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Household responses to public home care programs

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Abstract

A choice-theoretic model of household decision-making with respect to care-giving time allocations and the use of publicly and privately financed home care services are proposed. Predictions concerning the effect of increased availability of publicly financed home care services on home care utilization, informal care giving, and health status are derived. These predictions are assessed through use of Canadian inter-provincial survey data on home care use and care giving that are matched with data on home care funding for the period 1992–1998. Increased availability of publicly financed home care is associated with an increase in its utilization, a decline in informal care giving, and an improvement in self-reported health status.

JEL classification: I1; J14

Keywords: Home care; Public provision

1. Introduction

One of the dominant shifts in the delivery of health care over the past decade has been in the place of care, particularly from the hospital to the home (Coast et al., 1998, 2000). Whereas individuals used to spend prolonged periods in hospital for treatment and recovery, hospital stays have dramatically decreased (or ceased altogether) and many aspects of care now take place at

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home (Coyte and McKeever, 2001). An important implication of this change in the care setting is its effect on who pays for and who delivers care. In both the United States and Canada, hospital care provided to the elderly is explicitly covered under the Medicare Program and the Canada Health Act, respectively. However, home care is not necessarily covered by public insurance in either country. More significantly, once outside the hospital, the onus on family and friends to assist with, or even take responsibility for the provision (and financing) of care is greater (Netten, 1993). As such, the public–private financing of home care has become a prominent issue for health policy makers.

Despite a dramatic increase in the provision of home care, there are wide variations in the services used. In many jurisdictions, under the home service designation, an array of agencies and providers participate in the provision of a complex range of health professional and lifestyle enhancement services to a variety of recipients. The range of services is large and includes nursing, social work, physiotherapy, speech language pathology, personal support, audiology, occupational therapy, and meals on wheels. While most care recipients receive these services to prevent or retard the deterioration of health and to assist them to maintain independence in the community, others receive a more specialized variety of rehabilitation services following hospitalization. These services "enable clients, incapacitated in whole or in part, to live at home, often with the effect of preventing, delaying, or substituting for long term or acute care alternatives" (Health Canada, 1998).

In the last 25 years, Canadian public home care expenditures have increased at an average annual compound rate of 17.4% from $62 million in fiscal year 1975 to $2096 million in fiscal year 1997 (Health Canada, 1998). This increase was more than double the equivalent annual growth rate of 8.3% for total public health spending (Canadian Institute for Health and Information, 1999) and represents an extension of provincial health insurance to services and settings not encompassed by the principles of the Canada Health Act. Since this Act stipulates the terms and conditions of physician and hospital service provision that the provinces must abide by to ensure that they receive their full share of federal transfers, the exemption of home care services from such conditions provide provinces with discretion in their allocation of health expenditures. Thus, while Canadian public per capita spending on home care services was $69, in 1997, there was almost a three-fold variation in spending by comparing New Brunswick, Newfoundland, Ontario and Manitoba, where per capita spending exceeded $90, to Quebec and Prince Edward Island, where spending was less than $40 (Coyte and McKeever, 2001).

As public programs expand into what was previously a privately dominated segment of the health system, families may alter their behavior in order to take advantage of these public offerings. In some cases, these public offerings substitute for services that were previously funded privately through either direct payments or time commitments by family and friends. In other circumstances, this extension of public coverage may meet some previously unmet need, and thereby, increase overall utilization as these services complement existing care.

This paper investigates household responses to publicly funded programs for home care. The paper begins with a choice-theoretic model of household decision-making when one member requires home care. The model produces testable implications that result from an increase in publicly funded homecare including (1) increased demand for formal care giving, (2) increased overall health of the care recipient, and (3) changes in the use of informal care depending on whether the household consumes at or above the maximum public allotment of home care. The paper then uses Canadian data on home care use and care-giving matched with provincial level data on home care funding to test these implications. Our findings suggest that family behavior is consistent with the simple economic model. Increases in the generosity of public programs affect

home care utilization and the amount of family care-giving undertaken. In addition, increases in publicly funded home care are correlated with improvements in the health of home care recipients.

This paper proceeds as follows: Section 2 reviews the previous literature on public provision of home care and household decision-making. Section 3 outlines a model of household decision-making that incorporates home care. Section 4 describes the public home care programs in Canada. Section 5 outlines the data used in the analysis. Section 6 outlines our empirical specification and trends in home care use. Section 7 presents our findings with respect to health status, while Section 8 reports on the propensity to engage in care giving. Section 9 provides a brief conclusion.

2. Previous literature

Much of the literature on the impact of public health subsidies and programs for the elderly on care giving, living arrangements and use of home care services comes from the United States. This research has focused primarily on the effects of Medicaid reimbursement for nursing home facilities and various state level policies designed to combat the moral hazard problem that Medicaid reimbursements may create.

