Right before the end: Asset decumulation at the end of life

Eric French, Mariacristina De Nardi, John Bailey Jones, Olesya Baker, and Phil Doctor

Introduction and summary

What happens to people's assets in the period immediately preceding their death? This is an important question for a number of reasons. To begin with, the elderly have a lot of wealth—households whose heads are 65 or older account for more than one-third of U.S. household wealth[1]—and the way in which they manage all this wealth may depend critically on end-of-life events. If, for example, elderly people are afraid of incurring large medical expenses just before they die, they might keep large amounts of assets even in very old age and not run down their assets until their illnesses appear terminal. Moreover, the need to pay for end-of-life expenses should affect the amount of wealth that younger households accumulate to fund their retirement. The issue of whether working households are saving enough has raised enough debate to warrant its own chapter in the current *Economic Report of the President*. This debate cannot be resolved until we learn the magnitude of end-of-life expenses.

In this article, we use data from the *Asset and Health Dynamics of the Oldest Old* (AHEAD), collected by scholars at the University of Michigan, to track the assets and expenses of elderly households in their last years of life. We find that the assets of people who die decline much faster than the assets of people who survive, even after controlling for age, sex, and initial asset levels. For single-person households, average wealth declines by 30 percent in the year preceding death and by 50 percent in the three years preceding death. The assets of single survivors with characteristics similar to those of the deceased, on the other hand, are flat over the same period.

Our main finding is that death is often preceded by a costly illness. Out-of-pocket medical expenditures related to drug costs, doctor visits, and hospital and nursing home stays go up by about 200 percent in the few years before death. The increase in medical spending before death, combined with burial expenses, can explain about 24 percent of the decline in assets of the soon-to-be deceased and about 37 percent of the decline in assets in the last year of life. In short, out-of-pocket medical expenses right before death can deplete the assets of many elderly households and constitute an important reason to keep assets in old age. Our findings also suggest that even if government insurance and transfer programs, such as Medicare, Medicaid, or Supplemental Security Income, are shielding the elderly from medical expenses, the coverage is far from complete.

Related literature and contributions of our article

The principal model that economists use to understand saving and to project how policy changes—such as changes in social security or Medicare—will affect saving is the life-cycle model.[2] The life-cycle model assumes that people are forward-looking and base their consumption and saving decisions on their preferences for consumption and knowledge of their future income. In the simplest version of the model, individuals know with perfect certainty the age at which they will die, and they place no value on leaving bequests to their children. Under this framework, individuals choose to die with no wealth: An individual in the last period of life, knowing that he is going to die and receiving no utility from bequests, forgoes utility if he does not consume all of his remaining wealth.

Eric French and Mariacristina De Nardi are senior economists at the Federal Reserve Bank of Chicago. John Bailey Jones is an associate professor of economics at the University at Albany, State University of New York. Olesya Baker and Phil Doctor are associate economists at the Federal Reserve Bank of Chicago. *The authors thank Kristin Butcher, Gene Amromin, Craig Furfine, and Wojciech Kopczuk for helpful comments.*

This simple version of the life-cycle model, however, is at odds with a large body of empirical research showing that many households retain large amounts of assets even in very old age (see Hurd, 1990, for a review). There are several reasons why a simple life-cycle model might underpredict saving by the elderly. First, people are usually uncertain about the exact time of their death and might need to save against the possibility of a long life. Second, people might save in order to bequeath assets to their children. Third, people might retain assets in case they need to pay for large out-of-pocket medical expenses.[3]

In this article, we consider another possibility, namely, that the data are incomplete. Although the age profile of assets has been carefully documented, we are among the first to document the changes in assets and medical expenditures that occur immediately before death. This is extremely important because many studies do not include people that are just about to die. For example, people in nursing homes are not included in the core sample of the *Survey of Consumer Finances* (SCF), although they are included in the high wealth oversample. If high medical expenses incurred from nursing home visits cause assets to decline before death, this will be completely missed in any study that uses SCF data. The predictions of the life-cycle model refer to what happens immediately before death: We are constructing a more precise test of the theory.

In addition, by studying the medical expenditures that are incurred right before death, we can develop a better measure of how much medical expense risk households face. This helps us better understand the importance of precautionary motives. Finally, our analysis helps us evaluate the risk of poverty immediately before death, an issue of major policy relevance.

Our work in this article is arguably most related to work by Hurd and Smith (2001), Yun (2003), and Hoover et al. (2004). Hurd and Smith find that assets decline very little at death, but base their comparison on the 1993 wave of the AHEAD, for which assets appear to be underreported much more severely than in other waves. Yun uses AHEAD data to consider how "expecting death" affects asset growth and, like us, finds that people run down their assets as they approach death. Using the *Medicare Current Beneficiary Survey*, Hoover et al. find that medical expenditures rise dramatically in the final year of life.

Data

We use data from the *Asset and Health Dynamics Among the Oldest Old* data set. The AHEAD is a survey of individuals who in 1993 were both noninstitutionalized and aged 70 or older. A total of 8,222 individuals in 6,047 households were interviewed for the first wave in 1993. These individuals were interviewed again in 1995, 1998, 2000, and 2002. The AHEAD data include a nationally representative core sample, as well as additional samples of blacks, Hispanics, and Florida residents.

The AHEAD has comprehensive asset measures. It has information on the value of housing and real estate, autos, liquid assets (which include money market accounts, savings accounts, and Treasury bills), individual retirement accounts (IRAs), Keogh plans, stocks, the value of farms or businesses, mutual funds, bonds, and "other" assets and investment trusts. Our measure of wealth is the sum of all these assets, less mortgages and other debts. Following common practice (for example, Hurd, 1989; and Attanasio and Hoynes, 2000), we exclude pension and social security wealth. Because assets appear to be significantly underreported in the first wave (see Rohwedder, Haider, and Hurd, 2004), we begin our analysis with data from wave two (the 1995 wave).

