectories among those who never had a stroke, stroke survivors and stroke decedents, log odds of independence for each person *i* at each wave *t* was modeled as:

$$\begin{aligned}\text{Logit}(\text{independence}_{\text{ti}}) = &\beta_0 + \beta_1 * (\text{Current Age for Stroke Free} - 75)_{\text{ti}} \\ &+ \beta_2 * (\text{Ever Survived Stroke})_{\text{i}} \\ &+ \beta_3 * (\text{Age at Stroke} - 75)_{\text{i}} \\ &+ \beta_4 * (\text{Years Before Survived Stroke})_{\text{ti}} \\ &+ \beta_5 * (\text{Before or After Survived Stroke})_{\text{ti}} \\ &+ \beta_6 * (\text{Years After Survived Stroke})_{\text{ti}} \\ &+ \beta_7 * (\text{Ever Decedent Stroke})_{\text{i}} \\ &+ \beta_8 * (\text{Year Before Decedent Stroke})_{\text{ti}} + \boldsymbol{\beta_{\text{k}}} \textbf{Covariates}\end{aligned} \quad (1)$$

where β_0 is the log odds of independence at age 75 for a reference category individual (detailed below) who remained stroke free during follow-up; β_1 is the coefficient for time-updated current age for those who remained stroke free during follow-up (current age is set to 0 for those who did have a stroke); β_2 is the coefficient for an indicator of whether the respondent ever had and survived a stroke during follow-up; β_3 is the coefficient for age at stroke for those who ever had a stroke (age at stroke is set to 0 for individuals who remained stroke free); β_4 is the annual rate of change in log odds of ADL independence prior to the stroke event among those who eventually survived a stroke (the variable is set to 0 those who did not have or did not survive a stroke); β_5 is the coefficient for an indicator of whether the stroke has already occurred among those who survived a stroke and represents the decrement in functioning associated with stroke onset (the variable is 0 for stroke decedents and stroke free); β_6 describes the annual change in log odds of independence after the stroke for those who survived the stroke (the variable is set to 0 for those who did not have or did not survive a stroke and for years prior to a survived stroke); β_7 is the coefficient for an indicator for stroke decedents (the variable is set to zero for those who did not have a stroke or who survived a stroke); β_8 describes the annual change in log odds of independence prior to the stroke for stroke decedents (the variable is set to 0 for all others); and β_k represents a vector of coefficients for covariates, which are all time-constant. Odds ratios (ORs) < 1 reflect lower independence (i.e., more disability) or greater loss of independence (i.e., faster onset of disability). See Appendix for further decription of model parameters.

To illustrate patterns visually, predicted probabilities of independence for each ADL (defined as predicted odds/(1+predicted odds)) were estimated from this model and plotted for a reference category: a 75 year old, white, married woman who was not born in the South, whose mother had 8 years of education, who herself had 12 years of education, was 1.7 meters tall, with household wealth of $108,600.

Primary analyses were conducted in SAS 9.3 with PROC GENMOD (SAS, Cary, NC) using a *logit* link, robust variance estimates, and the 1998 (baseline) sampling weights. We found linear time-terms offered the best fit for these data and that there was no variation by sex; we present results from models that are linear terms for time and estimated in the full sample (i.e., both men and women). Our analytic models account for repeated measures on the same individual but not for sample design clustering, which is quite small in HRS.

Results

Over an average of 7.9 years of follow-up, 16,816 participants remained stroke free, 1,208 participants survived a stroke and provided a post-stroke interview, and 417 respondents experienced a stroke but died prior to the next interview (Table 1).

