18-05

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May 24, 2018

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Abstract

This paper reports survey evidence on long-term care (LTC) risk misperceptions and demand for long-term care insurance (LTCI) in Canada. LTC risk misperceptions is divided into three different risks: needing help for at least one activity of daily life, needing access to a nursing home, and living to be 85 years old. We contrast subjective (i.e. stated) probabilities with actual probabilities for these three dimensions. We first provide descriptive statistics of how objective and subjective probabilities differ and correlate to each other. Second, we study cross-correlations between different types of risks. We then study how risk misperceptions correlate with individual characteristics, and evaluate how misperceptions affect intentions and actual purchase of LTCI. Our conclusions are two-fold. First, we find that most subjects are not well informed about their individual LTC risks, making it difficult for them to take the correct LTCI decisions. Second, and even though misperceptions explain an individuals actual or his intentions to take-up LTCI, misperceptions are unlikely to explain the poor take-up rate of LTCI in our sample.

    Keywords: Long-term care insurance puzzle, disability, misperceptions, subjective probability.
    JEL codes: D15, D91, I13

1 Introduction

According to the Canadian Life and Health Insurance Association (CLHIA), by the year 2036, 25% of the Canadian population should be above 65 years old with almost one million people afflicted with dementia. This ageing trend is observed in all developed countries, and goes together with an increase in the number of elderly dependents, who will likely be needing costly long-term care (LTC hereinafter) services.[1] According to Brown and Finkelstein (2009), the probability that a 65 years old will someday use a nursing home at some point in his life ranges from 35 to 50% in the U.S.. This is likely to put additional financial pressure on households and ultimately on governments. For instance, the median annual cost for a private nursing home in the U.S. is more than $85,000$ USD (Genworth, 2012) while in Canada, the annual cost of a private nursing home ranges between $40,000$ CAD and $60,000$ CAD a year. In addition, the cost of home care services ranges between 20 CAD and 80 CAD per hour (before tax credits).[2]

Yet, looking at the shallowness of the LTC insurance (LTCI hereinafter) market, it seems that most individuals do not realize that the need for LTC services spending is a sizeable and increasing risk. For instance, the CLHIA reports that almost three quarters of Canadian admit they have made no financial plan to pay for LTC in case they would need it. This is what is often referred as the "LTC Insurance puzzle" in the literature (see Pestieau and Ponthiere, 2011 as well as Costa-Font and Courbage, 2012). Indeed, the OECD (2011) reports that the share of (public and private) LTC expenditures accounted for 1.5% of GDP on average across 25 OECD countries in 2008, while the share of formal LTC expenditures covered by private LTC insurance varies from roughly 0.5% in France and Canada to a maximum of 57% in Japan and the United States.

Many factors have been put forward in the literature to explain the lack of a market for LTCI. For example, Boyer al. (2018) investigate a number of factors in the Canadian context. As it turns out, awareness of the existence of LTCI is low. Moreover, using a stated-preference experiment, Boyer al. (2017) show that, in addition to low awareness, risk misperceptions are likely to play an important role in explaining intentions to purchase LTCI. The present paper investigates the nature of these misperceptions across different sources of risk and considers the relationship with actual purchases of LTCI. Based on a review of several surveys, Pauly (1990) indeed attributes the non-purchase of private LTCI to the fact that individuals lack awareness of their probability of needing LTC services. The importance of

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[1] LTC is defined as the care for people needing daily living support over a prolonged period of time. Support can be provided with activities of daily living, such as bathing, dressing, eating, getting in and out of bed, toileting and continence) or instrumental activities of daily living (which include preparing meals, cleaning, doing the laundry, taking medication, getting to places beyond walking distance, shopping, managing money affairs, and using the telephone and nowadays the Internet).

[2] These values are obtained from the Canadian Life and Health Insurance Association (CLHIA, 2018).

perceptions for the demand for LTCI is also at the heart of Courbage and Roudaut (2008, 2011), who find, using the SHARE database for France, that the experience of sickness or disability as well as of having provided informal care to relatives plays a significant role in explaining the purchase of LTCI. The underlying rationale is that individuals have obtained information about their health and LTC risks from these experiences, which in turn has made them modify their economic behaviour regarding insurance.[3] Zhou-Richter et al. (2010) also find evidence that, when given information about *average* LTC risks and LTC costs, uninsured individuals are more willing to buy LTCI. De Donder and Leroux (2013) show that misperception biases regarding the probability of dependency can explain why so few governments have implemented a public LTCI program.

Yet, although there is research on misperception regarding various risks in isolation (for example, survival risk), no study has ever looked at the interplay between these risks.[4] For instance, Hamermesh (1985) compares subjective (i.e. as stated by respondents) and actual survival probabilities and shows that middle-aged individuals tend to under-estimate their survival probability to ages below 70 years old but over-estimate it for ages above 70. Ludwig and Zimper (2007) obtain similar results. Hurd and McGarry (2002) show that subjective survival risk is predictive of future mortality. As for LTC subjective risks, to the best of our knowledge, the only reference is Finkelstein and McGarry (2006) who compare the subjective probability of entering a nursing home within 5 years for respondents aged on average 78 to the actual decisions of the same respondents after 5 years. They find that on average respondents correctly estimate their probability of nursing home use, reporting on average around 18% while the actual average probability is 16%. Our paper extends this analysis by studying three different measures of risks: the probability of needing help with activities of daily living (ADL hereinafter), the probability of entering a nursing home, and the probability of dying before the age of 85. And by going beyond average responses to assess the heterogeneity in the respondents misperceptions, our paper extends our understanding of the links between the three measures studied and how they correlate with personal characteristics and with the demand for LTCI. Our results have clear implications both for practitioners (banks and insurers) and for governments as they shed light on the relationship between the individuals misperception bias, individual characteristics, and the demand for LTCI. Finally, our paper gives relevant information regarding product design (such as bundling of LTCI and life insurance) and about the expected profitability of such products.

We have commissioned *Asking Canadians*, a Canadian online panel survey organization to undertake in late 2016 a large survey on LTCI among 2000 randomly selected panel members aged 50 to 70 and living

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[3] Coe et al. (2015) find similar results using HRS data from 1998 to 2006.
[4] See Hurd (2009) for a review of studies which elicit subjective risk assessments in surveys.

in two Canadian provinces (Ontario and Quebec).[5] We have asked them several questions about their socio-economic characteristics, reasons for having purchased (or not) LTCI as well as their preferences regarding the type of LTC they would prefer to receive. Results suggest very modest take-up of LTCI in Canada (between 2% and 12% report having LTCI depending on classification of responses). We also asked them questions about their subjective assessment of three different risks: first, their probability to live past 85; second, their probability to become dependent (having ADLs); and third, the risk to enter a LTC home at some point in their life. We then matched respondents with a health microsimulation model (called COMPAS) devised to estimate personalized lifetime exposure to disability, nursing home and formal care (Boisclair et al., 2016). This allows us to estimate actual (objective) probabilities that households live up to 85 or become dependent, and to confront these objective probabilities with the (subjective) ones estimated by the respondents. We provide descriptive evidence on each of the three measures by studying the distribution of the subjective risk (as declared by the agent in the survey), of the objective risk (as obtained using the health microsimulation model COMPAS) and of the difference between the two (namely, the mistake that the agent makes when assessing his own risk, compared to what COMPAS tells us is the best estimate of the individual's risk). We then study the links between misperceptions in the ADL and longevity risks, and between the ADL and nursing home risks. Finally, we study the individual determinants of these misperceptions and how the biases in the risk estimations may impact intentions to buy LTCI and the actual demand for LTCI.

First, we find that survey respondents make quite small mistakes on average when assessing their risk (defined as their probability of either needing –formal or informal– LTC or of dying before 85), with the average mistake being twice as large for LTC (whether ADL or nursing home, at around 10 percentage points) as for survival (at 5 percentage points). Survey agents are on average optimistic for ADL and for their survival probability, and pessimistic for their need of a nursing home. Second, there is a lot more heterogeneity in subjective estimates of risks than in the objective estimates, with many more people estimating that they have either a low or a high risk than is the case in reality. Third, there is little correlation at the individual level between subjective and objective measures of risk, except for survival, suggesting that survey participants are better informed about their survival probability than about their LTC risks.

We then look at cross correlations. First, we find a (slightly) positive correlation between objective measures of LTC and longevity risks consistent LTC risks increasing with age, but a (slightly) negative correlation between those two subjective measures, consistent with the hypothesis that the current subjective health status of the respondent drives his/her answers on both dimensions. The correlation between

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errors in the two dimensions –longevity and LTC– is (slightly) negative, with 40% of respondents being optimistic on both dimensions. Not surprisingly, we also find a strong positive correlation between the probability to enter a nursing home and that of having an ADL at some point in life. This correlation is however stronger in reality than what agents anticipate. Looking then at correlates of misperceptions, we find that women and residents of the province of Quebec are more optimistic regarding ADL and nursing home risk, while more educated respondents are more pessimistic regarding survival risk. There is rarely a consistent pattern across all three risks in terms of determinants, which highlights the importance of looking at all three risks. This holds as well for determinants of the probability of knowing these risks. Finally, we find that agents who are more pessimistic regarding their ADL risk are more likely to have bought or intend to buy LTCI if offered. A 25 point difference between subjective and objective risk translates into a 0.7 percentage point increase in coverage and a 1.6 percentage point increase in intentions to purchase. Hence, although important at the individual level, pessimism does not explain much of the lack of LTCI at the aggregate level. In the same way, awareness of nursing home risk and of ADL risk are found to be good predictors of the intention to purchase and of actual purchase at the individual level, but do not explain much of the LTCI puzzle at the aggregate level.

The paper is organized as follows. The next section presents the data. Section 3 shows descriptive evidence about risk misperceptions. Section 4 studies individual determinants of these misperceptions and Section 5 explains how they correlate with intentions to purchase LTCI and with actual purchase. The last section concludes.

2 Data

2.1 Survey

We have commissioned Asking Canadians, a Canadian online panel survey organization, to conduct a survey on LTCI in late autumn 2016. We have randomly selected 2000 panel members aged 50 to 70 residing in the two largest and most populous provinces of Canada, Ontario and Quebec. Participants were rewarded for their participation (with loyalty rewards from major retailers). Despite those efforts, some groups were underrepresented, in particular low-educated respondents. We have stratified by age, gender, province and education groups (three levels) and used the Labor Force Survey of 2014 to re-weigh the data.