Given their age, many members of the sample die over the sample period. A novel feature of the AHEAD data is that survivors of the deceased (usually either a surviving spouse or a child) are interviewed. Survivors are asked about the value of the estate, insurance payments, medical expenses immediately preceding death, and costs associated with death, such as burial expenses. The key variable is the value of the estate. The exact question asked of the survivors of the deceased varied year to year, but in most years they were asked: "Altogether, what was the value of (his/her) total estate?" How the survivors of the deceased interpret this question is unclear. However, in appendix A, we show that, at least for the children of the deceased, the most likely interpretation of the question is the total value of the estate, inclusive of all possessions, such as the house and other valuables. If one member of the household dies but the other survives, we do not use the response to the estate question, but instead use the survivor's responses to the usual asset questionnaire.

There are several problems with our asset data. The first is that the wealthy tend to underreport their wealth in virtually every household survey (Davies and Shorrocks, 2000). This leads us to understate asset levels at all ages. However, Juster, Smith, and Stafford (1999) show that the wealth distribution of the AHEAD matches up well with aggregate values for all but the richest 1 percent of households. A second problem with our data is that it spans the years 1995 to 2002, a period in which there was a rapid rise in asset prices. This makes it difficult for us to distinguish between intended asset growth due to active

saving and unintended asset growth due to unexpectedly high returns.

Our data also suffer from attrition—people leaving the sample over time—a problem common to all panel data sets. In the AHEAD, attrition is largely due to death: Reported deaths are confirmed using the National Death Index. However, in some cases, interviewers are unable to track down sample members as they move from house to house, and some individuals refuse to give follow-up interviews. If the people who are difficult to contact differ systematically from those we are able to keep track of, "nondeath" attrition could distort the composition of our sample. If, for example, it is more difficult to track down poor individuals, poor households will be dropped from the sample at greater rates than the rich ones.

Two additional problems arise from the fact that assets are a household-level rather than an individual-level variable. First, some of the households in our sample consist of two unmarried individuals. Because it is not clear how these respondents might answer the asset questions, we drop these households. Second, many sample members get married or divorced over the sample period. Therefore, changes in wealth over time reflect not only savings decisions (the object of interest in this study), but also household formation decisions. To counter this problem, we drop individuals who get married or divorced during the sample period. To sum up, we keep only those households that were either married or single living alone in wave one and that changed household structure only because of death.[4]

Table 1 presents some descriptive statistics of our sample and reports average asset holdings by wave. (Assets are measured in 1998 dollars and do not include the value of any estates.) Our analysis begins with 3,880 households in 1995, of which 2,312 have at least one surviving member in 2002. Housing is the largest component of our households' portfolios, but liquid assets (such as bonds) and stocks are also important.

Tables 2 and 3 summarize the demographic transitions in our sample by showing how household composition changes between 1995 and 2002. Table 2 shows that of the 501 single men alive in 1995, 62 percent (309) had died by 2002. Of the single women, 48 percent were dead in 2002. Table 3 shows that of the 1,165 married couples that were alive in 1995, 32 percent had just the male die, 11 percent had just the female die, and 18 percent had both members die during the sample period.

TABLE 1

Household wealth, by asset type and year

	1995	1998	2000	2002
Housing	75,391	77,051	84,256	84,183
Liquid assets	52,078	47,236	48,081	61,021
Stocks	49,946	52,675	50,387	43,619
Automobiles	4,778	5,148	4,804	4,550
Businesses	12,057	8,916	8,480	17,183
Individual retirement accounts	7,558	9,013	11,312	7,963
Other assets	3,278	5,553	4,606	3,525
Debt	2,456	2,649	2,501	3,052
Total assets	202,630	202,943	209,425	218,992
Observations	3,880	3,303	2,777	2,312

Notes: Table does not include the value of estates. All values are in 1998 dollars.
Source: Authors' calculations based on data from the *Asset and Health Dynamics of the Oldest Old.*

Table 4 shows starting and ending wealth, by 1995 and 2002 household structure, for people who were initially single. The leftmost column in table 4 shows 1995 and 2002 wealth for men who did not die during the sample period. The second column of table 4 shows wealth in 1995 and wealth at the time of death for men who did die between 1995 and 2002. Table 4 displays two measures of wealth at the time of death. The first measure ("excluding estates") is

TABLE 2

Survival probabilities of singles

	Single male	Single female
Alive in 1995	501	2,214
Alive in 2002	192 (38)	1,161 (52)
Dead in 2002	309 (62)	1,053 (48)

Note: Percentage of sample is in parentheses.
Source: Authors' calculations based on data from the *Asset and Health Dynamics of the Oldest Old.*

TABLE 3

Survival probabilities of married couples

Married couples in 1995	1,165
Both alive in 2002	457 (39)
Wife alive in 2002	376 (32)
Husband alive in 2002	128 (11)
Both dead in 2002	204 (18)

Note: Percentage of sample is in parentheses.
Source: Authors' calculations based on data from the *Asset and Health Dynamics of the Oldest Old.*

TABLE 4

Singles' characteristics, by demographic status in 1995 and 2002

	Single male in 1995		Single female in 1995		All singles in 1995	
2002 household structure	Single male	Dead	Single female	Dead	Single	Dead
1995 assets	202,035	219,675	159,197	126,454	165,276	147,603
Final assets, excluding estates	226,228	210,740	156,258	107,634	166,187	131,026
Final assets, including estates	226,228	110,380	156,258	98,732	166,187	101,374
Death expenses		5,779		4,590		4,860
Death insurance payouts		422		528		504
Life insurance payouts		2,857		1,312		1,663
Observations	192	309	1,161	1,053	1,353	1,362