Predicted trajectories of change for a reference person who remained stroke free, survived a stroke, or died after a stroke are shown for each ADL in Figures 1a–1e. Precise coefficients for the logistic regression models are shown in Table 2. For those who remained stroke-free over follow-up, the odds of independence in dressing declined by 5% for each additional year of age (OR=0.95, 95% CI: 0.94, 0.95) (Table 2). The annual decline in odds of independence, prior to stroke, was steeper for stroke survivors (OR=0.84, 95% CI: 0.79, 0.89) and stroke decedents (OR=0.82, 95% CI: 0.76, 0.89); lower odds ratios represent larger losses in ADL independence (i.e., more disability) relative to those who remain stroke free. On average for a stroke survivor, the predicted odds of independence in dressing for a 75-year old in the month prior to stroke was 28% lower than the odds of independence for a person of similar age and covariates who remained stroke free during follow-up (OR=0.72, 95%CI: 0.59, 0.86). For individuals who died after their stroke, the odds of independence in dressing in the month prior to stroke was 36% lower (OR=0.64; 0.47, 0.88) than the odds of independence among those who remained stroke free. These odds ratios, although quite far from the null, reflect the fact that most people, regardless of stroke status, were independent in ADLs. For example, for a stroke-free respondent with reference group background characteristics the predicted probability of independence in dressing was 92%, whereas a similar person in the month prior to stroke onset had a predicted probability of independence of only 89% (Figure 1a).

Among those who survived the stroke, the stroke event was associated with a 47% decline in odds of independence in dressing (OR=0.53, 95% CI: 0.44, 0.63), compared to their pre-stroke odds of independence. There was also a statistically significant continuation of decline in independence as time elapsed after stroke: each year after stroke was associated with a 7% decreased odds of independence in dressing (OR=0.93; 0.90, 0.96). However, this decline in independence in dressing was slower than the decline pre-stroke (OR=0.84 for annual pre-stroke decline among survivors; test for equivalence of ORs rejected at $p<0.001$).

In general, patterns were similar across all ADLs. For every ADL, the slope of decline in odds of independence prior to stroke was steeper than the slope after stroke. However, there were slightly different magnitudes of association for some parameters. For example, just prior to stroke, a 75 year old who survived the stroke had a 28% lower odds of independence dressing compared to stroke-free respondents (OR=0.72, 95% CI: 0.59, 0.86), but a 50% lower odds of independence in eating compared to stroke-free respondents (OR=0.50, 95% CI: 0.38, 0.66). The annual decline prior to stroke was slower for independence in dressing (OR=0.84, 95% CI: 0.79, 0.89) than for eating (OR=0.67, 95% CI: 0.57, 0.80). The magnitudes of association were similar between ADLs for stroke decedents compared to stroke-free respondents. These patterns for all ADLs are depicted in Figure 1.

In sensitivity analyses, we also assessed how the length of post-stroke follow-up time influenced the precision of the estimate for the rate of change in independence for all ADLs. As anticipated, CIs are generally wider because of the smaller number of observations contributing to these analyses (Table 3), but patterns are generally similar in these models as in the primary results.

Discussion

In a prospective, longitudinal observational study of ADL independence and stroke incidence, timing, and fatality, we found significant differences in ADL independence prior to stroke between those who had strokes and those who remained stroke-free throughout follow-up. Individuals who ever had a stroke experienced faster declines in ADL independence, even before stroke onset, than those who never had a stroke. Also, compared to similar aged individuals who remained stroke-free, those who had strokes had lower odds of ADL independence immediately prior to their stroke. As would be expected, we also found significant drops in ADL independence associated with the stroke itself, among those who survived. Over the long-run, we found evidence of a continued decline in ADL independence post-stroke; we note that our models could not describe short term improvements in the weeks or few months immediately following stroke. This study provides some of the first evidence on how differences in the level and trajectory of independence in ADLs emerge years before stroke onset and how long-term post-stroke declines compare to pre-stroke trajectories.

Study limitations

Although self- or proxy-reported strokes may result in information bias, incidence of strokes in this sample is similar to cohorts with physician verified stroke data.[15] As with any study of medically diagnosed strokes, individuals with “silent” strokes may be misclassified. We did not restrict to deaths with stroke listed as a contributing cause because stroke likely played a role in the death, even if it was not considered the primary cause of death.[16] Some information on the timing of stroke was missing for approximately 17% of the sample; we imputed dates through methods that have previously been described.[9,17] Most of the uncertainty in dates was within a fairly narrow possible date band, typically a calendar year, so results were generally similar in analyses excluding cohort members with missing stroke dates. Results of a sensitivity analysis to assess whether selective survival post-stroke influenced apparent trends in post-stroke ADL independence indicated that results did not differ substantially when the minimum amount of post-stroke follow-up time was varied (Table 3). No information on stroke subtype was available.

