IMPACT OF HOME CARE ON THE CHOICE OF LIVING ARRANGEMENT FOR ELDERLY IN CANADA:

A SURVIVAL ANALYSIS APPROACH

By

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1 Introduction

Aging in modern societies has brought many new challenges to deal with. Taking care of the elderly has always been part of the Canadian collective values. However, the forecast of a higher proportion of senior citizens in Canada creates the problem on how to finance all this. Choices need to be made to ensure a decent quality of life to them. After pension plans, health expenditure come to mind as an important problematic considering the increasing rate of chronic diseases associated with age. Alternatives to the Canadian acute health system has been developed to find a cost-effective solution. These programs recognize that people prefer receiving care at home and that this is a cost-effective delivery method. As a representation of the effort taken on this path, over 1994 to 2004, the real per capita provincial/territorial government home care spending grew annually, on average, by 3.6 percentage points more than the rate at which provincial and territorial government health expenditure grew. In 2004, 4.2% of provincial and territorial government health expenditure was for home care compared to 3.1% in 1994 (Ottawa: CIHI, 2007). By 2010, the level of home care was estimated to be between 4.6 and 5.5 percent of total health spending in Canada (Conference Board, 2012). This new approach is not without shortcomings since home care relies heavily on unpaid care where the cost to Canadian businesses was estimated conservatively to be over \$1.28 billion in 2007 as a result of absenteeism and turnover (Conference Board, 2012). On the other hand, the Final Report of the National Evaluation of the Cost-Effectiveness of Home Care (Hollander & Chappell, 2002) concludes that home

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The research and analysis are based on data from Statistics Canada and the opinions expressed do not represent the views of Statistics Canada.

care can be a cost-effective substitute for long-term care facilities. This is one reason for the enthusiasm revealed in government expenditures. However, those results do not answer the crucial question; it remains to inspect if home care leads to lower use of expensive long-term institutions. One way to investigate this question is to evaluate if home care users delay their entrance to long term facilities compared to non-users.

Based on this premise, this study tries to answer this question using the longitudinal National Population Health Survey (NPHS). The definition for home care used in this research given the data is the one of the Canadian Institute for Health Information (CIHI) where only home health care and home support in the home setting is considered. Other ways to define home care is mentioned in the literature review. Factors affecting the risk of entry to long-term institution is determined using a Cox model. The results of this survival analysis allow to judge the efficacy of home care based on the association of home care users with late institutionalization. The results are then tested in order to know the independence of the findings to different situations such as the users' health level and the types of care used. The conclusion of this analysis is that home care in general does not seem to have an impact on the institutionalization. However, when care are related to *instrumental activities of daily living* (IADL), home care can delay institutionalization if the health of the respondents are relatively good. Also, respondents who have experienced a health shock seem to stay longer at home when home care are related to health or *activities of daily living* (ADL).

The remainder of this paper is organized as follows. The next section introduces the reader to home care with its definition and its context in Canada, followed by a brief overview

of the different directions taken by researchers on the question of home care. Section 3 and 4 will present the data and the methodology used by this article to answer question just introduced. Then, the results will be presented and interpreted in section 5. Finally, section 6 concludes.

2   Literature Review

2.1   Definition of Home Care

The definition of home care has expanded over time leading to difficulties in the analysis. Health and Welfare Canada defined home care, in 1990, only in term of substitution of health care that would have been delivered in a health institution. Many think of home care with this traditional definition called *home health care* (Ottawa: CIHI, 2007). However, in 2001, the Canadian Institute of Health Information defined home care in terms of all services that "enable clients incapacitated in whole or in part to live at home" (Canadian Healthcare Association, 2009). This shifts the view of home care as hospital health care offered in the home setting to the view of home care as a more complete bundle of activities including home support with the daily activities (Conference Board, 2012). Finally, The Canadian Home Care Association (CHCA) defined it "as an array of services, provided in the home and community setting, that encompass health promotion and teaching, curative intervention, end-of-life care, rehabilitation, support and maintenance, social adaptation and integration, and support for the informal (family) caregiver" (Canadian Healthcare Association, 2009). Including community setting in the definition implies that the services are not necessarily

given at home. In fact, everything that enables individuals to stay at home is considered as home care. One can recognize, from a research point of view, the ambiguity of this last definition even if it seems appropriate. For instance, this definition allows certain home care programs in which minor health procedure are done in a local center.