Notes: Assets in the final period refer to assets in 2002 if the household survived to 2002; otherwise, excluding estate value means excluding assets in the final period before death. Assets are in 1998 dollars. Observations refer to the number of observations that made the demographic transition.
Source: Authors' calculations based on data from the *Asset and Health Dynamics of the Oldest Old.*

the wealth reported for the last year the person is alive. The second measure ("including estates") replaces, when possible, the previous measure of wealth with the value of the estate reported by the person's survivors. The third and fourth columns show the corresponding statistics for single women. Both sets of columns indicate that assets decline much more quickly for the deceased than for the survivors. Table 5 shows the same data for households that initially consisted of married couples. Table 5 also suggests that death is associated with a faster rate of asset decline.

Empirical methodology

In considering how assets behave immediately before death, it is useful to work with the asset accumulation equation:

$$1) \quad A(it+1) = (1+r)\,A(it) + y(it) - m(it) - e(it) - c(it),$$

where $A(it)$ denotes assets of individual i at time t, r denotes the interest rate, $y(it)$ denotes income (from social security, pensions, and so on), $m(it)$ denotes medical expenses, $e(it)$ denotes end-of-life expenses (burial fees, less insurance payouts), and $c(it)$ denotes consumption. In short, assets can fall at the end of life because consumption rises, medical expenditures rise, income falls, or end-of-life expenses are high.[5]

While we have good measures of $A(it)$, r, $y(it)$, $m(it)$, and $e(it)$, we do not have a good measure of consumption, $c(it)$. The consumption measures contained in the AHEAD are very poor, and moreover, it is always difficult to measure the service flow from housing and durables. Fortunately, we can use equation 1 to infer consumption:

$$2) \quad c(it) = [(1+r)\,A(it) - A(it+1)] + y(it) - m(it) - e(it).$$

Appendix B contains a detailed description of our consumption inference procedure. In interpreting this measure of consumption, it is important to note that we do not measure some key variables, such as *inter vivos* (nonbequest) transfers between parents and children. The measure of consumption given by equation 2 should thus be interpreted as the sum of consumption and any expenditure not assigned to medical or end-of-life expenses.

TABLE 5

Married couples' characteristics, by demographic status in 1995 and 2002

	Married in 1995			
2002 household structure	Married	Single male	Single female	Dead
1995 assets	345,878	252,879	220,426	268,196
Final assets, excluding estates	341,733	232,266	194,218	212,435
Final assets, including estates	341,733	232,266	194,218	224,801
Death expenses		4,897	4,403	8,031
Death insurance payouts		369	359	731
Life insurance payouts		2,773	5,418	2,999
Observations	457	128	376	204

Notes: Assets in the final period refer to assets in 2002 if the household survived to 2002; otherwise, excluding estate value means excluding assets in the final period before death. Assets are in 1998 dollars. Observations refer to the number of observations that made the demographic transition.
Source: Authors' calculations based on data from the *Asset and Health Dynamics of the Oldest Old.*

In practice, all of the variables in equations 1 and 2 are measured with error. Therefore, even if the asset accumulation equation holds, its measured counterpart will not. As a matter of notation, we will use an asterisk to denote measured values, so $A(it)^*$ is the measured value of the asset level $A(it)$.

Our goal is to identify how assets and expenditures change immediately before death. The principal econometric problem we face in making this comparison is that people who die earlier might differ systematically from people who die later along a large number of (nondeath) dimensions. For example, poor people tend to die at younger ages than rich people (Shorrocks, 1975; and Attanasio and Emmerson, 2003). This means that people who have died in our sample might have lower assets than people who lived, not because they have run down their wealth in their final years of life, but simply because they were poorer all along.[6]

To deal with this problem while keeping our methodology simple and intuitive, we use a two-step approach. In step one, we collect the people in the AHEAD who die either between 1995 and 1998 or between 1998 and 2000. We then estimate fixed effects regressions on this group, using the methodology explained next.

In step two, we construct an artificial sample of people who have similar characteristics to those in step one described previously, but did not die between 1995 and 2000. For every household that did die during the sample period, and thus belongs in the sample described in step one, we find a household in the AHEAD that has the same age, the same 1995 composition (that is, for every single female who died, we find a single female who did not die), and a similar 1995 asset level. Next, we pretend that each of these matched survivors "died" at the same date as their counterparts who actually did not survive. If an individual in step one dies in 1998, we assign the comparison individual who did not die a fictitious time of death in 1998. We then repeat the fixed effects regressions described next with the sample of comparison individuals.

We then compare the various profiles of the people in these two groups by plotting the average fixed effect of each group and using the estimated coefficients from the fixed effects regressions. Since the households in the comparison group (who did not die) had the same age, sex, and 1995 wealth level as the household heads who did die, and since they faced the same aggregate environment, the wealth trajectories of the two groups arguably should differ only because of the event of death.