Activities of daily living were also provided by self-report, which are subject to recall and same-respondent bias.[18,19] Furthermore, ADL independence was reported by proxies when the respondent was unavailable. Although proxy reports of ADLs are imperfect measures of the true ADL independence,[20] the number of proxy reports was small (8%) and thus unlikely to induce considerable bias. A dichotomized measure of limitation/independence may not be sensitive to subtle changes in capabilities. Also, we used baseline values of the covariates, which was a simplified approach.

Notwithstanding these limitations, this study has important strengths and advances the empirical understanding of how pre-stroke functional abilities are associated with onset of stroke and post-stroke functioning. Our study used a prospective, longitudinal design. Unlike many studies of stroke and physical functioning that recruit at the time of stroke or otherwise use retrospective data collection, this design allowed us to prospectively assess the long term ADL trajectory before and after stroke. The study's size is also notable: it allowed a sufficient number of stroke events, but also facilitated comparisons between ever/never stroke status, adjusting comparisons between those who had a stroke and those who did not for a number of key covariates. Lastly, the HRS cohort is also nationally representative, which enhances the generalizability of our findings beyond geographically specific samples common in stroke research.

Comparisons to other studies

This study is consistent with the sizable literature that suggests functional limitations are associated with negative health outcomes. For example, an extensive research base suggests disability is associated with increased mortality risk.[21–24] Our findings add to this literature; we found lower independence prior to stroke among both stroke decedents and stroke survivors compared to those who never had a stroke. Since the skills and demands of certain activities may be more or less taxing than others[25], our study's results about specific ADL limitations adds to this literature.

Our results fit with the few studies that have assessed disability as a predictor of new onset diseases, particular Mendes de Leon and colleagues' study of myocardial infarction.[7] Our findings suggest a slightly different story with post-event recovery: they found a non-significant increase in ADL disability post-MI, while we find the stroke itself is associated with a significant loss in independence, and that independence continues to decline after stroke, although the post-stroke decline was generally slower than the pre-stroke decline.

Our results also diverge slightly from Mendes de Leon et al with respect to the trajectory of increase in ADL disability prior to the event: while they found onset of disability may increase faster in the last year pre-MI, we found the trajectory of the log odds of ADL independence declined approximately linearly prior to stroke. Other studies have looked at disability immediately prior to incident stroke.[26,27] While Guralnik and Ferrucci have classified stroke-related onset of disability as catastrophic,[8,28] our results and others' work suggests there may be both progressive onset of disability before stroke and catastrophic onset as a consequence of stroke. In general, our results are in line with other studies that find stroke may be part of a longer-term health decline.[29] Although some studies on post-stroke recovery have used pre-stroke disability to predict post-stroke physical function,[30,31] the evidence remains somewhat mixed.[32]

Implications and Future Directions

Decreased independence in ADLs may be a marker of increased stroke risk. This risk is not necessarily independent of other stroke risk factors, because ADL limitations may merely serve as a physical presentation of the constellation of stroke risk factors commonly apparent in geriatric patients. On the other hand, undiagnosed ischemic events, e.g., transient ischemic attacks or silent strokes, may cause ADL limitations, in which case changes in ADL independence might add important new clinical information when assessing future stroke risk. Distinguishing between these two possibilities is an important empirical question that should be assessed in a data set with very comprehensive clinical information. Our findings also imply that comprehensive assessments of quality of stroke care should include information on patients' pre-stroke functioning. A substantial fraction of the post-stroke disability observed in stroke survivors is probably attributable to declines that occurred long before stroke diagnosis. In other words, the excess disability among stroke survivors should not be entirely attributed to effects of acute stroke or medical care delivered in the context of acute stroke. This may be especially important when understanding disparities in stroke outcomes across population subgroups: such disparities may be due to differences in acute stroke care or, quite plausibly, simply reflect differences that prevailed prior to stroke. This topic merits careful future analyses.