The questionnaire (see Appendix A) has five sections. In the first three sections, which are the ones relevant for the present paper, the survey asks respondents about their socio-economic characteristics, reasons for having purchased (or not) LTCI, risk perceptions and their preferences regarding the type of LTC they would prefer to receive. For questions where we expected a significant fraction of missing

4

information, such as savings and income, we used unfolding brackets. We then used multiple imputation to impute missing values with information from the bracketing, conditional on basic socio-demographic covariates (age, gender). The last section of the survey (see last section of the questionnaire in the Appendix) consists in a stated-preferences experiment. In that section, we presented our respondents with 5 scenarios where we varied LTC benefits and premiums, and asked them about the probability they would purchase such a product. From their answers, we can infer their *intentions* to buy LTCI, which we use in the last section of this paper, to relate them to risk misperceptions.

2.2 Health simulation model

We use the microsimulation model COMPAS developed to project the long-term evolution of health and health care use in Canada (Boisclair et al., 2016). The structure of the model follows from other models such as the Future Elderly Model (Goldman et al, 2005). Each individual in the model has multiple characteristics :

- Socio-demographic characteristics: age, sex, immigration status, education level, income bracket

- Diseases: diabetes, high blood pressure, heart diseases, stroke, cancer, lung diseases, dementia

- Risk factors: smoking, obesity

- Disability: limitations in ADLs and Instrumental ADLs (IADL)

- LTC: formal home care, nursing home

Based on these characteristics, the core of the model consists of a Markovian transition model of the health state variables listed above. The transition matrix is based on a set of transition models which were estimated using the National Population Health Survey (1994-2010). The model delivers simulated life-trajectories conditional on a set of initial conditions. When designing the questionnaire for our survey, we deliberately asked questions we could then feed directly into the health transition matrix of COMPAS. In particular, we asked respondents for their education level, their health conditions (same as in COMPAS) and smoking habits. Nevertheless, data limitations are likely to impact some of the calculations we make. COMPAS uses NPHS data which records the location of respondents at the time of the survey but no location is available when the respondent has been found to have died. Since nursing home stays tend to occur more frequently at the end of life, this could impact our estimates. Hurd et al (2017) find that shorter stays, in particular those near the end of life are missed by core interviews in the Health and Retirement Study. This means that it may be that by using COMPAS we underestimate the individual probabilities of entering a nursing home. Despite these caveats, we assume in the sequel that

the probabilities generated by COMPAS reflect correctly the objective risk pattern of the respondents, and that any gap between these probabilities and those reported by respondents is due to misperceptions.

3   Descriptive evidence

3.1   General statistics

Among our 2000 respondents, 181 of them did not know whether they had LTCI coverage, and among those who report to know about LTCI coverage, 215 report having LTCI. However, looking at how these respondents got coverage, 184 either report receiving it from their employer benefits (although LTCI is almost inexistent in employee benefit packages in Canada) or do not know the premium or the benefit of the policy. Hence, it appears that many respondents think they are covered for LTCI but are not. Excluding those 184 respondents from those covered (considered as "doubtful coverage"), we obtain a take-up rate of 1.6% which is roughly equal to the take-up rate we would obtain when using the number of policies reported by CLHIA. Hence, take-up rates vary from less than 2%, using the least restrictive definition of coverage to 11.8%, using the most unrestrictive definition. Table 1 reports descriptive statistics of individual characteristics by LTCI coverage.

A number of interesting patterns already emerge from this table. First, those with LTCI are more likely to be younger, male, college educated, with higher savings (but not necessarily higher income). Interestingly, they are also more likely to report having a bequest motive and to report that family members should take care when they can for the elderly. They are also more likely to have a preference for formal care. They are more likely to have life insurance and an employer pension. Interestingly, those with doubtful coverage are quite different from those more likely to have LTCI. They are more likely to be from Quebec, have higher income (but less savings) and have a worse health profile (i.e. higher number of health conditions and more likely to have smoked in the past more than 100 cigarettes). Finally, those who do not know whether they have coverage look a lot like those who report they do not have one.

	no LTCI	LTCI	doubtful LTCI	dnk LTCI	Total
age	60.22	58.13	58.63	58.29	59.86
	(5.616)	(5.290)	(5.375)	(5.205)	(5.595)
quebec	0.479	0.452	0.679	0.503	0.499
	(0.500)	(0.506)	(0.468)	(0.501)	(0.500)
female	0.513	0.387	0.364	0.536	0.499
	(0.500)	(0.495)	(0.482)	(0.500)	(0.500)
married	0.671	0.710	0.761	0.641	0.677
	(0.470)	(0.461)	(0.428)	(0.481)	(0.468)
high school	0.300	0.226	0.234	0.354	0.297
	(0.458)	(0.425)	(0.424)	(0.479)	(0.457)
college	0.660	0.742	0.739	0.630	0.666
	(0.474)	(0.445)	(0.440)	(0.484)	(0.472)
n kids	1.548	1.484	1.696	1.193	1.528
	(1.243)	(1.262)	(2.031)	(1.116)	(1.329)
log hh income	10.96	10.58	11.15	10.95	10.97
	(1.260)	(2.723)	(1.184)	(1.489)	(1.311)
log savings	9.955	10.57	10.34	9.712	9.978
	(4.180)	(3.440)	(3.421)	(4.304)	(4.117)
number health conditions	0.617	0.452	0.571	0.586	0.607
	(0.835)	(0.723)	(0.765)	(0.882)	(0.831)
owner	0.792	0.806	0.848	0.779	0.796
	(0.406)	(0.402)	(0.360)	(0.416)	(0.403)
bequest motive	0.220	0.419	0.299	0.249	0.233
	(0.414)	(0.502)	(0.459)	(0.433)	(0.423)
family should care	0.641	0.774	0.609	0.663	0.642
	(0.480)	(0.425)	(0.489)	(0.474)	(0.480)
pref. formal care	0.499	0.581	0.565	0.414	0.498
	(0.500)	(0.502)	(0.497)	(0.494)	(0.500)
has life insurance	0.690	0.871	0.755	0.674	0.698
	(0.463)	(0.341)	(0.431)	(0.470)	(0.459)
smoked at least 100 cigarettes	0.561	0.484	0.565	0.508	0.555
	(0.496)	(0.508)	(0.497)	(0.501)	(0.497)
has employer pension	0.562	0.677	0.701	0.657	0.586
	(0.496)	(0.475)	(0.459)	(0.476)	(0.493)
employer pension DB	0.415	0.419	0.533	0.459	0.430
	(0.493)	(0.502)	(0.500)	(0.500)	(0.495)
Observations	2000				

mean coefficients; sd in parentheses

Table 1: Descriptive Statistics by LTCI coverage status. Doubtful LTCI coverage is defined as reporting LTCI obtained from employer benefits or not knowing both premiums and benefit under the policy. "dnk LTCI" refers to respondents who report not knowing whether they have LTCI.

In Table 2, we report statistics on objective and subjective risks for ADL, nursing home and survival (to age 85).[6] We denote by p_j the objective probability (i.e. obtained through COMPAS) and by $\tilde{p}_j$ the subjective probability, for risk $j \in \{ADL, NH\}$. We also denote the objective survival probability by π and the subjective survival by $\tilde{\pi}$. The average objective risk of having ADLs is 55.5%, of requiring a stay

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[6]Note that in this table, the statistics on objective probabilities are computed only on the sample of respondents who declared to know the corresponding subjective probability.

in a nursing home, 25.6% and of living to age 85, 65%. From the different columns, we can already see substantial heterogeneity in both subjective and objective risks and how they differ from each other. In the section below, we study them in more details.

	mean	sd	min	p25	p50	p90	max
$\tilde{p}_{ADL}$	45.79	32.82	0.00	15.00	50.00	99.00	100.00
p_{ADL}	55.51	7.12	34.00	50.50	55.25	65.25	76.75
$\tilde{p}_{ADL} - p_{ADL}$	-9.72	33.41	-72.50	-39.75	-9.50	38.75	59.00
$\tilde{p}_{NH}$	35.62	29.56	0.00	10.00	30.00	80.00	100.00
p_{NH}	25.58	11.20	5.50	15.75	24.25	41.50	52.25
$\tilde{p}_{NH} - p_{NH}$	10.04	31.95	-48.75	-16.50	6.75	56.50	92.50
$\tilde{\pi}$	70.13	27.44	0.00	50.00	75.00	100.00	100.00
π	64.97	11.86	6.25	57.50	66.12	79.25	87.50
$\tilde{\pi} - \pi$	5.16	27.31	-83.25	-10.25	9.50	35.50	93.75

Table 2: Descriptive Statistics on Subjective, Objective Risks and Misperceptions (in %). Variables with tilde refer to subjective responses while those without refer to objective risks (from COMPAS).

3.2 Probability of needing help for ADLs

Since 34.8% of our sample of 2000 respondents (i.e 697 respondents) declare not to know $\tilde{p}_{ADL}$, we start by assessing if the distribution of p_{ADL} is different between those who report a value for $\tilde{p}_{ADL}$ and those who do not. A Kolmogorov-Smirnov test rejects the assumption that both distributions are identical, at the 99% confidence interval.
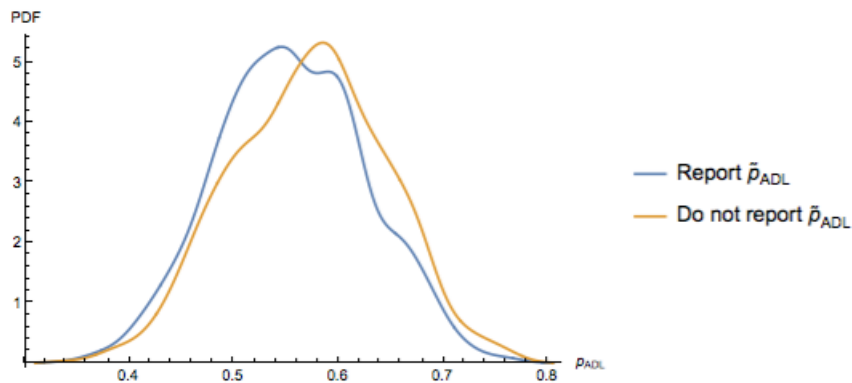

Figure 1: PDF of p_{ADL} depending on whether report to know or not their probability of needing ADL

The above figure shows that individuals who report not to know their probability of needing ADL have larger objective probabilities of needing help for ADLs, as the PDF of p_{ADL} for them is shifted to the right compared to the PDF of those who report a value for their subjective probability $\tilde{p}_{ADL}$. The difference in average values of p_{ADL} is significant at the 1% level, with an average value of p_{ADL} of 55.5% for those who report a value for $\tilde{p}_{ADL}$, and of 57.2% for those who do not.[7] Our first observation

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[7]A variance equivalence test cannot reject the assumption that variances are equal.

is then that agents who report not to know their LTC risk are indeed riskier (in the sense of having a larger probability of needing help for ADLs) than those who do report. We now concentrate on the 1303 respondents who have reported some value for $\tilde{p}_{ADL}$ (or 65.2% of the original sample).