Our fixed effects regressions are computed as follows. Consider, for example, the regression for the assets of a single-person household:

$$3)\quad A(it)^* = f(i) + a0 \times 1\{\text{died between time } t-1 \text{ and } t\} + a1 \times 1\{\text{died between time } t \text{ and } t+1\} + e(it),$$

where $f(i)$ is a constant that varies across households but not across time and $a0$ and $a1$ are the parameters we wish to estimate. The $1\{.\}$ function is the 0–1 indicator function that returns 1 when the argument is true, so that $1\{\text{died between time } t-1 \text{ and } t\}$ equals 1 if the individual died between time $t-1$ and t, and equals 0 otherwise. (Since everybody in these exercises has a real or fictitious death, the omitted category is whether the individual dies between time $t+1$ and time $t+2$.) Thus, if the individual dies between 1998 and 2000,

$$4)\quad 1\{\text{died between time } t-1 \text{ and } t\} = 1 \text{ in 2000 and 0 in all other periods, and}$$
$$1\{\text{died between time } t \text{ and } t+1\} = 1 \text{ in 1998 and 0 in all other periods.}$$

Because the fixed effect $f(i)$ varies by household, it will capture systematic differences between people who die earlier and people who die later; put differently, the terms $a0$ and $a1$ capture the way in which dying causes assets to differ from their household-level average. The fixed effect term $f(i)$ is thus potentially correlated with the death indicators, although, by assumption, $e(it)$ is not.

Even though assets are measured with error—equation 3 uses $A(it)^*$ rather than $A(it)$—as long as the measurement error has a zero mean, and is uncorrelated with the fixed effects and the death indicators, the coefficients $a0$ and $a1$ will consistently estimate the way in which assets change immediately before death.

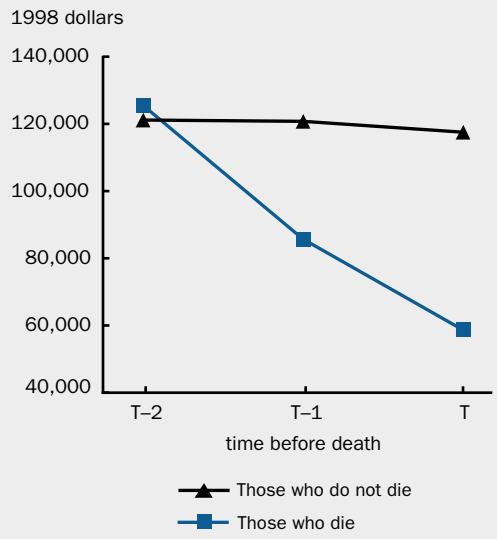
Asset rundown right before death: How important is it and why does it happen?

In this section, we document asset rundown right before death. We also document some of the possible reasons for this, such as high medical and death expenses.

Figure 1 presents average assets for our two groups of people. The first group consists of single people who died either between the 1995 and 1998 waves or between the 1998 and 2000 waves. (We consider only single-person households in order to simplify the interpretation of our results.) For the members of this group, we plot the average estate

FIGURE 1

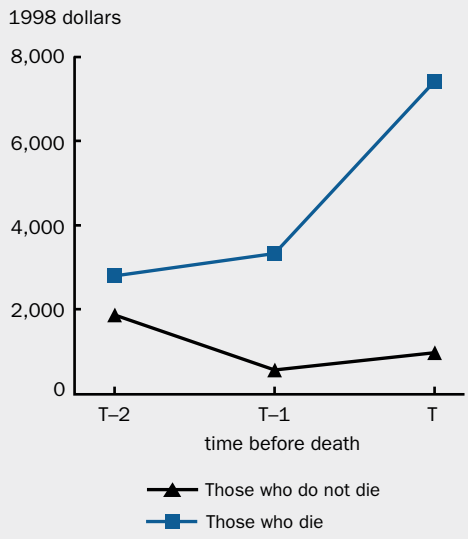
Assets, those who die vs. those who do not



Source: Authors' calculations based on data from the *Asset and Health Dynamics of the Oldest Old.*

FIGURE 2

Annual medical costs, those who die vs. those who do not



Source: Authors' calculations based on data from the *Asset and Health Dynamics of the Oldest Old.*

and average assets one and two waves before they die. We derive these averages from the regression described previously, which contains a person-specific fixed effect and indicators for periods before death. We construct average assets, using the regression estimates and the average fixed effect for that group. On the vertical axis are asset levels. On the horizontal axis are waves before death, so that T is the time of death, $T-1$ is one wave before the time of death, and $T-2$ is two waves before death. Recall that waves in the AHEAD data are two or three years apart. Thus, the time difference between $T-1$ and T can be anywhere from zero to three years, and the time difference between $T-2$ and T can be anywhere from two to five years. The second group consists of comparable single people who did not die during the sample period.

Figure 1 shows that average assets of the soon-to-be deceased are $126,000 two periods before death, $86,000 one period before death, and $59,000 at the time of death. Thus, in the few years before death, average assets decline over 50 percent, and in the period just prior to death, they decline about 30 percent. These declines are statistically significant, with t-statistics of 2.3 for the difference in wealth between time $T-2$ and time $T-1$ and 3.8 for the difference in wealth between time $T-2$ and T. In contrast, individuals in the comparison group, who are similar in age, sex, and 1995 wealth, show relatively small asset declines. For this group, assets decline from $121,000 at time $T-2$ to $118,000 at time T.

The end-of-life wealth declines shown in figure 1 are much larger than those reported in Hurd and Smith (2001), who use 1993 AHEAD asset data and 1995 estate data for those who die between 1993 and 1995. Hurd and Smith find that assets only decline from $82,000 to $81,600. We find similar declines when comparing 1993 asset data with 1995 estates. As we noted previously, however, the 1993 asset measures are likely understated. This means that the asset declines between 1993 and 1995 are likely understated as well.