Conclusions

People who had a stroke had steeper declines and lower levels of ADL independence before the stroke compared to healthy persons of the same age. This study also provides unique insight on the actual decrement in ADL independence associated with stroke. There was a continual loss of independence in all ADLs after the stroke. These results suggest that pre-stroke ADL dependence is a marker of risk for stroke incidence and fatality, and that the declines in independence associated with strokes begin long before the stroke itself.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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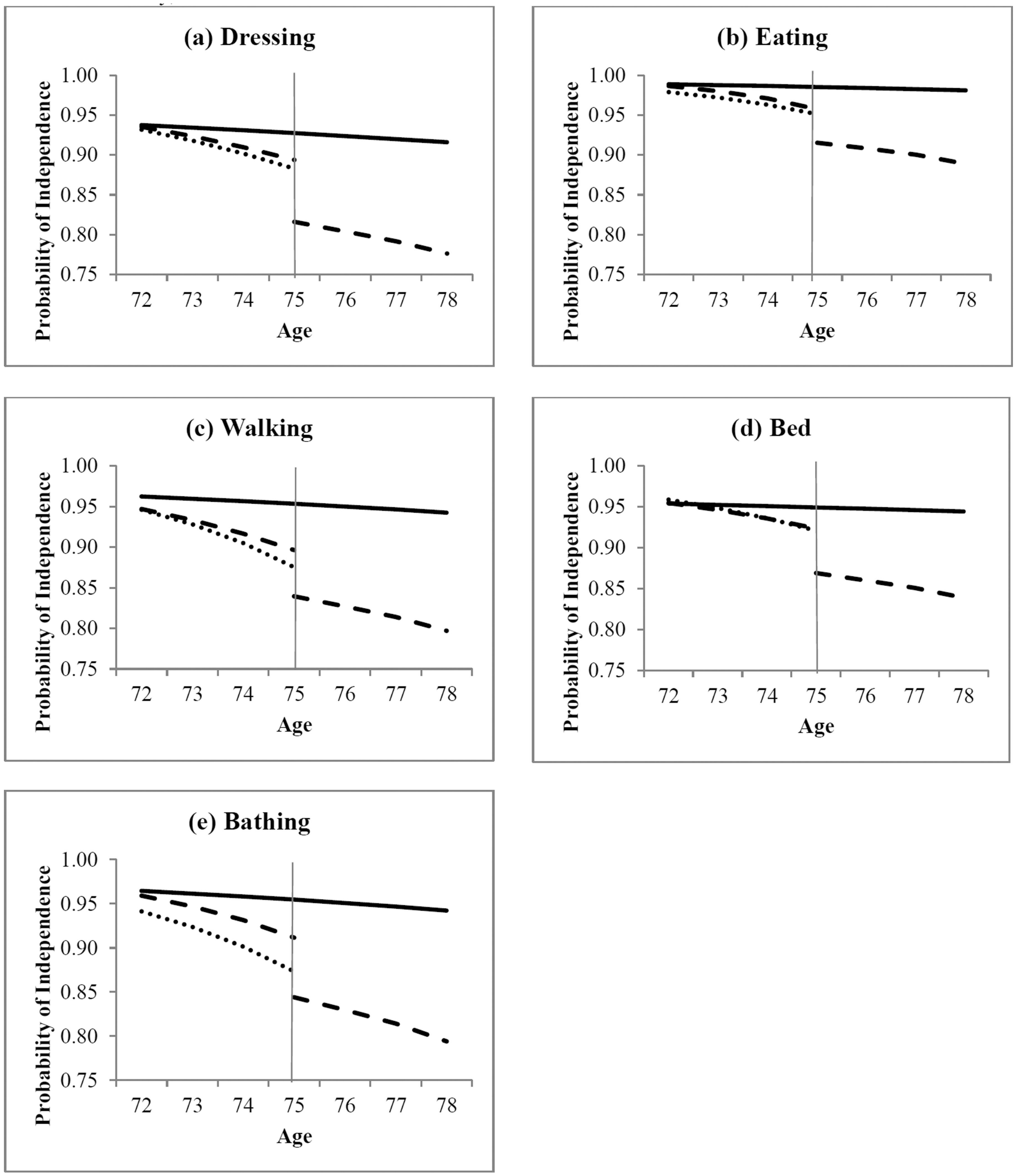

