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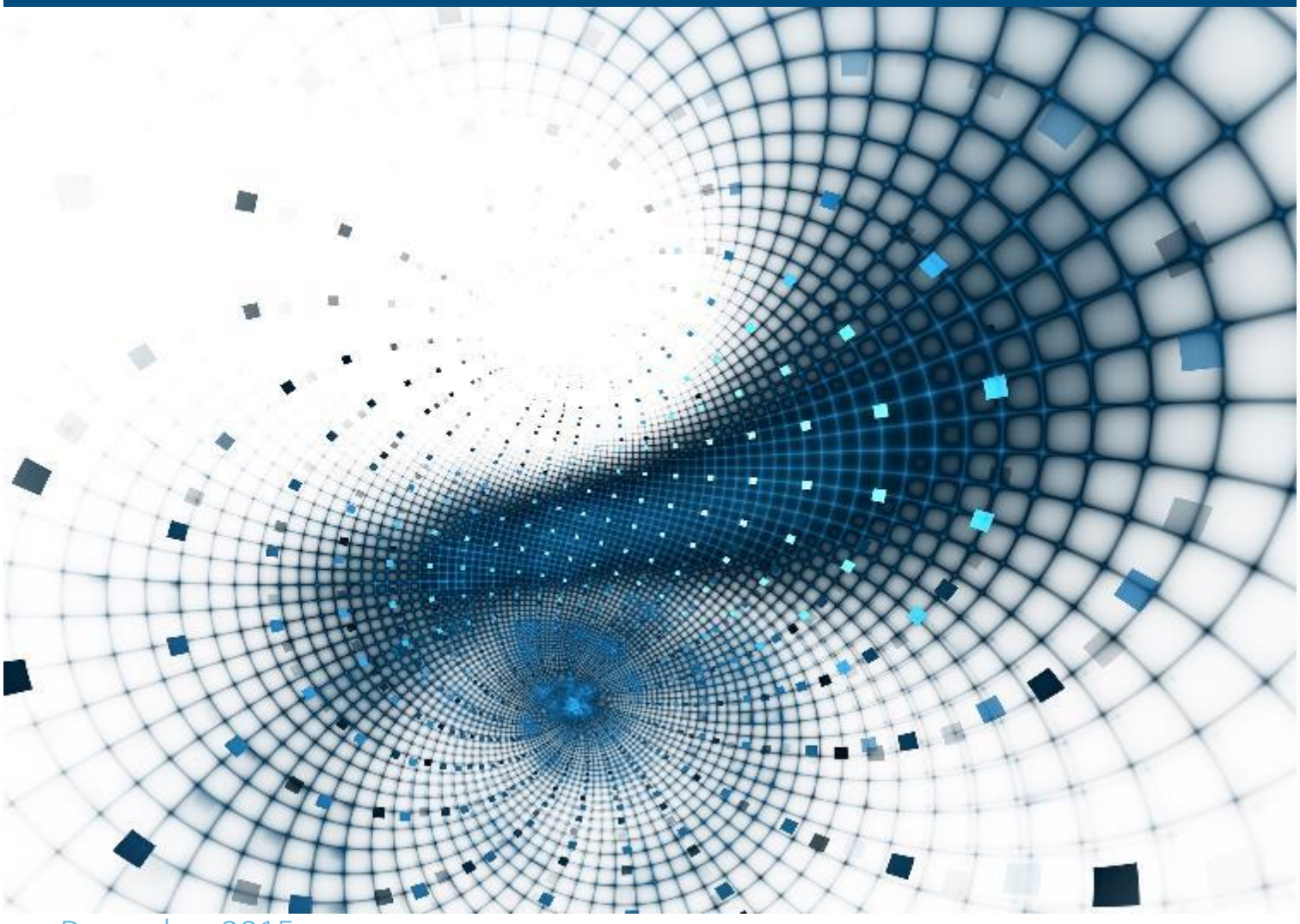
Challenges and Strategies for Financing an Increasingly Long Life



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Challenges and Strategies for Financing an Increasingly Long Life

SPONSOR Society of Actuaries

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Executive Summary

In our previous SOA-sponsored studies, *Measures of Retirement Benefit Adequacy* and *Improving Retirement Outcomes: Timing, Phasing, and Benefit Claiming,* we modeled retirement outcomes under a variety of scenarios, incorporating many stochastic post-retirement risks, including mortality, investment, inflation risk, long-term care and health risk. This study builds on the prior studies with a specific focus on how longevity impacts household financial needs in retirement and which strategies can best address these financial strains.

Our goal in the prior studies was to estimate the relative impact on retirement income security of various risk-mitigating and retirement-timing strategies. In this study, we consider similar strategies, but seek to better understand the link between life span and the wealth needed to successfully fund the retirement period. As with our previous studies, we focus on representative married-couple households based on national data and simulate their finances from entry into retirement through the death of the second spouse, incorporating the various risks that they face during retirement, including investments, mortality, health and long-term care risks. We assume that these individuals have mortality expectations consistent with the population of people in their age bracket, but we simulate their actual ages of death for 50,000 possible lifepaths, thus allowing us to examine more carefully the outcomes for those lifepaths in which at least one of the spouses lives much longer than expected.

A major conclusion from this research is that the risk of living long should be more carefully incorporated in household retirement planning. Most people, if they plan at all, appear to anticipate an average life span. The reality is that one-third of married couple households will have at least one spouse live to age 92 and, as compared to those with average lifespans, it will take substantially more wealth to maintain the pre-retirement standard of living through to old age. Financial products that provide lifetime income or that cover specific future expenses can help households have more successful retirement periods.

Key findings from the background research include:

- Continued improvements in average life spans, without corresponding increases in retirement ages, have resulted in longer periods of retirement than were typical in previous generations.

- As compared to individual life expectancy, joint life expectancy is longer. As a result, for married couples who are age 66 at retirement, 2/3 will have at least one spouse live to age 86 and 1/3 will have at least one spouse, usually the wife, live to at least age 92. (Figure A-1) Based on SOA surveys and focus group research, most people do not incorporate greater joint life expectancies in their planning.

- Retirement wealth levels in the US are, on average, insufficient to support increasingly long retirement periods without significant reductions in standard of living.

- The total income of married couples declines by age group for those age 65 and older, and Social Security becomes a proportionately larger source of income.

- The marital status of elderly persons is very different by gender. Women are much more likely to be alone, either widowed, divorced or never married.

Key findings from the simulation model results include:

- US households age 55-64, at both the median and 75th percentile based on income and wealth, have insufficient wealth to maintain their living standards throughout life if they both retire at age 66.

- Households can significantly improve their prospects for financial success in retirement by combining delayed retirement with other financial strategies that help to mitigate various post-retirement risks.

- People who live longer than average need more wealth to maintain their standard of living in retirement. Simulation results show that the 75th percentile base case household with the $105,000 household preretirement income needs $880,000 in non-housing wealth to retire at age 66 with 90% confidence of meeting all expected retirement expenses. Delaying retirement to age 70 reduces the amount needed at age 66 to $610,000. In contrast, the wealth needed at age 66 increases to $990,000 for those households who have at least one spouse who lives to age 92 or longer. For the longest-lived, delaying retirement to age 70 reduces the wealth needed at age 66 to $710,000. (Table 14)

- Simulation outcomes for the median household with $60,000 preretirement income show lower levels of wealth required, but similar effects of delayed retirement and longevity. That household needs $430,000 at age 66 to be 90% confident of retiring at age 66 with sufficient wealth to meet all expected expenses, and $290,000 at age 66 if they plan to retire at 70. For the longest-lived, the amounts needed increase to $520,000 for age 66 retirement and $380,000 for age 70 retirement. (Table 14)

- For each of the sets of simulation results in this report, we tabulate the amount of wealth needed to be 90% confident of meeting all needs and also the amount needed to be 50% confident of meeting all needs. In general, the differences between the 90th and 50th percentile confidence levels are quite large ($120,000 to $220,000). For example, in the base case, the median household needs $430,000 to be 90% confident but only $290,000 to be 50% confident. The 75th percentile household needs $880,000 to be 90% confident but only $660,000 to be 50% confident. These differences can be attributed to the combined effect of the various shocks to income and wealth that we have modeled in the simulation. Clearly, planning for what is needed "on average" will result in a much larger probability of shortfall because accumulated wealth will not be sufficient to cover unexpectedly large expenses. (Table 14)

- For couples who own a home at retirement and do not have an outstanding mortgage, a reverse mortgage can improve financial well-being in retirement. The reverse mortgage produces life income that reduces the need to tap other financial resources, but also reduces home equity that could be needed to meet future needs. (Table 15)

- Households that enter retirement with a mortgage are worse off than those who do not. (Table 15)

- All else equal, downsizing housing by 30% at retirement reduces the amount of wealth needed to be financially successful in meeting household needs. At the 90% confidence level, this strategy reduces wealth needed by about 7%. (Figure 15) This is a combined effect of reduced expenses (e.g. property taxes, insurance, and repairs) and increased investment wealth as the net difference in home value after transaction costs is added to the retirement nest egg.

- The purchase of long-term care insurance on one or both spouses has only a small effect on wealth needed at retirement, but may be a beneficial component of a combination strategy for managing post-retirement risks. This can be particularly important for the surviving spouse who is likely to be a widow and will have depleted assets by the time she may need to enter care. (Figures 16 and 18)

- We do not find immediate or deferred joint and survivor annuities to have much impact on the wealth needed at retirement for these representative households. (Figure 17) If annuities are fairly priced (present value of the payments equals the price of the annuity), then this result is not surprising. For the longest-lived, the survivor is assured of continuing annuity payments, but the purchasing power of these fixed payments declines over time.

- For the 75th percentile household, the best combination strategy we tested (delayed retirement to age 70, reverse mortgage at age 75, and the purchase of LTC insurance on the wife only), the wealth needed at age 66 to be 90% confident of making it through retirement is reduced by 74%, from $880,000 to $230,000. This wealth level is approximately equivalent to the amount of non-housing wealth these representative households actually have based on national data. For the longest-lived, the wealth needed is reduced by 67% (from $990,000 to $340,000).

I. Introduction

In our previous studies, *Measures of Retirement Benefit Adequacy* and *Improving Retirement Outcomes: Timing, Phasing, and Benefit Claiming*, we modeled retirement outcomes under a variety of scenarios, incorporating many stochastic post-retirement risks, including mortality, investment, inflation risk, long-term care and health risk. Our goal in those studies was to estimate the relative impact on retirement income security of various risk mitigating and retirement timing strategies. The analysis focused on the probability of a financially successful retirement and on the wealth needed to achieve this success. In this research, we focus on representative households whose mortality expectations are consistent with the population of people in their age bracket.

A major conclusion from both previous studies is that financial strategies that result in increased income or decreased expenses during retirement can result in incremental improvement in outcomes, but do little to mitigate the impact of large wealth shocks. To be 90 or 95 percent confident of a successful retirement, households need significantly more wealth at retirement to

hedge against the tail risk of unexpected longevity, extended periods of health or long-term care costs, or a long and deep financial crisis. Typical US households have far too little wealth to be confident of meeting their needs when the risk of these events are factored into the analysis.

Recent SOA focus groups and surveys have shown that many individuals do not fully understand the impact that living longer than average may have on their retirement. Whereas many studies consider retirement issues for the broader population, the purpose of this study is to focus on the challenges and risks faced by those who live much longer than their life expectancy. Because we incorporate stochastic mortality risk in our retirement forecast model, we can use it to more carefully quantify longevity risk and evaluate the differential impact of various retirement strategies on households segmented by length of life. The longest-lived segment will be proportionately more female, and we expect that the availability of social safety nets such as Social Security spousal benefits and Medicaid will be important. In this study, we investigate whether certain financial products such as long term care insurance, annuities, and reverse annuity mortgages are more or less beneficial strategies for those who live long.

This study builds on the prior two studies and uses a similar micro-simulation model that incorporates all the stochastic risks faced by retirees, including investments, mortality, health and long-term care risks.

II. Background on Longevity Risk, Women's Financial Security in Old Age, and Social Safety nets

A. Longevity and Demographic Issues

Longevity Risk

Over the past 100 years, average life expectancies in developed countries have increased by more than 20 years. Although the rate of increase has slowed, this upward trend is expected to continue in the future. In the earlier part of the 1900s, the increases in life expectancy were primarily attributable to improvements in mortality at the younger ages, resulting from advances in modern medicine--the introduction of antibiotics, vaccines, and improved sanitation. More recently, we have seen decreases in mortality at older ages, due to life-extending technologies and improved disease management. Further improvement is projected by most experts, but they disagree about how much improvement to expect.

Although there have also been corresponding increases in retirement dates over the last decades, they have been more modest than the changes in life expectancies. As a result, most individuals will have much longer retirement periods than were experienced by previous generations. For example, the Expert Commission on the Future of the Quebec Retirement System reports that whereas expected work life in 1970 was 46 years and the expected retirement period was 13 years, by 2009, expected work life was 38 years and expected retirement was 23 years. The eight-year drop in expected work life was the result of an increase in age of entry to the labor force from 19 to 22, and a decline in expected retirement age from 65 to 60. The 10-year increase in expected retirement period was the result of a five-year decrease in average retirement age and a five-year increase in life expectancy (Expert Commission on the Future of the Quebec Retirement System 2013).

Other developed countries have experienced changes in life expectancy and retirement periods similar to those in Canada. For example, Tables 1 and 2 show US Social Security Administration life expectancies at birth and age 65, respectively. These can be viewed as "middle of the road" projections with some demographers expecting greater increases in life spans.

