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Cognitive ability impact on life insurance lapsation

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Abstract

Life insurance is an important household risk management and financial tool. Policy lapsation has economic effects on life insurance companies, policyholders, and beneficiaries that may be detrimental when these lapses are unexpected. Prior literature examined several hypotheses of life insurance lapse focusing mainly on macroeconomic factors using aggregate data and household microeconomic factors using household-level data. We introduce and test individual cognitive ability variables in a model of the life insurance voluntary lapse decision by individual policyholders using household-level data from the Health and Retirement Study. We find that one measure of cognitive ability, in particular, numeracy, is related to the voluntary lapse decision. While controlling for numeracy, we find evidence that those individuals with higher levels of net worth are less likely to voluntarily lapse a policy which is consistent with the emergency fund hypothesis. We introduce a new measure of liquidity shock, kids moving home, into the model and find it has a strong positive relationship with the decision to voluntarily lapse a policy. Consistent with life insurance demand theory, we find that those who have recently entered retirement are more likely to lapse their policy.

Keywords: Health and Retirement Study; Life insurance; Cognitive ability; Lapsation

1. Introduction

Permanent life insurance is an important household risk management and financial tool that generally requires an ongoing premium payment to remain in force. Life insurance acts as a hedge against the uncertainty of the labor income flows of household members

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(Campbell 1980; Fischer, 1973; Yaari, 1965), it helps beneficiaries meet their need for smoothing consumption over the life cycle (Lewis, 1989), and it helps policyholders meet their bequest motives with a potentially guaranteed source of funds (Bernheim, 1991). It can also be used as a tax-advantaged savings tool (Rankin, 1987) and as a tool to reduce estate tax erosion (Milevsky, 2006; Mulholland et al., 2016).

Life insurance policies are designed to build cash value early in the life of the policy that pays for the increasing cost of providing a death benefit as the insured ages. The failure to make premium payments results in the termination of the policy, also known as lapsation. Each year, about 7% of all individual life insurance policies lapse (Fang & Kung, 2012). Lapsation can be costly for consumers because accumulated cash value is a tax-deferred asset that can be borrowed against or efficiently transferred at death, and the secondary market value of the policy can be far greater than the cash value among those whose health is worse than average (Daily et al., 2008). Consumer lapsation of older policies results in so-called lapsation profits that insurance companies build into the pricing of life insurance products (Fang & Kung, 2012). Gottlieb and Smetters (2021) find that policyholders who lapse a policy before death or policy maturity subsidize policyholders who hold their policies until death or policy maturity.

Gottlieb and Smetters (2021) note that consumers are subject to two types of risk: mortality risk that life insurance is intended to mitigate, and other non-mortality background risks such as unemployment, medical expense shocks, or unexpected needs of dependents, that result in a need for liquidity. While consumers can more easily estimate mortality risk when they purchase a policy, they may underweight the risk of experiencing background shocks that affect their ability to make regular premium payments. Lapsation often occurs because an insured experiences an income shock; however, changes in income affect lapsation for younger households but not for older households (Fier & Liebenberg, 2013).

Another potential background risk is a reduced ability to recognize the financial consequences of failing to make required premium payments. Gottlieb and Smetters (2021) find evidence in a national survey of insurance purchasers that 37.8% of policy lapses result from consumers forgetting to pay their premiums, and 15.4% are due to unexpected liquidity shocks. Banks and Oldfield (2007) find that a large portion of older adults are unable to perform simple interest calculations with accuracy. Gerardi et al. (2013) find that borrowers with lower levels of numerical ability are more likely to default on their mortgages—another behavior that requires a consistent payment to avoid a contractual default and loss of wealth. Christelis et al. (2010) find a positive relationship between the cognitive ability of older individuals as measured by numeracy, verbal fluency, and recall (memory), and complex investments such as stocks, while Korniotis and Kumar (2011) find that stock investors in their 70s and 80s significantly underperform younger investors. Financial literacy related to insurance declines consistently in old age despite higher rates of life insurance ownership among older cohorts (Finke et al., 2017).

Policy lapsation decisions can have both positive and negative effects on the household. Intended lapsation of policies that are no longer needed to meet the basic life cycle purposes of life insurance—labor income protection (Campbell 1980; Fischer, 1973; Yaari, 1965), beneficiary needs (Lewis, 1989), and bequest motives (Bernheim, 1991)—may improve household utility after being lapsed. Lapsation decisions can positively affect the liquidity of the household through the elimination of the premium payments that release those funds for use in other areas of consumption, such as improving lifetime consumption for current household members. The subsequent removal of a sophisticated financial tool from the household portfolio may make management of the portfolio less burdensome.

On the other hand, unintended lapsation may be problematic for policyholders and their beneficiaries. For married couples, the loss of the policy may remove guaranteed funds intended to provide for the final expenses associated with death, such as medical out-of-pocket expenses, health insurance copays, and funeral expenses. It may also reduce the assets available to fund the surviving spouse's lifestyle since funds from the lapsation will provide fewer survivor proceeds than the death benefit would have paid at the death. In addition, if the lapsed policy has a cash surrender value, that cash is brought into the estate of the policyholder which then makes it subject to ongoing income taxation and future probate distribution, both of which are avoided in an active life insurance policy.

In this study, we explore whether the observed decline in cognitive ability in later life is related to a potential wealth loss from insurance lapsation. This article adds to the literature by providing insight into unintentional lapsation among older consumers that represents a potential source of welfare loss. Awareness of the risk of cognitive aging on life insurance lapsation represents an opportunity for financial planners to avoid this risk by automating payment, considering a life settlement for seniors who do not value the bequest, or fully paying up the policy to avoid the risk of late life lapsation.

2. Objective

From the life insurance demand theory, we use several key theories as guides for our work. Yaari (1965), Fischer (1973), and Campbell (1980) collectively indicate that life insurance is a hedge against the uncertainty of labor income flows. Lewis (1989) suggests that the beneficiaries' desire to smooth their expected lifetime consumption will influence life insurance demand, and Bernheim (1991) suggests that policyholder bequest motives influence the demand for life insurance.