The distributions of $\tilde{p}_{ADL}$ and p_{ADL} are statistically different, as established by a Kolmogorov Smirnov test (at 99% confidence level). We also reject the assumption that either the means or the variances of the distributions are the same, at the same level of confidence. In Figure 2 we report the CDF and histogram of p_{ADL} and $\tilde{p}_{ADL}$. We find that many more respondents think that their probability of needing help for ADLs is either very low, or very large, than it is the case in reality. Also, we can see that the subjective CDF is flatter than the real one, and that the subjective CDF crosses the objective one only once. The histogram confirms that there is much more heterogeneity in the subjective risk assessment than in the objective one. This is also apparent in Table 2, as both the range and the standard deviation of $\tilde{p}_{ADL}$ are much larger than those of p_{ADL}.
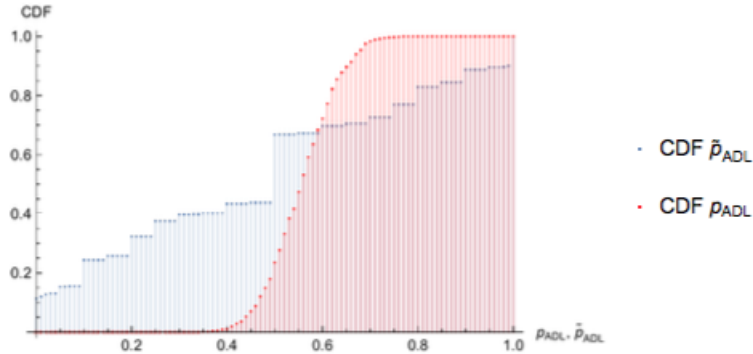
(a) CDF
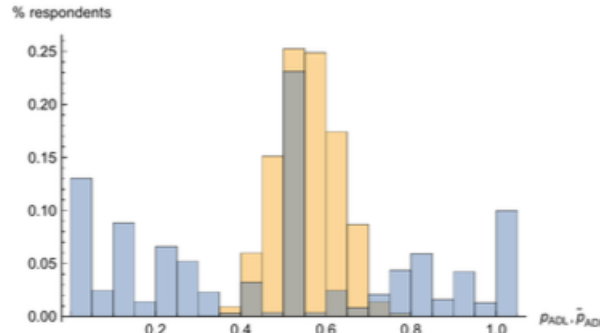
(b) Histogram

Figure 2: CDF and Histogram of objective and subjective probabilities of needing help for ADL

We then move to the distribution of mistakes that agents make when assessing their ADL risk, measured by $\tilde{p}_{ADL} - p_{ADL}$. Table 2 indicates that the average mistake made by survey respondents is quite small at -9.72% (measured as the average value of $\tilde{p}_{ADL} - p_{ADL}$). We then obtain that agents are,

9

on average, slightly optimistic, since they underestimate their probability of needing help for ADLs. We obtain similar values when looking at median mistakes. Figure 3 shows that there is a large heterogeneity among individuals in the mistakes made, with around 60% of the population who under-estimate their ADL risk. The density function is trimodal, with a first mode of very optimistic individuals (who under-estimate by around 50 percentage points their value of p_{ADL}), a second mode of (mostly) unbiased individuals, and a third mode of very pessimistic agents (who over-estimate their risk by around 40 percentage points).[8]
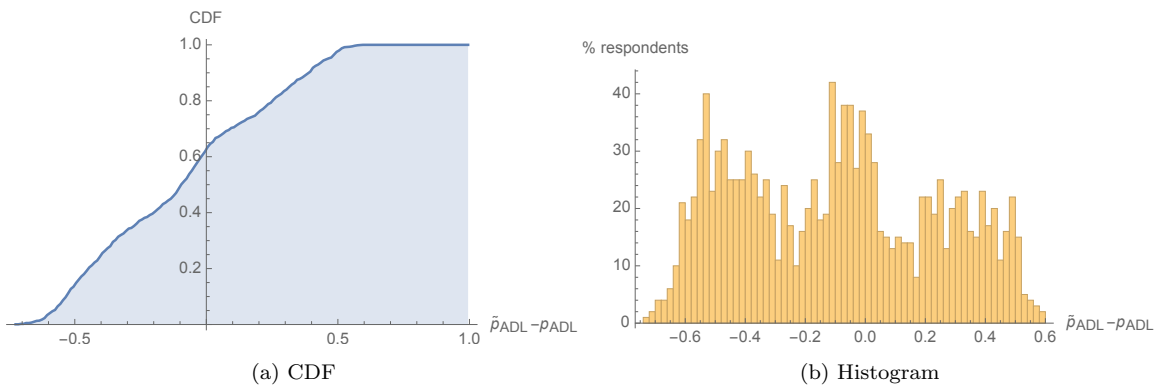

(a) CDF   (b) Histogram

Figure 3: CDF and Histogram of $(\tilde{p}_{ADL} - p_{ADL})$

We now check the link between subjective and objective probabilities, at the individual level. The correlation between $\tilde{p}_{ADL}$ and p_{ADL} is very low (but positive) at 0.025.[9]

The conclusion we draw from this section is that, although agents make a small mistake on average (less than 10 percentage points) when assessing their value of p_{ADL}, there is a large heterogeneity in the mistakes made, and very little relationship between $\tilde{p}_{ADL}$ and p_{ADL} at the individual level. This reminds us of the "wisdom of the crowd" effect: the average of guesses as to $\tilde{p}_{ADL}$ is close enough to the average value of p_{ADL}, but individuals seem to have very little correct knowledge about their own idiosyncratic value of p_{ADL}.

3.3 Probability of needing a stay in a nursing home

We denote by p_{NH} the objective (i.e., obtained through COMPAS) probability of staying in a nursing home at some point in the future, and by $\tilde{p}_{NH}$ the same probability as declared by the subject in the survey. Since 32% of our sample of 2000 respondents (i.e. 646 respondents) declare not to know their estimate of $\tilde{p}_{NH}$, we again start by comparing if the distribution of p_{NH} is different between those who report a value for $\tilde{p}_{NH}$ and those who do not. We obtain results similar to those obtained in the previous

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[8]This may be related to the distribution of $\tilde{p}_{ADL}$ having the same three modes.
[9]Note that regressing p_{ADL} over $\tilde{p}_{ADL}$, the regression coefficient is statistically not different from zero.

section, with the two distributions being significantly different from each other at the 99% confidence level, and with the average value of p_{NH} being significantly (same confidence level) larger (at 27.5%) for those who do not report $\tilde{p}_{NH}$ than for those who do (at 25.6%). Figure 4 below indeed shows that the distribution of p_{NH} of those who do not know its value is shifted to the right compared to the distribution of those who report $\tilde{p}_{NH}$.[10]
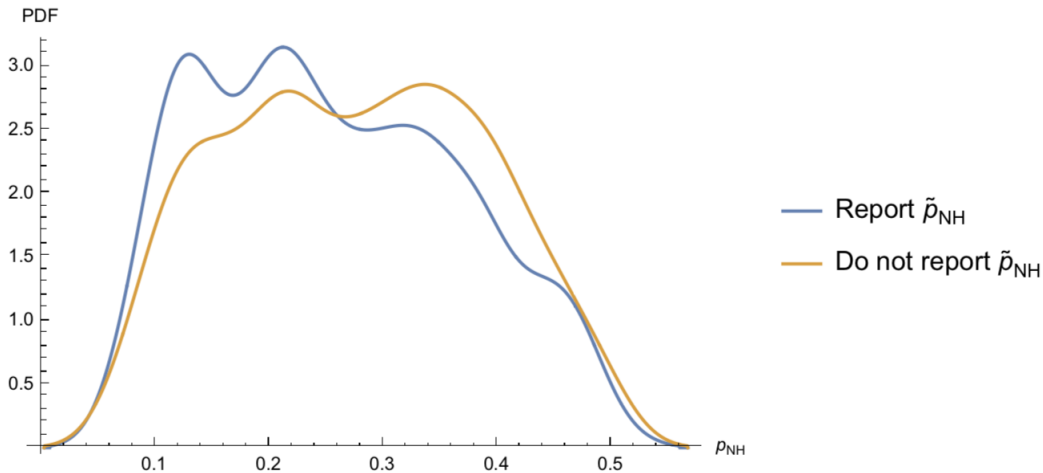

Figure 4: PDF of p_{NH} depending on whether report to know or not their probability of entering a nursing home

From now on, we concentrate on the subsample of respondents who have reported some value for $\tilde{p}_{NH}$. We obtain (using a Kolmogorov-Smirnov test with a 99% confidence level) that the distributions of $\tilde{p}_{NH}$ and p_{NH} are statistically different and we also reject the assumptions that either their means or variances are identical. Table 2 shows that the average subjective probability to enter a nursing home is higher than the objective one. We also observe a larger variance for the subjective probability than for the objective one. In Figure 5 we graph the CDF and the density (histogram) of p_{NH} and $\tilde{p}_{NH}$. We obtain results which are qualitatively similar to the ones we have obtained in the previous section: there are more people who think that their probability is either very low, or very high, than is the case in reality. There is more heterogeneity in the subjective assessment than in the objective one. The CDF curves cross only once.

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[10]We could not reject the assumption that variances are the same at the 99% confidence level.
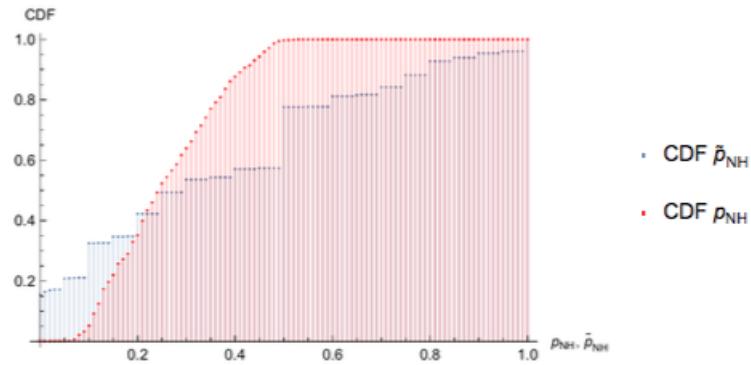
(a) CDF
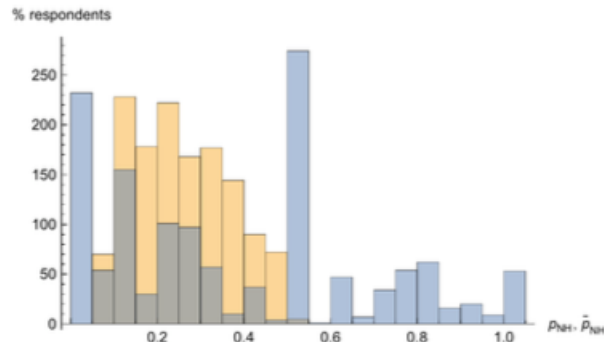
(b) Histogram

Figure 5: CDF and Histogram of subjective $\tilde{p}_{NH}$ and objective nursing home probability p_{NH}.