Cutler and Sheiner (1993) examine the effect of government nursing home policies on institutionalization rates and on the amount of care received in the community. The authors examine both the price differential between Medicaid and the private market, as well the ability of some higher income elderly beneficiaries to receive Medicare support for nursing home care. They find that in states with more liberal Medicaid rules, the higher income elderly are more likely to use a nursing home. In states with larger underpayments the poor appear to have reduced access to nursing homes. They find that as Medicaid support increases, informal family care decreases.

Ettner (1994) examines whether Medicaid home care benefits affect nursing home entry and the use of formal and informal care. Home care subsidies were found to reduce the rate of nursing home use for the elderly in need of long-term care and resulted in a substantial replacement of informal care with formal care for non-medical services.

Pezzin et al. (1996) use data from the Channeling experiment, a national assessment of expanded public financing for home care conducted from 1982 to 1985.[3] They found that more generous public home care programs lowered the probability that an individual would live in a nursing home, and increased the probability that *unmarried* individuals would live independently.[4] They found that increases in public home care program generosity had only modest effects on both provision of informal care, and changes in living arrangements.

Hoerger et al. (1996) quantify the use of state policies that encourage the elderly to stay in their communities. They use the National Long Term Care Survey and exploit the variation in Medicaid State policies for formal home care and care in nursing homes. They found that Medicaid subsidies affected the choice of living arrangements. A loosening of financial requirements for Medicaid eligibility for nursing home care increased the use of nursing homes. However, subsidizing home health services simply increased the probability that individuals lived independently from their children rather than affecting the probability of institutionalization.

[3] Pezzin et al. suggest seeing Kemper et al. (1988) for a description of the Channeling experiment.

[4] Previous research using the Channeling Demonstration by Christianson (1988) and Wooldridge and Schore (1988), however, found only a small effect/no effect of the formal home care program on informal care or institutionalization. Pezzin et al. argue that their result comes from modeling living and care arrangements jointly and having examined shifts in living arrangements in the community.

While much of the literature has examined the effects of various policies on the types of care received, there is little evidence of the effects of policy on the health of the individuals receiving care. In this paper, we not only consider how provincial home care policies affect care giving, living arrangements and the use of home care services, we also examine their effects on the self-reported health status of care recipients.

3. A model of family home care decisions

We consider a simple model of decision-making using a representative household with both care receivers and care givers. The purpose of the model is to determine what testable implications arise from implementing or increasing public home care programs. Households allocate time and financial resources subject to resource and technology constraints. In a two-person household, where one person is a care recipient and the other is a healthy care giver, household utility is defined by the function:

$$U(X, L, A|\tau), \tag{1}$$

where X represents market goods and services, L the leisure time, A the ability of care recipients to perform activities of daily living, and τ represents household preferences.

A care recipient's performance ability is defined by the production technology:

$$A = A(M_1, M_2, C|H), \tag{2}$$

where M_1 is publicly funded care up to a maximum allocation of m, M_2 denotes privately financed care, C the care-giving time performed by the other family member and H is the care recipient's health status.

Time and financial constraints are satisfied if

$$P_x X + PM_2 + (P - s)M_1 + WC = V + W(T - L), \tag{3}$$

where P_x is the unit cost of X, P the unit cost of private care, M_2, $(P - s)$ the unit out-of-pocket cost of public care, M_1, s the unit subsidy for public care, V the non-wage income, W the unit cost of time, and finally, T is the total time for leisure, care giving and labor market work.

The household's optimization problem has three elements. First, the household selects performance ability, A^*, where the marginal benefit of greater ability just offsets the marginal cost of its production. Second, the household cost-effectively selects production inputs, M and C, in order to achieve the optimal level of performance ability, A^*. Finally, leisure time, L, is selected where the marginal benefit of increased leisure just equals the marginal cost of forgone market goods and services. In short, the household maximizes utility, Eq. (1), by selecting M, C, and L subject to technology, Eq. (2), and resource, Eq. (3), constraints. The solution to this optimization problem is based on the following Lagrangian:

$$\mathcal{L} = U(A, X, L|\tau) + \lambda_1[V + (T - L - C)W - P_x X - PM_2 - (P - s)M_1] + \lambda_2[m - M_1] \tag{4}$$

and the associated first-order conditions are:

$$\partial\mathcal{L}/\partial M_1 : U_A A_1 - \lambda_1(P - s) - \lambda_2 = 0 \tag{4a}$$