Several hypotheses have been suggested for the reason policyholders lapse their life insurance policies: the emergency fund hypothesis (EFH), the interest rate hypothesis (IRH), and the policy replacement hypothesis (PRH). Linton (1932) proposed the EFH, suggesting households regard the cash value in their life insurance policies as a source of emergency funds that can be accessed in times of financial need. Schott (1971) describes the foundations for the IRH which suggests that when interest rate arbitrage potential exists between high market rates and low policy interest rates, policyholders may be encouraged to take policy loans or lapse the policies to make the funds available to earn the higher rates. Russell et al. (2013), building upon empirical research by Outreville (1990), articulate the PRH which suggests that policyholders will surrender their policies to replace them with a policy with better pricing or more favorable terms.

Cole and Fier (2021) find that policyholders tend to surrender their policies for the cash values when confronted with longer-term financial issues and tend to take policy loans when dealing with shorter-term financial crises. Their findings support the emergency fund, alternative funds (interest rate), and the policy replacement hypotheses. Nolte and Schneider (2017) find mixed results of policyholders surrendering policies before the optimal time to surrender the policy under the EFH, which is when there are no other liquidity options available. Their analysis suggests behavioral issues have a meaningful impact on surrender decisions, with more financially literate policyholders being less likely to make suboptimal policy surrender decisions.

Our analysis will be limited to the use of the EFH for several reasons. First, the data we use is limited in the cross-section of the policyholders who indicate they lapse a policy with the intention of replacing it with another policy, a practice Fang and Kung (2012) refer to as insurance optimization. Fier and Liebenberg (2013) use longitudinal HRS data from the 1996 through 2008 waves in their analysis of the PRH. Second, Liebenberg et al. (2010) suggest that different types of data allow for better analysis when exploring the IRH and the EFH. They suggest that the IRH is best explored with aggregate-level data while the EFH is best examined with household-level data. The data used in our analysis is household-level in scope, thus we limit our analysis to the EFH.

Cognitive ability and its impact on financial decision-making have been an important area of current research (Banks & Oldfield, 2007; Christelis et al., 2010; Lusardi & Tufano, 2009; McArdle et al., 2011; Smith et al., 2010). Consideration has been given to whether fluid intelligence or crystallized intelligence is the most important aspect of cognition. As defined by Smith et al. (2010), fluid intelligence is deliberate processing or the ability to think about a problem in a clear and quick manner, while crystallized intelligence is the accumulation of relevant knowledge about various problems through education and lifetime experience. Smith et al. (2010) create a shorthand division of the two components of intelligence by defining fluid intelligence as the thinking part involving memory, abstract reasoning, and executive function or decision-making, and defining crystallized intelligence as the knowing part consisting of education and lifetime experience.

Several measures exist within these areas of intelligence and have been used by researchers as they explore the impact of cognitive ability on financial decisions. Smith et al. (2010) indicate that the three measures are: (1) episodic memory, which is used as a general measure of an important aspect of fluid intelligence because memory access is important to any cognitive ability; (2) numeracy, which is used to measure the actual ability to perform numerical skills learned in schools and is used to measure crystallized intelligence; and (3) mental status scores, which measure elements of both fluid and crystallized intelligence, non-specific cognitive skills needed for everything. Both numeracy and episodic memory are related to household total wealth and financial wealth holdings.

We model the impact that a policyholder's cognitive ability, whether measured by episodic memory or numeracy, has on the probability of voluntarily lapse of a life insurance policy when controlling for other factors that have been shown to predict lapsation.

3. Data and methods

3.1. Data

We use data from the Health and Retirement Study (HRS) from the 2008 and 2010 waves (Waves 9 and 10) for our analysis. The HRS is a longitudinal survey capturing the health and economic circumstances of a nationally representative sample of U.S. citizens over the age of 50. Conducted every two years by the Institute for Social Research at the University of Michigan since its first wave in 1992, the original cohort has been interviewed in each wave. With attrition over the time frame of the survey, additional cohorts have been added in the ensuing years, bringing the complete sample size to nearly 37,000 individuals who participated in the survey to some extent throughout the life span of the survey. The HRS is supported by the National Institute on Aging (NIA) and the Social Security Administration (SSA).

Liebenberg et al. (2012) indicate that household-level panel data are well suited for showing the impact of events at the household-level on the financial decisions made by these households. We use the HRS survey because it has extensive information on life insurance ownership choices made by household members as well as respondent and household information on health, income, wealth, and family structure.

Our initial interest in modeling lapse behavior in the presence of cognitive ability measures is on the identified respondents for which information is included in both the 2008 and 2010 waves; our sample is first reduced to 17,217 respondents. Because the HRS follows participants until they are deceased, we further limit our sample to those who were alive in 2010 and who indicated their life insurance ownership status in that wave. This further reduces our sample to 14,659 respondents.

Our dependent variable is those respondents who self-lapse a life insurance policy during the prior two years. Consistent with prior research using the HRS (Fang & Kung, 2012; Fier & Liebenberg, 2013), we use two questions in combination from the HRS to develop our dependent variable. The first question allows us to identify respondents who allowed a policy to lapse in the prior two years.[1] We use the response to a follow-up question to specifically identify self-lapsers.[2] Combining those who indicated a policy lapse in the first question with an affirmative response that the lapse was their choice creates our dependent variable.

Because it is not possible to lapse a life insurance policy unless you first own one, we next limit our sample to those who indicated they owned life insurance in 2008. This criterion reduced our sample size to 9,359 individuals.

Finally, we narrow our sample to those who answered the questions related to our main independent variable of interest, cognitive ability. Fisher et al. (2013) indicate that the design of the HRS study creates some methodological issues for measuring cognitive functioning which requires appropriate adaption of the standard tests. In particular, the HRS does allow for proxy respondents for individuals who may have reached a point of incapacity that interferes with their ability to respond, so we limit our sample to self-respondents. Our analysis will explore both episodic memory and numeracy to determine if either predicts lapse behavior and if one measure is a more powerful predictor of lapse behavior than the other.

Table 1 Sample selection criteria

Selection criteria	Sample size
All individuals tracked in the HRS from 1992 to 2010 . . .	36,986
. . . Respondents included in the 2008 and 2010 waves	17,217
. . . Those who were alive in 2010 and indicated their life insurance ownership status	14,659
. . . Those who owned life insurance in 2008	9,359
. . . Those who answered the Total Word Recall (TWR) and numeracy questions in 2010	8,795

Note. The selection criteria are cumulative. HRS = Health Retirement Study.