2.2 Home care in Canada

Under the Canada Health Act of 1984, no provinces are obligated to provide coverage of home care. Therefore, each province and territory has developed their own programs characterized by different payment schemes, funding, type of services included, proximity of resources, etc. Faced with an increase in home care recipients of almost 100% between 1995 and 2006 (Canadian Healthcare Association, 2009), some efforts have been made to standardized home care across Canada. Therefore, in 2003, with the First Ministers Accord on Health Care Renewal, first dollar coverage for short-term acute home care, including acute community mental health, and end-of-life care was announced to be provided by 2006 (Health Canada, 2006). Then, through the 10-Year Plan to Strengthen Health Care, in 2004, First Ministers gave more detail on the type of care mentioned in the 2003 accord (Canadian Healthcare Association, 2009). Despite this achievement, provinces stay largely heterogeneous.

One interesting difference is the providers of home care in each province and territory. The report Home Care in Canada from the Margins to the Mainstream produced by the Canadian Healthcare Association divide the provinces into 4 categories based on providers of care:

- "Saskatchewan, Manitoba, Nunavut, the Northwest Territories, Quebec and Prince Edward Island have a public provider model, in which provincial or territorial government employees manage and deliver both home care (which includes professional services such as nursing care) and home support services (which include such services related to personal care, housework, meals, shopping and respite care) directly; intermediate agencies either play a limited role or have no role at all.

- In British Columbia, New Brunswick and Newfoundland and Labrador, all professional services are delivered by public employees, but home support services are delivered by private agencies.

- In Alberta and Nova Scotia, both public and private employees provide professional home care services; public employees provide the administration; and home support services are contracted out.

- In Ontario, Community Care Access Centre (CCAC) employees provide single-entry coordinating services, but all publicly paid professional home care and home support services are contracted to the private sector. A few CCACs deliver services through their Employees."

2.3   Overview of Research Approaches

Long-term care is a relatively new field of health economics. Therefore, articles on this topic in the economic literature appear only recently. On the particular topic of community care as an alternative to traditional long-term care, health publications in the 70s and the 80s where already empirically attempting to grasp the pros and cons of giving care in the home setting. Experimental design was the usual approach taken in this literature since rich data sets representative of the population was not available. However, it quickly appeared that the research on the topic were inconsistent. In a need to clarify the research of the impact of home care, the meta-analysis of Hugues (1985) took 13 previous researches on community-bases long term care and tried to understand their similarities and divergences in view of their conflicting conclusions. The result of this exercise was the conclusion that

the research could be classified into 3 different models. This article exposed the difficulties of this literature in term of divergence of care offered at home and the population targeted by those programs.

With the advent of longitudinal data sets researchers could get more global estimates less dependent to the experiment characteristics. On the other hand, the relationship between the variables was less clear leading again to unexpected results. For instance, using the National Long-Term Care Survey (NLTCS) in 1982 and 1984, Newman et al. (1990) get that formal care in the home setting has a significant impact, but increasing the risk of nursing home use instead of decreasing it. Also, the paper shows no significant impact for informal care at home. Newman et al. argue that perhaps this is the result of a too broad description of informal care that does not take account of important aspect of care giving such as the burden of taking care of someone in need, the quality of care given and the access to informal care. In order to control for those aspects, they use as a proxy of informal care the information about whether the care are given by the spouse or the daughter, and whether the informal caregiver lived within 10 minutes of the dwelling of the person in need. When this proxy is used, the impact of informal care results in a significant lower risk of institutionalization. This might be the result that people using home care are already more at risk of institutionalization, which show that the model used in this article cannot control appropriately for the health of the individuals.

It seems reasonable to think that the use of care is a good predictor of unobserved bad health condition that might need higher level of care usually offered in health institution. Following this logic, Charles & Sevak (2005) analyzed the 1993–2000 waves of the Study

of Asset and Health Dynamics among the Oldest Old (AHEAD), and they opted for an instrumental approach where the proxy of informal care must be some variables that are not related directly to the use of nursing home. Based on the literature on factors associated with higher care giving, they use as instruments indicators for having children living within 10 miles and if they are married or not. They first test that the location of children is not dependent on the health status of their parent since this problem could lead to a bad instrument which is still correlated with the error term of the main regression. Since this is not the case, they estimate their logit model with two stage least squares. The result is a large decrease in the probability of institutionalization between 39 and 49 percentage points.

Byrne et al. (2009) use a structural setting to health choices by elderly. The goal is to evaluate the choice of care whether given by the children or by paid caregiver within a game-theoretic model. Each member of the family chooses their consumption, hours worked, leisure, allocation of time for informal care, and money transferred for formal home care. The utility of each member of the family depends on the level of health of the parents, and this level of health depends on a health production function. The willingness of providing informal care by the children can be analysed according to the quality of the care given, the childrens opportunity costs, the care giving burden, and even any strategic behaviour such as free riding on the care given by a sibling. Using the 1993 wave of the Assets and Health Dynamics among the Oldest Old (AHEAD) data set, they estimate the model by maximizing a likelihood function specific to each family. Many interesting conclusions can be made from this exercise such as:

- Formal and informal cares have a modest impact on the parents health, however informal care is more effective;