Table 1 US Life Expectancy at Birth, by gender (selected years)

Years	Total	Men	Women
1900–02	49.2	47.9	50.7
1919–21	56.4	55.5	57.4
1939–41	63.6	61.6	65.9
1969–71	70.8	67	74.6
1989–91	75.4	71.8	78.8
2002	77.3	74.5	79.9
2003	77.5	74.8	80.1

Source: Birth Years through 1989-91: Shrestha (2006), Table 1. Congressional Research Service compiled data from the National Center for Health Statistics.

Table 2 Social Security Administration Projected Life Expectancies (in years)

		Life Expectancy at Birth		Life Expectancy at Age 65	
Born in:	**Age 65 in:**	**Male**	**Female**	**Male**	**Female**
1950	2015	73.8	79.8	19.3	21.6
1960	2025	75.2	80.9	20.0	22.3
1970	2035	77.3	82.3	20.7	22.8
1980	2045	79.1	83.7	21.2	23.3
1990	2055	80.5	84.8	21.8	23.8
2000	2065	81.7	85.7	22.3	24.3
2010	2075	82.7	86.5	22.8	24.7

Source: *2014 OASDI Trustees Report*, data from Table V. A4 Cohort Life Expectancy, Intermediate Assumptions, www.ssa.gov.

It should be noted that the Census Bureau projects increasing higher life expectancies for future age cohorts. For those born in 2060, the projected life expectancy is 84.0 years for males and 87.1 years for females. (U.S. Census Bureau, 2014).

The Society of Actuaries issued new mortality tables for pension plan financial measurement early in 2014. The RP-2014 and MP-2014 mortality improvement scale is intended to bring pension valuation mortality up to date. The age-65 life expectancy increased 10.4% for males (from 19.6 years to 21.6 years) and 11.3% for females (from 21.4 years to 23.8 years) as compared to the previous tables (the RP 2000 mortality table with Scale AA). (Society of Actuaries 2014, page 45, Section 12.4) [1]

There is disagreement about forecasts for future improvements in life expectancy. The Intermediate projections of Social Security actuaries are essentially middle of the road, but the SSA High Cost projections assume an additional one to three years of life expectancy, with large improvements for younger workers. The 2014 Living to 100 symposium included a range of views about improvements in life spans. James Vaupel projects improvements in life expectancies of 2.5 years per decade. (Stryker, 2014), whereas Jay Olshansky projects a slowing in the rate of mortality improvement due to factors like obesity, environmental issues, and new diseases. (Reither, Olsansky, and Yang, 2011)

Tables 3 and 4 show the probably of living to various ages in retirement for men, women, and a surviving spouse, on average and for a healthier subset of the population, respectively. As mortality improves over time, these probabilities will increase. In a group of age-65 couples with average population mortality, at least one will live to age 90 in 45% of the couples, and at least one will live to age 95 in 18% based on these tables. The survivor is more likely to be the wife. The issues discussed in this report are important to many people.

[1] These life expectancies are somewhat better than what would be expected for the general population because the population covered by pension plans reflects a higher-income subset of the total population, which is correlated with lower rates of mortality and longer life spans.

Table 3 Probability of Living from Age 65 to Older Ages

Age	Male	Female	Surviving Spouse
80	60%	71%	88%
85	40	53	72
90	20	31	45
95	6	12	18
100	1	3	4

Source: *Key Findings and Issues, Longevity, (SOA, 2012).* Estimates based on Social Security Administration mortality tables. Originally from an Academy of Actuaries webinar "Lifetime Income--Risks and Solutions" sponsored by the Academy's Lifetime Income Risk Task Force (March 7, 2012)

Table 4 Probability of Living from Age 65 to Older Ages For Healthier Subset of the Population

Age	Male	Female	Surviving Spouse
80	68%	77%	93%
85	50	62	81
90	30	42	60
95	13	21	31
100	3	7	10

Source: *Key Findings and Issues, Longevity, (SOA, 2012).* Estimates based on 75% Social Security Administration mortality risk. Originally from an Academy of Actuaries webinar "Lifetime Income--Risks and Solutions" sponsored by the Academy's Lifetime Income Risk Task Force (March 7, 2012)

Key points with regard to life expectancies and the issues of the very old:

- Average life spans in developed countries have increased substantially over the last 100 years and, while this trend is expected to continue, experts disagree on the extent of future improvement.
- Women have longer life expectancies (by about three years).
- The issues of the very old therefore affect more women than men, and are often most troubling for older women alone.

Demographics of Old Age

Tables 5 and 6 respectively report the number of US adults in 2012 by gender and marital status and the percentage distribution in each age group by marital status. It is important to note that, although the gender distribution by marital status is relatively equivalent at younger ages, in older age groups, there are major differences. For example, there are 1.8 million men and 3.2 million women who were age 85 or older. In that age group, there were 1.0 million married men compared to only 0.6 million married women. Women are more likely than men to be living alone, whether widowed, divorced, or separated.

An important takeaway from this data is the prevalence of widowhood, here defined as those who have lost a spouse and not remarried. In the 85+ age group, there were 2.4 million widowed women compared to 0.7 million widowed men. Nearly half of all women age 75-84 and three-quarters of those age 85 and over are widowed. This is in contrast to the much lower percentage of men who are widowers. This is generally because women have longer life spans and marry older men, whereas men are more likely to remarry after they lose a spouse.

The structure of Social Security benefits can also be a deterrent to remarriage in some situations. An elderly widow is entitled to a benefit that is the greater of the benefit based on her own earnings history or a benefit based on her deceased spouse's earnings history. If a surviving spouse is receiving a survivor benefit as the lower earner in a couple, remarriage could result in a reduced benefit.

Married people are different from others for purposes of this discussion because they generally share a household with their spouse, and can rely on each other financially. Although our study considers the retirement period for a married couple, our focus on the longest-lived households implies that we are also focusing on what happens to the widows as we follow the households through the death of the second spouse.

Table 5 Marital Status of the Population 15 Years and Over, by Sex and Age, 2012 (in 000s)

Gender and Age	Total	Married	Widowed	Divorced	Separated	Never Married
Male						
15 to 49	72,550	29,091	177	4,519	1,577	37,188
50 to 64	29,063	20,258	573	4,461	692	3,081
65 to 74	10,980	8,325	690	1,278	146	541
75 to 84	5,543	4,144	769	383	51	196
85 and over	1,809	1,004	656	61	10	79
Total	119,945	62,822	2,865	10,702	2,476	41,085
Female						
15 to 49	73,298	32,419	565	5,817	2,162	32,336
50 to 64	31,281	19,860	2,088	5,611	796	2,924
65 to 74	12,404	6,992	2,720	1,935	168	588
75 to 84	7,574	3,035	3,490	708	50	291
85 and over	3,196	564	2,336	152	21	125
Total	127,753	62,870	11,199	14,223	3,197	36,264

Source: U.S. Census Bureau, Current Population Survey, Annual Social and Economic Supplement, 2012; includes civilian noninstitutionalized population plus armed forces living off post or with their families on post.

Table 6 Marital Status of the Population 15 Years and Over, by Gender and Age, 2012 (as percentage of total for each age group)

Gender and Age	Total	Married	Widowed	Divorced	Separated	Never Married
Male						
15 to 49	100%	40%	0%	6%	2%	51%
50 to 64	100%	70%	2%	15%	2%	11%
65 to 74	100%	76%	6%	12%	1%	5%
75 to 84	100%	75%	14%	7%	1%	4%
85 and over	100%	56%	36%	3%	1%	4%
Female						
15 to 49	100%	44%	1%	8%	3%	44%
50 to 64	100%	63%	7%	18%	3%	9%
65 to 74	100%	56%	22%	16%	1%	5%
75 to 84	100%	40%	46%	9%	1%	4%
85 and over	100%	18%	73%	5%	1%	4%

Source: U.S. Census Bureau, Current Population Survey, Annual Social and Economic Supplement, 2012; includes civilian noninstitutionalized population plus armed forces living off post or with their families on post.

Poverty rates

Table 7 reports the percentage of individuals age 65 and older who have income below the poverty level, which in 2012 was defined as $11,011 for a single person and $13,878 for a family of two with an aged head. The incidence of poverty in these age groups varies substantially by gender and marital status. In general, for obvious reasons related to shared household expenses and potential for dual incomes, married couples are much better off than unmarried individuals. Among the unmarried individuals, women have higher poverty rates than men, with the highest incidence of poverty experienced by women who are divorced (17.1%) or have never been married (23.2%). Other studies suggest that female poverty in old age is due to many factors, including lower lifetime income, lower savings levels, and lower rates of employer-sponsored retirement plans.

Table 7 Poverty Rates by Gender and Marital Status, Age 65+, 2012

	Percentage below 100% of poverty		
Marital Status	**Total Group**	**Males**	**Females**
All	9.1%	6.6%	11.0%
Married	4.4	4.5	4.3
Widowed	13.6	10.1	14.5
Divorced	15.2	12.2	17.1
Never Married	19.8	15.7	23.2

Source: Social Security Office of Retirement Policy, 2012.

This data may understate the serious issue of retirement insecurity because official poverty levels are significantly lower than the amount needed to maintain a minimum standard of living at older ages. This issue is discussed in detail in Bajtelsmit, Rappaport and Foster (2012).

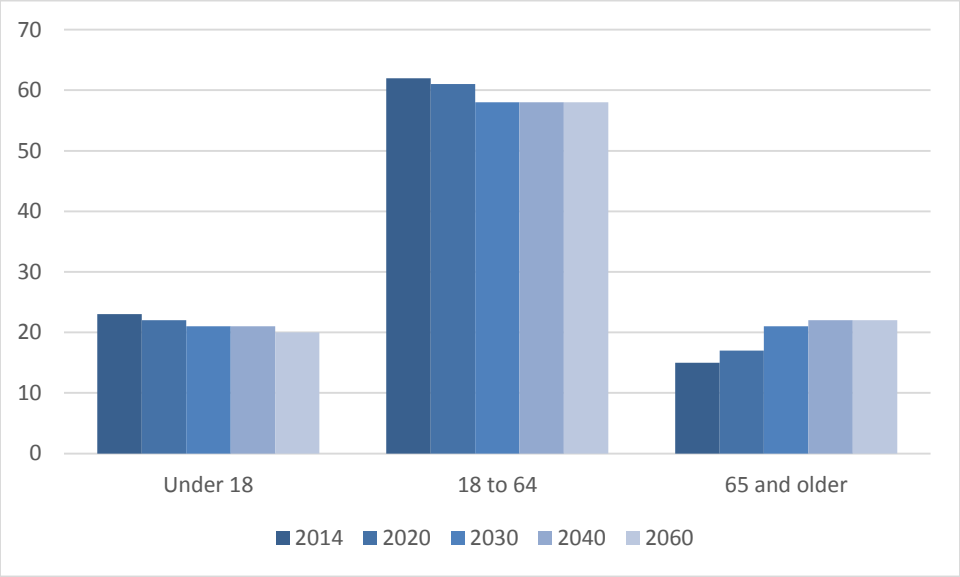
Key points about marital status and poverty in old age

- Nearly two-thirds of people over age 85 in the US are women.
- Most women over age 85 are widows.
- Widows and divorcees are more likely to be living in poverty than married couples.

Population projections

The population is projected to gradually age over the next 50 years. This is the result of historical fertility rates, immigration rates and longer life spans. Figure 1 shows that the percentage of the population that will be age 65 or over is projected to increase from approximately 15% in 2014 to 24% by 2060.

Figure 1 Current and Projected Age Distribution of the Population, 2014 - 2060



Source: "Projections of the Size and Composition of the U.S. Population: 2014 to 2060, U.S. Census Bureau (2015)

Maximum Life Spans

The oldest documented life span is age 122. There are few people who reach ages greater than 100 and even fewer who reach age 110. The International Database on Centenerians (IDL) is a project formed to study supercentenerians (people who are age 110 or older). The IDL database included entries from 14 countries as of December 31, 2008. The U.S. had the most entries (341, including 309 women and 32 men). The two countries with the next highest counts were Japan with 78 and England and Wales with 66. (Maier et al, 2010: page 38, Table 3).

The Society of Actuaries issued an exposure draft (the RP 2014 table) of new mortality tables for pension valuation early in 2014. The maximum life span in these new tables is age 120. (Society of Actuaries 2014) As mentioned previously, these reflect more favorable life expectancies for the population subgroup who receive pensions, who are generally higher income, more educated, and healthier than the general population.