By limiting our sample to those who performed both the episodic memory (total word recall) test components and answered the series of three numeracy questions, our sample size was reduced to 8,795 respondents.

The resulting sample size following the application of each step of our selection criteria can be seen in Table 1.

3.2. Model

Our dependent variable is the choice to voluntarily lapse a life insurance policy in the prior two years.

Our independent variable of interest is cognitive ability measured using numeracy and cognitive ability. McArdle et al. (2011) find that within person correlations are moderate for men and women between episodic memory and numeracy.

The decision to lapse a life insurance policy is at its roots a decision about retention of a life insurance policy that is already owned by the policyholder. Demographic and economic predictors for life insurance ownership include age, bequest motive, education, employment, children, marital status, homeownership, income, net worth, and race (Zietz, 2003).

Gender is also shown to be an important factor in determining demand for life insurance (Gandolfi & Miners, 1996), with men more likely to be insured. Eling and Kiesenbauer (2014) find that women are less likely to lapse life insurance policies than men. We control for these differences by including gender in our model.

Mulholland et al. (2016) find that the financial sophistication of the policyholder plays an important part in the decision to own life insurance. Therefore, our model includes a proxy for financial knowledge.

The stated bequest motive is the ideal variable to identify specific desires of the individual to leave a bequest. In the absence of a bequest motive variable in the HRS, Bernheim (1991) uses marital status and the existence of children of the insured as proxies for the bequest motive. We do the same in our model.

An important factor in life insurance ownership is homeownership, or more importantly the mortgage debt that is associated with homeownership. Prior research suggests a positive relationship between the amount of total household debt and the amount of life insurance it holds (Frees & Sun, 2010; Lin & Grace, 2007). Yet, Fier and Liebenberg (2013) find increased debt is positively related to the decision to lapse a policy. We include total debt as a control variable, allowing it to proxy for homeownership.

Fang and Kung (2012) indicate that the health condition of the insured is an important factor due to reclassification risk from the increasing cost of life insurance on the spot market due to declines in overall health and the resulting increase in mortality risk of the insured. As the insured's health declines, they will find it increasingly expensive to replace a policy they currently own. Accordingly, we include the health condition of the respondent in our model.

Life insurance is used as both a tax-sheltered form of savings (Brown & Poterba, 2006) and for non-human-capital-replacement issues like accumulating cash to pay estate taxes for those households vulnerable to estate taxes (Milevsky, 2006). Mulholland et al. (2016) find that households vulnerable to U.S. estate taxes are more likely to own cash value life insurance. For these reasons, we control for estate tax vulnerability under the 2010 estate tax laws.

Prior life insurance loan and lapse research suggest loans and lapses are driven by various shocks affecting the household. Liebenberg et al. (2010) find evidence that policy loans increase as a result of household income shocks while Kuo et al. (2003) find evidence that the unemployment rate is positively related to the lapse rate.

Fang and Kung (2012) find some evidence that health shocks positively impact policy lapsation. Bernheim (1991) finds that bequest shocks reduce the demand for life insurance. Liebenberg et al. (2012) find a positive relationship between those who recently retired and those who lapse life insurance policies. We control for health shocks, bequest shocks, and those respondents who have retired in the past two years.

Bernheim (1991) indicates that households with bequest motives, often as intergenerational transfers, hold life insurance to enhance their bequest utility. But just as income shocks and unemployment with the resulting loss of income have been found to increase the likelihood of lapse, we question if unexpected increases in household expenses cause similar behaviors. In particular, does the sudden appearance of children as members of the household put a drain on household expenses that may cause similar results as an income shock? Therefore, we include the increase of children living in the home since the prior wave as a control variable in our model.

We use the following logistic regression model to model the life insurance lapse decision:

$$\begin{aligned}\ln\left(\frac{P_i}{1-P_i}\right) = {} & \beta_0 + \beta_{1-3}(\text{cognitive ability quartiles} > 25\%) \\ & + \beta_{4-6}(\text{income quartiles} > 25\%) + \beta_{7-9}(\text{net worth quartiles} > 25\%) \\ & + \beta_{10}(\text{financial knowledge}) + \beta_{11}(\text{married}) + \beta_{12}(\text{children}) \\ & + \beta_{13-17}(\text{age groups} < 60 \text{ or} > 64) + \beta_{18}(\text{gender}) \\ & + \beta_{19}(\text{log of Total Debt}) + \beta_{20-21}(\text{non-White race groups}) \\ & + \beta_{22-24}(\text{education} > \text{no} - \text{HS degree}) + \beta_{25-28}(\text{health problems} > 0) \\ & + \beta_{29}(\text{estate tax vulnerable}) + \beta_{30}(\text{newly retired since 2008}) \\ & + \beta_{31}(\text{income shock}) + \beta_{32}(\text{additional kid at home shock}) \\ & + \beta_{33}(\text{marriage shock}) + \beta_{34}(\text{health shock})\end{aligned}$$

where P_i is the probability of the individual lapsing a life insurance policy.

3.3. Variables

In our model, the dependent variable, LAPSE, is a binary variable set to 1.0 when the respondent has answered affirmatively to both HRS questions about life insurance lapse: first that they did lapse a policy in the two years before responding to the survey in 2010, and second that they chose to proceed with the lapse or cancellation. For all other combined responses, the variable is set to zero.

We measure episodic memory using two measures of word recall found in the HRS, immediate word recall and delayed word recall (Ofstedal et al., 2005). To test word recall, the respondent is read a list of 10 nouns. The first time they receive the word list, it is drawn randomly from four sets of words, of which no words overlap. In each subsequent wave, the respondent is presented with a different word list from the four lists, resulting in the respondent only receiving the same word list every fourth wave. Respondents and their spouses are given different word lists in each wave. For immediate word recall, the respondents are read the list of nouns and then asked to immediately recall as many of the words as they can. The respondent receives a score of the number correctly repeated. After testing for immediate word recall and after approximately five minutes of asking other survey questions, the delayed word recall test is administered. Again, the respondent is asked to recall as many words as they can from the list. The respondent again receives a score for the number of correctly recalled words.