- Children face greater incentives to provide care for mothers than for fathers, abstracting from the effect of gender on the quality of care and the burden associated with its provision;

- Informal care provided to mothers is significantly less effective than informal care provided to fathers;

- Daughters provide the highest quality care and experience the least burden followed by sons, then daughters-in-law, and finally sons-in-law;

- Married children provide less care and less effective care for their elderly parents than do unmarried children;

Finally, two articles that influenced this study are Sarma, Hawley & Basu (2009) and Bonsang (2009). As a result, this essay is a combination of both contributions. On one hand, Sarma, Hawley & Basu (2009) use duration analysis in order to evaluate the difference in the timing of institutionalization for people using home care. This methodology is an appropriate method since this literature tries to explain the time period before the occurrence of a certain event which is the institutionalization of a respondent. In their article, they showed that home care reduces the likelihood of institutionalization for any kind of home care. On the other hand, Bonsang (2009), in its evaluation of substitution between informal and formal home care, showed that the substitution effects are not constant. In

particular, informal and formal cares are substitute only for "low-skilled" tasks. Therefore, some tasks need some knowledge or might be just embarrassing for the helped person if it is done by a family member. Moreover, the substitution between informal and formal care was decreasing as the level of disability was increasing. This research showed that interaction of other characteristics with home care might change the impact of home care on the timing of institutionalization.

As more detail is going to be given in the next section, in a few words, the objective of this research is to give more information to the result of Sarma et al. (2009) by analysing the possible heterogeneity of the impact of home care considered constant in their work. Moreover, by having access to nine cycles of the Canadian longitudinal National Population Health Survey instead of only six cycles in their case, more information might lead to more precise estimates.

3   Data

All the data used for this research is from the National Population Health Survey (NPHS) – Household Component – Longitudinal. This data set follows 17,276 individuals every two years from 1994-1995 until 2010-2011 for a total of nine cycles. Information on health status, home care use, transition to institution, and other socio-demographic variables are available. Furthermore, in the case of a transition to an institution, the National Population Health Survey – Health Institution Component attempts to collect information on these individuals to be incorporated in the Household Component. This survey is representative

of the population as long as the weighting procedure included with the data is appropriately applied. Available bootstrap weights generated by Statistics Canada are used to obtain robust standard errors.

Table 1 presents the number of respondents that are considered institutionalized per cycle. Note that the numbers include the ones of the previous periods. Number of death is also important since those individuals lower the set of observations at risk of institution. As it can be seen in the Table 1 the number of censoring due to death is quite high. However, some of the institutionalized respondents are considered non-respondent by Statistics Canada if no contact is possible with the individual. This is one possible reason for the decrease of institutionalization between Cycle 5 and 6. Therefore the numbers presented are only a lower bound for the occurrence. Fortunately, as it will become clear soon, only the first period of institutionalization is important for the model used in this research. Therefore, as long as the information of the cycle when someone is transferred to an institution is known, any lack of information for the following cycles will not impact the results. In total, 560 different respondents older than 50 years old are institutionalized in at least one of the periods. In the survival analysis vocabulary this is the number of failures.

Table 1: Occurrence of Death or Institutionalization in the Data Set

Cycles	Number of Panel Members	
	Deceased	**Institutionalized**
2	290	62
3	615	114
4	976	133
5	1311	161
6	1682	144
7	2073	148
8	2400	163
9	2678	167

4   Methodology

4.1   Cox Model and its Characteristics

The objective of this study is to analyse the timing of the respondents of the survey to enter in any kind of long term health institution. One of the obvious methodologies to analyse this kind of outcome is the survival analysis where the coefficients on the explanatory variables included give information on the relation between the variables and the risk of early occurrence of the main outcome. Since the shape of the hazard function is indeterminate, a semi-parametric survival model such as the Cox model is appropriate. This model has been widely used in research since the baseline $h_0(t)$ of the model in Equation (1) can be left unspecified, whereas the parametric part $(\sum_{i=1}^{p} \beta_i x_i)$ of the model is the lineal combination of the explanatory variables and their coefficients.

$$h(t, X) = h_0(t) exp \left(\sum_{i=1}^{p} \beta_i x_i \right) \qquad (1)$$

The Cox model has the important characteristic that the distribution of the dependent variable does not need to be specified since the methodology used to estimate the coefficients is not based on the statistic distribution of the main outcome but on the ordering of the time until the occurrence of the event. Based on this ordering, the coefficients are estimated in order to maximize, in this case, a partial-likelihood since the likelihood function does not represent the joint distribution of the events. The coefficients will be set such that the explanatory variables associated with an early occurrence of the event have a higher value meaning a higher risk of failure. However, the ordering needs some adjustment if the data does not allow to observe the exact ordering of the failure when multiple failures happen at the same time, called *ties*. It is known that the same observed timing of institutionalization is not an accurate depiction of the reality, but just a limitation of the data to order the occurrence of two data collections. One way to deal with that, called *exact-marginal calculation*, is to calculate separately the probability of each possible ordering, and then add them up to be included in the partial-likelihood. However, this can be computationally intensive. This study uses the *Breslow approximation*, which is a less computationally intensive procedure and still allowed by Stata with the weighting procedure used to deal with the survey data. This method is an approximation of the *exact-marginal calculation* by using a common denominator for all possibilities which largely reduce the calculations (Cleves et al., 2010).