Retirement Age Trends

As people live longer, periods of work and periods of retirement are potentially affected. Because retirement ages have not generally increased with increasing life spans, periods of retirement have

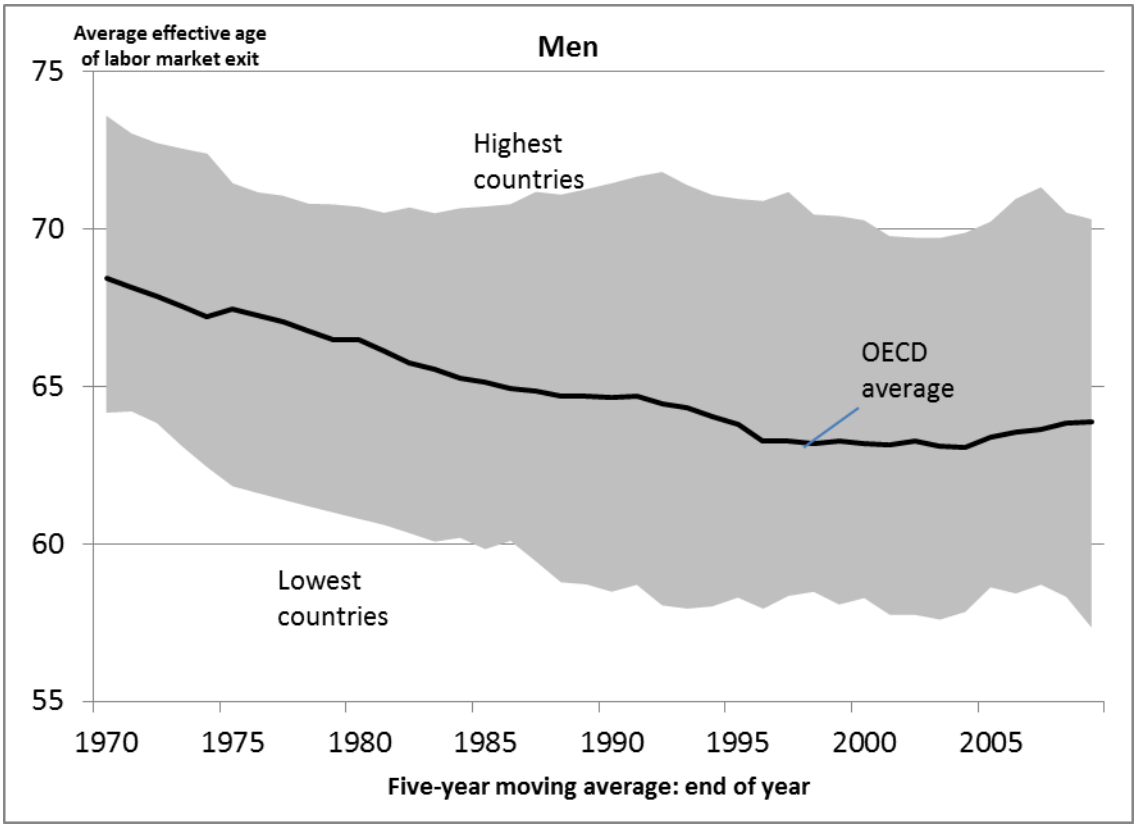
increased a great deal over the past 50 years. To adequately fund longer periods of retirement, retirees need to accumulate greater wealth prior to retirement.

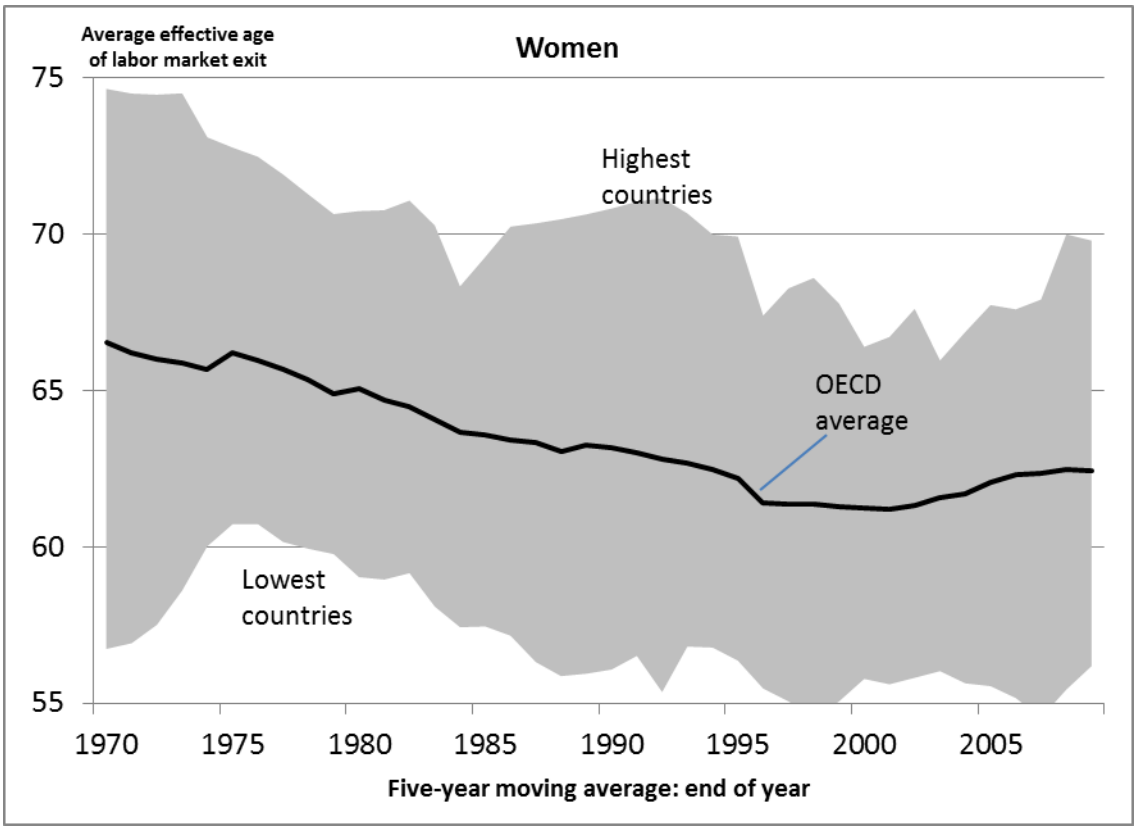
Retirement age is important in thinking about how people at the oldest ages will fare because retirement age drives how long people will have been retired as they reach the oldest ages. Retirement age can be defined in various ways. Labor market exit is a useful definition, particularly for comparison purposes. Labor market exit does not directly impact the latest ages, but later labor market exit allows households more years to accumulate retirement wealth and reduces the number of years of retirement income they need to fund.

The Organisation of Economic Co-operation and Development (OECD) publishes data on labor market exit, indicating retirement age trends. Retirement ages vary significantly by country, and have seen a long-term decline in many countries. The two panels in Figure 2 (men and women respectively) show the average effective age of labor market exit and the range of high and low for OECD countries from 1965 to 2007. More than 30 countries from around the world are OECD members, including Australia, Germany, Italy, Mexico, Turkey and the United States.

As is strikingly illustrated in these graphs, the effective retirement age has declined substantially since 1970. Despite a slight trend reversal more recently, the effective retirement age remains well below the levels of the 1960s and 1970s in most OECD countries (exceptions are Japan and South Korea). For men, the average effective retirement age fell from 68.6 in the late 1960s to 63.5 in the five years prior to 2009. For women, the average age of labor market exit dropped from 66.7 to 62.3 over the same period (Organisation of Economic Co-operation and Development 2011).

Figure 2. Average labor market exit age in OECD countries, Men and Women, 1965–2007





Source: Organisation of Economic Co-operation and Development 2011, figure 2.4

There is a great deal of similarity in demographic trends between the United States and Canada, as well as overlap with countries in Europe. The issues raised in this report would be generally applicable in both the United States and Canada. The strategies for making retirement more secure also apply in Canada and other countries, depending on the structure of their social benefit programs, retirement age structure, employment practices, employee benefits, tax structure, and financial services markets.

The general structure of the model and the principles used to develop the model should be generally applicable across geographies. The model is built using demographic assumptions, sample individuals typical of the population, social insurance benefits and elections under these programs, tax structures, employee benefit structures, etc. In order to test the strategies in other countries, it would be necessary to adapt the model to that country's situation. This would require a combination of reprogramming and resetting the assumptions to fit the local situation. Because there are similar issues in many countries, we believe that this would be worthwhile. How difficult it would be depends on the country by country situation.

Key points about retirement age trends:

- Although there are large differences by country, developed countries have seen a significant decline in labor force participation of both men and women since the 1970s.
- Earlier retirement combined with greater longevity means that people need to fund a longer retirement period.

B. Financial Challenges of the Very Old

The major financial challenges of the very old include outliving assets, paying for long term care and major health costs, and keeping up with inflation. Some will have cognitive difficulties and gradually lose the ability to function independently, a problem that is particularly difficult for those who do not have a spouse to rely on.

Older Americans face a variety of risks, some of which are mitigated by social programs and employee benefits, and some of which are borne primarily by the individual and family. Some post-retirement risks can be transferred and pooled, whereas others cannot. Table 8 highlights these risks and summarizes strategies that potentially can be used to manage or mitigate them. A more comprehensive list of risks and discussion of the treatment of the risks can be found in the Society of Actuaries publication, "Managing Post-Retirement Risks."

Table 8 Risks Facing Americans at Ages 75+ and Comments about Their Management

Risk	Products and Approaches for Risk Transfer and Potential for Pooling	Comments
Loss of spouse	▪Life insurance ▪Joint and survivor life annuities ▪Long-term care insurance can protect marital assets from depletion. ▪Delayed Social Security claiming can increase survivor benefits.	▪The impact of spousal loss is much greater for women than men. For women, periods of widowhood of 15 years and more are not uncommon. ▪Poverty rates are much higher for women alone than for couples. ▪Social Security survivor benefits provide an important base layer of protection. Four in ten older women rely exclusively on Social Security for income.
Family caregiving and support	▪Not poolable ▪Family support may come from spouses, siblings, children, or grandchildren. ▪Moving closer to other family members can make it easier to give and receive help. ▪Cooperative living arrangements are possible	▪Women are more likely to be care-givers and less likely to get help from others. ▪Provision of care to others may have reduced their ability to save for retirement. ▪Many seniors provide childcare support for children and grandchildren.
Cognitive decline	▪Not poolable. ▪Annuities to manage financial risks ▪Family and/or paid support system ▪A legally valid Power of Attorney is important.	▪The impact is more severe for people without family or a partner to support them. ▪Need to carefully screen potential caregivers to limit risk of fraud and/or incompetence.
Fraud	▪Not poolable ▪Limit investments to reputable firms ▪Many bank accounts, insurance contracts and some investments have back-up guarantee funds.	▪Concerns include identity theft and screening of caregivers. Family members can even be a problem. ▪Credit cards, passwords, etc. need to be guarded.
Outliving assets	▪Reduce expenses and increase saving. ▪Delay retirement ▪Delay Social Security claiming to increases monthly income and is somewhat like an annuity purchase. ▪Joint and survivor annuities and deferred annuities commencing at higher ages, such as 85 (longevity insurance). ▪Inflation-adjusted annuities ▪Life income options from DB or DC plans ▪Programmed withdrawals, bond ladders, and other strategies to produce steady cash flow	▪Earlier retirement increases this risk because it lengthens the retirement period that must be funded. ▪Impact of this risk is most often at the high ages, affecting the survivor after the death of a spouse. ▪Strategy must consider the needs of both spouses. ▪Few people purchase individual annuities, and the purchase decision involves significant trade-offs. ▪Inflation-adjusted annuities are less common, but provide important protection against loss of purchasing power. ▪Programmed withdrawals are more popular than bond ladders. Changes in regulations in 2014 make longevity insurance more available in qualified plans. ▪It is challenging to invest funds so that they last until the point that longevity insurance starts, so this risk should be considered in a strategy combining longevity insurance and conventional investments.

Table 8 Risks Facing Americans at Ages 75+ and Comments about Their Management (continued)

Risk	Products and Approaches for Risk Transfer and Potential for Pooling	Comments
Cost of disability and long-term care	▪Long-term care insurance ▪Continuing care retirement communities ▪Medicaid pays for cost for many people without assets or income. ▪Most care is provided at home, and the extent to which family members and friends are available to help greatly impacts the amount of paid care needed.	▪Only 10% have long-term care insurance. ▪Care can be provided at home, in an assisted living facility, adult day care center, or nursing home. ▪Nursing home costs can exceed $70,000 per year. ▪Risk is higher for, but not limited to, older retirees. ▪Women have longer expected periods of disability and, because they are more likely to single at older ages, require long-term services and support in old age. ▪Buying LTC insurance for wife only might be an option. ▪It is important to have a support system, and living near family who can help can be very useful. Churches and community groups can also offer help and support.
Cost of acute health care	▪Medicare for those who are over age 65 ▪Medicare supplemental insurance including employer-sponsored retiree health benefits. ▪Private health insurance for early retirees	▪For early retirees, cost likely to be a challenge. ▪Insurability is no longer an issue in light of health reform. ▪Fidelity (2014) estimate that an average couple both age 65 and covered by Medicare will have cash medical costs for premiums, co-payments and uncovered services with a present value of $220,000 over their lifetimes.
Investment risk, inflation and interest rate risk	▪Investment allocation and asset selection strategies can reduce risk. ▪Some products provide minimum guarantees. ▪Inflation-protected bonds ▪Annuity products with cost of living adjustments	▪Strategies that work well when assets are being built may not work well during the spend-down phase. ▪Experts disagree on what is the best approach for investment of assets during the spend-down phase. ▪Active management strategies may become a problem with cognitive decline, which may go undetected by family members for some period. ▪Both spouses should share in decision-making so that the survivor has the capability to continue after the death of a spouse.

Source: Created by authors; content draws from the Society of Actuaries (2014), *Managing Post-Retirement Risks*

The Role of Housing

Housing is the largest item of expenses for older Americans and it is the largest component of wealth for most families. Although it was rare in previous generations for a household to enter retirement with mortgage debt, low interest rates have encouraged more pre-retiree households to refinance homes with new debt. Although they may still intend to pay these loans back before formal retirement commences, it is likely that the percentage of retirees who are making mortgage payments will be higher than it has been in the past.

For households with significant home equity, reverse mortgages are a possible way to tap housing wealth without selling the home. So far, this has not been a very popular strategy. Similar to other types of annuities, retirees may worry that they will die before getting their "money's worth" from the house. In addition, retirees may correctly be concerned about fees and paperwork or loss of spending power of fixed annuities over time.

The Federal Housing Authority offers a reverse mortgage program called the Home Equity Conversion Mortgage (HECM) which allows homeowners age 62 years of age or older to access their home equity. The funds can be received as a lump sum, a line of credit, a fixed number of payments or joint and survivor life annuity. The costs for originating an HECM include FHA mortgage insurance (1.25%), closing costs, an origination fee, and monthly servicing costs. The total cost can differ substantially across lenders.