While Smith et al. (2010) create a combined word recall measure for each respondent by averaging her immediate and delayed word recall scores, we follow the common practice of adding the two scores to create a total word recall (TWR) score for each respondent, leading to a score range of 0 to 20 (see Browning, 2014).

Following Smith et al. (2010), we measure numeracy by using three questions that were first included in the 2002 core survey questions and repeated every second wave since. The first question asks the respondent to calculate the number of people given a known percentage while the second question asks respondents to perform a division problem.[3,4] If the respondent gets either of the first two questions correct, they are then asked the third question where they are asked to solve a two-year compounding interest problem.[5] They receive one point for each correct answer. We create a numeracy score by adding these results for each respondent, developing a score range of 0 to 3.

To create comparable measures for episodic memory and numeracy, we quartile each measure.

We separate income and net worth into quartiles. Following Mulholland et al. (2016), we create a dummy variable to identify those households who may be vulnerable to estate taxes in 2010 because they have net worth, including a second home, of greater than $5 million, the then-current maximum estate tax exemption.

Following prior research (Brown & Poterba, 2006; Fier & Liebenberg, 2013), we separate age into bands to capture the non-linear predicted effect of the life cycle stage and life insurance demand.

To proxy for unknown bequest factors, we create dummy variables for the respondent being married and having any living children, setting the affirmative to 1.0. We also create a dummy variable for gender, setting it to 1.0 for males.

We create a total household-level debt variable by first adding the total mortgage debt to the total other household debt. Following Fier and Liebenberg (2013), we control for household-level debt by using the natural logarithm of the total household-level debt.

The categories for race, education, and health problems are separated into dichotomous variables. The categories of race are separated into the binary variables white, black, and other race. Education is separated into four variables consisting of less than high school, high school, some college, and college degree. Eight separate health problems are identified in the HRS, including high blood pressure, diabetes, cancer, lung disease, heart disease, stroke, psychological problems, and arthritis. Respondents are asked in each wave if they have been diagnosed with any of these health problems. Similar to Fang and Kung (2012), we total the number of health problems the respondents indicate, creating a health problem score of 0 to 8. We then create dummy variables for each of 0 through 3 problems and create a dummy variable capturing 4 or more health problems.

The five shocks or major changes we control for include newly retired, income shock, additional kids at home shock, marriage shock, and health shock, creating dichotomous variables for each. Just as Fier and Liebenberg (2013) do, we set newly retired equal to 1.0 if the respondent identifies herself in 2008 as not retired and then identified herself as retired in 2010. Fier and Liebenberg explore the EFH over the entire range of income decline and find that lapse is related to income shock for those households with the most extreme levels of income decline, roughly the worst 24% of their sample. Since our focus is to explore the impact of cognitive ability and not specifically find additional validation for the EFH, we use a more conservative 10% income decline in real dollars from the prior wave to indicate an income shock. We set the dichotomous variable measuring additional kids in the home to 1.0 when there is an increase of one or more kids at home since the prior wave. The marriage shock variable is set to 1 if the marital status has changed to unmarried, whether because of divorce or the death of the spouse, since the 2008 wave. Finally, since the number of health conditions usually increases over time (Fang & Kung, 2012), an increase of one health condition from the prior wave may not capture a true health shock. Therefore, we specify health shock to be an increase of two health problems since the prior wave.

All variables are listed with the summary statistics in Table 2.

4. Results

4.1. Descriptive analysis

Approximately 4% of our sample lapsed their policies in the two years prior to 2010. This appears to be in line with the typical 5 to 5.5% annual individual policy lapse rates as reported by ACLI in their annual industry report (ACLI, 2012). Non-voluntary policy lapsation is occurring as evidenced by the additional 10% decline in life insurance ownership indicated by our sample.

Table 2 Variable summary statistics

Wave 10–2010		
N = 8,795		
384 respondents reported lapse		
	Mean	*SD*
Insurance ownership variables		
% of sample own life insurance in 2010	0.86	0.35
Life insurance status		
Lapse a policy due to their choice in prior two years	0.04	0.20
Explanatory variables		
Cognitive ability		
Episodic memory (total word recall) (no. correct)	9.75	3.48
Memory quartiles (no. correct)		
< 25th percentile	5.99	1.91
25th to 50th percentile	9.50	0.50
50th to 75th percentile	11.48	0.50
> 75th percentile	14.50	1.60
Numeracy (no. correct)	1.24	0.89
Numeracy quartiles (# correct)		
< 25th percentile	0.00	0.00
25th to 50th percentile	1.00	0.00
50th to 75th percentile	2.00	0.00
>75th percentile	3.00	0.00
Economic factors		
Income in 2010	$68,057	$84,585
Income quartiles ($)		
<25th percentile	$14,666	$5,961
25th to 50th percentile	$33,672	$5,804
50th to 75th percentile	$60,287	$10,703
>75th percentile	$163,600	$123,344
Net worth in 2010	$480,293	$1,002,237
Net worth quartiles ($)		
<25th percentile	$11,517	$48,998
25th to 50th percentile	$128,233	$41,899
50th to 75th percentile	$340,062	$91,184
>75th percentile	$1,442,672	$1,649,010
Log total debt	5.27	5.28
Financial knowledge		
Financial respondent	0.70	0.46
Bequest factors		
Married in current wave	0.63	0.48
Has living children	0.93	0.26
Demographic factors		
Age in 2010	69.56	9.76
Less than 60	0.17	0.37
60 to 64	0.17	0.38
65 to 69	0.15	0.36
70 to 74	0.20	0.40
75 to 79	0.15	0.36
80 and higher	0.16	0.37

(continued on next page)

Table 2 (Continued)

Wave 10–2010
N = 8,795
384 respondents reported lapse

	Mean	*SD*
Insurance ownership variables		
Male	0.44	0.50
Race		
White	0.82	0.39
Black	0.16	0.37
Other	0.02	0.15
Education		
Less than high school degree	0.15	0.36
High school	0.37	0.48
Some college	0.24	0.43
College	0.24	0.43
Health problems		
Zero problems	0.10	0.30
One problem	0.21	0.41
Two problems	0.26	0.44
Three problems	0.23	0.42
Four or more problems	0.20	0.40
Estate tax vulnerable		
Net worth over current exemption[a]	0.01	0.09
Shocks or major changes		
Newly retired since 2008	0.12	0.32
Income shock (decline) of > 10% compared with 2008	0.40	0.49
Additional kids residing at home since 2008	0.05	0.22
Marriage ended since last wave	0.04	0.20
Health shock (2+ additional health issues) since last wave	0.03	0.17

Note. [a]2010 Exemption was $0 but was retroactively changed to allow an election of $5,000,000. This variable set at $5,000,000.