The main difference with the previous section is that individuals on average over-estimate their risk (i.e., they are pessimistic). More precisely, the average mistake $(\tilde{p}_{NH} - p_{NH})$ has about the same absolute value as for the ADL risk, but the opposite sign. The median mistake is smaller, but also positive as found in Table 2. In Figure 6, we find that around 60% of respondents are pessimistic regarding their probability of entering a nursing home.
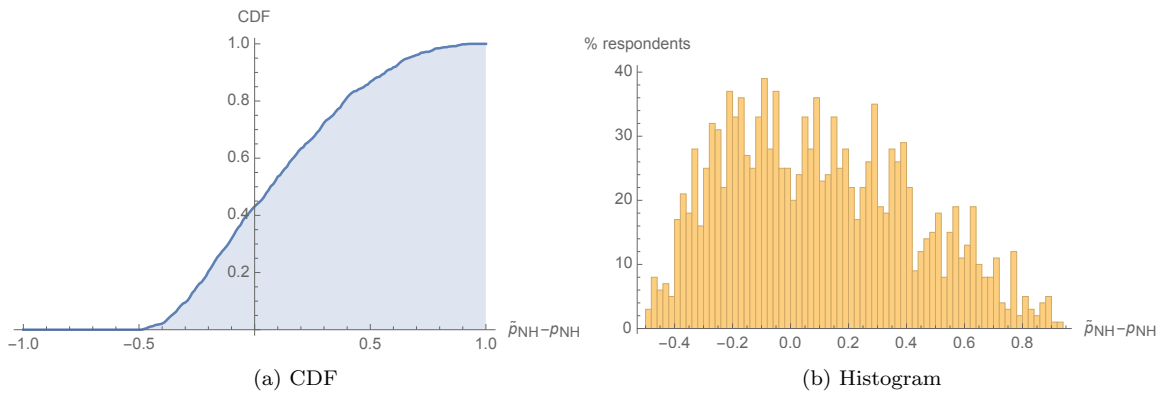

(a) CDF

(b) Histogram

Figure 6: CDF and Histogram of $\tilde{p}_{NH} - p_{NH}$.

Finally, we obtain that the correlation between subjective and real risks ($\tilde{p}_{NH}$ and p_{NH}) is very low at -0.033. Also in an (unreported) regression of p_{NH} over $\tilde{p}_{NH}$, we find that the coefficient of the regression line is non significantly different from zero. Our results can be related to Finkelstein and McGarry (2006) who find, using the U.S. Health and Retirement Study, a significant but very small relationship between individual prediction of nursing home and subsequent nursing home use (the dependent variable).[11]

So the conclusion of this section is that, as in the previous section, the average mistake is quite small (less than 10%), as in Finkelstein and McGarry (2006), and similar to the one made for ADL, but in the opposite direction. This would also imply that conditional on being dependent, respondents overestimate by a lot their probability to enter a nursing home, since they underestimate the probability of needing help with ADL but overestimate that of entering a nursing home. As in the previous section, there is a lot of heterogeneity in subjective risk, and basically no link, at the individual level, between subjective and objective risks.

3.4 Probability of living to 85 years old

Since 17% of our sample of 2000 respondents (i.e. 340 respondents) declare not to know their survival probability at age 85, we start by comparing if the distribution of π is different between those who report a value for $\tilde{\pi}$ and those who do not. Performing mean and variance difference tests, as well as a Kolmogorov-Smirnov test on the two distributions, we find that there is no statistical difference between the two distributions at a 99% confidence level.

Table 2 provides descriptive statistics on (objective and subjective) survival probabilities. The average objective survival probability is equal to 65% while its subjective counterpart is equal to 70%. In addition, we obtain that the distributions of $\tilde{\pi}$ and π are statistically different. Performing mean and variance difference tests, we reject the assumptions that the means and variances of $\tilde{\pi}$ and π are equal at the 99% confidence level. This is confirmed by a Kolmogorov-Smirnov test on the two distributions, which shows that the distributions are statistically different at the same confidence level.

In Figure 7, we report the CDF and density function (histogram) of π compared to $\tilde{\pi}$. We obtain results which are very similar to what we have obtained in the previous two sections: there is a lot more heterogeneity in the subjective assessment of the survival probability than in the objective one, with many more respondents believing they have either low, or high, probabilities to survive than it is the case in reality. The density function is thus much flatter for $\tilde{\pi}$ than for π, and the CDF of $\tilde{\pi}$ cuts once, from above the CDF for π.

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[11]The regression coefficient they obtain is equal to 0.091.The difference in significance between our studies may in part be explained by differences in sample sizes, as they have around 5000 observations.
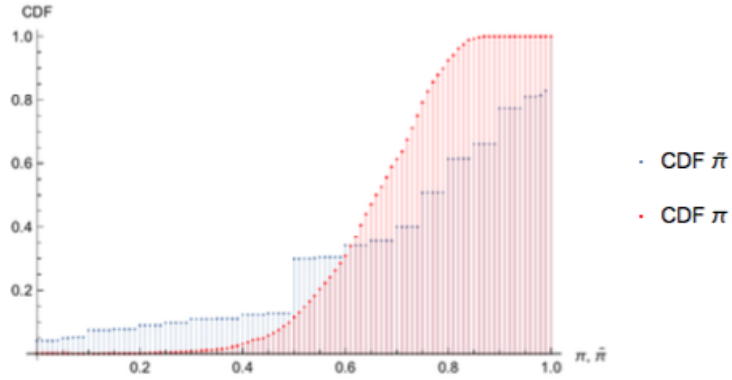
(a) CDF
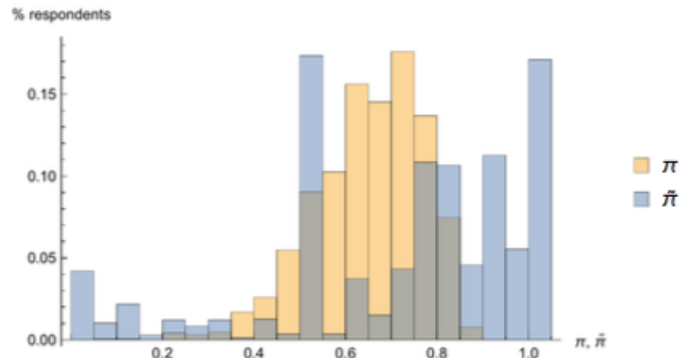
(b) Histogram

Figure 7: CDF and Histogram of subjective and COMPAS survival probability

We then move to the distribution of the mistakes, measured as $\tilde{\pi} - \pi$, made by survey respondents. Note that a positive (resp. negative) value of this difference denotes that the individual is optimistic (resp. pessimistic) regarding his survival probability. Table 2 shows that the average mistake is very small (at 5 percentage points) and positive, indicating that individuals are on average very mildly optimistic regarding their survival probability at 85. Figure 8 shows that more than 60% of our sample overestimate their probability of living to 85 years. We find a two mode distribution, with a first low mode around -0.5 (indicating agents who are very pessimistic, since they report a survival probability that is 50 percentage points lower than the objective one), and a larger mode around 0.3 for optimistic agents. The median error is positive and almost twice as large as the average error, reflecting the fact that the distribution of errors is negatively queued.
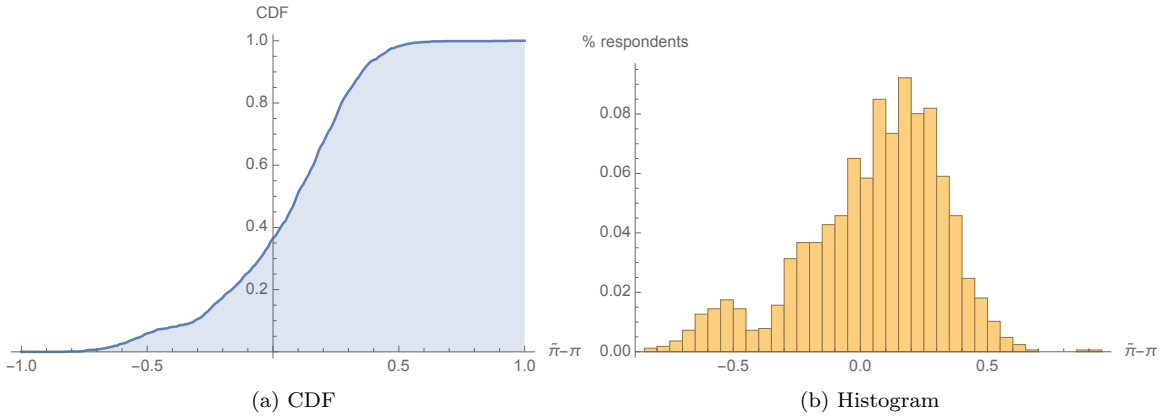
(a) CDF   (b) Histogram

Figure 8: CDF and Histogram of $\tilde{\pi} - \pi$

We obtain a much higher coefficient of correlation (at 0.23) between $\tilde{\pi}$ and π than between either $\tilde{p}_{ADL}$ and p_{ADL}, or between $\tilde{p}_{NH}$ and p_{NH}. The regression line yields a coefficient estimate of 0.098 which is statistically significant (p-value close to 0). Survey respondents then seem to be better informed about their idiosyncratic survival risk than about their LTC (whether ADL or, especially, NH) risks. This may in part explain why the demand for LTCI insurance is low while the demand for life insurance products, which is related to longevity, is much higher.

So, to summarize the results obtained so far, we observe first that respondents who report not to know their LTC risk are riskier than those who do (in the sense that the probability distribution of needing either informal or formal help is shifted to the right for those who report not to know these probabilities). By contrast, we do not observe such significant differences when asking respondents about their probability to live to 85 years old. We then show that survey respondents make quite small average mistakes when assessing their risk, with the average mistake being twice as large for LTC (whether ADL or nursing home, at around 10 percentage points) than for survival (at 5 percentage points). There is a lot more heterogeneity in subjective estimates of risks than in their objective value (obtained with COMPAS), with many more people estimating that they have either a low or a high risk than is the case in reality. Survey agents are on average optimistic for ADL ($\tilde{p}_{ADL} < p_{ADL}$) and for their survival probability ($\tilde{\pi} > \pi$), and pessimistic for their need of a nursing home ($\tilde{p}_{NH} > p_{NH}$). There is little correlation at the individual level between subjective and objective measures of risk, except for survival. Finally, survey participants seem to be better informed about their survival probability than about their LTC risks: (i) fewer respondents answer that they don't know their value of π, as compared to p_{ADL} and p_{NH}, (ii) the average mistake for π is half what it is for p_{ADL} and for p_{NH}, and (iii) the correlation between subjective and objective probabilities is much higher for the survival probability than for LTC risks.