4.2 Survival Time Description

The information on the institutionalization is given by the Longitudinal Response Pattern at each cycle, where each respondent are categorized as either complete-response, deceased, institutionalized, partial-response, and non-response. The dependent variable in the model is the time t until an individual is considered having moved to an institution in one of the cycles of the survey. It is important to spend some time describing how the duration until institutionalization has been set in this research since it is the core of the study, and not as straightforward as the preceding definition seems suggest. Additionally, the ordering used in the maximum partial-likelihood is all based on how the survival time is defined. This time t is the number of years one individual has been considered at risk to be institutionalized in any period. This survival time stops when a respondent is institutionalized, censored, or deceased. Conversely, the starting point is more complicated. When should a respondent be considered as a potential entrant to an institution? Setting a certain condition to decide when to start the survival time based on some health criteria would be arbitrary. Therefore, two conventional approaches should be considered. The basic approach called *time-on-study* is to use the entry into the survey as the beginning of time and try to control that respondents were at risk before the survey. However, when the observations are done at a discrete interval of time like in the NPHS, the risk of a large number of ties might reduce the exactitude of the estimates. Another approach called *chronological age* is to use the date of birth as the beginning of time. This would reduce the number of ties by getting closer to a continuous survival time since the likelihood of equal survival times when the

time-to-event is the difference between the date of interview and the date of birth is reduced.
It is sometime believed that both time-scales give similar results if age is controlled in time-on-study. However, Chalise, Chicken and McGee (2010) showed that both methods can give differences in results that are increased with the variability in the age of entry. Since *time-on-study* includes the information about age-at-entry in the partial-likelihood via the inclusion as a variable, an analysis with a large variability in the age-at-entry should use *time-on-study* as the time scale. *Chronological age* cannot adjust for a highly spread age-at-entry, and could lead to a model that perform poorly. Since the population of interest in this study includes all individuals that might be at risk of being institutionalized during the 9 cycles of the NPHS, a large range of age is included in the analysis as showed in Table 2. Due to the variability of age-at-entry, the methodology used in this study is to control for the age of entry in the survey of 1994, and consider the first cycle as $t = 0$. Then, even if individuals are surveyed every two years at different non-constant date in the year, the interval between each cycle is assumed to be two years for everyone. A fixed two years interval for everyone is explained by the fact that it is not possible to know when the transfer to institution happened between two cycles, and ordering the timing of institutionalization of two individuals based only on the date of interview is illogical. By giving the same survival time, it increases the number of ties, but at least does not biased the ordering used in the maximum partial-likelihood.

4.3   Time-Varying Covariates

In order to take account of the variation in the characteristics of the respondents such as health in every cycle, time-varying covariates have been used. This extension of the classic Cox model is easily done with Stata by splitting the observations of the respondents by cycle such as in a panel data setting. Therefore, the characteristics of the respondents are specific to the period between two cycles. However, one must be conscious that the Cox model associates only the value of the time-varying covariates at the failure time with the event. Therefore, if one is more interested in the impact of the history of a variable on the risk of event, instead of the impact of the specific value of the time-varying variable at the failure time on the risk of event, a modification of the variable must be made (Zhang, 2005). Such modifications for any variables are explained in the next subsection.

4.4   Variables

Table 2 presents the relative frequency distributions for the categorical variables used in this research, and the mean and the standard error for the only continuous variable; the Health Utility Index. All the descriptive statistics are adjusted with the survey weights in order to be representative of the population. This table is followed by a description of each variable, as well as some explications on the reasons why some of the initial variables were modified.