$$\partial\mathcal{L}/\partial M_2 : U_A A_2 - \lambda_1 P = 0 \tag{4b}$$

$$\partial \mathcal{L}/\partial C : U_{\mathrm{A}} A_{\mathrm{C}} - \lambda_1 W = 0 \tag{4c}$$

$$\partial \mathcal{L}/\partial X : U_x - \lambda_1 P_x = 0 \tag{4d}$$

$$\partial \mathcal{L}/\partial L : U_{\mathrm{L}} - \lambda_1 W = 0 \tag{4e}$$

$$V + W(T - L - C) - P_x X - PM_2 - (P - s)M_1 = 0 \tag{4f}$$

$$m - M_1 = 0 \tag{4g}$$

Condition (4f) is based on the budget constraint, while (4g) is based on limits to public care. If the public care constraint (4g) is non-binding, the household uses less than their maximum allotment of publicly funded services (i.e. $M_1 < m$ and $\lambda_2 = 0$) and Eq. (4a) becomes $U_{\mathrm{A}} A_1 - \lambda_1 (P - S) = 0$. Moreover, if publicly funded home care M_1, and privately funded home care M_2, were equally productive in the production of ability A, i.e. $A_1 = A_2 = A$,[5] then Eqs. (4a) and (4b) may be expressed as $U_{\mathrm{A}} A = \lambda_1 (P - s)$ and $U_{\mathrm{A}} A = \lambda_1 P$, respectively. In this case, if the public subsidy s were positive and $\lambda_2 = 0$, then the first order conditions in Eqs. (4a) and (4b) cannot both be satisfied. In order to solve this problem we invoke the Kuhn–Tucker condition for a non-linear programming problem.[6]

While the model described in this section is a simplification of complex household decision-making processes, it may be used to examine the effects of changes in both the availability and price of publicly financed home care. Because the effects of such changes depend on the initial equilibrium, we here examine three possible household care-giving equilibria under two regimes: first, when publicly (M_1) and privately funded (M_2) home care services are perfect substitutes; and second, when they are not perfect substitutes. We highlight the key results of the model under these regimes below and present details of the solution in Appendix A.

Let us consider the case where publicly (M_1) and privately funded (M_2) home care services are perfect substitutes where each household's care-giving equilibrium depends on the relationship between the total use of home care, M, i.e. $M_1 + M_2$, and the publicly financed maximum allocation for care recipients, m. First, in a low home care equilibrium, $M_1 < m$, the use of home care is less than the care recipient's publicly financed maximum allocation of care, m. This occurs where the subsidized unit price for publicly financed care, $(P - s)$, is sufficiently large relative to the household's willingness to pay. In this case, the care recipient's full allocation of publicly financed care, m, is not exhausted. Second, in a medium (or corner solution) utilization equilibrium, $M_1 = m$, the household fully exhausts the publicly financed allocation of care, m, but the unit cost of private home care, P, is too large for utilization, $M_2 = 0$. Third, in the high utilization (or interior) equilibrium ($M_1 = m$ and $M_2 > 0$), the household fully exhausts its publicly financed allocation, m, and supplements this care with privately financed care.

If we were to focus on an equilibrium in which care recipients supplemented publicly financed care with privately financed care, an increase in the allocation of publicly financed care, m, is tantamount to an increase in the household's non-wage income. Specifically, this change *increases* the optimal level of performance ability, A, through an income effect; it *increases* inputs of care-giving time, C, and total home care, M, if these inputs are normal inputs to the production

[5] The perfect substitute case ($A_1 = A_2$) involves a linear isoquant between M_1 and M_2 with a slope of -1. The case when they are not perfect substitutes ($A_1 \neq A_2$) involves an isoquant that is convex to the origin.

[6] This condition requires that if the household consumes less than its allowable limit of publicly subsidized service then it will not purchase any services privately (i.e. if $M_1 < m$, then $M_2 \not> 0$). In relation to first-order condition (4b) this implies that if $\partial \mathcal{L}/\partial M_2$: $U_{\mathrm{A}} A_2 < \lambda_1 P$ then $M_2 = 0$.

process, as relative input prices are invariant to this increase in m; it *increases* the consumption of leisure time and market goods and services through an income effect. In this case, an increase in publicly financed care, m, results in a complementary increase in care-giving activities. In contrast, however, if the initial equilibrium were represented by a low utilization equilibrium, $M_1 < m$, in which households do not fully exhaust their maximum allocation of publicly financed care, m, household behavior would be invariant to a marginal change in this maximum allocation.