The percentage of home equity that can be accessed with reverse mortgages is lower than on other types of mortgages. Rather than being a straight percentage of home value (such as 75% or 80% commonly applied on conventional loans and home equity loans), the amount of the reverse mortgage is typically 50 to 60% of the value of the home and depends on the home value, the age of the youngest homeowner, the interest rate on the loan, and the type of loan (fixed versus adjustable). Unlike a regular mortgage, the homeowner does not have to make a payment on the loan, instead being the recipient of the funds. During the period of the loan, however, it is still the homeowner's responsibility to pay property taxes, insurance, and repairs on the home.

Retirees may also consider selling their original homes and downsizing, moving into senior housing, or buying into a continuing care community. Downsizing can take many forms, but is often focused on reducing the monthly cost of property taxes, insurance, maintenance of the property, and mortgage payments, if applicable. Although there are a number of different options for continuing care communities, a buy-in commonly allows a younger retiree couple to live in an independent apartment, from which they can graduate to various levels of assisted care in the future as their health and cognitive abilities require. In general, continuing care communities are relatively expensive housing choices and are not likely affordable risk management solutions for lower- to middle-income retirees. Other senior housing options provide some support services combined with housing, and may be rented, or secured under different arrangements. Note that the "initial payment" for a continuing care community or other senior housing may not be refundable on leaving the community, depending on the arrangements. Some allow for no refund, and some allow for partial refund. This is different from a house in an age 55+ community where the resident owns the house. (Rappaport, 2014).

How Different are the Very Old?

Income sources, family status, and health are all characteristics that change with age. Although it is common for researchers to categorize retirees in one group for comparison with younger age groups, the over-65 population is becoming less homogeneous over time. In general, the younger old have more income, are more likely to work, to be married, and to be in good health. In contrast, the very old are more likely to be widows who need assistance and have less income. In this section, we summarize some of the more important differences between older and younger elders.

Sources of Retirement Income by Age: Median income among the total older population declines with increasing age and the sources of income change as well. The amounts of income are very different for married couples than for single persons. As detailed in Table 9, elder singles have less than half the income of married couples across all the age groups. With total income declining with age and Social Security remaining relatively stable with age, more elders over the age of 80 rely on Social Security for most, or nearly all, of their income. At 80 and older, fully seven in 10 seniors get half or more of their income from Social Security, including nearly four in 10 who get almost all (90% or more) of their income from Social Security.

Note: A caution is in order in interpreting income by age data. The March Supplement of the Current Population Survey is the underlying database for much of the Social Security Administration analysis of income by age, and it does not include some of the sources of retirement wealth that contribute to people's well-being, including lump sum payouts from DB and DC plans, withdrawals from DC account balances, and some in-kind public program payments. As DC plans are an increasingly important source of retiree income, this becomes more important in interpreting income data in Social Security reports.

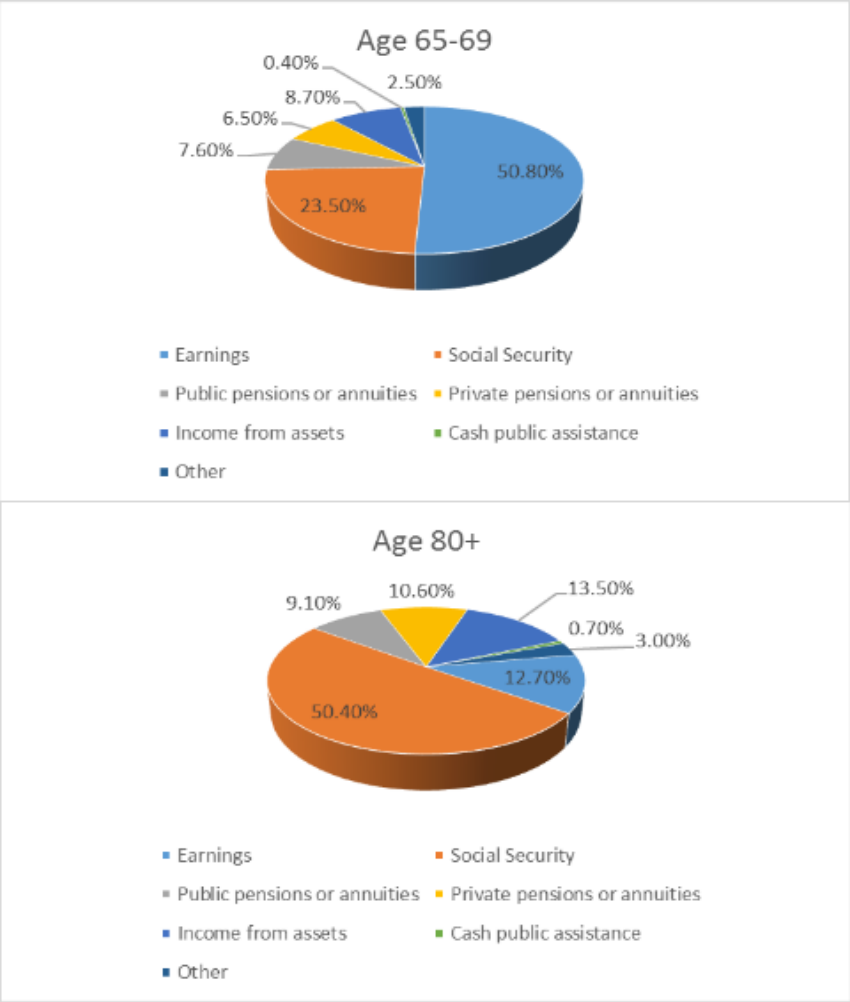
Table 9 Median Income and Reliance on Social Security

	Median total income, by Age			
Type of Household Unit	65-69	70-74	75-79	80 +
All units	$39,599	$31,339	$25,244	$20,517
Married couples	62,122	49,866	41,222	35, 182
Unmarried persons	22,194	19,209	16,908	16,931
Social Security as a % of Household Income	**Percent of Age Group by Degree of Reliance on Social Security**			
	65-69	70-74	75-79	80 +
50% or more of income	50%	62%	70%	76%
90% or more of income	24	32	39	47
100% of income	17	22	25	30

Source: Social Security Administration, Income of the Aged Chartbook 2012 (Released April 2014) (page 4) and Income of the Aged Data Tables 9.A1, 2012

Role of Social Security and other income sources: Figure 3 shows the large differences in sources of income for younger versus older retiree households. Whereas Social Security provides less than ¼ of income for the younger elderly, it provides more than 50 percent for the older group. These charts also illustrate the importance of employment income at younger ages versus older ages.

Figure 3 Percentage of Aggregate Income by Age and Source, 2012



These differences are even more pronounced when we compare the sources of retirement income for married couples versus singles. Table 10 shows the percentage of households receiving various sources of income, by age and marital status, and Table 11 shows the average dollar income from different sources by age and marital status. Because so many elderly singles are widows, they are disproportionately less likely to have income from pensions and wage earnings, making them more reliant on Social Security than couples. The increasingly important role Social Security fills in

maintaining purchasing power at advanced ages weighs in favor of delayed claiming strategies that produce larger inflation-adjusted income at older ages.

Table 10 Percent of Households Receiving Sources of Income, by Age and Marital Status

	Age				
Sources of income	Total	65-69	70-74	75-79	80 +
	Married couples				
Social Security	89	83	92	93	94
Pensions	50	44	54	51	54
Asset income	66	67	67	65	63
Earnings from work	38	58	39	28	13
	Unmarried persons				
Social Security	88	80	88	91	91
Pensions	35	30	36	37	37
Asset income	47	45	46	48	49
Earnings from work	15	34	20	12	4

Source: Reno and Lavery (2010) "When Should I Take Social Security: Questions to Consider" National Academy of Social Insurance

Table 11 Median Income for Recipients of Social Security, Pensions, and Earnings, by Age and Marital Status, 2006

	Age				
	Total	65-69	70-74	75-79	80 +
	Social Security				
Married couples	$19,960	$18,390	$20,400	$20,360	$20,120
Unmarried persons	11,860	11,620	11,800	11,860	11,860
	Pensions				
All Pension income*	$11,840	$13,500	$12,000	$11,400	9,600
Government pension*	16,800	19,800	19,200	15,600	14,400
Private pension*	8,500	10,800	9,550	8,400	6,010
	Earnings				
Married couples	$29,000	$35,000	$25,160	$15,000	$18,720
Unmarried persons	16,000	20,600	15,000	10,000	13,000

Source: Reno and Lavery (2010) "When Should I Take Social Security: Questions to Consider" National Academy of Social Insurance. Note: Pension income is the median for those households receiving a pension.

Key points:

- Major risks in old age include running out of money, needing long term care, and major health challenges.
- Risks related to fraud and cognitive decline are among the risks more often overlooked.
- Women are more likely to be alone in old age and to experience longer periods of disability. They, therefore, face greater financial challenges than elderly men.
- Older retirees are more reliance on Social Security income than younger retirees.

C. Social Safety Nets

The public programs that offer primary protection to the elderly include Social Security, Medicare, Medicaid, SSI and other public programs.

Social Security offers retirement income, disability income, and survivor benefits to most of the U.S. population. In our prior study, *Improving Retirement Outcomes*, we explored important issues relative to Social Security Claiming and provided background on issues relative to Social Security claiming.

While Social Security income is of great importance to a large percentage of retirees, the average benefits are relatively modest. As detailed in Table 12, the retirement benefits for retirees in 2012 who qualified on their own earnings history averaged $1,417 and $1,103 per month for men and women, respectively. For those who received a spousal benefit, the average benefit was only $433 and $633 for males and females respectively.

Table 12 Average Monthly Social Security Benefit (in dollars), by Gender and Beneficiary Type, December 2012

Beneficiary type	Men	Women
Workers		
Retired	1,417	1,103
Disabled	1,256	993
Spouses of workers		
Retired workers	433	633
Disabled workers	267	306
Survivors of deceased workers		
Nondisabled widow(er)s	1,057	1,218
Disabled widow(er)s	522	723
Mothers and fathers	771	912

Source: Social Security Administration, Fast Facts and Figures About Social Security, 2013, page 20

Social Security Supplemental Security Income (SSI) provides additional income to the elderly poor. Some States supplement the Federal SSI benefit with additional payments which can cause some disparities across states. SSI benefit amounts and State supplemental payment amounts vary based upon income, living arrangements, and other factors.

Medicare offers a wide variety of acute health care benefits to most of the population over age 65 and to individuals who qualify for Social Security disability benefits. Medicare is funded through payroll taxes and general revenues as well as beneficiary premium contributions during retirement for premiums for Medicare Parts B and D, as well as co-payments and deductibles. Fidelity estimates that an age-65 couple needs to have accumulated an additional $220,000 in savings, on average, to pay for premiums and out-of-pocket health costs in retirement. For lower income seniors, Medicare is supplemented by Medicaid which helps to fill in the gaps not covered by Medicare. Many seniors purchase additional insurance, i.e. Medicare supplement insurance, to fill in the gaps.

Only 10 percent of the population has private LTC insurance and there are no public programs offering LTC protection to the general population. Medicare offers very limited LTC coverage, Medicare supplement policies do not cover this risk, and state-based Medicaid programs, the largest payer of nursing home expenses, are limited to those who have spent down their assets.

In addition to the programs and services listed above, there may be other community services and safety nets available for the elderly in some situations. The California Department of Aging lists a variety of programs and services on their website. Some examples of the types of programs that may be offered include:

- Community-Based Adult Services – this program replaces a former adult day health care program. Its objectives are to restore or maintain optimal capability for self-care to frail elderly persons or adults with disabilities, and to delay or prevent inappropriate or personally undesirable institutionalization.

- Disease Prevention and Health Promotion -- Services include routine health screening, nutrition counseling, nutrition education and activities that promote physical fitness, falls prevention, emotional well-being, and evidence-based health promotion programs. Individuals participate in programs at multi-purpose senior centers and at other locations. Disease Prevention and Health Promotion Services promote healthy aging and the maintenance of optimal physical, mental, and social well-being in older adults. An active healthy lifestyle can help older adults prolong their independence and improve their quality of life.

- Family Caregiver Support Program

- Legal Assistance

- Nutrition Support – including, in some cases, home delivered meals.

Key points:

- Social Security and Medicare benefits in retirement provide an important safety net for US retirees.
- Other means-tested public programs include Medicaid and nutrition support.
- There are other public services available as well as private supports in the community.

III. The Retirement Simulation Model

In the previous sections of this report, we summarized the risks faced by retirees and highlighted the extent to which the oldest old are most exposed to and financially challenged by these risks. In the remainder of the report, we use a simulation methodology to more carefully quantify these effects and evaluate various risk management strategies.

In our previous retirement simulation studies (Bajtelsmit et al., 2012; Bajtelsmit, et al. 2013), we developed a model that incorporates the most common risks and uncertainties faced by retirees, including longevity, inflation, investment, health and LTC risks. The simulation forecasts potential post-retirement income and expenses for representative pre-retiree households who are exposed to various risks during their retirement period. For each of these households, the parameters for income, wealth, expenses, and retirement plan participation are selected based on national data. The design of the model allows estimation of retirement wealth needs, probability of shortfall, and the effect of various risk mitigation strategies on retirement outcomes.

This paper builds on the model used in our previous studies and has some similar characteristics, but differs in several respects. Because we have updated basic assumptions regarding income, wealth, expenses, and risks based on more recent national data, the dollar estimates from our previous studies, although similar in magnitude, are not directly comparable to those presented here.