The sample averaged slightly fewer than 10 total words recalled and approximately 1.24 numeracy questions answered correctly. Both numbers are very similar to results from the analyses by McArdle et al. (2011) and Smith et al. (2010).

Means and standard deviations for both income and wealth are reported for the entire sample as well as the quartiles for both variables. We observe apparent non-linearity of the increase in means across quartiles in both measures.

Approximately 70% of our sample appears to have financial knowledge since they are identified as the financial respondent for the households they represent. Over 60% of the respondents are married while over 90% have living children.

Demographically, our sample is on average nearly 70 years old, contains a majority of females, racially is predominantly white, has nearly half of its respondents with education beyond high school, and indicates that that a little over half have fewer than three of the eight identified health problems. While our statistical summary suggests a positive level of total household debt for our sample, in an unreported analysis, we find that 48.3% of the sample had no household debt.

In our final control variable, we see that only about one percent of the sample was vulnerable to U.S. estate taxes due to household net worth in excess of $5 million, the 2010 estate tax exemption amount. We note that the U.S. estate taxes were in legislative flux that year due to the elimination in 2010 of estate taxes as a result of the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA-2001). The Taxpayer Relief Act of 2010 (TRA-2010) reinstated the estate, gift, and generation-skipping transfer taxes with different exclusion amounts and top tax rates for taxable estates. TRA-2010 also presented a choice to the estates of those who died in 2010 on how they wanted to be taxed. They could either avoid any estate taxes while accepting the loss of the stepped-up basis for assets; thus, making the assets susceptible to capital gains taxes, or accept the new transfer tax laws implemented by the TRA-2010 that allowed estates to retain the stepped-up basis along with a $5 million estate tax exemption.

Looking finally to the shock and major change variables we include in our analysis, we see that about 12% of the sample retired between their survey interviews in 2008 and 2010. Approximately 40% of the sample experienced real income loss in excess of 10% over that period. Additionally, five percent of the sample indicated they had children join them in the home, four percent of their marriages end through divorce or the death of their spouse, and three percent experienced health shocks.

4.2. Univariate analysis

It is important to know how individual and household factors impact the respondent's decision to voluntarily lapse a life insurance policy. We first conduct a univariate comparison of the independent variables between those households choosing to lapse a policy and those that did not lapse a policy in 2010. Our results are reported in Table 3.

Both measures of cognitive ability appear to play a part in the lapse decision, though the level of cognitive ability appears to be important as to which decision is made. Both measures indicate a similar pattern across the levels of cognitive ability. A greater share of those within the lowest quartile in each cognitive measure do not lapse their policies while a larger proportion of those in the highest quartile lapse a policy. More quartiles of the numeracy measure showed a univariate relationship between cognitive ability and the decision lapse to lapse a policy.

The household economic factors indicate some level of univariate relationship. Those respondents in households with the lowest income indicate a higher proportion that do not lapse a policy while those with the highest income have a higher proportion that lapse. Respondents in households falling in the lowest and highest quartiles of net worth have greater percentages that lapse policies while those in the inner quartiles have larger percentages that do not lapse. Those who lapsed policies also had higher debt than those who did not.

From a demographic perspective, there is a positive univariate relationship between lapsing a policy and being male, or being black, or having a college degree.

From a life cycle perspective, we see a relationship among respondents who are age 75 and older and not lapsing a policy. Of particular interest is the highly significant difference among respondents in the age 60 to age 64 group, suggesting a univariate relationship between this age group that is often associated with the beginning of retirement (Brown, 2013) and the decision to lapse.

Table 3 Univariate difference for lapses of life insurance between 2008 and 2010

Differences in means of demand determinants for individuals lapsing life insurance			
Explanatory variables	(1) Lapse = 0	(2) Lapse = 1	Diff (1) − (2)
No. of individuals	8411	384	
Cognitive ability			
Episodic Memory quartiles (no. correct)			
<25th percentile	0.3481	0.2943	0.0538**
25th to 50th percentile	0.2337	0.2318	0.0020
50th to 75th percentile	0.2133	0.2318	−0.0185
>75th percentile	0.2049	0.2422	−0.0373*
Numeracy quartiles (no. correct)			
<25th percentile	0.2318	0.1536	0.0782***
25th to 50th percentile	0.3770	0.3854	−0.0084
50th to 75th percentile	0.3189	0.3594	−0.0405*
>75th percentile	0.0723	0.1016	−0.0293**
Economic factors			
Income quartiles ($)			
<25th percentile	0.2518	0.2109	0.0409*
25th to 50th percentile	0.2499	0.2526	−0.0027
50th to 75th percentile	0.2500	0.2474	0.0026
>75th percentile	0.2482	0.2891	−0.0408*
Net worth quartiles ($)			
<25th percentile	0.2473	0.3281	−0.0808***
25th to 50th percentile	0.2519	0.1901	0.0618***
50th to 75th percentile	0.2526	0.1953	0.0573**
>75th percentile	0.2481	0.2865	−0.0383*
Log total debt	5.2279	6.2421	−1.0142***
Financial knowledge			
Financial respondent	0.7029	0.7057	−0.0028
Bequest factors			
Married in current wave	0.6270	0.6432	−0.0162
Has living children	0.9289	0.9271	0.0018
Demographic factors			
Age in 2010			
Less than 60	0.1682	0.1797	−0.0115
60 to 64	0.1686	0.2240	−0.0554***
65 to 69	0.1549	0.1484	0.0065
70 to 74	0.1952	0.2109	−0.0157
75 to 79	0.1504	0.1198	0.0306*
80 and higher	0.1626	0.1172	0.0455**
Male	0.4336	0.4818	−0.0482*
Race			
White	0.8189	0.7917	0.0273
Black	0.1571	0.1901	−0.0330*
Other	0.0240	0.0182	0.0058
Education			
Less than high school degree	0.1531	0.1224	0.0307*
High school	0.3667	0.3307	0.0359
Some college	0.2385	0.2318	0.0067
College	0.2416	0.3151	−0.0735***