Table 2: Descriptive Statistics of Sample 50 Years Old and Older

Variables	Proportions	Variables	Proportions
Home Care		**Socio-Economics**	
Home Care (broad)		Home Ownership	
No utilisation	0.83	Yes	0.76
Low utilisation	0.14	No	0.24
High utilisation	0.03	Household Income	
Home Care (ADL)		Lowest income	0.03
No utilisation	0.87	Lower middle income	0.10
Low utilisation	0.12	Middle income	0.30
High utilisation	0.01	Upper middle income	0.36
Home Care (IADL)		Highest income	0.21
No utilisation	0.91	Age-at-Entry	
Low utilisation	0.07	50-54 years	0.22
High utilisation	0.02	55-59 years	0.18
		60-64 years	0.16
Health		65-69 years	0.13
Health Utility Index (continuous)	0.83 (0.004)	70-74 years	0.11
	Mean (Std. Err.)	75-79 years	0.10
Health Shock		80-84 years	0.06
Yes	0.38	85-89 years	0.03
No	0.62	90 years and older	0.02
Cognition		Marital Status	
No cognition problem	0.70	Married or Comm.-law	0.64
Little cognition problems	0.26	Widowed	0.16
Larger cognition problems	0.04	Single or Divorced	0.19
		Provinces	
Support		Newfoundland & Labr.	0.02
Affective Support		P.E.I.	0.004
Lowest	0.02	Nova Scotia	0.03
Lower middle	0.04	New Brunswick	0.03
Middle	0.12	Quebec	0.24
Upper middle	0.30	Manitoba	0.04
Highest	0.52	Saskatchewan	0.03
		Alberta	0.09
Socio-Economics		Ontario	0.39
Sex		British Columbia	0.14
Male	0.49	Yuk. & N.T. & Nunavut	≈ 0
Female	0.51		
Immigration			
Yes	0.24		
No	0.76		

4.4.1   Home Care

One of the main objectives of this study is to detail the impact of home care by determining if the types of care have different relationships with delaying institutionalization. One reasonable distribution is to separate home care based on the categorization of the tasks as *activities of daily living* (ADL) or as *instrumental activities of daily living* (IADL). Inability to perform ADL is widely used as a measure of the functional status of a person. ADL refers to daily self-care activities such as eating, dressing, bathing, functional mobility, etc. On the other hand, IADL refers to activities that are not necessary for functional functioning such as meal preparation, shopping, housework, laundry, etc. In consequence, home care has been divided in two; one category for activities that seems more intense in term of care including activities related to health or ADL, and one category for IADL.

No information is given on the intensity of the use of home care in the NPHS. The only information available is a dummy variable for the use of home care in every cycle. Since the history of home care matters more than the use of home care at the date of institutional-ization, the method to aggregate the history of home care while giving information on the level of utilisation is to cumulate the number of two-years interval of utilization. The value given by this counting procedure is considered as constant over time for each individual and categorized as low utilisation for 1 or 2 uses, and as high utilisation for 3 uses and more. This process has been done as well for the two categories of home care. By doing this process, experience and knowledge with the use of home care can be tested. A care recipient might be more apt to cope at home with some functional difficulties if this person knows

the resources available and has a network of individuals that are experienced in helping.

4.4.2   Health

Control for health is essential in order to prevent relationships between variables that are the result of an omitted-variable bias as it is going to be explained in the subsection Limitation of the Analysis. Taking advantage of the wide variety of health information available in the data set, the *Health Utility Index* (HUI) reports a numeric value between -0.360 and 1.00 that gives a convenient description of the overall functional health of the respondents derived from eight health attributes in each cycle.

Also, following the conclusions of Luppa et al. (2010) systematic review of nursing home placement, cognition is included as a variable in the model. Luppa et al. have identified this factor as a large predictor of nursing home in many of the researches analysed. The original variable categories: 1-No cognition problem, 2-A little difficulty thinking, 3-Somewhat forgetful, 4-Somewhat forgetful/A little difficulty to think, 5-Very forgetful/Great deal difficulty to think, 6-Unable to remember or to think were transformed into three categories where 2, 3 and 4 are considered as little cognition problems, and 5 and 6 as larger cognition problems.

As well, following the idea of dynamic predictors of change in the article of Gaugler et al. (2003), this essay uses dummy variables if one of the health factors get worse over time showing the health instability or the occurrence of a shock. These time-dependent dummy variables are equal to zero until a health shock, and then equal to one until the end. A threshold of 0.2 for the *Health Utility Index* (HUI) has been set such that any decrease of

the HUI larger than 0.2 would change the value of the health shock variables to one for the rest of the cycles. Shock to the cognitive status had been considered, but then rejected since the result of this attempt was inconclusive.

4.4.3   Support

Social support is usually neglected as an important factor for elderly to live adequately. Loneliness can strongly influence the willingness to face the daily difficulties. Home care can help with what is related to physical tasks. However, just being in presence of people may not attenuate the feeling of being lonely (Cherry, year: n.a.). A support variable associated to the affection received is used in order to take account of the real social support. This variable is based on 3 questions in the survey. In each of the questions the respondents were asked the frequency of the occurrence of the following circumstances; support available if need someone to show you love and affection, support available if need someone to hug you, and support available if need someone to love you and to make you feel wanted. For each question, the frequencies were initially categorized into 5 categories in the survey from 0 to 4. The affection support variable is thus the sum of the values of these 3 questions leading to values between 0 and 12, and then divided into 5 categories as showed in Table 2. Institutions have the advantage of offering a living environment in community with people facing similar problems. Including affective social support in the model allows to test the hypothesis that people living in an environment where they feel loved and wanted lowers the likelihood of institutionalization.