The primary focus of this report is to investigate the financial issues faced by the longest-lived. The basic model construct is a detailed cash flow forecast for a married-couple household from age 66 to the date of the death of both spouses. Post-retirement risks that impact the household's cash flows are introduced through the use of Monte Carlo simulation. The base case assumes that a married couple, age 65 at the outset of the simulation, have income and wealth corresponding to either the median pre-retiree household ($60,000 income and $100,000 non-housing wealth)[2] or the 75th percentile household ($105,000 income and $250,000 non-housing wealth). Housing equity is assumed to be three times income at age 66 and increase with inflation throughout the retirement period.[3] We assume initially that the household has two financial goals: 1) to maintain

[2] Although we provide the median non-housing wealth levels here, our forecast output is focused on how much they would have needed in retirement wealth to meet all their expenses for the respective scenarios. Non-housing wealth is important, however, in that households who wish to purchase an annuity are assumed to use a proportion of their wealth to do so. Thus, lower wealth levels limit the amount of the potential annuity purchase and payment. In the several scenarios in which households make use of housing wealth to fund retirement expenses, the assumptions about the level of housing wealth are important to the analysis.

[3] The assumptions about the level of housing wealth are important to the analysis because we consider several scenarios in which households make use of housing wealth to fund retirement expenses.

their pre-retirement standard of living in retirement while meeting all normal and unexpected expenses, and 2) to make it through retirement without running out of money.[4]

A. Model Assumptions

Stochastic elements are incorporated in the cash flow forecast by imposing risky distributions on various elements for each year of a hypothetical retirement. For example, instead of assuming that inflation is 3% every year, it is assumed to be drawn from a risky distribution with a 3% mean such that the household may, in some years, be subject to much higher or lower inflation than the average rate. Parameters for each of the stochastically-modeled risks are drawn from historical data. The advantage of this methodology is that, instead of assuming that everyone gets the average outcome, we can see the impact of risks that, while uncommon, can have a devastating impact on household finances.

For a given married-couple household, we run the retirement cash flows for 50,000 hypothetical life paths, with random draws each year for each of the risk factors. Based on the outcomes of these many different possible lifepaths, we can measure the percentage for which the household is able to meet all expenses in retirement, as well as estimate the amount of pre-retirement wealth that would have been sufficient to meet those needs at various levels of confidence.

Table 13 is divided into two panels. In the panel labeled 13a**,** we summarize the simulation assumptions for two representative households with income and wealth at approximately the 50th and 75th percentiles of pre-retiree households in 2015. The panel labeled 13b summarizes the assumptions made for each of the risks that are incorporated in the model.

[4] Households are assumed to be able to access investment wealth and also to sell their home to cover expenses once they don't need to live in it (e.g. surviving spouse or both spouses are permanently in long-term care).

Table 13a Summary of Simulation Model Assumptions- Households

Characteristics	**Median Household**	**75th Percentile Household**
Total Pre-Tax Income	$60,000	$105,000
Husband (age 62)	H: $42,000	H: $74,000
Wife (age 62)	W: $18,000	W: $31,000
Base Case Housing	Home-Owner	Home-Owner
Home Equity	$180,000	$315,000
Mortgage	No Mortgage	No Mortgage
Non-Housing Wealth	$100,000	$250,000
Social Security Status	H:Fully Insured W: Qualifies on H's Earnings Both retire at full retirement age (66)	
Defined Benefit	Base Case: None	
LTC Insurance	Base Case: None	
Desired Standard of Living in Retirement	Retirement period same as pre-retirement	

Table 13a Summary of Simulation Model Assumptions- Households

Stochastic Risks	Model Parameters
Household Cash Flows	First year after-tax retirement expenditures age-based from Consumer Expenditure Survey. Retirement cash flows paid first from income sources and then, if income is insufficient, from taxable withdrawals from retirement savings. Future years' income and expenditures increase with stochastic inflation and may be affected by other risks. if one spouse goes into LTC, the discretionary expenses for the remaining spouse (covering everything except housing and health care) are reduced by 25 percent.
General Inflation	General inflation is simulated for each year and applies to all expenses except health care and LTC costs.[a]
Health Costs and Inflation	Both spouses are assumed to have Medicare coverage. Out-of-pocket health expenditures are stochastically determined for each year of retirement, with the minimum set at approximately the cost of Medicare Part B premiums. Future health expenditures for each year are forecast to increase with simulated medical inflation. [b]
LTC Costs and Inflation	LTC is defined in this simulation to be out-of-pocket costs of assisted living or nursing home care beyond what is covered by Medicare. The annual cost of LTC in the base year is $80,000, approximately the national average data for skilled nursing with a semi-private room (Genworth, 2014), and increases over the retirement period with simulated medical inflation. LTC costs for each year are determined in a two-step process. The probability of needing care in a given year is assumed to depend on age and gender. If a person enters care, their length of stay is 3 months, 1 year, or 5 years. [c]
Housing	Households are assumed to be homeowners who enter retirement with no mortgage. Home market value is three times income and increases annually with inflation. When neither spouse is living in the home, e.g., one person is deceased and the other is in LTC, the house is assumed to be sold, for 90 percent of market value, one year after the last person vacates the home.
Mortality	Mortality risk in each year for each spouse is stochastically generated based on the Social Security Administration's (SSA's) actuarial life table, given the individual's current age and gender.
Investment/Market	Investment wealth is tax-deferred savings of all forms including IRAs and employer defined-contribution (DC) plans. It is accessible to the household and can be drawn down in retirement as taxable income. In any years in which the household has more income than it needs to meet its expenses, the extra is assumed to be invested. Investment wealth is allocated between stocks (split equally between large cap and small cap) and long-term corporate bonds with annual rebalancing such that the percent in equities is always 100 minus current age (e.g., at age 66 the equity portion is 100 – 66 = 34 percent). Returns on each asset class in each year of the simulation are stochastically modeled based on the historical distribution of investment returns. [d]

[a] General inflation is assumed to be normally distributed with mean, standard deviation, and correlation with the previous year based on historical inflation (CPI-U) from January 1947 through October 2011 (mean: 3.71 percent; standard deviation: 1.22 percent; correlation with the previous year's general inflation: 0.60).

[b] In the first year, health care costs are simulated with a mean of $2,000; standard deviation of $2,000; a minimum of $1,560, which is approximately the cost of Medicare Part B premiums; and a maximum of $100,000 (an extremely rare event). Medical inflation is assumed to be normally distributed with a mean, standard deviation, correlation with general inflation, and correlation with the previous year's medical inflation, based on Medical Care cost component of the CPI, from January 1947 through October 2011 (mean: 5.43 percent; standard deviation: 1.06 percent; correlation with the previous year's medical inflation: 0.78; correlation with the current year's general inflation: 0.73; correlation with last year's general inflation: 0.77).

[c] The distributional assumptions for LTC risk are modeled based on Leora et al. (2014). Although there is some evidence of higher mortality for people in LTC, we have not included this assumption in our analysis.

[d] Investment returns are assumed to be drawn from a lognormal distribution with mean and standard deviation consistent with historical returns. For the period January 1947 through December 2010, the large cap/small cap portfolio returned an average of 14.2 percent with a standard deviation of 15.2 percent, and bonds averaged 6.5 percent with a standard deviation of 9.3 percent. Historical bond-stock correlation was statistically insignificant during this period, so is not incorporated in the simulation. Some experts believe that future asset market returns may be lower than historical averages, in which case, the estimated wealth needed to support retirement needs should be viewed as a lower bound.

Table 13b Summary of Simulation Model Assumptions - Risks

B. Strategies for the Longest-Lived

As discussed in the background section of this report, longevity creates special challenges for retirement preparation. Most U.S. households approach retirement with too little financial wealth to support an average life expectancy, let alone an extra-long life. The approach we take in our analysis is to first estimate the amount of wealth that would be needed for the base case that assumes no change in standard of living and no reliance on financial products to mitigate the risk. We also compare the wealth needed by those who live to their life expectancy to that needed to support unusually long lives. We then alter the assumptions and report on improvements, if any, resulting from various strategies and products. We conclude by evaluating combination strategies.

The following list summarizes the main scenarios that we consider in the remainder of the paper.

- Base cases with normal retirement age: Both spouses retire and collect Social Security at age 66; homeowner; no mortgage; no annuities; no LTC insurance.
- Base cases with delayed retirement: Both spouses retire and collect Social Security at age 70; homeowners; no mortgage; no annuities; no LTC insurance.
- Downsize housing: Downsize housing by 30% at retirement (reduces property taxes and insurance; no mortgage payment). Net difference in housing values, after transaction costs, is added to investment wealth at the time of sale.
- Reverse mortgage: The household enters into a reverse mortgage arrangement at age 66, 70, 75, or 80; life annuity payment is determined based on joint life expectancy at the time of purchase.
- Long-term care insurance: Purchase LTC insurance (for both spouses or wife only) at age 60 or 66, with $250,000 or $500,000 lifetime caps. Age-rated level premiums paid until individual enters care.
- Annuities: Household uses 50% of retirement wealth to purchase an immediate annuity at retirement (66 or 70) or a deferred annuity at retirement (with payout at 70, 75, 80, 85);
- Increase leverage: House is mortgaged for 80% of value at retirement and the proceeds after expenses are added to investment wealth.

IV. Results for Different Longevity Profiles

A. Base Cases

We first present the results of the simulated outcomes for the two base case households. For comparison to the later simulations, we initially assume that no strategies are undertaken to manage post-retirement risk and that the household desires to maintain their pre-retirement standard of living during retirement. For each of these scenarios, and also for the alternative scenarios presented in the next several subsections, we use our simulation model to estimate the amount of

non-housing wealth that would have been sufficient to meet the household's spending objectives with 90% confidence (or alternatively stated, to run out of money in less than 10% of the simulated lifepaths).

Table 14 shows the approximate required wealth for the base case households, for normal (age 66) and delayed retirement and Social Security claiming (age 70). The first two results columnssummarizes the median and 90th percentile outcomes for the full 50,000 simulated lifepaths. For normal retirement, the median household needs approximately $430,000 in pre-retirement savings and the higher-income household needs about $880,000. This latter value is so much greater because the household is attempting to finance a higher standard of living consistent with what they enjoyed during their working years, and also because Social Security replaces a smaller percentage of their preretirement income.

Table 14 Base Case Results: Wealth Needed at Age 66 to be 50% and 90% Confident of Meeting All Simulated Household Expenses, By Retirement Age and Longevity (in $000)

Scenario	Tercile, by Age of Second-to-Die							
	All		**Youngest 1/3**		**Middle 1/3**		**Oldest 1/3**	
Median Household	50%	90%	50%	90%	50%	90%	50%	90%
(Pre-ret. Income = $60,000)	Conf.	Conf.	Conf.	Conf.	Conf.	Conf.	Conf.	Conf.
Retire and Claim Soc Sec at Age 66	$290	$430	$220	$280	$300	$370	$400	$520
Retire and Claim Soc Sec at Age 70	$170	$290	$110	$170	$180	$250	$260	$380
	All		**Youngest 1/3**		**Middle 1/3**		**Oldest 1/3**	
75th Percentile Household	50%	90%	50%	90%	50%	90%	50%	90%
(Pre-ret. Income = $105,000)	Conf.	Conf.	Conf.	Conf.	Conf.	Conf.	Conf.	Conf.
Retire and Claim Soc Sec at Age 66	$660	$880	$520	$630	$700	$790	$840	$990
Retire and Claim Soc Sec at Age 70	$410	$610	$300	$400	$440	$530	$570	$710

Source: Authors' calculations based on Monte Carlo simulation model.

Figure 4 illustrates the retirement wealth needed for the two base-case households over all 50,000 possible lifepaths. The median household needs less wealth on average because they are financing a lower standard of living than the higher-income household. In addition, the median households' *range* of needs exhibits less variance, primarily because Social Security replaces a larger percentage of their preretirement income than it does for the higher-income couple. In Table 14 above and all the results tables presented in later sections of this report, the 50th percentile values represent approximately the midpoint of the distribution of outcomes generated by the simulation in question. The 90th percentile value will be the wealth level that leaves only 10% of the lifepaths in the right hand tail of the distribution. The distribution of simulated outcomes for each of the two income levels and retirement dates are illustrated in Figures 5 and 6.