We now study the links between, on the one hand, p_{ADL} and, on the other hand, either p_{NH} or π.

3.5 Link between ADL risk and survival probability

For this section, we restrict the sample to survey respondents who have reported a value for both p_{ADL} and for π, namely 1255 individuals among the 2000 interviewed. Figure 10 reports a scatterplot of the values of (p_{ADL}, π) for these individuals, namely the objective probabilities obtained from COMPAS, as well the regression line between the two. Note that the sign of the relationship between p_{ADL} and π is a priori ambiguous: on the one hand, a bad current health state of the respondent may mean both a larger probability of LTC and a low survival probability at 85 while, on the other hand, it is well known that dependency strikes often at old ages, so that agents with a larger life expectancy (and value of π) may be more at risk of needing LTC during their life. From Figure 10, we obtain that the second factor is more important among our survey respondents, with a correlation of 0.2 between p_{ADL} and π. This is confirmed by the regression line in panel (a) of Figure 10 where the regression coefficient is significant and equal to 0.33 (p-value close to 0).

(a) π and p_{ADL}

(b) $\tilde{\pi}$ and $\tilde{p}_{ADL}$

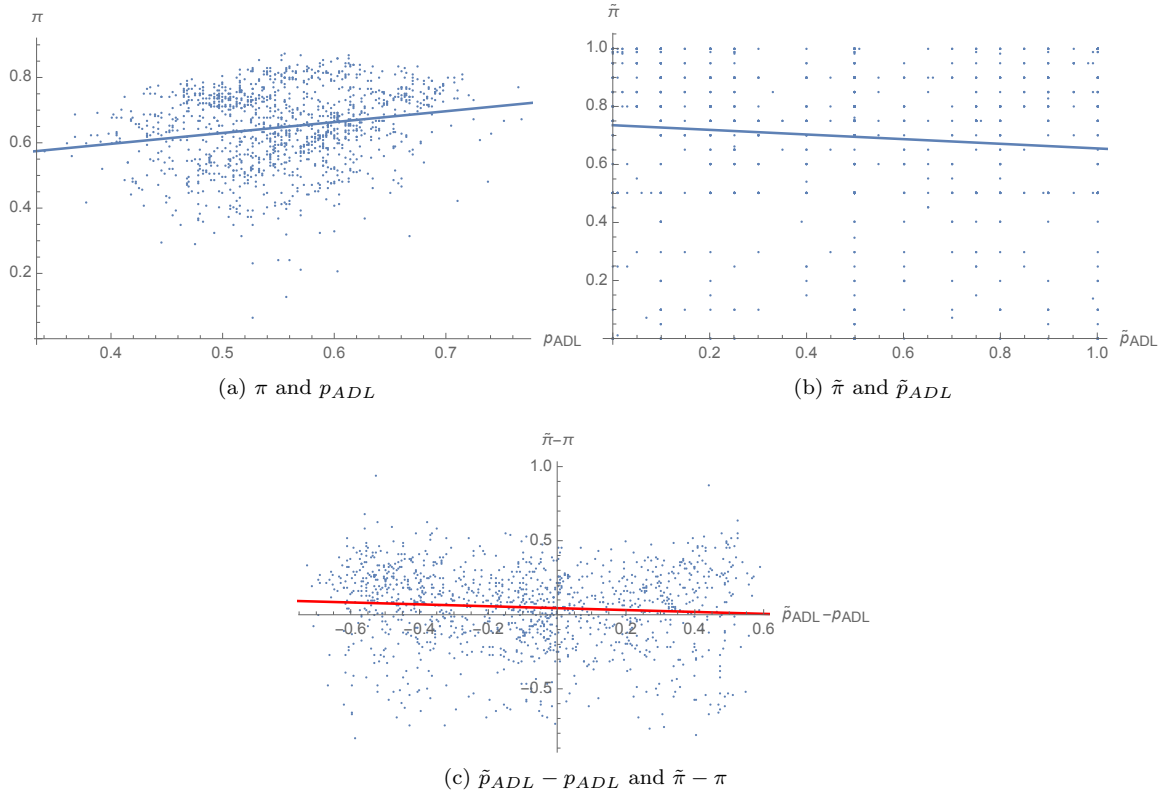(c) $\tilde{p}_{ADL} - p_{ADL}$ and $\tilde{\pi} - \pi$

Figure 9: Relationship between Survival and ADL risk

We now move in panel (b) of Figure 10 to the correlation between the subjective values $\tilde{p}_{ADL}$ and

$\tilde{\pi}$. Here, the correlation between the two is (slightly) negative, at -0.1, and the slope of the regression line is significant and equal to -0.08 (with a p-value close to 0). This negative correlation suggests that the first explanation given above for the link between longevity and probability of becoming dependent (namely that current health status drives both estimates) is more prevalent than the second one (a larger life expectancy means a larger chance of becoming dependent at some point) when agents report their estimates.

Finally, we look at the joint distribution of the mistake made in estimating the ADL risk ($\tilde{p}_{ADL} - p_{ADL}$) and the survival risk ($\tilde{\pi} - \pi$) in panel (c) of Figure 10. We obtain a slightly negative correlation between the two, at -0.08, meaning that optimism in terms of survival probably goes in hand with optimism in the ADL dimension. Table 3 tabulates the fraction of respondents in all four quadrants. Focusing first on each dimension separately, we obtain that the same proportion of 63% of respondents is optimistic regarding their need for help in ADLs, and regarding their longevity. As for the joint distribution of biases, a plurality (40%) of respondents is optimistic on both dimensions, and only 14% of respondents are pessimistic on both dimensions. This being said, close to half of the respondents (46%) is optimistic on one dimension and pessimistic on the other. Interestingly, we obtain the same proportion of agents in the upper left and bottom right cells of Table 3.

	$\tilde{\pi} - \pi > 0$	$\tilde{\pi} - \pi < 0$
$\tilde{p}_{ADL} - p_{ADL} > 0$	292 (23%)	178 (14%)
$\tilde{p}_{ADL} - p_{ADL} < 0$	497 (40%)	288 (23%)

Table 3: Number of individuals in each quadrant (Total number of respondents= 1255).

To summarize this subsection, we obtain a (slightly) positive correlation between objective measures of LTC risk (p_{ADL}) and of longevity (π) consistent with older agents having a higher LTC risk, but a (slightly) negative correlation between those two subjective measures, consistent with the hypothesis that the current subjective health status of the respondent drives his/her answers on both dimensions. The correlation between errors in the two dimensions (namely between $\tilde{p}_{ADL} - p_{ADL}$ and $\tilde{\pi} - \pi$) is (slightly) negative, with a plurality of respondents being optimistic on both dimensions, although close to half of respondents are optimistic on one dimension, and pessimistic on the other.

3.6 Link between ADL risk and nursing home risk

This subsection concentrates on the 1159 respondents who have declared to know both their probability of entering a nursing home, $\tilde{p}_{NH}$, and of needing help for at least one ADL, $\tilde{p}_{ADL}$. Panel (a) of Figure

10 shows that there is a very large and positive (at 0.77) correlation between objective probabilities of needing help for ADL and of entering a nursing home, with the slope of the regression line being large and significant at 1.23 (with p-value close to 0). Moreover, observe that $p_{ADL} > p_{NH}$ for all respondents, which is intuitive since needing help for ADLs is a prerequisite to entering a nursing home.

(a) p_{NH} and p_{ADL}

(b) $\tilde{p}_{NH}$ and $\tilde{p}_{ADL}$

(c) $\tilde{p}_{NH} - p_{NH}$ and $\tilde{p}_{ADL} - p_{ADL}$
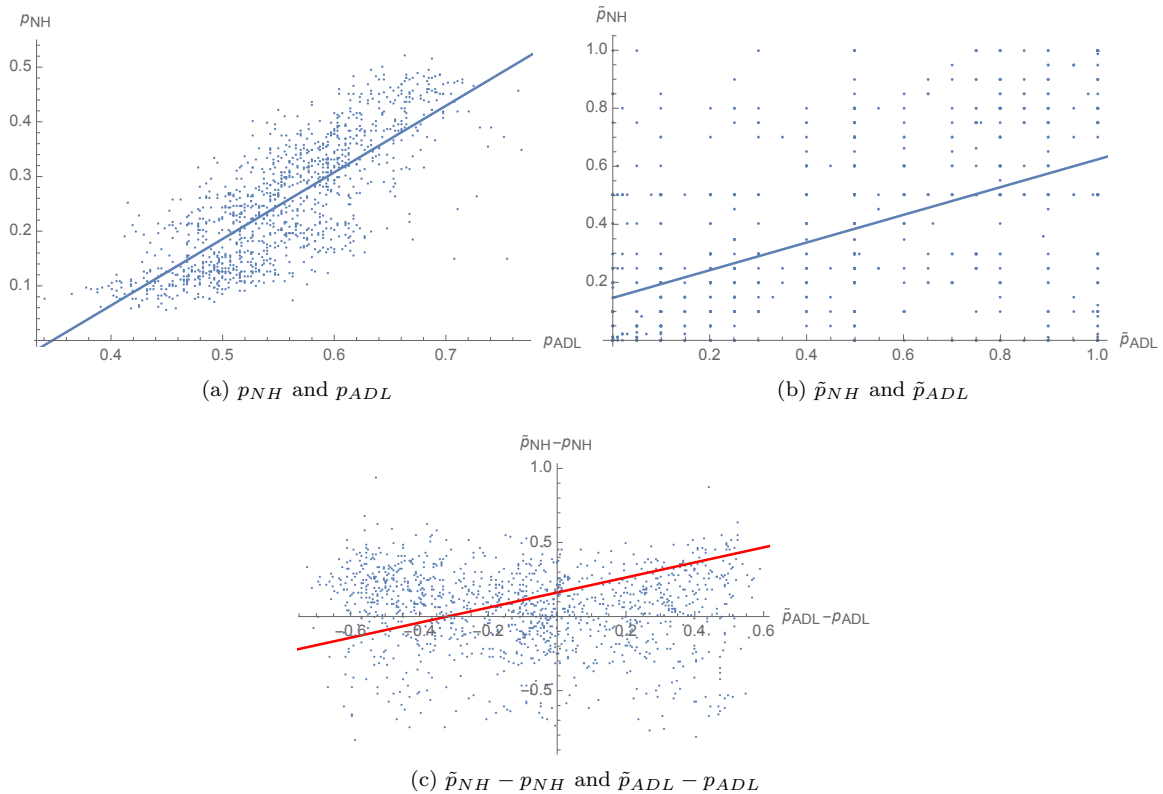
Figure 10: Relationship between Nursing Home and ADL risk

Panel (b) of Figure 10 shows that the correlation between subjective measures of risk $\tilde{p}_{ADL}$ and $\tilde{p}_{NH}$ is also strong and positive, although smaller than for objective risks at 0.52 (the slope of the regression line is also significant, at 0.48 with a p-value close to 0). Also, we find that a significant proportion of respondents (24.33%) declare $\tilde{p}_{NH} > \tilde{p}_{ADL}$. These agents seem to misunderstand that being dependent is a necessary condition to be accepted in a nursing home.