(continued on next page)

Table 3 (Continued)

Differences in means of demand determinants for individuals lapsing life insurance			
Explanatory variables	(1) Lapse = 0	(2) Lapse = 1	Diff (1) − (2)
Health problems			
Zero problems	0.1028	0.1068	−0.0040
One problem	0.2098	0.1979	0.0119
Two problems	0.2636	0.2682	−0.0046
Three problems	0.2257	0.2318	−0.0061
Four or more problems	0.1981	0.1953	0.0028
Estate tax vulnerable			
Net worth over current exemption[a]	0.0072	0.0182	−0.0110**
Shocks or major changes			
Newly retired since 2008	0.1172	0.1589	−0.0416**
Income shock (decline) of >10% compared with 2008	0.4033	0.4271	−0.0238
Additional kids residing at home since 2008	0.0487	0.0781	−0.0294***
Marriage ended since last wave	0.0414	0.0521	−0.0107
Health shock (2+ additional health issues) since last wave	0.0314	0.0313	0.0001

Note. Data from the 2010 Health and Retirement Study. A *t* test is used for difference of means of the variables. Statistical significance at 0.10, 0.05, and 0.01 levels is denoted by *, **, and ***, respectively.

[a]2010 Exemption was $0 but was retroactively changed to allow an election of $5,000,000. This variable set at $5,000,000.

We also observe univariate differences in two of our shock variables, those who are newly retired and those with more kids living with them. This suggests that both of these shocks are related to the decision to voluntarily lapse a policy.

We now turn our attention to the multivariate analysis using logistic regression to better understand the life insurance voluntary lapse decision by older individuals.

4.3. Logistic regression model analysis

We present in two tables our logistic regression analyses of the decision to voluntarily lapse a life insurance policy, using separately the two measures of cognitive ability. The regression incorporating episodic memory is presented in Table 4a and the regression incorporating numeracy is presented in Table 4b.

In each table we present the results of three regression analyses from the same model to explore the relationships that various independent variables have on the decision to voluntarily lapse a policy. The first two regressions are shortened forms of the model. Regression 1 in each table is the simplest form of each model where we examine the relationship of only our independent variable of interest, cognitive ability, with the decision to voluntarily lapse a policy. In Regression 2, we add variables representing household economic factors and bequest motives from life insurance theory, and financial knowledge from prior literature (Mulholland et al., 2016). Regression 3 includes our full model with all specified control variables.

For our variable of interest, cognitive ability, we see clear differences between the use of episodic memory and numeracy as the measure for this important respondent trait. Both variables in the Regression 1 analyses show a positive relation between the level of cognitive

Table 4a Logistic regressions—cognitive ability measured with episodic memory

Wave 10–2010 *N* = 8,795 384 respondents reported lapse	Dependent variable: lapse = 1					
	Reg 1		Reg 2		Reg 3	
	Odds ratio	Pr > χ^2	Odds ratio	Pr > χ^2	Odds ratio	Pr > χ^2
Intercept	−3.255	<.0001***	−3.266	<.0001***	−3.446	<.0001***
Explanatory variables						
Cognitive ability: Episodic memory (ref = TWR quartile with lowest ability)						
TWR quartile with 2nd lowest ability	1.173	0.2703	1.130	0.4063	1.105	0.5073
TWR quartile with 2nd highest ability	1.285	0.0831*	1.202	0.2171	1.163	0.3379
TWR quartile with highest ability	1.399	0.0192**	1.269	0.1184	1.229	0.2145
Economic factors						
Income quartiles (ref = lowest quartile)						
2nd lowest quartile			1.295	0.1133	1.288	0.1294
2nd highest quartile			1.194	0.3129	1.139	0.4812
Highest quartile			1.298	0.1730	1.173	0.4517
Net worth quartiles (ref = lowest quartile)						
2nd lowest quartile			0.525	<.0001***	0.540	<.0001***
2nd highest quartile			0.530	<.0001***	0.533	0.0002***
Highest quartile			0.782	0.1199	0.737	0.0801*
Log total debt			1.031	0.0053***	1.023	0.0412**
Financial knowledge						
Financial respondent			1.063	0.6250	0.985	0.9079
Bequest factors						
Married			1.042	0.7625	1.018	0.9036
Has living children			0.984	0.9365	0.959	0.8380
Demographic factors						
Age in 2010 (ref = ages 60 to 64)						
Less than 60					0.851	0.3451
65 to 69					0.781	0.1651
70 to 74					0.920	0.6174

(continued on next page)

Table 4a (Continued)

Wave 10–2010 N = 8,795 384 respondents reported lapse	Dependent variable: lapse = 1					
	Reg 1		Reg 2		Reg 3	
	Odds ratio	Pr > χ^2	Odds ratio	Pr > χ^2	Odds ratio	Pr > χ^2
75 to 79					0.730	0.1148
80 and higher					0.720	0.1193
Male (ref = female)					1.248	0.0533*
Race (ref = White)						
Black					1.261	0.1083
Other					0.758	0.4801
Education (ref = less than high school degree)						
High school					1.177	0.3741
Some college					1.192	0.3790
College					1.604	0.0229**
Health problems (ref = zero problems)						
One problem					0.942	0.7642
Two problems					1.100	0.6262
Three problems					1.136	0.5304
Four or more problems					1.118	0.6020
Estate tax vulnerable						
Net worth over current exemption[a]					2.078	0.0799*
Shocks or major changes						
Newly retired since 2008					1.410	0.0197**
Income decline > 10% from 2008 (real $)					1.082	0.4863
Additional kids residing at home since 2008					1.533	0.0334**
Marriage ended since last wave					1.354	0.2361
Health shock since last wave					0.895	0.7171
Pseudo R^2 =	0.0023		0.0167		0.0298	

Note. Data from the 2010 Health and Retirement Study. Statistical significance at 0.10, 0.05, and 0.01 levels is denoted by *, **, and ***, respectively.