Figure 4 Distribution of Retirement Wealth Needed for 50,000 Simulated Lifepaths, Median Household ($60,000 Preretirement Income) versus 75th Percentile Household ($105,000 Preretirement Income)

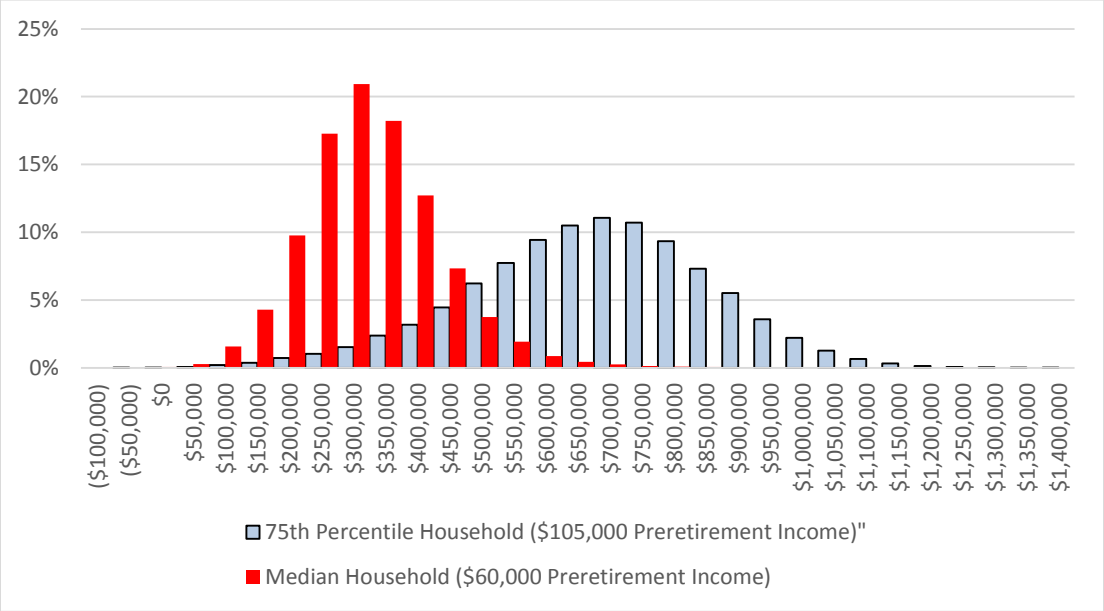


Figure 5 Comparison of Retirement Wealth Needed at Age 66 by Median Household ($60,000 Preretirement Income) to Meet All Household Retirement Expenses, Age 66 versus Age 70 Retirement, based on 50,000 Simulated Lifepaths

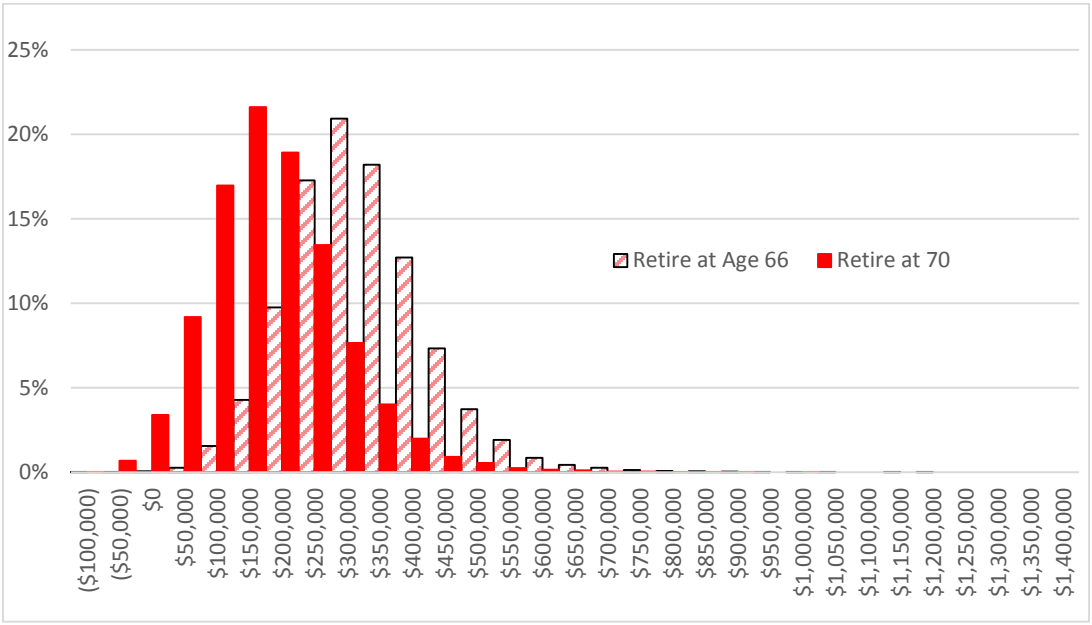
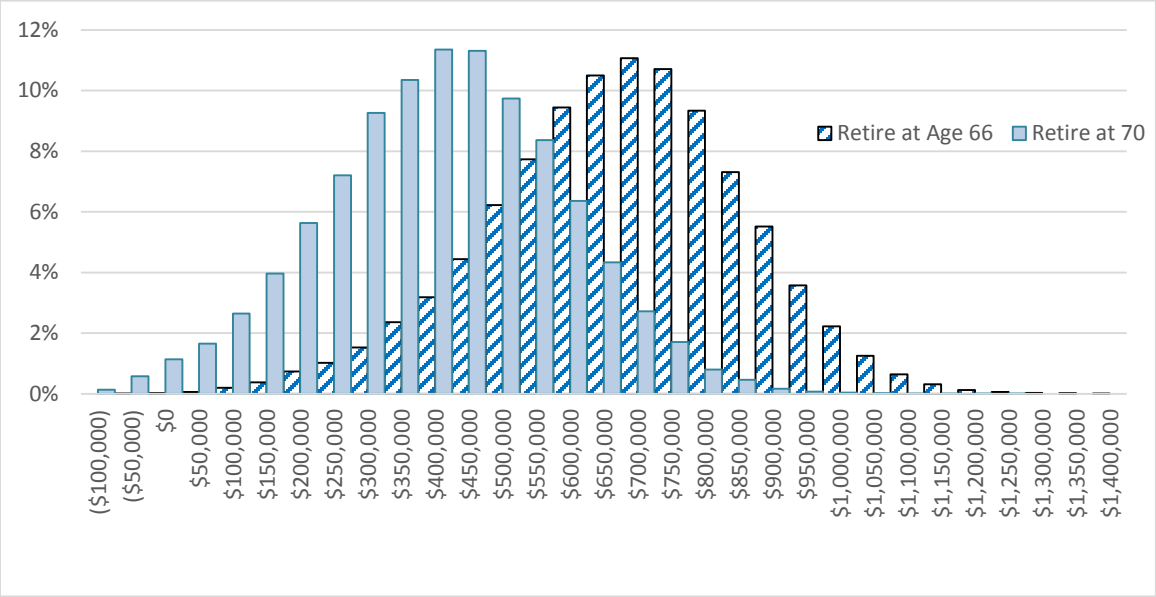


Figure 6 Comparison of Retirement Wealth Needed at Age 66 by 75th Percentile Household ($105,000 Preretirement Income) to Meet All Household Retirement Expenses, Age 66 versus Age 70 Retirement, based on 50,000 Simulated Lifepaths



In order to make the delayed retirement simulation results more directly comparable to the age 66 retirement age simulations, we report the amount that would be needed at age 66 for all cases. When retirement is delayed to age 70, the household is assumed to continue to receive employment income to cover their expenditure needs, save for retirement, and earn investment returns on invested assets. Delaying retirement to age 70 reduces the amount needed at age 66 by about 1/3 for both household income levels. The median household would be able to maintain their standard of living 90% of the time if they had $290,000 in pre-retirement wealth as of age 66 (as compared with $430,000 for retirement at age 66) and the higher-income household would need $610,000 to do so (compared with $880,000). These values reflect the shorter retirement period they ultimately need to finance, but also take into account the additional four years that they will contribute to savings prior to retirement.

To be 50% confident of meeting their needs, the median household needs about one-third as much in savings at retirement as they do to be 90% confident. For the 75th percentile household, they need about 25% less. This illustrates an important point: if the household plans for the amount needed on average, they have a 50% chance of running out of money before the second spouse dies.

Because living longer exposes retirees to more years of regular household expenses and also greater risk of health and LTC shocks, we are particularly interested in what happens to those who live the longest. To investigate this issue, we split the simulated household lifepaths into thirds based on the age of the longest-lived spouse. The bottom tercile includes the results from lifepaths in which both spouses died before age 86. The oldest tercile includes lifepaths in which at least one spouse lived to age 92 or older. The distribution of male and female life-expectancies compared to the distribution of life expectancy of the second-to-die is illustrated in Figure A-1 in the Appendix.

The right hand columns in Table 14 and other tables in this report are the results for the longest-lived tercile. Not surprisingly, we find that living longer costs more. To meet the objective of being 90% confident of covering all future expenses, the longest-lived households at the median income level need $520,000 at age 66, almost twice as much as they would need if they were short-lived ($280,000) and about $90,000 more than our estimate over all potential life paths. We see similar outcomes for the higher-income household, although the dollar differences are larger and the proportional differences are smaller.

Key findings:

- The base case households, who have income and financial assets based on the median and 75th percentile American retiree household, have insufficient wealth to maintain their living standards throughout life if they both retire at age 66.
- People who live longer need more wealth to maintain their standard of living in retirement. The base case household with the $105,000 household income needs $880,000 to retire with 90% confidence at age 66. Delaying retirement to age 70 reduces the amount needed at age 66 to $610,000. In contrast, the wealth needed at age 66 increases to $990,000 for those households who have at least one spouse who lives to age 92 or older. For the longest-lived, delaying retirement to age 70 reduces the wealth needed at age 66 to $710,000.
- Simulation outcomes for the median household with $60,000 preretirement income show similar effects of delayed retirement and longevity. That household needs $440,000 to be 90% confident if retiring at age 66, and $290,000 at age 70. For the longest-lived, the amounts needed increase to $520,000 and $380,000.

In the next several sections, we explore several risk management strategies that have been suggested to mitigate the financial costs of unexpected longevity.

B. Housing Strategies

For most households, housing wealth represents a fairly large percentage of total wealth and most households have historically paid off their mortgages prior to retirement. In our base case model, we assume that households do not tap housing equity to meet expenses and that they only sell the home if a surviving spouse is permanently in LTC. We explore three options for using housing wealth to finance living expenses:

- Downsize the house 30%: In these scenarios, we assume that the couple sells their primary residence and uses 70% of the proceeds after closing costs to buy a smaller home, resulting in housing costs (property taxes, insurance, and repairs) that are 70% of their previous housing expenses. The remaining cash is added to investment wealth.
- Reverse annuity mortgage: In these scenarios, we assume that the couple accesses their housing equity to obtain a fixed joint and survivor 100% life annuity stream.[5] For the normal retirement age, we run scenarios in which the couple enter into this transaction at ages 66, 70, or 75. For the delayed retirements, we alternatively assume mortgage contracts at ages 70, 75, and 80.
- Mortgage the house at retirement and invest the proceeds: With mortgage rates at all-time lows, many households today may be entering retirement with mortgages in place. To estimate the retirement effects, we run scenarios in which the household mortgages their house at retirement and adds the proceeds, net of closing costs, to their pre-retirement wealth.

Table 15 summarizes the results for the housing-related scenarios. As with Table 14, we report the wealth needed to be 50% versus 90% confident of meeting all household projected expenses. We include the base case results from the previous section in the shaded rows (both income levels, normal and delayed retirement) to facilitate direct comparison.

[5] We assume the same interest rate for the reverse mortgage and the following mortgage scenarios. The loan and interest rolls up and is designed to equal the expected house value at the joint life expectancy.

Table 15 Effect of Housing Strategies on Wealth Needed at Age 66 to be 50% or 90% Confident of Meeting All Simulated Household Expenses, by Retirement Age and Longevity (in $000)

Median Household (Joint Pre-retirement Income = $60,000)

Scenario	Tercile, by Age of Second-to-Die							
	All		Youngest 1/3		Middle 1/3		Oldest 1/3	
	50% Conf.	90% Conf.	50% Conf.	90% Conf.	50% Conf.	90% Conf.	50% Conf.	90% Conf.
Retire at Age 66								
Base Case	$290	$430	$220	$280	$300	$370	$400	$520
Downsize Housing by 30%	$270	$400	$200	$250	$280	$350	$370	$500
Mortgage at Retirement	$370	$510	$290	$350	$380	$450	$480	$600
Reverse Mortgage at Age 66	$210	$350	$150	$200	$220	$300	$310	$450
Reverse Mortgage at Age 70	$230	$370	$170	$220	$240	$310	$330	$470
Reverse Mortgage at Age 75	$250	$380	$190	$240	$260	$330	$340	$490
Retire at Age 70								
Base Case	$170	$290	$110	$170	$180	$250	$260	$380
Downsize Housing by 30%	$150	$270	$90	$150	$160	$220	$230	$360
Mortgage at Retirement	$250	$370	$180	$240	$260	$330	$340	$460
Reverse Mortgage at Age 70	$90	$220	$50	$100	$100	$170	$170	$320
Reverse Mortgage at Age 75	$110	$230	$70	$120	$120	$190	$190	$330
Reverse Mortgage at Age 80	$130	$250	$90	$150	$140	$210	$200	$340

75th Percentile Household (Joint Pre-retirement Income = $105,000)

Scenario	Tercile, by Age of Second-to-Die							
	All		Youngest 1/3		Middle 1/3		Oldest 1/3	
	50% Conf.	90% Conf.	50% Conf.	90% Conf.	50% Conf.	90% Conf.	50% Conf.	90% Conf.
Retire at Age 66								
Base Case	$660	$880	$520	$630	$700	$790	$840	$990
Downsize Housing by 30%	$620	$830	$490	$590	$650	$750	$790	$930
Mortgage at Retirement	$800	$1,020	$650	$770	$840	$930	$980	$1,130
Reverse Mortgage at Age 66	$530	$730	$400	$500	$550	$640	$690	$830
Reverse Mortgage at Age 70	$550	$750	$430	$530	$580	$670	$710	$860
Reverse Mortgage at Age 75	$580	$780	$470	$560	$610	$700	$740	$880
Retire at Age 70								
Base Case	$410	$610	$300	$400	$440	$530	$570	$710
Downsize Housing by 30%	$370	$560	$260	$360	$400	$490	$520	$660
Mortgage at Retirement	$550	$750	$430	$530	$580	$670	$710	$850
Reverse Mortgage at Age 70	$270	$450	$180	$260	$300	$380	$410	$540
Reverse Mortgage at Age 75	$310	$480	$220	$300	$330	$410	$440	$570
Reverse Mortgage at Age 80	$350	$500	$270	$340	$360	$450	$460	$590

Source: Authors' calculations based on Monte Carlo simulation model.