There are several reasons why assets might decline in the period preceding death. Perhaps the most obvious explanation is that medical expenses are high right before death. Figure 2 shows medical expenses before death for the same two groups of people, calculated with the same methodology used for assets. The vertical axis shows total out-of-pocket medical expenditures—the sum of insurance premiums and payments for drugs, doctor visits, and hospital and nursing home stays that were not covered by insurance. Figure 2 shows that for those who die, medical expenses rise rapidly before death. At time $T-2$, medical expenses are $2,800 per year; at time $T-1$, they rise to $3,300; and at time T (that is, the year before death), they are $7,400. The difference in medical costs between time $T-2$ and time $T-1$ is not statistically significant, but

the difference between time $T-2$ and time T is highly significant, with a t-statistic of 5.9. For the comparison group (with the same 1995 age, sex, and asset level), medical expenses remain roughly constant, and average $1,900 per year at time $T-2$, $500 at time $T-1$, and $1,000 at time T. The end-of-life increase in medical expenses shown in figure 2 is slightly higher than that found by Hoover et al. (2004), who estimate medical expenditure in the year before death using the *Medicare Current Beneficiary Survey*.

Note that in addition to affecting wealth directly, medical expenses can also affect wealth indirectly over the entire life cycle if people save to pay for future medical expenses. This preemptive effect might be especially important if people save to insure themselves against catastrophic medical expenses, as suggested by Hubbard, Skinner, and Zeldes (1994), Palumbo (1999), and De Nardi, French, and Jones (2006).

Figure 3 shows income, both for those who die and those who do not. Although we do not have good income data for time T, we do have good data for the two preceding waves ($T-1$ and $T-2$). Figure 3 shows that income for those who die and for those who do not is similar across both of these waves. Reported income falls modestly from about $11,500 to around $10,800 between time $T-2$ and time $T-1$ for those who do not die, and it remains roughly constant at approximately $10,900 for those who do die.

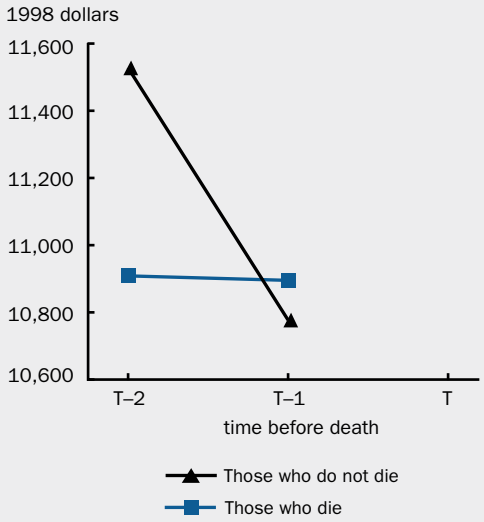
There are also several expenses associated with death, such as burial expenses. Average burial expenses for our sample are about $4,900. Part of these expenses are covered by "death insurance," small insurance policies designed to pay for burial expenses. These death insurance payments average a mere $500.

The measure of estates used in our analysis does not include the value of life insurance payments. The asset trajectories shown in figure 1 thus understate the estate actually received by the household's heirs. As it turns out, however, life insurance payouts are small, with an average value of $2,700.

Our findings suggest that much of the rundown in assets just before death can be attributed to medical costs and other end-of-life expenses. To give a sense of magnitude, recall that figure 1 shows that assets decline by $27,000 in the period just before death, and $67,000 in the two periods preceding death. Figure 2 shows that relative to the comparison group, the annual medical expenses of people who die are about $6,000 higher in the last year of life (our estimated gap between $T-1$ and T) and about $3,000 higher in the preceding two years (our estimated gap between $T-2$ and $T-1$). If death expenses (net of burial insurance) are about $4,000, it is then the case that

FIGURE 3

Annual household income, those who die vs. those who do not



Note: Data for time *T* are not yet available.
Source: Authors' calculations based on data from the *Asset and Health Dynamics of the Oldest Old*.

about 37 percent (10/27) of the asset decline in the last year of life and 24 percent (16/67) of the total end-of-life asset rundown are due to these expenses.