Turning to the joint distribution of mistakes made on the two dimensions (namely $\tilde{p}_{ADL} - p_{ADL}$ and $\tilde{p}_{NH} - p_{NH}$), panel (c) of Figure 10 shows that there exists a strong and positive (at 0.53) correlation between the two, with the slope of the regression line being significant and equal to 0.51 (p-value close to 0). Table 4 shows that 58% of respondents are pessimistic regarding their probability of needing a nursing home, while only 37% are pessimistic concerning their probability of needing help for ADLs. Table 4 also shows that few agents are pessimistic for ADLs and optimistic for NH (a mere 8% of the subsample), but

that the other three cases are nearly equally populated.

	$\tilde{p}_{NH} - p_{NH} > 0$	$\tilde{p}_{NH} - p_{NH} < 0$
$\tilde{p}_{ADL} - p_{ADL} > 0$	337 (29%)	95 (8%)
$\tilde{p}_{ADL} - p_{ADL} < 0$	336 (29%)	391 (34%)

Table 4: Number of individuals in each quadrant (Total number of respondents= 1159)

To conclude, this section finds a strong positive correlation between the probability of entering a nursing home and that of needing help for an ADL at some point in life. This correlation is however stronger in reality than what agents anticipate.

4 Individual determinants of misperceptions

We use multivariate regression analyses to relate the survey respondents' misperception of the risk they face with their personal characteristics. In Table 5, we run three regressions to explain the misperception in the probability of living with an ADL ($\tilde{p}_{ADL} - p_{ADL}$), in the probability of ever living in a nursing home ($\tilde{p}_{NH} - p_{NH}$), and in the probability of living to be 85 ($\tilde{\pi} - \pi$). We explain these errors based on a host of different variables. First, we control for age, gender, marital status, province of residence, education and the number of children in the household. Second, we include the log of total household income, savings and whether or not the respondent is a homeowner and whether he has life insurance. We also control for whether he has an employer pension and whether that pension is a defined benefit pension. Finally, we control for preference proxies for bequest motives, family values (family should care for member when sick), preference for formal care over informal care.

	(1)	(2)	(3)
	$\tilde{p}_{ADL} - p_{ADL}$	$\tilde{p}_{NH} - p_{NH}$	$\tilde{\pi} - \pi$
age	.27	-.0397	.343***
	(.166)	(.154)	(.119)
quebec	-12.4***	-5.8***	6.12***
	(1.86)	(1.7)	(1.35)
female	-4.92***	-10.1***	-4.97***
	(1.89)	(1.78)	(1.37)
married	4.18*	.341	-.606
	(2.16)	(2.02)	(1.57)
high school	-2.21	1.53	-3.64
	(6.32)	(5.42)	(4.84)
college	-.59	8.28	-10.3**
	(6.25)	(5.41)	(4.8)
n kids	-1.53**	-.979	.652
	(.754)	(.682)	(.553)
log hh income	-.819	.555	.464
	(.763)	(.698)	(.536)
log savings	.108	.748***	.0469
	(.26)	(.234)	(.194)
number health conditions	1.01	1.92*	-1.62
	(1.17)	(1.04)	(1.01)
owner	-4	-2.44	2.13
	(2.51)	(2.39)	(1.89)
bequest motive	8.02***	.988	-2.81*
	(2.17)	(2.01)	(1.67)
family should care	-1.52	-1.16	.534
	(1.98)	(1.88)	(1.39)
pref. formal care	1.86	8.23***	-1.05
	(1.9)	(1.75)	(1.36)
has life insurance	.247	-.684	.334
	(2.13)	(1.94)	(1.5)
smoked at least 100 cigarettes	3.05	1.86	5.88***
	(1.87)	(1.75)	(1.35)
has employer pension	-4.69*	-3.73	5.68***
	(2.81)	(2.57)	(1.99)
employer pension DB	4.21	4.95**	-1.58
	(2.73)	(2.52)	(1.9)
N	1303	1354	1660
r2	.0683	.0916	.0708

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Regression estimates of deviation from objective risk on characteristics: Missing values are excluded and standard errors are robust to heteroscedasticity.

For ADL and nursing home risk, optimism is defined as reporting a lower probability than the objective assessment. For survival, optimism refers to reporting a higher subjective survival probability compared to the objective risk computed from COMPAS. We obtain that women are more optimistic than men regarding their LTC risk (both for ADL and for nursing homes), but more pessimistic regarding their probability of reaching 85 years old. Residents of Quebec are more optimistic than those of Ontario regarding all 3 risk dimensions. More educated respondents are more pessimistic regarding survival risk. Those who report having a bequest motive (willing to sacrifice current comfort to leave money for kids)

are more pessimistic regarding ADLs and survival risk. Those who have smoked are more optimistic regarding their survival prospects, with a similar association for those who have an employer pension. It is important to note that although several characteristics are associated with misperceptions, the explanatory power of these characteristics is low. Overall, a small fraction of the observed variation in misperceptions is explained by observables.

In Table 6, we report the determinants of the probability of not knowing the risk of ADL (column 1), of nursing home (column 2) and of survival to age 85 (column 3). Those living in Quebec as well as women are less likely to know the risks of having ADL and of staying in a nursing home. Interestingly, several variables capturing preferences for care are correlated with not knowing these risks. First, those who think the family should take care of elderly parents are more likely to report these risks. Second, those who report having a preference for formal care are also more likely to report those risks. Finally, respondents reporting a better health condition (i.e. the number of health conditions decreases) are more likely not to know their ADL and their nursing home probabilities. Except for these preference variables, there is again no clear pattern that explains knowing about these risks better, independently of the risk considered.

	(1)	(2)	(3)
	$\tilde{p}_{ADL}$	$\tilde{p}_{NH}$	$\tilde{\pi}$
age	-.000763	.000566	-.00245
	(.00194)	(.00194)	(.00153)
quebec	.0802***	.0757***	.0172
	(.0217)	(.0213)	(.017)
female	.0693***	.0548***	.0228
	(.0218)	(.0212)	(.0178)
married	-.00107	-.00772	.00765
	(.025)	(.0247)	(.0209)
high school	.0266	-.0324	-.0287
	(.0585)	(.0605)	(.0539)
college	-.0475	-.115*	-.0684
	(.0579)	(.0599)	(.0531)
n kids	.011	.00063	.0018
	(.00829)	(.00866)	(.00805)
log hh income	-.00842	-.00513	-.0105
	(.00852)	(.00828)	(.00721)
log savings	.00785***	.000404	.000703
	(.00287)	(.00297)	(.0024)
number health conditions	-.042***	-.0323***	-.0044
	(.0125)	(.0123)	(.0104)
owner	-.0229	-.0299	-.0318
	(.0292)	(.0291)	(.0246)
bequest motive	.00161	.00287	.00613
	(.0252)	(.0248)	(.0203)
family should care	-.0594***	-.0777***	-.0338*
	(.0224)	(.0223)	(.018)
pref. formal care	-.118***	-.105***	-.0793***
	(.0217)	(.0212)	(.0176)
has life insurance	-.0184	-.0327	-.028
	(.024)	(.0235)	(.0196)
smoked at least 100 cigarettes	-.0278	-.0518**	-.0232
	(.022)	(.0216)	(.0176)
has employer pension	-.0315	-.0217	-.0267
	(.0319)	(.0311)	(.0255)
employer pension DB	-.013	-.0354	-.00104
	(.0316)	(.0308)	(.0246)
N	2000	2000	2000
r2	.0468	.0486	.0275

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Regression estimates of probability of not knowing risk: OLS estimates with standard errors robust to heteroscedasticity.

5   LTC risk misperceptions and insurance

We have shown that substantial variation in misperceptions exists. But if that variation is unrelated to insurance demand, it has little relevance for understanding what drives the LTCI puzzle or more generally the demand for these products. To assess the relationship between misperceptions and LTCI demand we use three regressions. First, given that demand is low for these products, we look at what we call "intentions". To do so, as explained in Section 2.1, we presented respondents with 5 possible contracts

where we varied exogenously both benefits and premiums and, we asked them about the probability they would purchase such LTCI products. The text of these questions can be found in the appendix (section 5). From their responses, we are able to construct a measure of intentions using the average of these choice probabilities over the 5 scenarios (see Boyer et al., 2017 for details on these scenarios). The average intention is 22% which is much larger than actual LTCI take-up rate (from 2 to 12%). In Table 7, we report in column 1 results from a regression of the average of those intentions on risks, controlling for the same set of characteristics as in Table 6 as well as for objective risk. We find that misperceptions are strongly correlated with intentions. A 10 percentage point increase in misperception of ADL risk increases demand by 0.6 percentage point, by 0.8 percentage point for nursing home risk and by 0.5 percentage point for survival risk. These effects are sizeable although they cannot explain why take-up of LTCI is low at the aggregate level. Indeed, we found in Table 2 that the average misperception of ADL risk is -9.72%, 10.04% for nursing home risk and 5.16% for survival risk so that the combined effect of these risks would raise demand by only 0.47 percentage points. This is mostly due to the fact that both nursing home and survival risk misperceptions are actually favorable to LTCI demand but it is almost quite entirely compensated by the underestimation of the ADL risk. Hence, although at the aggregate level, risk misperceptions cannot explain intentions to purchase LTCI, there is a strong relationship at the individual level between intentions and misperceptions.

In column 2 (resp. column 3) of Table 7, we report similar regressions for the probability of purchasing LTCI including both probable and doubtful coverage, i.e. 12% of our respondents (resp. including only those with probable coverage, i.e. 2% of our respondents). We scale coefficients so that they can be compared to those in column 1 (multiplied by 100). Using all those who report LTCI coverage, we find that both ADL and survival misperceptions are uncorrelated with demand. For nursing home risk, we find that misperceptions are negatively associated with LTCI demand. One possible explanation is that, since nursing home risk is better covered than formal care at home in Canada, conditional on risk, those who overestimate nursing home risk may prefer not to purchase LTCI.[12] In column 3, we find that restricting the definition of coverage to those with probable coverage only has a sizeable effect on the relationship between ADL misperceptions and demand. The effect is about half that of intentions (for a 10 percentage point increase in ADL misperception, a 0.3 percentage point increase in the probability of demanding insurance). We find again a negative relationship between nursing home misperceptions and demand but no relationship with survival risk.