[a]2010 Exemption was $0 but was retroactively changed to allow an election of $5,000,000. This variable set at $5,000,000.

Table 4b Logistic regressions—cognitive ability measured with numeracy

Wave 10–2010 *N* = 8,795 384 respondents reported lapse	Dependent variable: lapse = 1					
	Reg 1		Reg 2		Reg 3	
	Odds ratio	Pr > χ^2	Odds ratio	Pr > χ^2	Odds ratio	Pr > χ^2
Intercept	−3.498	<.0001***	−3.414	<.0001***	−3.547	<.0001***
Explanatory variables						
Cognitive ability: Numeracy (ref = numeracy quartile with lowest ability)						
Numeracy quartile with 2nd lowest ability	1.543	0.0057***	1.585	0.0041***	1.600	0.0050***
Numeracy quartile with 2nd highest ability	1.701	0.0008***	1.719	0.0014***	1.684	0.0045***
Numeracy quartile with highest ability	2.120	0.0004***	2.024	0.0020***	1.867	0.0113**
Economic factors						
Income quartiles (ref = lowest quartile)						
2nd lowest quartile			1.234	0.1990	1.265	0.1597
2nd highest quartile			1.113	0.5433	1.108	0.5790
Highest quartile			1.206	0.3285	1.146	0.5205
Net Worth quartiles (ref = lowest quartile)						
2nd lowest quartile			0.511	<.0001***	0.533	<.0001***
2nd highest quartile			0.502	<.0001***	0.523	<.0001***
Highest quartile			0.724	0.0437**	0.718	0.0576**
Log total debt			1.029	0.0082***	1.022	0.0506*
Financial knowledge						
Financial respondent			1.007	0.9586	0.961	0.7586
Bequest factors						
Married			1.008	0.9550	1.013	0.9314
Has living children			0.992	0.9687	0.951	0.8085
Demographic factors						
Age (ref = ages 66 to 75)						
Less than 60					0.850	0.3409
65 to 69					0.784	0.1719
70 to 74					0.918	0.6071

(continued on next page)

Table 4b (Continued)

Wave 10–2010 N = 8,795 384 respondents reported lapse	Dependent variable: lapse = 1					
	Reg 1		Reg 2		Reg 3	
	Odds ratio	$Pr > \chi^2$	Odds ratio	$Pr > \chi^2$	Odds ratio	$Pr > \chi^2$
75 to 79					0.727	0.1091
80 and higher					0.713	0.1008
Male (ref = female)					1.171	0.1632
Race (ref = White)						
Black					1.365	0.0348**
Other					0.796	0.5618
Education (ref = less than high school degree)						
High school					1.062	0.7472
Some college					1.044	0.8308
College					1.383	0.1281
Health problems (ref = zero problems)						
One problem					0.927	0.7043
Two problems					1.082	0.6885
Three problems					1.118	0.5849
Four or more problems					1.095	0.6723
Estate tax vulnerable						
Net worth over current exemption[a]					2.085	0.0781*
Shocks or major changes						
Newly retired since 2008					1.430	0.0153**
Income decline > 10% from 2008 (real $)					1.074	0.5293
Additional kids residing at home since 2008					1.518	0.0381**
Marriage ended since last wave					1.372	0.2174
Health shock since last wave					0.895	0.7176
Pseudo R^2 =	0.0063		0.0208		0.0331	

Note. Data from the 2010 Health and Retirement Study. Statistical significance at 0.10, 0.05, and 0.01 levels is denoted by *, **, and ***, respectively.
[a]2010 Exemption was $0 but was retroactively changed to allow an election of $5,000,000. This variable set at $5,000,000.

ability and the probability of lapse. Numeracy indicates higher levels of significance and probability. While numeracy maintains its high significance in all three forms of the model, episodic memory quickly loses significance as a predictor of voluntary lapse with the introduction of other independent variables. Numeracy maintains consistent direction and magnitude of effect in each form of the model. In addition, using the pseudo R^2 values as a measure of relative model strength, we see that the models using numeracy consistently display higher strength of association. Based upon our statistically significant numeracy quartiles in our model, we conclude that cognitive ability is an important factor in the ownership decisions of existing life insurance policies. We also conclude that numeracy is a better measure of cognitive ability when modeling lapse decisions. Our findings are consistent with the prior research that explores the appropriate measure of cognitive ability in relation to financial decisions (Christelis et al., 2010; Smith et al., 2010).

We observe a consistent pattern across both analyses using the different measures of cognitive ability. Higher levels of income, when compared with the lowest quartile of income, is not predictive of voluntary lapse while greater net worth is a significant predictor of a reduced likelihood to voluntary lapse a policy when compared with those respondents in the lowest quartile of net worth. Total household debt is also a significant predictor of voluntary lapse, indicating that increasing debt increases the likelihood of policy lapse. For both net worth and total debt, the magnitude and direction of the effect are consistent between the reduced model in Regression 2 and the full model in Regression 3.

We find no difference in likelihood to lapse a policy based upon the respondent's household financial knowledge as proxied by whether or not they were the identified financial respondent for answering household financial questions in the survey.

Demographic control variables display similar effect patterns and magnitudes but with shifting significance with the change in cognitive ability measure. Men, Blacks, and those with college degrees appear more likely to lapse. As suggested in the univariate analysis, we use those in the typical preretirement or early retirement years, ages 60 to 64, as our reference group for the multivariate analyses. While falling just outside the traditional levels of significance, policyholders 75 and older appear to be nearly 30% less likely to lapse their existing policies than the reference age group.

The presence of health problems was not indicative of a change in likelihood to voluntarily lapse a policy.

When considering estate tax vulnerability of the household, we find that those respondents with household net worth in excess of the $5 million estate tax exemption level are significantly more likely to lapse a policy than those with less than this level of net worth. Those from the vulnerable households are about twice as likely to lapse a policy. Given prior research that suggests life insurance is a tool to improve the efficient transfer of the estate upon death (Milevsky, 2006) and is used as such (Mulholland et al., 2016), we initially find this result puzzling. We will address this puzzling result in the next section.