4.4.4   Socio-Economics

Based on the literature, the following variables are also included. These ones need less detailed explanations as they are explicit in Table 2. It is however important to note that sex, immigration, age group at entry and total household income are constant over time. The household income was available in the survey for each cycle, but treating this variable as time-varying would have associated the likely lower income when institutionalized to an income prediction. Therefore, as a measure to proxy the income history of this categorical variable before institutionalization, the mode is used.

The other variables such as the marital status, home ownership (dummy), and province of residence are time-varying. As a matter of fact, institutionalized individuals can hardly be owner of a propriety. Therefore, for all periods of institutionalization, the value of this variable have been replace with that of the most recent time at which the variables was last observed allowing the model to correctly incorporate the information before institutionalization.

4.5   Model

The baseline model is a stratified Cox model. After having tested the proportional hazard assumption based on the Schoenfeld residuals, a model stratified by the age-at-entry, sex and provinces seems to be appropriate. The proportional hazard assumption needs that those residuals are not related to survival time. Therefore, the impact given by the coefficients in the model should be independent of time (Kleinbaum & Klein, 2012). The proportional hazard assumption test for the model without stratification can reject the null hypothesis

of a zero slope when the Schoenfeld residuals are regressed on time with a p-value of 0.011. However, when the model is stratified by age-at-entry, sex and provinces, the test, with a p-value of 0.34, cannot reject the null hypothesis. By stratifying by ages, the cohort effect can be controlled, and it allows the model to compare characteristics of the respondents by age group. Moreover, by stratifying by provinces, this is one way to incorporate some kind of fixed effect to deal with characteristics specific to each province. This is one alternative to the inclusion of shared-frailties in the model which is not allowed on Stata when the model need to be controlled for survey data.

The analysis for this research is based on two models. The first one uses home care in its most broad sense with all the other variables previously presented, but excluding the variables that are used to stratified the model. Additionally, given the goal of testing the relationship for different health characteristics, home care has been interacted with the HUI and the dummies for health shock. The second model is completely identical excepted that home care is split between ADL home care and IADL home care. The differences between the models should give some intuition on how and when home care is used effectively to delay institutionalization.

4.6   Limitation of the Analysis

One must be careful in the interpretation of this study. Survival analysis is usually used in controlled experiment setting with proper test group and control group where the impact of one variable can be considered as causal. In this study, on the other hand, the results cannot be interpreted in the same matter. In fact, the methodology used based on survey data leads

only to relationship between variables in order to give information on the characteristics and behaviors of the individuals most at risk of being institutionalized. Therefore, the results of this research could orient policy analysts on important relationships or behaviours that could influence the elaboration of a policy, but should never be used as a justification for the implementation of a particular policy based on the result of a lower risk of institutionalization found in this research. Any policy based on the following results should be justified by a proper policy analysis where the causal effect of this particular policy could be estimated.

Another problematic is the strong relationship between home care and the potential use of health institution. Someone using home care is definitely characterized by a declining ability to take care of itself, and therefore home care can be considered as a good predictor of institutionalization in certain cases. Some research found a positive relationship between home care and institutionalization due to this omitted-variable bias. One approach, mentioned in the literature review, used by Charles & Sevak (2005) is to opt for an instrumental approach where informal care is proxy by some variables that are not related directly to the use of nursing home. Since the NPHS does not include the instruments used in that article, this approach cannot be tested for this study. As an alternative, the rich information on health available in this survey is used to properly control for the health of the respondents in order to avoid this relation between use of home care, health and institutionalization.

5 Results

One drawback of the data used is an absence of details on how home care is used by the respondents. As a result, a lot of variability is present in the estimations leading to the footnotes associated with almost every result of this study in the following tables that are mandatory when using the data sets of Statistic Canada. As well, it is absolutely necessary to use the bootstrap weights generated by Statistics Canada as mentioned previously. However, after applying this procedure, this study is left without interesting results concerning home care unless one can think that absence of result is a result in itself. However, without the bootstrap procedure some results appeared to stand out. Therefore, the following results are showed both without and with the bootstrap weights. The standard errors without the bootstrap weights are inaccurate since usually underestimated (Statistics Canada, 2012); however, some relationships might guide other researches with more detailed data or more ingenious methodologies to investigate those plausible relationships. It is important to note that "without the bootstrap weights procedure" does *not* mean that the weights for a representative sample have been removed. In Tables 3 and 4 the estimates is the same for both procedures, therefore reported only once, but both standard errors are showed. In order to know the level of signification for both procedures, the usual star system is applied on the standard errors instead of on the estimates.