Overall, we find strong evidence that ADL misperceptions are associated with higher LTCI demand

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[12]For instance, in Quebec, the out-of-pocket cost of a public nursing home (CHSLD) is 20,000CAD a year at maximum. This amount is conditional on the individual resources and could even be reduced to zero.

but conflicting evidence for nursing home risk when using intentions and actual purchase.

Finally, it is also interesting to highlight the role of awareness about these risks in shaping the intentions to purchase or in the actual purchase of LTCI products. For instance, not knowing the probability to have ADL is a strong predictor for having no intention to buy LTCI (the associated coefficient in column 1 is significant and equal to -3.65). Since in our sample, almost 35% of respondents declared not to know this risk, informing them about it would translate into an increase of 1.27% in the intentions to buy LTCI. In the same way, not knowing the risk of entering a nursing home decreases the probability that respondents have LTCI. The coefficient associated with not knowing this nursing home probability in the third column is significant and equal to -2.14. Hence, since 32% of our respondents declared not to know that probability, we can infer that informing them about this risk would increase demand by 0.64%. Again, although at the individual level this effect is important, at the aggregate level, it seems quite limited.

	(1)	(2)	(3)
	Intentions	Purchase (All)	Purchase (Probable)
$\tilde{p}_{ADL} - p_{ADL}$	.0645***	-.0139	.0295**
	(.0241)	(.0318)	(.0145)
$\tilde{p}_{NH} - p_{NH}$	.0823***	-.105***	-.0338**
	(.0258)	(.034)	(.0153)
$\tilde{\pi} - \pi$	.053**	-.0155	-.000675
	(.0235)	(.031)	(.014)
$\tilde{p}_{ADL}$ unknown	-3.65**	.283	-1.29
	(1.62)	(2.14)	(.966)
$\tilde{p}_{NH}$ unknown	-.567	-2.23	-2.14**
	(1.61)	(2.13)	(.969)
$\tilde{\pi}$ unknown	-2.36	1.53	1.6
	(1.78)	(2.35)	(1.07)
p_{ADL}	.232	.00292	-.00479
	(.173)	(.228)	(.104)
p_{NH}	-.0142	.0503	-.0385
	(.0975)	(.129)	(.0583)
π	.307***	-.00249	-.117*
	(.107)	(.141)	(.0631)
N	1819	1819	1635
r2	.0964	.0585	.0297

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Regression estimates of intentions and actual purchase decisions on misperceptions

6 Conclusion

One of the many explanations often mentioned for the lack of LTCI is related to individual misperceptions of the LTC risks. Although there are some theoretical papers on how risk misperceptions could explain the

low-demand for LTCI products, the empirical literature on this topic is still quite scarce. One exception is Finkelstein and Mc Garry (2006) who compare the *average* subjective risk of entering a nursing home with its actual *average* realization five years later.

Using both survey questions asked to 2000 Canadian respondents and the health microsimulation model COMPAS, this paper fills this gap by first exploring three types of risk misperceptions (the probability of needing help in performing ADL, the probability of entering a nursing home and the probability to reach the age of 85 years old) which may impact differently the demand for LTCI. Rather than concentrating exclusively on average risk misperceptions in the economy, we give a detailed description of the distributions of these risks, of how they relate to personal characteristics and to the actual purchase of LTCI.

We draw the following conclusions. First, respondents who report not to know their LTC risk are riskier than those who do. Second, while survey respondents make quite small average mistakes when assessing their risk, there is a lot more variance in subjective estimates of risks than in their objective values at the individual level. Survey respondents are on average optimistic for needing help with ADL and for their survival probability but pessimistic about their need of a nursing home. Third, the correlation at the individual level between subjective and objective measures of risk (except for survival) is low, indicating that people have difficulties estimating their own LTC risk. Fourth, we obtain a (slightly) positive correlation between objective measures of LTC risk and of longevity consistent with older agents having a higher LTC risk, but a (slightly) negative correlation between those two subjective measures, consistent with the hypothesis that the current subjective health status of the respondent drives his/her answers on both dimensions. We also find a strong positive correlation between the probability of entering a nursing home and that of having one ADL or more at some point in life. This correlation is however stronger in reality than what agents anticipate.

We then relate risk misperceptions to personal characteristics. We find that women are more optimistic regarding their LTC risks but more pessimistic regarding survival to age 85. People from Quebec are more optimistic on all the three dimensions. College educated individuals are more pessimistic regarding survival. Respondents willing to leave a bequest are more pessimistic regarding all the three risks. All in all, there is no consistent pattern over all three risks.

Finally, we relate risk misperceptions to intentions to purchase LTCI and to the actual purchase of such a product. Accounting for personal covariates, we find that agents who are more pessimistic with respect to their probability of needing help in ADL are more likely to have a LTCI (both intentions and actual purchase). In addition, awareness of these risks plays an important role at the individual level since not knowing the ADL risk decreases the intentions to purchase and, not knowing the nursing home

risk decreases actual purchase. However, at the aggregate level, the predictive power of both pessimism and awareness in explaining whether agents hold LTCI is quite low.

Hence, coming back to our original question of whether LTC and survival risk misperceptions could explain the LTCI puzzle, our study suggests that misperceptions (and awareness) of these risks are only one explanation among many others. Indeed, subjects make systematic mistakes when assessing their LTC risks (even if the average mistake is small), but these mistakes are far from being always in the direction of optimism, and optimism does not seem to explain why people do not have LTCI: we find that the predictive power of misperception bias even if significant, plays a limited role in the decision to hold LTCI at the aggregate level.

Nonetheless, our study highlights that governments and insurers should better inform individuals about both their own LTC risks. This is in their own interest. On the government side, this would lower the financial pressure due to ageing. On the insurer side, it would open avenues for new financial products. Such measures (like advertisement campaigns, online calculators of one's LTC risk) can be done at relatively small costs.

Finally, our study is a first step toward understanding better risk correlations and therefore how financial products, such as life insurance, annuity and LTCI, could be bundled to increase demand for such products and ultimately for LTCI. Simply looking at the cross correlations of objective, subjective probabilities as well as at the cross correlations between errors, there is a priori no easy answer on how these products should be designed. Going deeper into the comprehension of these mechanisms is on our research agenda.

A   Questionnaire

Long-Term Care Insurance Survey (Paper Version of Questionnaire for Internet Survey)

Introduction

For purposes of this survey, when we use the term 'long-term care,' we are referring to assistance with personal care needs such as dressing, bathing, getting in and out of bed, using the bathroom or eating. A long-term care home or assisted living facility refers to a facility that offers board, meals and other basic care services for persons who need long-term care. The facility also offers medical services. It is therefore distinct from a retirement home, where no or limited care is offered.

Section 1: Long-Term Care Insurance

Q1 This survey is going to ask you questions about long-term care insurance. Which of the following best describes your current knowledge about this type of insurance?
1 A lot
2 A little
3 None at all

Q2 For purposes of this survey, we define long-term care insurance as a type of insurance that helps to pay for extended stays in a long-term care home or assisted living facility, or for personal or medical care in your home. It is typically separate from your health insurance and requires paying separate premiums. Do you have a long-term care insurance policy?
1 Yes
2 No
3 Don't Know

IF Q2==3 (Don't know) GOTO Q6
ELSE IF Q2==2 (No)
       Q3a Why don't you have a long-term care insurance policy? Choose the main reason.
       1 I have never thought about buying one, and I have never been offered one (for instance by a financial advisor).
       2 I have thought about buying one, but I have not (yet) made a decision.
       3 I used to have such a policy, but I let it lapse.
       4 Such insurance policies are too expensive for me.
       5 Such insurance policies do not cover my needs.
       6 I do not think I will need such a policy.
       7 I don't know what that is.
       8 Other, open...
       GOTO Q6
ELSE IF Q2==1 (Yes)
       Q3b How did you come to purchase that insurance policy?
       1 I was offered a long-term care policy
       2 I searched myself for a long-term care policy
       3 Other, open …

       Q4 What is the monthly premium on that policy, including taxes?
       Numeric
       9999 Don't know

IF Q4==9999
      Q4a Is it more than $200 1 Yes 2 No 8888888 Refuse to answer
      IF Q4a==1
            Q4b Is it less than $400 1 Yes 2 No 8888888 Refuse to answer
      ELSE IF Q4a==2
            Q4c Is it more than $100 1 Yes 2 No 8888888 Refuse to answer
      END IF
END IF
Q5 What is the amount of the benefit the insurance would pay out (monthly)?
Numeric
9999 Don't know
IF Q5==9999
      Q5a Is it more than $2,500 1 Yes 2 No 8888888 Refuse to answer
      IF Q5a==1
            Q5b Is it less than $3,500 1 Yes 2 No 8888888 Refuse to answer
      ELSE IF Q5a==2
            Q5c Is it more than $1,500 1 Yes 2 No 8888888 Refuse to answer
      END IF
      END IF
END IF

Q6 Do you have life insurance for which you currently pay a premium (or that is in force)?
1 Yes
2 No
3 Don't Know

Section 2: Background

Q7 At the present time, do you smoke cigarettes daily, occasionally or not at all?
1 Daily
2 Occasionally
3 Not at all
IF Q7==1 GOTO Q8
ELSE IF Q7==2,3
      Q7a Have you ever smoked cigarettes daily?
      1 Yes
      2 No
      IF Q7a==1 GOTO Q8
      ELSE IF Q7a==2
            Q7b Have you smoked 100 cigarettes or more in your life?
            1 Yes
            2 No
            IF Q7b==1 GOTO Q8
            ELSE IF Q7b==2
                  Q7c Have you ever smoked a whole cigarette?
                  1 Yes
                  2 No

END IF
            END IF
END IF

Q8 What is the highest degree, certificate or diploma you have obtained?
1 Less than high school diploma or its equivalent
2 High school diploma or a high school equivalency certificate
3 Trade certificate or diploma
4 College, CEGEP or other non-university certificate or diploma (other than trades certificates or diplomas)
5 University certificate or diploma below the bachelor's level
6 Bachelor's degree (e.g. B.A., B.Sc., LL.B.)
7 University certificate, diploma, degree above the bachelor's level

Q9 What is your marital status?
1 married
2 living common-law
3 widowed
4 separated
5 divorced
6 single, never married