Downsize: For both household income levels and for both normal and delayed retirement, we can make similar conclusions from this analysis. Downsizing housing does not have a large effect on wealth needed at retirement. This makes sense when you consider that housing expenses are not a

large category of expenditures when there is no mortgage payment. The wealth needed at retirement is reduced by $20,000 to $50,000 depending on the retirement age and household income level. The effect is greater for the delayed retirement scenarios because downsizing in advance of formal retirement allows the household to spend less and save more during their last few working years. Downsizing results in a similar decrease in retirement wealth needed across each of the longevity terciles.

Mortgage the house: If households continue to owe payments on a mortgage in retirement, they will need greater wealth to support this expense. In the scenario considered here it is assumed that the couple adds the mortgage proceeds to their investment portfolio, and could therefore potentially offset the expense of the mortgage payment with investment returns. Unfortunately, due to the relatively low level of beginning wealth, investment wealth is rapidly depleted by household expenditures. The net effect of having a mortgage in retirement is negative for these households, requiring an additional $80,000 to $140,000 in pre-retirement wealth, depending on the retirement age and income level. Continuing a mortgage into retirement results in a similar increase in retirement wealth needed across each of the longevity terciles.

Reverse mortgages: We find that reverse mortgages have a beneficial effect, significantly reducing the amount of wealth needed at retirement. Based on our simulations, the amount of non-housing wealth needed at age 66 can be reduced by from 17% to 26%, depending on the income level and retirement age. For example, the higher income couple in the base case needed $880,000 to retire successfully at age 66 with 90% confidence. If they take a reverse mortgage at the time of retirement, the amount of non-housing wealth needed is reduced by about $150,000. If they plan to retire at age 70 and take a reverse mortgage at that time, the amount of wealth needed to be 90% confident of meeting all of their expenses goes from $610,000 to $450,000. Delaying the timing of the reverse mortgage results in a larger annuity payment for the household but decreases the expected number of payments. In addition, the household will have to cover any income shortfalls between the date of retirement and the onset of the annuity payments. As a result, we find that the optimal timing of the reverse mortgage, based on the simulated wealth needed in these scenarios, is at the date of retirement (or possibly in the first year in which expenses exceed retirement income).

There are two issues that should be noted regarding this result. Under current rules, the loan-to-value ratios for reverse mortgages are low enough that the household continues to have significant equity in their home and can benefit from increases in home value throughout their retirement period. In general, the reduction in wealth needed is less than the actual housing wealth that is being mortgaged. This reflects both the cost of the mortgage itself and also the risk that is being taken on by the financial institution. The annuity itself is fixed and is not assumed to have a guaranteed number of payments option. Therefore, as with any life annuity, short-lived households will get a worse “deal” on this strategy, but the benefit to long-lived households of receiving more years of annuity payments is eroded by inflation. When we consider the financial effects of reverse mortgages by longevity tercile, the longest-lived households see the greatest reduction in wealth needed.

Key Findings

- For couples who own a home at retirement and do not have an outstanding mortgage, a reverse mortgage can improve financial well-being in retirement by converting housing wealth into a lifetime income stream. The reverse mortgage produces life income that reduces the need to tap other financial resources, but also reduces home equity that could be needed to meet future needs.

- Households that enter retirement with a mortgage are worse off than those who do not.

- Downsizing housing by 30% at retirement reduces the amount of wealth needed to be financially successful in meeting household needs by about 7%. This is a combined effect of reduced expenses (e.g property taxes, insurance, and repairs) and increased investment wealth as the net difference in home value after transaction costs is added to the retirement nest egg.

C. Long-term Care Insurance

As discussed previously, one of the more serious "shocks" faced by retired households is the risk of an extended stay in long-term care. Strategies that focus on controlling regular household expenses can reduce annual income shortfalls, but do little to mitigate the effect of this risk on household finances. Long-term care (LTC) insurance is a product that will pay some or all of these expenses, but is not widely purchased in today's marketplace, partially due to its relatively high cost and lack of awareness by the public. In this section, we report the results of our simulation scenarios for the effects of various LTC insurance strategies. These are limited to consideration of the higher-income household only (pre-retirement income = $105,000) because premium costs are generally prohibitive for lower income households and those households can more easily qualify for future Medicaid coverage.

Although lifetime benefits were provided by LTC products sold over the last few decades, currently-marketed products typically have lifetime caps. These may, for example, be marketed as an amount sufficient to cover a typical number of years of care, but the funds not used in one year can be applied to another. This design allows insurers to limit their own tail risk and also keeps premiums down for customers. However, lifetime caps also make the product less valuable to households who want to mitigate the risk of extended nursing home stays.

LTC insurance can be purchased by healthy individuals at older ages, but insurer data suggests that the likelihood of being turned down for coverage increases substantially with age. Our model assumes level premiums from the date of purchase to the date of entry into care. Taking both the expected number of premium payments and life expectancy into account, the annual premiums for purchase at age 60 is lower than if the same product is purchased at age 66. Our model incorporates price quotes for healthy applicants from a major LTC insurer. We consider two possible lifetime

caps, $250,000 and $500,000. Based on average annual costs for residential care in an LTC facility, this is approximately three years and six years of coverage, respectively. Because the higher cap does not change our results significantly, we report those simulation outcomes in the Appendix (Table A-1).

As summarized in Table 16, the results suggest that the purchase of LTC insurance has only a small beneficial effect on the wealth needed at age 66 ($10,000 to $30,000). Given that insurers price these policies based on LTC risk and life expectancy, which are both built into our simulation model, this result is not surprising, i.e., it implies that the present value of the premiums and the present value of the expected LTC costs are approximately equivalent.

Based on other metrics, however, a household might still find the purchase of a LTC product to be an important retirement strategy. As with many other types of insurance products, the household is able to spread the cost of the future risky outcome over many years of payments and rely on the insurer to pool the risk of unusually long periods of care across many policyholders. Having the insurance in place can reduce the financial strain on a spouse who might otherwise struggle to pay for both their own household expenses and the costs of formal care for their husband or wife. The LTC insurance will extend the number of years that household resources will last. Furthermore, if household resources are depleted by an extended illness of one spouse, the surviving spouse will have the ability to pay for his or her own future LTC costs. For this reason, we also simulate scenarios in which the household purchases LTC insurance on the wife only. Although we do not find significant differences in outcomes for wife-only versus both spouses in these simulations, the wife-only LTC insurance is found to be beneficial when combined with other risk management strategies, as will be discussed in a later section of this report.

Although LTC insurance is a risk management strategy that might otherwise be thought to alleviate financial risk for the longest-lived, the product designs considered here, consistent with what is available in the market, do not provide true catastrophic coverage and therefore do not completely cover the tail risk of extended long-term care stays. We therefore see very little difference between the wealth needed for the full sample of life paths versus the subsample of life paths in which one of the spouses lives to be over age 90.

Table 16 Effect of Long-term Care Insurance (LTC) on Wealth Needed at Age 66 to be 50% and 90% Confident of Meeting All Simulated Household Expenses for 75th Percentile Houshold (Pre-retirement Income = $105,000), by Retirement Age and Longevity (in $000).

LTC Insurance Scenarios:			Tercile, by Age of Second-to-Die							
			All		**Youngest 1/3**		**Middle 1/3**		**Oldest 1/3**	
Purchase LTC Policy for:	Age of Purchase	Lifetime Benefit Cap	**50% Conf.**	**90% Conf.**	**50% Conf.**	**90% Conf.**	**50% Conf.**	**90% Conf.**	**50% Conf.**	**90% Conf.**
Base case (66):										
Neither	N/A	N/A	$660	$880	$520	$630	$700	$790	$840	$990
Both	60	$250K	$660	$850	$530	$630	$690	$770	$820	$960
Both	66	$250K	$690	$880	$550	$650	$710	$790	$840	$990
Wife Only	60	$250K	$670	$870	$530	$630	$690	$780	$830	$970
Wife Only	66	$250K	$680	$880	$540	$640	$710	$790	$840	$990
Base case (70):										
Neither	N/A	N/A	$410	$610	$300	$400	$440	$530	$570	$710
Both	60	$250K	$410	$590	$300	$390	$440	$510	$550	$690
Both	66	$250K	$430	$620	$310	$400	$460	$540	$580	$730
Wife Only	60	$250K	$420	$600	$300	$390	$440	$520	$560	$700
Wife Only	66	$250K	$430	$610	$310	$400	$450	$530	$570	$710

Note: Household is assumed to spend $125,000 of their wealth at the date of retirement to purchase a 100% joint and survivor annuity.

Key Findings

- The purchase of long-term care insurance on one or both spouses has only a small effect on wealth needed at retirement, but may be a beneficial component of a combination strategy for managing post-retirement risks.
- LTC insurance can be particularly important for the surviving spouse who is likely to be a widow and will have depleted assets by the time she may need to enter care.

D. Annuities

In this section, we consider a variety of life annuity alternatives as a means of mitigating the risk of retirement income shortfall. For each alternative considered, we assume a 100% joint and survivor annuity purchased at the date of retirement with 50% of the household's wealth at that time. For the age 66 retirement dates, 50% of wealth is $50,000 for the median household and $125,000 for the 75th percentile household. For the age 70 retirement dates, the annuity alternatives include immediate annuities that begin paying at retirement and deferred annuities that will begin payout at specified future ages. Because of the smaller number of expected payments for the deferred annuities, the same amount of wealth can buy a larger annual annuity payment. However, the tradeoff is that the household must give up some of their limited wealth and is therefore less prepared to cover expense needs in the period before the annuity payments begin.

As with the previous scenarios, for each income level and retirement age, we simulate the wealth needed to meet all retirement expenses and we report the results for 50% and 90% confidence levels. Table 17 reports the results of these simulations for both income levels and for 66 and age 70 retirement ages. The base case results (with no annuities or other risk management strategies) are included in the table for comparison. The amounts reported on this table are inclusive of the up-front cost of the single premium annuity payment.

We conclude from these simulations that the purchase of an annuity does not significantly change the amount of wealth needed at retirement. Nevertheless, annuities provide some incremental benefit in that they reduce income shortfalls during the retirement period and ensure an ongoing source of supplemental income even after wealth is depleted. However, the purchase of the annuity significantly depletes limited household resources and therefore reduces the household's ability to cover emergency funding needs. Although this should be most beneficial to the longest lived households, the fixed payment becomes less and less beneficial over time as it fails to keep up with inflation.

Key Findings

- Immediate or deferred joint and survivor annuities, as modeled in this project, do not have much impact on the wealth needed at retirement for these representative households.
- For the longest-lived, annuities assure the survivor of continuing lifetime income, but the purchasing power of these fixed payments declines over time.
- To be a useful strategy for mitigating longevity risk, households need to have sufficient wealth to purchase sufficient annuity income that can meet their needs so that they do not have to deplete investment wealth early in their retirement period.

Table 17 Effect of Buying Life Annuity at Age 66 on Wealth Needed at Age 66 to be 50% and 90% Confident of Meeting All Simulated Household Expenses, by Pre-retirement Income Level, Retirement Age and Longevity (in $000).

	Tercile, by Age of Second-to-Die							
	All		Youngest 1/3		Middle 1/3		Oldest 1/3	
Annuity Scenarios (Buy at Retirement)	**50% Conf.**	**90% Conf.**	**50% Conf.**	**90% Conf.**	**50% Conf.**	**90% Conf.**	**50% Conf.**	**90% Conf.**
Median Household (Joint Pre-retirement Income = $60,000)								
Retire at Age 66								
Base Case	$290	$430	$220	$280	$300	$370	$400	$520
Immediate annuity, age 66	$280	$420	$220	$270	$300	$360	$380	$510
Deferred annuity, age 70	$300	$430	$230	$290	$310	$370	$400	$520
Deferred annuity, age 75	$310	$440	$250	$300	$320	$380	$410	$530
Deferred annuity, age 80	$320	$450	$260	$310	$330	$390	$420	$540
Retire at Age 70								
Base Case	$170	$290	$110	$170	$180	$250	$260	$380
Immediate annuity, age 70	$190	$310	$130	$190	$190	$270	$270	$400
Deferred annuity, age 75	$190	$310	$140	$190	$190	$260	$270	$390
Deferred annuity, age 80	$200	$320	$150	$200	$210	$270	$280	$400
Deferred annuity, age 85	$210	$320	$160	$210	$210	$280	$290	$410
75th Percentile Household (Joint Pre-retirement Income = $105,000)								
Retire at Age 66								
Base Case	$660	$880	$520	$630	$700	$790	$840	$990
Immediate annuity, age 66	$650	$850	$530	$630	$680	$770	$810	$950
Deferred annuity, age 70	$670	$880	$560	$660	$710	$800	$840	$980
Deferred annuity, age 75	$700	$900	$590	$690	$740	$830	$870	$1,010
Deferred annuity, age 80	$730	$930	$630	$720	$760	$850	$890	$1,030
Retire at Age 70								
Base Case	$410	$610	$300	$400	$440	$530	$570	$710
Immediate annuity, age 70	$450	$640	$360	$450	$480	$570	$600	$740
Deferred annuity, age 75	$460	$640	$370	$450	$480	$570	$600	$730
Deferred annuity, age 80	$480	$660	$400	$480	$510	$590	$620	$750
Deferred annuity, age 85	$510	$680	$420	$510	$530	$620	$640	$770

Note: Median household and 75th percentile households are assumed to spend $50,000 and $125,000 respectively of their wealth at the date of retirement to purchase a 100% joint and survivor annuity, either immediate or deferred. Immediate annuities begin payment at the date of retirement. Deferred annuities begin payments at the ages indicated and are priced to reflect the shorter life expectancies.