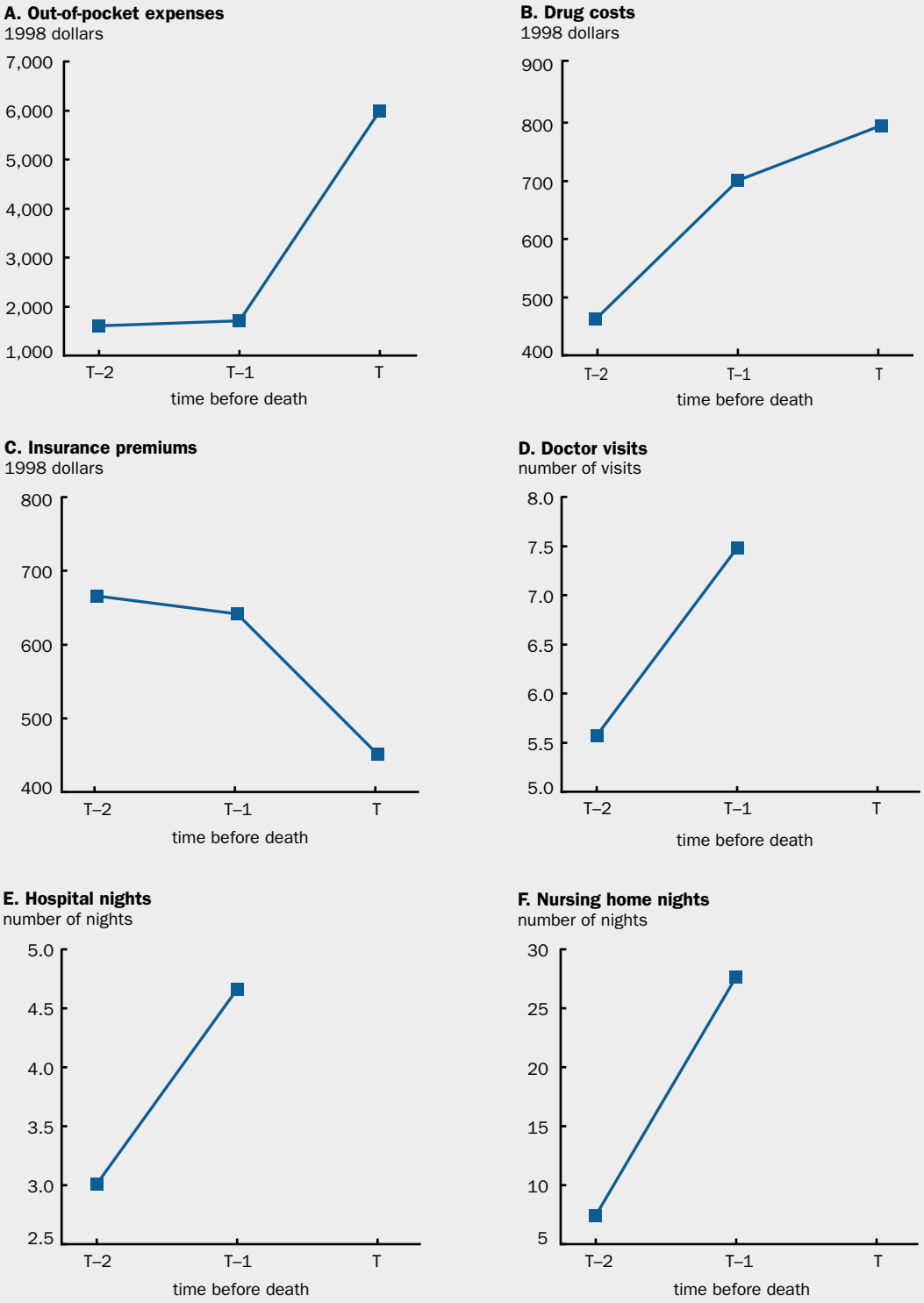
Understanding the rise in medical costs before death

Perhaps the most striking result we have shown is the sharp rise in medical expenses immediately preceding death. Although virtually all elderly individuals are covered by Medicare, there are gaping holes in Medicare coverage. Until the start of 2006, Medicare did not pay for prescription drugs. Medicare enrollees pay a 20 percent co-pay for doctor visits. Perhaps most importantly, Medicare puts caps on the number of hospital and nursing home nights that it covers per year. Medicare covers 100 percent of nursing home costs for only 20 days per year and only pays part of the cost of the next 80 days. Therefore, an individual who is in a nursing home for 365 days in a year will have to pay the full cost of the nursing home for 265 days out of the year, unless he or she has long-term care insurance or is financially destitute and eligible for Medicaid. French and Kamboj (2002) and French and Jones (2004) provide additional details about the medical expense data.

Figure 4 shows some of the subcomponents of health-related expenses, as well as the time spent using various health care services. In this figure, we

FIGURE 4

Annual health-related expenses and usage, those who die



Notes: Out-of-pocket expenses include those for doctor visits and nights spent in a hospital and nursing home. For panels D, E, and F, data for time *T* are not yet available.

Source: Authors' calculations based on data from the *Asset and Health Dynamics of the Oldest Old*.

divided the medical expenses into prescription drug costs, insurance premiums, and other out-of-pocket expenses, such as co-pays and deductibles for doctor visits and hospital and nursing home stays. Figure 4, panel A shows average out-of-pocket expenses for doctor visits and hospital and nursing home stays, which rise from $1,600 at time $T-2$ to $1,700 at time $T-1$ and $6,000 at time T. Figure 4, panel B shows drug expenses, which also rise before death, although not nearly as much as out-of-pocket expenses. Drug costs rise from about $500 at time $T-2$ to $700 at time $T-1$ and $800 at time T. Figure 4, panel C shows premiums for private health insurance (for example, "Medigap" coverage) and long-term care insurance, along with co-pays for Medicare part B insurance. Insurance premiums are approximately $700 at time $T-2$ and $600 at time $T-1$ and then fall to around $500 at time T. In short, the main expenditure change immediately before death is a sharp rise in out-of-pocket expenses associated with doctor visits and hospital and nursing home stays.

Further, figure 4 shows the rise in doctor visits, as well as nights spent in a hospital and in a nursing home. Unfortunately, we have not yet coded these variables at time T. However, panels D, E, and F of figure 4 show that all these utilization measures rise as individuals near death.

Figure 5 shows consumption before death, as well as consumption by those who do not die. As described in the empirical methodology section (and in appendix B), we infer consumption by using the asset accumulation equation. In order to infer consumption at a point in time, we need assets at two time periods. Therefore, because we only have assets over three periods, we can only infer consumption for two points in time. Figure 5 shows that consumption of those who die is much larger than for those who do not. Consumption rises from $25,000 at time $T-2$ to $33,000 at time $T-1$. For those who do not die, consumption rises from $13,000 to $15,000.

There are several potential explanations for the high level of inferred consumption right before death.