Q10 Do you have children?
1 Yes
2 No
IF Q10==1
        Q10a How many children do you have?
        Numeric (>0)
END IF

Q11 For 2016, what is your best estimate of the total income received by all members of your household, from all sources, before taxes and deductions?
Numeric
9999999 Don't know or prefer not to say
IF Q11==9999999
        Q11a Is it more than $60,000 1 Yes 2 No 8888888 Refuse to answer
        IF Q11a==1
                Q11b Is it less than $120,000 1 Yes 2 No 8888888 Refuse to answer
        ELSE IF Q11a==2
                Q11c Is it more than $30,000 1 Yes 2 No 8888888 Refuse to answer
        END IF
END IF

Q12 Do you consider yourself retired?
1 Yes
2 No
IF Q12==2

Q12a What is your best estimate of what total income received by all members of your household will be once you are fully retired, as a fraction of your current income?
Numeric (0%-200%)
9999999 Don't know
IF Q12a==9999999

       Q12b Is it more than 50%? 1 Yes 2 No 8888888 Refuse to answer
       IF Q12b==1

              Q12c Is it less than 75%? Yes 2 No 8888888 Refuse to answer
       ELSE IF Q12b==2

              Q12d Is it more than 25%? 1 Yes 2 No 8888888 Refuse to answer
       END IF
       END IF
END IF

Q13 Do you own your primary residence?
1 Yes
2 No

IF Q13==1

       Q13a What is the current market value of your residence?
       Numeric
       9999999 Don't know
       IF Q13a==9999999

              Q13b Is it more than $300,000? 1 Yes 2 No 8888888 Refuse to answer
              IF Q13b==1

                     Q13c Is it less than $600,000? 1 Yes 2 No 8888888 Refuse to answer
              ELSE IF Q13a==2

                     Q13d Is it more than $150,000? 1 Yes 2 No 8888888 Refuse to answer
              END IF
       END IF

       Q14 How much do you still carry as a mortgage, as a proportion of the current market value of your residence?
       1 Less than 20%
       2 Between 20 and 40%
       3 Between 40 and 60%
       4 More than 60%
       5 Don't know
END IF

Q15 – We are interested in your pension plan and its nature, if you have one. Do you currently contribute to, or receive benefits from, an employer provided pension plan?
1 Yes
2 No
3 Don't Know

IF Q15==1

       Q15a Is your pension plan a defined-benefit or a defined-contribution plan? A defined-benefit plan is one where you receive fixed income in retirement for as long as you live and you don't

get to decide how much is contributed and how it is invested. A defined contribution plan is one where you decide how the contributions are invested and you receive at retirement the amount accumulated from your contributions.
1 Defined-benefit
2 Defined-contribution
3 Other
4 Don't Know
END IF

Q16 What is your best estimate of how much you have accumulated in Registered Retirement Savings Plans (RRSPs), Tax-Free Savings Accounts (TFSAs) and other savings accounts?
Numeric
9999999 Don't know or prefer not to say
IF Q16==9999999
      Q16a Is it more than $50,000? 1 Yes 2 No 8888888 Refuse to answer
      IF Q16a==1
            Q16b Is it less than $200,000? 1 Yes 2 No 8888888 Refuse to answer
      ELSE IF Q16a==2
            Q16c Is it more than $10,000? 1 Yes 2 No 8888888 Refuse to answer
      END IF
END IF

Q17 Looking at the following list of health conditions, has a doctor ever told you you had:
[Check any of:]
1 Heart disease
2 Stroke
3 Lung disease
4 Diabetes
5 Hypertension
6 Depression or other mental health problems
7 Cancer

Section 3: Risk Perception

Q18 On a scale of 0 to 100, where 0 is absolutely no chance and 100 is absolutely certain, what do you believe is the percent chance you will live to age 85 or more?
Numeric (0-100)
9999999 Don't know

Q19 On a scale of 0 to 100, where 0 is absolutely no chance and 100 is absolutely certain, what do you believe is the percent chance you will live more than 1 year during your lifetime with two or more limitations in activities of daily living? Activities of daily living include eating, bathing, getting dressed, walking about one's home and getting in and out of bed.
Numeric (0-100)
9999999 Don't know
IF Q19>0
      Q19a 2 or more years?
      Numeric (Range 0 – Answer to Q19)

9999999 Don't know
IF Q19a>0
      Q19b 4 or more years?
      Numeric (Range 0 – Answer to Q19a)
      9999999 Don't know
END IF
END IF

Q20 Of course nobody wishes to go to a long-term care home, but sometimes this becomes necessary. On a scale of 0 to 100, what do you believe is the percent chance that you will have to move to a long-term care home because of important limitations in your activities of daily living?
Numeric (0-100)
9999999 Don't know

Q21 On a scale of 0 to 100, what do you believe is the percent chance that your family would take up the responsibility of taking care of you if you had important limitations in activities of daily living?
Numeric (0-100)
9999999 Don't know

Formal care refers to that provided by qualified caregivers who are usually paid and unrelated to the person receiving care; **informal** care refers to that usually provided for free by relatives. Please keep these definitions in mind for the following questions.

Q22 **Formal** care refers to that provided by qualified caregivers who are usually paid and unrelated to the person receiving care; **informal** care refers to that usually provided for free by relatives.

Do you agree with the following statements? (Answers: 1 Strongly Agree; 2 Agree; 3 Disagree; 4 Strongly Disagree; 5 Don't know)
Q22a It is the responsibility of the family, when feasible, to take care of elderly parents
Q22b Parents should set aside money to leave to their children or heirs once they die, even when it means somewhat sacrificing their own comfort in retirement
Q22c It is children's duty to provide their parents with informal long-term care or to pay for their formal long-term care, should the need arise.

Q23 **Formal** care refers to that provided by qualified caregivers who are usually paid and unrelated to the person receiving care; **informal** care refers to that usually provided for free by relatives.

If you found yourself in a situation where you needed long-term care, which type of care would you prefer to receive: formal or informal?
1 Formal
2 Informal
3 Don't know

Section 4: Literacy and Knowledge

Now we would like to ask some questions about your familiarity and comfort with financial concepts. Please answer these questions the best you can.

Q24 Suppose you have $100 in a savings account, the interest rate is 2% per year and you never withdraw money. After 5 years, how much will you have in this account in total?
1 More than $110
2 Exactly $110
3 Less than $110
4 Don't know

Q25 True or false? You should invest most of your money in a single stock that you select rather than in lots of stocks or in mutual funds.
1 True
2 False
3 Don't know

Q26 Suppose the chances of someone aged 50 living to age 85 are 60%. What do you think the chances are that this same person will live to age 60?
1 Fewer than 60%
2 More than 60%
3 Don't know

Q27 Which of the following statements comes closest to describing the amount of financial risk that you are willing to take when you save or make investments?
1 I am willing to take substantial financial risks expecting to earn substantial returns
2 I am willing to take above average financial risks expecting to earn above average returns
3 I am willing to take average financial risks expecting to earn average returns
4 I am willing to take under average financial risks expecting to earn under average returns

IF PROV = QC
        Q28 In 2016, what is the average monthly cost of staying in a private, unsubsidized long-term care home (CHSLD) if you are uninsured (for a private room)? This would include the cost of room and board as well as that of all personal and nursing care.
        Numeric
        9999999 Don't know
        IF Q27==9999999
                Q27a Is it more than $3,000? 1 Yes 2 No 8888888 Refuse to answer
                IF Q27a==1
                        Q27b Is it less than $5,000? 1 Yes 2 No 8888888 Refuse to answer
                ELSE IF Q27a==2
                        Q27c Is it more than $1,000? 1 Yes 2 No 8888888 Refuse to answer
                END IF
        END IF
END IF

TEXT

IF PROV = QC: $HOME = subsidized long-term care homes (CHSLD)
IF PROV = ON: $HOME = long-term care homes

Q29 Are [$HOME] free to the user?
1 Yes

2 No
IF Q29==2

> Q29a In 2016, what is the monthly fee that you think you would have to pay in [$HOME] for a private room?
> Numeric
> 9999999 Don't know
> Q29b Is there a reduced user contribution if you have low personal resources (income and assets)?
> 1 Yes
> 2 No
> Q29c If you receive benefits from a long-term care insurance, how does that affect the user contribution you have to pay in [$HOME] if you have low personal resources?
> 1 It increases my fee
> 2 It decreases my fee
> 3 It does not affect my fee
> 4 Don't know

END IF

Q30 Is there a waiting period to obtain a room in a [$HOME]?
1 Yes
2 No
IF Q30==1

> Q30a On average, how many months do you think the wait is in your province?
> Numeric (>0)
> 9999 Don't know

END IF

Q31 If you purchase a long-term care insurance policy and you stop paying premiums after having paid them for several years, do you generally get reimbursed for what you already paid?
1 Yes
2 No
3 Don't know

Section 5: Preferences for Insurance Products

We are going to show you some simple insurance policies and ask you to rate those. You can assume that if you were to have two or more limitations in activities of daily living, the insurance company offering you this product would pay the benefits no matter what the circumstances. Once you receive benefits, you do not pay any premiums.

Each product has three attributes:
a) a monthly premium you have to pay;
b) a monthly benefit if you have 2 or more limitations in activities of daily living, starting 3 months after your limitations have been verified; and
c) a payout to your survivors if you die before age 85.

Assume that if you are healthy and you stop paying premiums for 3 consecutive months, the contract is cancelled and you lose coverage.

The premium cannot increase once you have purchased the product. Finally, the benefits are adjusted for inflation (indexed).

*****
Randomization scheme

Parameters:

$$Benefit\_ltc = [2000,3000,4000] \text{ with probability } [0.33,0.33,0.33]$$
$$Benefit\_life = [0,10000,25000] \text{ with probability } [0.6,0.2,0.2]$$

With these benefits we will provide EPremium (3 x 3 = 9 data points; see table attached) which is the fair premium by age and sex.

The premium for the contract is given by (please round to nearest dollar):
    prem = EPremium * Load where Load [0,6,0.8,1.0,1.2,1.4] with probability [0.2,0.2,0.2,0.2,0.2]

Randomize both Benefits and Load independently (9 x 5 possibilities) for 5 plans (each respondent gets 5 draws of Benefit_ltc, Benefit_life and Load).

Present each plan following…

Example:
[Scenario]

While healthy…	*Once you have at least 2 limitations in your activities of daily living…*	*When you pass away…*
You pay $[prem] per month	You receive $[benefit_ltc] per month	Your survivors will receive $[benefit_life] once

*****

Q32-36

[Scenario]

What are the chances, 0% meaning no chance and 100% for sure, that you would purchase the policy if it were offered to you by a trusted insurance company?

Numeric (0-100)

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