Figure 1.
Predicted probabilities of independence in each ADL ((a)dressing, (b) eating, (c) walking, (d) transferring to/from bed, (e) bathing) by stroke status over follow-up (never/survivor/decedent): Health and Retirement Study, 1998–2008.
Reference group is defined as 75 year old, white, married women who were born in the South, whose mothers had 8 years of education, who themselves had 12 years of education, who were 1.7 meters tall, and with household wealth of $108,600. Vertical line represents

the transition at the time of stroke for stroke patients, with predicted probabilities of independence modeled for someone whose stroke occurred at age 75.

——— No Stroke During Follow-Up

······ Stroke Decedents

– – – Stroke Survivors

——— Date of Stroke (vertical line)

Table 1

Baseline Characteristics of Study Population by Stroke Status During Follow-up: Health and Retirement Study, 1998

	Ever Stroke (n=1625)			Never Stroke (n=16,816)	
	Decedents (n=417)	Survivors (n=1208)			
Variable	Mean/n (SD/%)	Mean/n (SD/%)	p-value (decedents v. survivors)	Mean/n (SD/%)	p-value (ever v. never stroke)
Age at Stroke	80.4 (9.4)	74.7 (9.9)	<0.001		
Age at Baseline	74.9 (9.6)	69.4 (9.8)	<0.001	65.6 (9.9)	<0.001
Male	164 (38.9)	545 (45.1)	0.03	7272 (43.2)	0.84
Height	1.7 (0.1)	1.7 (0.1)	0.01	1.7 (0.1)	<0.001
Race					
White	330 (18.4)	971 (80.3)	0.40	13995 (83.2)	<0.001
Black	78 (18.5)	207 (17.1)	0.51	2239 (13.3)	<0.001
Other	13 (3.1)	31 (2.6)	0.57	582 (3.46)	0.10
Marital Status					
Married	190 (45.13)	758 (62.7)	<0.001	11715 (69.7)	<0.001
Divorced/Separated	40 (9.5)	97 (8.0)	0.35	1688 (10.0)	0.04
Widowed	173 (41.1)	316 (26.1)	<0.001	2933 (17.4)	<0.001
Never Married	18 (1.1)	38 (3.1)	0.27	480 (2.9)	0.18
Wealth, per capita, Median (IQR)	58000 (141000)	71550 (180657)	0.1395	96183 (210160)	<0.001
Years of Education	10.8 (3.8)	11.6 (3.4)	<0.001	12.1 (3.3)	<0.001
Southern Birthplace	83 (19.7)	230 (19.0)	0.76	2652 (15.8)	<0.001
Mother's Education					
≥8 years	176 (41.8)	544 (45)	0.26	8565 (50.9)	<0.001
Missing	59 (14.0)	152 (12.8)	0.45	1737 (10.3)	<0.01

Numbers were similar but not identical for all outcomes.

Table 2

Odds ratios (OR) and confidence intervals (CI) for independence in activities of daily living by stroke status and timing