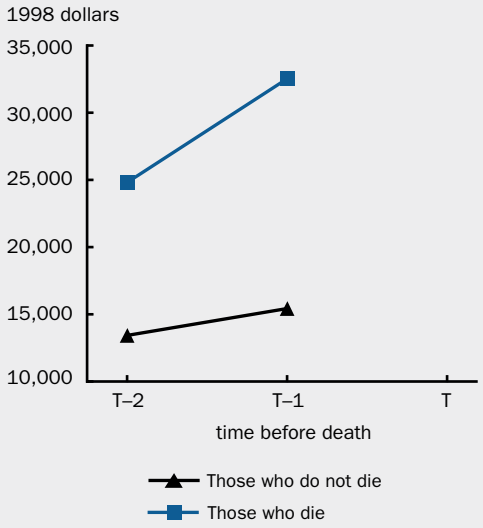
a) Individuals foresee the time of their death and run down their assets to enjoy higher consumption before death.

b) There is imprecise measurement. For example, there are many health-related expenditures (for instance, easy lifts that carry people up stairs) that are not included in our measure of medical expenditures.

c) There are large *inter vivos* transfers right before death. For example, Kopczuk (2005) compares individuals who die after short illnesses against those who die after lengthy illnesses. He finds that for those who die after lengthy illnesses, there are sizable declines in estates and sizable increases in gift giving immediately preceding their deaths. As we noted in our discussion of equation 2, these transfers would be included in our measure of consumption.

FIGURE 5

Annual consumption, those who die vs. those who do not



Note: Data for time T are not yet available.
Source: Authors' calculations based on data from the *Asset and Health Dynamics of the Oldest Old*.

Conclusion

A key implication of the basic life-cycle model is that assets are run down as individuals near death. Using data from the *Asset and Health Dynamics of the Oldest Old*, we present new evidence on asset rundown immediately before death.

We find that the assets of people who die decline much more quickly than those of people who survive. In single-person households, average wealth declines by 30 percent in the (roughly) one year preceding death and by 50 percent in the (roughly) three years preceding death. In contrast, the assets of comparable survivors are essentially flat over the same period.

We also find that death is often preceded by a costly illness. Out-of-pocket medical expenditures related to increased drug costs, doctor visits, and hospital and nursing home stays go up by about 200 percent in the few years before death. The increase in medical

spending before death, combined with burial expenses, can explain about 24 percent of the decline in assets of the soon-to-be deceased, and about 37 percent of the decline in assets in the last year of life. Our results thus suggest that end-of-life expenditures, medical and otherwise, provide an important reason for elderly households to retain their assets into very old age.

NOTES

[1]See table 11 of Wolff (2004). Estimates are based on the *2001 Survey of Consumer Finances* published by the Employee Benefit Research Institute.

[2]Recent surveys include Browning and Crossley (2001) and Carroll (2001). Altig et al. (2001) provide a good example of how the life-cycle model can be used for policy experiments.

[3]For example, in a recent survey of millionaires by the Northern Trust Corporation (2006), "nine out of ten … households are concerned that spiraling health care costs might affect their ability to enjoy retirement."

[4]Of 6,047 households in the AHEAD, we drop 362 households because of these criteria. We also drop 718 households whose heads were not retired, so our measure of income is clearer. We also drop 560 households who left the sample for reasons other than death. This leaves us with 4,407 households. As noted previously, we also drop wave-one data, as they are suspect. Because 527 households have all members die by 1995, we are left with 3,880 households alive in 1995 for the main analysis.

[5]We ignore taxes and assume that they are fairly minor. This is not too unreasonable, given that social security benefits are untaxed (so long as total income is below a certain threshold).

[6]A similar econometric problem is that in a cross-sectional or short panel data set, we observe individuals who were born at different times: Older people were born in earlier years than younger people. Households from older cohorts have, on average, lower real lifetime earnings than households from younger cohorts. Thus, we would expect the asset levels of households in older cohorts to be lower than those of younger cohorts in any given year. Therefore, comparing older households with younger households leads the econometrician to overstate assets when young and to understate assets when old when looking at a particular year. In other words, this will potentially lead one to infer that individuals run down their assets near the end of their lives when this is not actually the case. See Shorrocks (1975).

APPENDIX A: THE ESTATE DATA

We use estate data from 1998 and 2000 in the analysis. In 1995 and 1998, respondents (usually spouses or children of the deceased) were asked: "Altogether, what was the value of (his/her) total estate?" It is not totally clear whether respondents included the value of the house. However, in 2000, about half of respondents were asked the same question, and then in a later question were asked whether their previous answer had included the house. Most (but not all) responded that they were including the house. The remaining respondents in the year 2000 interview were asked: "Excluding (his/her) home and any life insurance, altogether, what was the value of (his/her) estate?" We make no attempt to add in the value of the house in the estate. Thus, we may be overstating asset declines at the time of death. We also assume that the value of the estate is net of all expenses related to death (the death expenses themselves are net of death insurance), but does not include life insurance.

For married couples, Hurd and Smith (2001) show that if one member of a couple dies, individuals are most likely interpreting "estate" to mean net of housing. To address this issue, we use reported assets when one member of a couple dies, as the surviving spouse usually gives both asset and estate information. We assume that when one member of a couple dies, no money goes to children or other individuals.

A second important issue is nonresponse. This is a particularly important issue for estates. About 55 percent of all estate values are actual reports. The other 45 percent are imputations made by the AHEAD. Many of the imputations use "unfolding brackets," where the respondents (usually children or spouses of the deceased) state that the estate of the deceased was worth more than some amount and less than another (for example, between $100,000 and $500,000). However, many of the estates are merely calculated using a hot-deck procedure that uses very little information. Thus, estates are likely measured with considerable error. Moreover, the 2002 data do not include any imputations at all and are thus excluded from the main analysis.

A third issue is that it is not clear whether the reported estate values are net of any estate taxes.

A final issue is that for some variables, such as death expenses, many people do not report a value. We set these values to zero, and thus, we likely understate death expenses of these households.