Table 3 presents the results for the Cox model when home care is considered as a whole without any distinction. The results for the case when home care is split between ADL care and IADL is presented in Table 4. The first finding to be drawn from those two tables

is that home care does not have any statistically significant impacts for any situations in the bootstrap setting. However, one must be careful with that conclusion since it might be the case that home care never delays institutionalization, but it is also possible that some precise home care programs might have delayed institutionalization but are concealed in the vague definitions of home care used in this study. This research cannot obtain a statistically significant estimate for home care in is generality. This shows how political decision making must take into consideration the types of home care if the tendency of increasing expenditures in home care continues. This study shows that not every type of home care, if any, have a clear relationship in the same direction. On the other hand, as mentioned before, some relationships seem to appear without the bootstrap procedure such as the result of the interaction between high utilisation of home care and health shock. Individuals using home care for a long time seem to react differently to a shock to their health. The hazard ratio for this interaction variable of 0.2062 implies that home care can lower the impact on institutionalization for people living a health shock. However, note that given the way those two variables were created, the shock can either precede or follow the use of home care. But in both cases, this relationship reveals that individuals that are used to home care react more favorably to a health shock or that home care can be used to delay institutionalization after a health shock. When home care is separated in Table 4, note that this interaction between home care and health shock is conserved only for ADL home care. This result was expected since the ADL home care includes health care. Interestingly, for IADL home care, the interaction with the Health Utility Index becomes statistically significant showing that the impact of support home care is dependent on the level of health

of the respondent. With a hazard ratio lower than one for this interaction, this means that home care related to IADL can delay institutionalization if the health status is relatively good. Therefore, this suggests that this type of care is limited to healthier recipients in order to have a positive impact.

In term of the other regressors, the direction of the results follows the general expectations. Cognition is a good predictor of institutionalization with almost three times higher risk for respondent with large cognition problems. This result is statistically significant even with the bootstrap weights. The Health Utility Index, with a value increasing with the quality of health, reduces the risk of institutionalization. Health shock increases the risk by more than 2.5 times. Surprisingly, affection support does not have any statistically significant estimates. Finally, for the socio-economics factors, immigration is associated with a lower risk of institutionalization. Many reasons might explain this such as having less access to public funding for institutionalization before getting the citizenship, or that most of the immigrant are in Canada for some particular reasons, such as work, reducing the likelihood of being in institution. Contrastingly to the research of Garber & MaCurdy (1990), home ownership does not seem to reduce the timing before admission to an health institution. Only visible without the bootstrap procedure, widowed respondents are associated with a higher risk of institutionalization compared to married respondents. Being single or divorced is not statistically significant. Finally, the income appears to be highly significant. There is no common agreement in the literature on that aspect. Based on the results in Table 3 and 4, low income increases largely the risk of institutionalization. At a 1% significant level, being in the lowest income category increases the risk by 7 times compared to the middle

class.

Table 3: Results of the Cox Model with the Broad Definition of Home Care

	Hazard Ratio	Standard Errors Without Bootstrap	With Bootstrap
Home Care			
Home Care (broad)			
No utilisation	Reference Category		
Low utilisation	0.32^F	0.22^*	0.50
High utilisation	3.46^F	2.47^*	19.10
Home Care * Health Utility Index			
Low utilisation	2.05^F	1.01	1.54
High utilisation	0.37^F	0.25	0.37
Home Care * Health Shock			
Low utilisation + shock	2.28^F	1.44	3.41
High utilisation + shock	0.21^F	0.14^{**}	1.13
Health			
Cognition			
No cognition problems	Reference Category		
Little cognition problems	1.36^E	0.28	0.37
Larger cognition problems	2.97^F	0.78^{***}	1.10^{***}
Health Utility Index	0.66	0.03^{***}	0.04^{***}
Health Shock	2.52^F	0.93^{**}	1.22^*
Support			
Affective Support			
Lowest	1.24^F	0.38	0.56
Lower middle	1.34^F	0.36	0.54
Middle	1.24^E	0.28	0.38
Upper middle	1.18^E	0.22	0.30
Highest	Reference Category		
Socio-Economics			
Immigration			
Yes	0.49^E	0.10^{***}	0.13^{***}
Home Ownership			
Yes	0.95^E	0.15	0.21
			Continued on next page

Table 3 – continued from previous page

	Hazard Ratio	Standard Errors	
		Without Bootstrap	With Bootstrap
Marital Status			
Married	Reference Category		
Widowed	1.54^E	0.32^{**}	0.48
Single or Divorced	1.29^F	0.31	0.46
Household Income			
Lowest income	7.15^F	2.89^{***}	4.59^{***}
Lower middle income	1.77^E	0.31^{***}	0.41^{**}
Middle income	Reference Category		
Upper middle income	1.05^E	0.22	0.31
Highest income	0.28^F	0.12^{***}	0.61