The wealth needed at retirement in Table 17 reflects both the assumed cost of the annuity and the present value of their unmet other expenditure needs. Unlike some of the other strategies considered in this report, the analysis of annuity strategies necessarily requires that we make assumptions about the amount of wealth a household can devote to the purchase of an annuity at

the date of retirement. As explained above, our simulation assumes that they use $50,000 and $125,000 of their preretirement wealth, respectively, to purchase the annuity. The two representative households, which are based on national data, have insufficient pre-retirement wealth to buy a payment stream that will be sufficient to meet their cash flow needs. If they had greater wealth, it would be possible to annuitize a larger amount of it to achieve a greater income stream.

E. Combination Strategies

In the previous results sections, we considered many different risk mitigation strategies in isolation and found that most made only modest differences in the wealth needed at retirement to achieve desired levels of financial security. Some of these strategies impacted regular cash flows (by reducing expenses or increasing income) and others focused on mitigating the risk of large shocks to expenses. In reality, retiree households are likely to take several combo actions to reduce their retirement shortfall risk. In this section, we consider the combined effect of various strategies. There is a very large number of potential combination strategies, but we experimented with various combinations to determine which produced the best outcomes in terms of lower retirement wealth needed at age 66. Some of the strategies were mutually exclusive; for example, if a couple took a reverse mortgage, they could not downsize their housing.

Table 18 summarizes the results of two combination strategies that we found to be most effective for the base case household at the 75th percentile of income. The table is organized to show the incremental benefit of adding each additional type of risk management relative to the base case of age 66 retirement with no risk mitigation. In the upper part of the table, Combination Strategy #1 quantifies the combined effect of delaying retirement, downsizing housing, buying LTC insurance for the wife only, and purchasing a deferred annuity that begins paying at age 80. This set of strategies reduces the wealth needed at age 66 by 60% on average and 49% at the 90 percent confidence level. The base case level of retirement wealth needed to be 90% confident of meeting all expense needs in retirement was $880,000 without any risk management and is reduced to only $450,000 for this combination. However, this is still almost twice the $250,000 pre-retirement wealth US families at this income and age actually have on average.

Combination Strategy #2 in Table 18 reports the results for delaying retirement, taking a reverse mortgage at age 75, and purchasing LTC for the wife. This set of strategies reduces the average wealth needed by 80%, and the amount needed to be 90% confidence by 74% (from $880,000 to only $230,000), resulting in the best outcome for the combination strategies we tested.

Table 18 The Effect of Combination Risk Management Strategies on Wealth Needed at Age 66 to be 50% and 90% Confident of Meeting All Simulated Household Expenses, by Longevity (in $000), 75th Percentile Household (Preretirement Income = $105,000).

		Tercile, by Age of Second-to-Die							
		All		**Youngest 1/3**		**Middle 1/3**		**Oldest 1/3**	
		50% Conf.	**90% Conf.**	**50% Conf.**	**90% Conf.**	**50% Conf.**	**90% Conf.**	**50% Conf.**	**90% Conf.**
Base Case: Retire at Age 66		$660	$880	$520	$630	$700	$790	$840	$990
Delay Retirement to Age 70	Cumulative Reduction in Wealth Needed	($250)	($270)	($220)	($230)	($260)	($260)	($270)	($280)
+ Downsize Housing 30%		($290)	($320)	($260)	($270)	($300)	($300)	($320)	($330)
+ LTC for Wife $250 Cap		($370)	($430)	($330)	($360)	($400)	($410)	($430)	($450)
Wealth needed for Combo Strategy #1		$290	$450	$170	$250	$290	$380	$410	$540
Combination Strategy 2									
Base Case: Retire at Age 66		$660	$880	$520	$630	$700	$790	$840	$990
Delay Retirement to Age 70	Cumulative Reduction in Wealth Needed	($250)	($270)	($220)	($230)	($260)	($260)	($270)	($280)
+ Reverse Mortgage at Age 75		($350)	($400)	($300)	($330)	($370)	($380)	($400)	($420)
+ LTC for Wife $250 Cap		($530)	($650)	($430)	($490)	($560)	($590)	($650)	($650)
Wealth needed for Combo Strategy #2		$130	$230	$90	$140	$130	$200	$190	$340

Source: Authors' calculations based on Monte Carlo simulations.

The dollar value of these risk management strategies is similar for the different longevity profiles, although the percentage reduction in wealth needed is lower. As noted previously, the base case households who survive the longest need significantly more wealth to meet all their retirement financial needs. When we consider the effect of these combination risk management strategies, the longest-lived households still need more than their short-lived counterparts, but the dollar reduction in wealth needed is comparable to the reduction seen for the full range of longevity. For example, employing Combination Strategy #2, we find that at the 90% confidence level, the oldest longevity tercile reduces the amount of wealth needed from $990,000 to $340,000. This is about $110,000 more than our simulated wealth needed for the full range of life expectancies and about $200,000 more than what is needed for the shortest-lived tercile.

Key Findings

- Combination strategies offer the most promise for mitigating post-retirement risks and ensuring financial success in retirement.
- For the 75th percentile household, the best combination strategy we tested (delayed retirement to age 70, take a reverse mortgage, and purchase LTC insurance on the wife only), the wealth needed at age 66 to be 90% confident of making it through retirement is reduced by 74%, from $880,000 to $230,000. This wealth level is approximately equivalent to the amount of non-housing wealth these representative households actually

have based on national data. For the longest-lived, the reduction in wealth needed is reduced by 67% (from $990,000 to $340,000).

- The best combination strategy will require an individualized plan tailored to personal circumstances. However, delayed retirement and downsizing expenses should probably be components of most households' plans.

Although we have focused these results on the estimate of wealth that would have been sufficient to meet the households desired level of spending with a high degree of confidence, there are other metrics of comparison that can be used to assess the benefits and costs of retirement risk management alternatives. For example, the probability of having any wealth left at death for the base case with age 66 retirement is only 16% of all life paths. However, delaying retirement increases this probability to 38%. Combination Strategy #1 increases the probability to 57 percent and Combination Strategy #2 results has a 63 percent probability of resulting in positive wealth at death. We find similar improvements in the number of years before wealth runs out and the average age that wealth runs out.

V. Conclusions and Policy Implications

In previous research studies, we examined the effects of post-retirement risks on retiree household financial well-being. This study builds on the prior studies with a specific focus on how greater longevity impacts household financial needs in retirement. Not surprisingly, our results show that the longest-lived household needs greater wealth accumulation than is required on average to be able to maintain their standard of living in retirement. In addition to financing more years of regular expenses, those who live longer have a greater chance of experiencing shocks such as unexpected health costs, extended periods of long-term care, or economic downturns.

The background research in this report documents increasing longevity but fairly stable retirement ages, resulting in longer retirement periods. The combination of changing demographics, shifts to defined contribution plans, and the current level of retirement savings is a call to action. A variety of changes are needed by individuals and institutions if retirees are to be able to maintain a reasonable standard of living.

Our goal in the prior studies was to estimate the relative impact on retirement income security of various risk-mitigating and retirement-timing strategies. In this study, we consider similar strategies, but seek to understand the link between life span and the wealth needed to successfully fund the retirement period. As with our previous studies, we focus on representative households based on national data and simulate their finances from entry into retirement through the death of the second spouse, incorporating the various risks that they face during retirement, including investments, mortality, health and long-term care risks. We assume that these individuals have mortality expectations consistent with the population of people in their age bracket, but we simulate their actual ages of death for 50,000 possible lifepaths, thus allowing us to examine more

carefully the outcomes for those lifepaths in which at least one of the spouses lives longer than expected.

As we have found in our prior studies, the representative households we use for our simulations do not have enough income and assets to make it through retirement and maintain their prior standard of living. Combination strategies are most likely to offer success.

Because this study focuses on longevity risk, we consider several strategies that can finance or mitigate the financial risks of a long retirement period, including delayed retirement, joint and survivor annuity purchase, long term care insurance purchase, and various housing alternatives including reverse mortgage and house downsizing. Although many of these are marginally beneficial alone, we conclude that combination strategies have the largest impact.

A major conclusion from this research is that the risk of living long should be more carefully incorporated in household retirement planning. Most people, if they plan at all, appear to anticipate an average life span. The reality is that one-third of married couple households will have at least one spouse live to age 92 and, as compared to those with average lifespans, it will take substantially more wealth to maintain the pre-retirement standard of living through to old age. Financial products that provide lifetime income or that cover specific future expenses can help households have more successful post-retirement periods.

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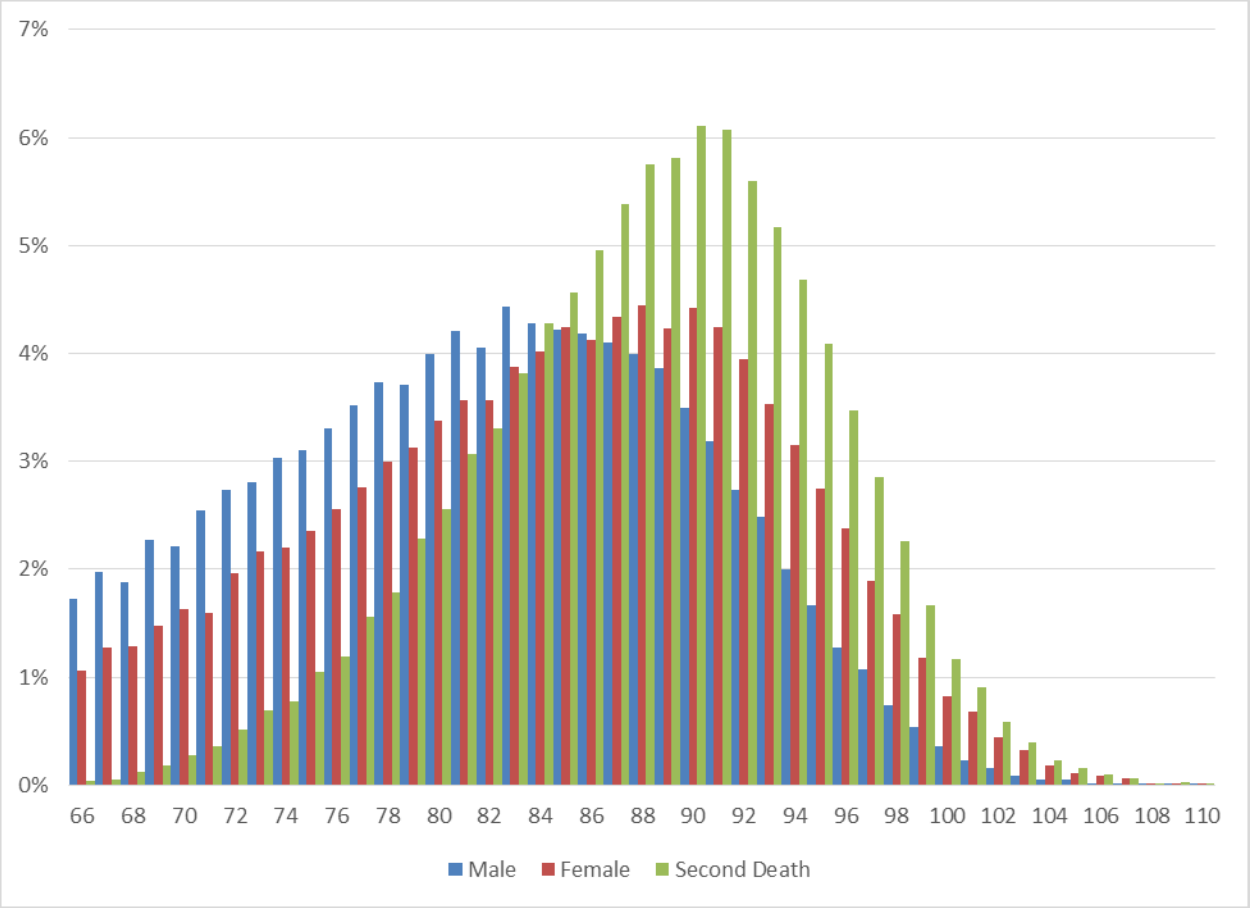
APPENDIX

Figure A-1 Assumed Mortality Distributions for Men and Women Compared to the Joint Mortality Distribution for the Married Couples



Appendix Table A-1 Effect of Long-term Care Insurance (LTC) on Wealth Needed at Age 66 to be 50% and 90% Confident of Meeting All Simulated Household Expenses for 75th Percentile Houshold (Pre-retirement Income = $105,000), by Retirement Age and Longevity (in $000).

LTC Insurance Scenarios:			Tercile, by Age of Second-to-Die							
			All		**Youngest 1/3**		**Middle 1/3**		**Oldest 1/3**	
Purchase LTC Policy for:	Age of Purchase	Lifetime Benefit Cap	**50% Conf.**	**90% Conf.**	**50% Conf.**	**90% Conf.**	**50% Conf.**	**90% Conf.**	**50% Conf.**	**90% Conf.**
Base case (66):										
Neither	N/A	N/A	$660	$880	$520	$630	$700	$790	$840	$990
Both	60	$500K	$660	$830	$540	$640	$690	$760	$800	$920
Both	66	$500K	$660	$880	$520	$630	$690	$790	$840	$990
Wife Only	60	$500K	$670	$850	$530	$630	$690	$780	$820	$950
Wife Only	66	$500K	$680	$870	$550	$650	$710	$800	$840	$970
Base case (70):										
Neither	N/A	N/A	$410	$610	$300	$400	$440	$530	$570	$710
Both	60	$500K	$410	$560	$310	$400	$440	$510	$530	$650
Both	66	$500K	$450	$600	$340	$430	$470	$550	$570	$690
Wife Only	60	$500K	$420	$580	$310	$400	$440	$520	$550	$670
Wife Only	66	$500K	$430	$600	$320	$410	$460	$540	$570	$690

Source: Authors' calculations based on Monte Carlo simulation model.