Finally, two important shock variables indicate a significant increase in likelihood to lapse a policy in the presence of these shocks. Newly retired respondents are over 40% more likely to lapse a policy. In a new finding, we see that the addition of a child to the household of these older respondents increases the likelihood of lapsing a policy by over 50%.

Overall, our results suggest numeracy as a measure cognitive ability is a significant predictor of life insurance policy lapse decisions.

5. Discussion and conclusions

The purpose of this study is to further explore the microeconomic determinants of life insurance lapse by introducing an additional variable into a model of lapse behavior. We find evidence that cognitive ability, when using numeracy as its measure, is a determinant in the decision to voluntarily lapse a life insurance policy. In addition, we find that specification of the correct measure of cognitive ability is important as seen in the lack of significant relationship when using episodic memory as the measure of cognitive ability, but a highly significant relationship when using numeracy as the cognitive ability measure. We conclude that numeracy is the appropriate measure of cognitive ability to include when modeling lapse behavior. Our results are statistically significant.

Numeracy may be related to the ability of the policyholder to perceive the value of lapsing a policy at the appropriate time, such as when a term policy is no longer needed to hedge against the loss of labor income flows at retirement or a permanent policy is no longer needed after a loss of a bequest motive. It is important to note here that we are not able to comment on the specific rationality of the individual respondent's decision to lapse a life insurance policy. With limitation in the data as to the specific reason the lapse decision is being made, such as loss of bequest motive, income shock, or health shock (Fang & Kung, 2012), we can only comment in general on the rationality of the decisions made by older policyholders.

Our results support prior literature in several ways. In the area of life cycle theory, we find that a greater proportion of policyholders are making the decision to lapse life insurance in the time frame surrounding when we see U.S. workers transition from the labor force to retirement, typically in the age 60 to age 64 timeframe (Brown, 2013). Our results suggest, though just beyond the typical level of significance, that in comparison, policyholders who are well into their retirement years are less likely to lapse their policies, possibly to meet bequest or end-of-life expenses.

While it is not the focus of our study, we find some evidence supporting the EFH. While controlling for cognitive ability, we find policyholders have an increased likelihood of lapsing a policy in the face of rising household debt. Conversely, we find that those policyholders with higher levels of net worth are less likely to lapse a policy. Income level is not significant in our model. We do not find evidence that income shock at the level we specify impacts the decision to lapse a policy, which is likely a result of the level of shock chosen. It is in the presence of very large income shocks that prior literature finds income shock to be a significant factor in life insurance lapse (Fier & Liebenberg, 2013; Liebenberg et al., 2012).

Our findings in this model indicate that those individuals with household net worth above the 2010 tax exemption limit of $5 million are twice as likely to lapse their policy as those with net worth below the exemption limit. This result is counter to prior research that finds estate tax-vulnerable households are more likely to own cash value life insurance (Mulholland et al., 2016). While on the surface this may be a puzzling result, we suggest this result may be an artifact of the data. In the prior study, Mulholland et al. use multiple years of cross-sectional data incorporating multiple waves of the Survey of Consumer Finances (SCF) to explore the relationship of life insurance demand to estate tax vulnerability. The 2010 wave of the SCF was one of seven waves used. In contrast, our study uses only the 2010 cross section of the HRS. This is important because 2010 was a unique year for estate tax laws in the United States. The EGTRRA-2001 eliminated the estate taxes in 2010 while also making all assets subject to capital gains taxes. This changed the tax rates for estate transfers. For those households that were vulnerable to estate taxation, this may have encouraged them to reoptimize their life insurance coverage, an area of life insurance lapse theory covered by the PRH. This is an area that should be considered for future study.

We also find new evidence that policyholders who had one or more children recently move home to live with them are much more likely to lapse a policy. Certainly, there may be an added expense component in the household and we suggest this is very similar to an income shock. However, this raises some interesting questions due to of the nature of the "expense shock." Are parents foregoing a typical bequest desire in exchange for current joint utility associated with helping their child? If the child knew about the exchange of utility by the parent and the impact it is having on the child's own present and future utility, would the saliency of that exchange affect the child's decision to move home? Finally, if there are other children that would have benefited from the life insurance proceeds, the loss of their share of the death benefits is effectively a 100% tax on their proceeds by their sibling that moved home. Understood in this manner, would the parent make the same choice or would they have sought policy support from the other siblings? The interplay of policy stakeholders in the lapse decision is an area of possible future research that may reveal some interesting results.

Our results are important to the various life insurance actors we discuss earlier in this article. For insurance companies, making tools available to policyholders and advisors that are targeted to the different levels of numerical ability may improve policyholder decision-making as they evaluate their current policies. For those policyholders with lower numerical ability, the current in-force ledger illustrations may confuse them to the point that they see lapse as their best, or only, option. It is a similar issue for regulators who are charged with protecting consumers. Mandating education and protection tools that are sensitive to the policyholder's cognitive ability should provide better protection for consumers.

For advisors, a better understanding of the cognitive ability of their clients or prospects should allow the advisor to tailor the advice to better meet the consumer's ability to understand it. If consumers are better informed, the advisors are less likely to the face legal issues like those that Glenn Neasham was forced to endure.

We caution that while understanding that numerical ability is important for financial decisions like the ownership of life insurance, the questions used in the HRS should not be viewed as the best way to measure numeracy among policyholders. We leave that research to those studying financial literacy, which Huston (2010) conceptualizes as having two dimensions, understanding and use. These are similar to the dimensions Smith et al. (2010) use in their definition of crystallized intelligence—knowledge and experience. Because numeracy is a form of crystallized intelligence, there may be improved life insurance decisions with improved financial literacy about life insurance.

Notes

1 HRS question MT036: "In the last two years, have you allowed any life insurance policies to lapse or have any been cancelled?"
2 HRS question MT041: "Was this lapse or cancellation something you chose to do, or was it done by the provider, your employer, or someone else?"
3 HRS question MD178: "If the chance of getting a disease is 10 percent, how many people out of 1,000 would be expected to get the disease?"
4 HRS question MD179: "If 5 people all have the winning numbers in the lottery and the prize is two million dollars, how much will each of them get?"
5 HRS question MD180: "Let's say you have $200 in a savings account. The account earns 10 percent interest per year. How much would you have in the account at the end of two years?"

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