APPENDIX B: CONSUMPTION INFERENCE

As mentioned in the main text, although the AHEAD's measure of consumption is poor, we can use equation 2 in the text to estimate consumption. Consider an individual who died between survey years $t-1$ and t. For this individual, anywhere from zero to three years may have elapsed between the survey interview at time $t-1$ and the time of death. For the purpose of this exercise, we assume that exactly one year passes between survey year $t-1$ and the time of death, which allows us to use equation 2 exactly as it is formulated in the main text.

Imputing the consumption that occurred between one period and two periods prior to death is a bit trickier. Anywhere between two years and three years may have elapsed between these two survey waves. In this instance, we assume that exactly three years pass between interviews. This introduces compounded returns into our equation, yielding:

$$C_{it-3} = \frac{y(it-3)+(1+r)^3 A(it-3)-A(it)-m(it-3)}{(1+r)^2+(1+r)+1}.$$

Death expenses and insurance payouts are omitted, as the person has not yet died.

REFERENCES

Altig, David, Alan J. Auerbach, Laurence J. Kotlikoff, Kent A. Smetters, and Jan Walliser, 2001, "Simulating fundamental tax reform in the United States," *American Economic Review*, Vol. 91, No. 3, June, pp. 574–595.

Attanasio, Orazio P., and Carl Emmerson, 2003, "Mortality, health status, and wealth," *Journal of the European Economic Association*, Vol. 1, No. 4, June, pp. 821–850.

Attanasio, Orazio P., and Hilary Williamson Hoynes, 2000, "Differential mortality and wealth accumulation," *Journal of Human Resources*, Vol. 35, No. 1, Winter, pp. 1–29.

Browning, Martin, and Thomas F. Crossley, 2001, "The life-cycle model of consumption and saving," *Journal of Economic Perspectives*, Vol. 15, No. 3, Summer, pp. 3–22.

Carroll, Christopher D., 2001 "A theory of the consumption function with and without liquidity constraints," *Journal of Economic Perspectives*, Vol. 15, No. 3, Summer, pp. 23–45.

Davies, J. B., and A. F. Shorrocks, 2000, "The distribution of wealth," in *Handbook of Income Distribution*, Vol. 1, A. B. Atkinson and F. Bourguignon (eds.), Amsterdam: Elsevier Science, chapter 11.

De Nardi, Mariacristina, Eric French, and John Bailey Jones, 2006, "Differential mortality, uncertain medical expenses, and the saving of elderly singles," Federal Reserve Bank of Chicago, working paper, No. WP-2005-13, revised March 2006.

French, Eric, and John Bailey Jones, 2004, "On the distribution and dynamics of health care costs," *Journal of Applied Econometrics*, Vol. 19, No. 6, pp. 705–721.

French, Eric, and Kirti Kamboj, 2002, "Analyzing the relationship between health insurance, health costs, and health care utilization," *Economic Perspectives*, Federal Reserve Bank of Chicago, Vol. 26, No. 3, Third Quarter, pp. 60–72.

Hoover, Donald R., Stephen Crystal, Rizie Kumar, Usha Sambamoorthi, and Joel C. Cantor, 2004, "Medical expenditures during the last year on life: Findings from the 1992–96 *Medicare Current Beneficiary Survey*," Center for Discrete Mathematics and Theoretical Computer Science, technical report, No. 2004-27, May.

Hubbard, R. Glenn, Jonathan Skinner, and Stephen P. Zeldes, 1994, "The importance of precautionary motives in explaining individual and aggregate saving," *Carnegie-Rochester Series on Public Policy*, Vol. 40, June, pp. 59–125.

Hurd, Michael D., 1990, "Research on the elderly: Economic status, retirement, and consumption and saving," *Journal of Economic Literature*, Vol. 28, No. 2, June, pp. 565–637.

_____, 1989, "Mortality risk and bequests," *Econometrica*, Vol. 57, No. 4. July, pp. 779–813.

Hurd, Michael D., and James P. Smith, 2001, "Anticipated and actual bequests," in *Themes in the Economics of Aging*, David A. Wise (ed.), Chicago: University of Chicago Press, pp. 357–389.

Juster, F. Thomas, James P. Smith, and Frank Stafford, 1999, "The measurement and structure of household wealth," University of Michigan, manuscript.

Kopczuk, Wojciech, 2005, "Bequest and tax planning: Evidence from estate tax returns," Columbia University, manuscript, November.

Northern Trust Corporation, 2006, "Northern Trust study reports soaring healthcare costs may threaten retirement," press release, Chicago, April 17, available at www.northerntrust.com/pws/jsp/display2.jsp?TYPE=interior&XML=http://web-xp2a-pws/content//primary/pressrelease/1145292555550_431.xml.

Palumbo, Michael G., 1999, "Uncertain medical expenses and precautionary saving near the end of the life cycle," *Review of Economic Studies*, Vol. 66, No. 2, April, pp. 395–421.

Rohwedder, Susann, and Steven J. Haider, and Michael D. Hurd, 2004, "Increases in wealth among the elderly in the early 1990s: How much is due to survey design?," National Bureau of Economic Research, working paper, No. 10862.

Shorrocks, A. F., 1975, "The age–wealth relationship: A cross-section and cohort analysis," *Review of Economics and Statistics*, Vol. 57, No. 2, May, pp. 155–163.

White House and Council of Economic Advisers, 2006, *Economic Report of the President*, Washington, DC: U.S. Government Printing Office, February.

Wolff, Edward, 2004, "Changes in household wealth in the 1980s and 1990s in the U.S.," Levy Economics Institute, working paper, No. 407.

Yun, Heesuk, 2003, "Empirical investigation of dissaving near the end of life," Columbia University, dissertation.