	Dress		Eat		Walk		Bed		Bathing	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
	(obs=146581)		(obs=146534)		(obs=146520)		(obs=146518)		(obs=146551)	
Intercept	7.55	6.82 , 8.35	27.91	23.73 , 32.83	9.80	8.75 , 10.96	13.39	11.89 , 15.08	9.00	8.08 , 10.04
Age, centered at 75										
Never Stroke	0.95	0.94 , 0.95	0.92	0.91 , 0.92	0.93	0.92 , 0.93	0.97	0.96 , 0.97	0.92	0.91 , 0.92
Age at Stroke	0.96	0.95 , 0.97	0.95	0.94 , 0.97	0.95	0.94 , 0.97	0.97	0.96 , 0.98	0.94	0.93 , 0.95
Never Stroke	--	-- --	--	-- --	--	-- --	--	-- --	--	-- --
Ever Stroke Survivor	0.72	0.59 , 0.86	0.50	0.38 , 0.66	0.55	0.45 , 0.68	0.66	0.52 , 0.84	0.61	0.50 , 0.75
Years Until Stroke	0.84	0.79 , 0.89	0.67	0.57 , 0.80	0.78	0.73 , 0.85	0.83	0.77 , 0.90	0.76	0.71 , 0.82
Stroke	0.53	0.44 , 0.63	0.48	0.38 , 0.62	0.60	0.51 , 0.72	0.55	0.44 , 0.68	0.52	0.44 , 0.62
Years Since Stroke	0.93	0.90 , 0.96	0.91	0.88 , 0.95	0.92	0.88 , 0.95	0.93	0.89 , 0.96	0.90	0.87 , 0.93
Ever Stroke Decedent	0.64	0.47 , 0.88	0.43	0.28 , 0.66	0.45	0.32 , 0.63	0.64	0.42 , 0.96	0.41	0.30 , 0.56
Years Until Stroke	0.82	0.76 , 0.89	0.75	0.66 , 0.85	0.74	0.67 , 0.81	0.79	0.71 , 0.89	0.75	0.69 , 0.83

Note: Persons who never had a stroke are the reference. The exponentiated intercept represents the odds of independence with the ADL for a person of reference characteristics: a 75 year old, white, married woman who was not born in the South, whose mother had 8 years of education, who herself had 12 years of education, was 1.7 meters tall, with household wealth of $108,600.

Table 3

Associations of timing of stroke with independence in each ADL, by years of follow-up post stroke

	First 2 years of post-stroke follow-up time				First 4 years of post-stroke follow-up time			
	OR	**95% CI**			**OR**	**95% CI**		
Dressing								
Years Until Stroke	0.91	0.82	,	1.01	0.92	0.74	,	1.14
Stroke	0.64	0.49	,	0.84	0.71	0.49	,	1.05
Years Since Stroke	0.76	0.66	,	0.88	0.91	0.82	,	0.99
Eat								
Years Until Stroke	0.73	0.53	,	1.00	0.87	0.54	,	1.39
Stroke	0.38	0.22	,	0.65	0.28	0.13	,	0.63
Years Since Stroke	0.73	0.61	,	0.88	0.95	0.83	,	1.09
Walk								
Years Until Stroke	0.86	0.76	,	0.97	1.05	0.83	,	1.34
Stroke	0.69	0.53	,	0.91	0.58	0.37	,	0.92
Years Since Stroke	0.82	0.71	,	0.95	0.87	0.77	,	0.98
Bed								
Years Until Stroke	0.85	0.73	,	0.99	1.04	0.80	,	1.37
Stroke	0.70	0.49	,	1.01	0.58	0.34	,	1.01
Years Since Stroke	0.85	0.72	,	1.01	0.91	0.81	,	1.02
Bathing								
Years Until Stroke	0.86	0.76	,	0.98	0.82	0.65	,	1.04
Stroke	0.60	0.45	,	0.80	0.67	0.46	,	0.97
Years Since Stroke	0.67	0.58	,	0.79	0.86	0.77	,	0.95

Note: Left-hand panel models pre- and post-stroke trajectory for people with at least2 years of post-stroke follow-up (i.e., individuals who completed at least two interviews after stroke); the coefficients are estimated with respect to only the first two years post-stroke. The number of observations for the left hand panel are: dressing (obs=3223), eating (obs=3221), walking (obs=3224), bed (obs=3227), bathing (obs=3223). Right hand panel models pre- and post-stroke trajectory for individuals with at least 4 years of post-stroke follow-up (i.e., stroke survivors who completed at least 3 post-stroke interviews); coefficients are estimated with respect to the first four years post-stroke. The number of observations for right hand panel are: dressing (obs=2450), eating (obs=2442), walking (obs=2450), bed (obs=2452), bathing (obs=2450).