* denotes significance at the 90% level, ** at the 95% level and *** at the 99% level

E — Any users of those estimates should note the high sampling variability associated with the estimates when evaluate with the standard error estimated by balanced repeated replication

F — The user is advised that this estimate given the standard error estimated by balanced repeated replication do not meet Statistics Canada's quality standards for this statistical program. Conclusions based on these data will be unreliable and most likely invalid. These data and any consequent findings should not be published. If the user chooses to publish these data or findings, then this disclaimer must be published with the data

Table 4: Results of the Cox Model with the Detailled Definition of Home Care

	Hazard Ratio	Standard Errors	
		Without Bootstrap	With Bootstrap
Home Care			
Home Care (ADL)			
No utilisation	Reference Category		
Low utilisation	0.27^F	0.19^*	0.74
High utilisation	2.76^F	2.84	21.10
Home Care(ADL) * Health Utility Index			
Low utilisation	1.79^F	0.96	1.40
High utilisation	0.33^F	0.37	0.55
Home Care(ADL) * Health Shock			
Low utilisation + shock	2.65^F	1.71	7.05
High utilisation + shock	0.17^F	0.16^*	1.25
Home Care (IADL)			
No utilisation	Reference Category		
Low utilisation	1.38^F	0.85	1.29
High utilisation	6.86^F	8.65	71.68
Home Care(IADL) * Health Utility Index			
Low utilisation	1.68^F	0.89	1.32
High utilisation	0.17^F	0.17^*	0.26
Home Care(IADL) * Health Shock			
Low utilisation + shock	0.70^F	0.39	0.59
High utilisation + shock	0.26^F	0.30	2.67
Health			
Cognition			
No cognition problems	Reference Category		
Little cognition problems	1.38^E	0.27	0.38
Larger cognition problems	2.81^F	0.70^{***}	$1.01***$
Health Utility Index	0.06^F	0.02^{***}	0.03^{***}
Health Shock	2.66^F	1.02^{**}	1.36^*
Support			
Affective Support			
Lowest	1.25^F	0.39	0.60
Lower middle	1.24^F	0.34	0.52
Middle	1.23^E	0.28	0.39
Upper middle	1.17^E	0.22	0.30
Highest	Reference Category		
			Continued on next page

Table 4 – continued from previous page

	Hazard Ratio	Standard Errors	
		Without Bootstrap	With Bootstrap
Socio-Economics			
Immigration			
Yes	0.54^E	0.11^{***}	0.15^{**}
Home Ownership			
Yes	0.93^E	0.15	0.21
Marital Status			
Married	Reference Category		
Widowed	1.53^E	0.33^{**}	0.50
Single or Divorced	1.24^F	0.31	0.47
Household Income			
Lowest income	6.95^F	2.87^{***}	4.71^{***}
Lower middle income	1.72^E	0.31^{***}	0.40^{**}
Middle income	Reference Category		
Upper middle income	1.02^E	0.21	0.31
Highest income	0.30^F	0.13^{***}	0.73

* denotes significance at the 90% level, ** at the 95% level and *** at the 99% level
E — Any users of those estimates should note the high sampling variability associated with the estimates when evaluate with the standard error estimated by balanced repeated replication
F — The user is advised that this estimate given the standard error estimated by balanced repeated replication do not meet Statistics Canada's quality standards for this statistical program. Conclusions based on these data will be unreliable and most likely invalid. These data and any consequent findings should not be published. If the user chooses to publish these data or findings, then this disclaimer must be published with the data

6   Conclusion

Home care in its generality does not seem to delay institutionalization. However, as mentioned before, it might be the case that some forms of home care that really influence people to stay at home are concealed in the wide differences of home care packages offered in the provinces. Heterogeneity in the care covered to facilitate home-living has led to the indication that a macro approach to this question is not that evident. At least, the results obtained shows that if governments keep investing in home care, they should be aware that not every kind of home care could reduce the cost of long-term care facilities. More investi-

gations on what kind of program works better in offering what elderly really need to be able to stay at home is needed. The interactions of home care with some health characteristics give some research opportunities such as home care related to IADL seems to be limited to the health status of the beneficiaries, and home care related to health and ADL seems to be appropriate to delay institutionalization in the cases when health shock occurs in the life of recipients. Investing in home care has benefits for the recipients other than just be a cost-effective alternative to long-term care facilities. Therefore, investment in home care is needed, but progressively orienting the existing programs in what is really working to delay institutionalization could increase the benefits of those investments for the society as a whole. Further research should therefore be dedicated to identify the successful bundles of home care and evaluate how they can delay institutionalization.

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