Finally, if the initial equilibrium were represented by a corner solution, $M_1 = m$, a marginal change in the maximum allocation of publicly financed care yields a relative price effect. This effect, which is associated with a reduction in the effective unit cost of home care from P to $(P - s)$, yields a *substitution away* from care-giving time, C, *towards more* home care, M, and also yields an *increase* in care recipient performance ability, A. Thus, in the case of a corner solution, whereby the household exhausts the public allocation of care, an increase in that allocation results in a *decrease* in informal care-giving activities as publicly financed care substitutes for household care-giving activities. Moreover, this increased allocation of public care *increases* the household's consumption of leisure time and market goods and services.

In sum, if households supplement publicly financed home care with private care, an increase in the public allocation yields an income effect that increases care-giving activities. In contrast, if households fully exhaust, but do not supplement the public allocation of care, an increase in that allocation results in a price effect that lowers care-giving activities. In both cases, care recipient performance ability is enhanced. Because the cost $(P - s)$ of publicly financed care is relatively low and the cost (P) of private care is relatively large, most Canadians fully exhaust their public allocation $(M_1 = m)$ without supplementing such care with services from the private sector, i.e. $M_2 = 0$. Consequently, an increase in the public allocation of home care is anticipated to *decrease* care giving, C, to *increase* the utilization of formal care, M, and to *increase* the performance ability of care recipients, A.

This simple theoretical model also allows for the investigation of the impact of changes in the subsidy s on M_1 and M_2. For publicly funded services M_1, the answer is straightforward. When the constraint is binding the household cannot utilize any more M_1 in response to an increase in s—it is already utilizing all that is available and $\partial M_1/\partial s = 0$. For privately funded services the model predicts that

$$\partial M_2/\partial s = M_1 \partial M_2/\partial V > 0 \tag{5}$$

Eq. (5) shows that there is a pure income effect, i.e. there is no substitution effect, because the individual is constrained. $\partial M_2/\partial V$ represents the amount of extra M_2 the household will buy when its income increases by one unit which is multiplied by the number of extra units of income it has (M_1).

When $M_1 < m$ an increase in s would lead to an increase in M_1 and perhaps even in M_2 if it is a normal good and if the household is consuming close to the maximum amount of publicly subsidized home care at the outset. At a corner solution equilibrium ($M_1 = m$ and $M_2 = 0$) the slope of the isoquant (relating C to $M = M_1 + M_2$) relative to that of the isocost curve would be of importance since an increase in the subsidy s would cause the lower segment of the isocost line to be flatter (Fig. 1a). Since the household was not at a point of tangency to begin with, it would still consume $M_1 = m$ of home care services. Of course, there would be an income effect but it would probably be too small to induce the household to purchase home care services $(M_2 > 0)$ unless the slope of the isoquant was steeper than that of the isocost curve at the corner (Fig. 1b).

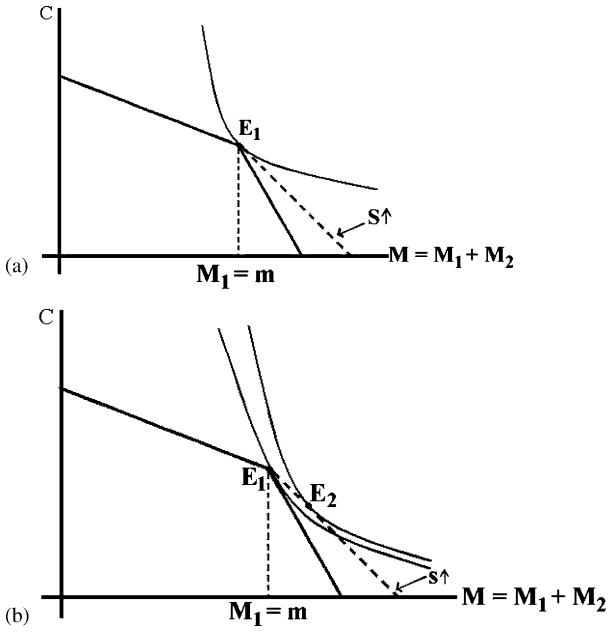

Fig. 1. The impact of changes in s when M_1 and M_2 are perfect substitutes.

For the case when M_1 and M_2 are not perfect substitutes ($A_1 \neq A_2$), they are effectively different goods. Condition (4a) incorporates the quantity constraint on M_1, but there is nothing preventing conditions (4a) and (4b) from being satisfied at the same time. If the quantity constraint on M_1 is not binding, we have a tangency solution (E_1 in Fig. 2a) between the isoquant (relating M_1 and M_2) and an isocost whose slope is—$(P - s)/P$ (Fig. 2a). When the constraint m is not binding, an increase in s (a rotation in the isocost) could, through an income effect, increase purchases of M_2 and of other inputs.

When the constraint is binding, it cuts the isocost off at m, at which point the constraint frontier becomes vertical. No tangency is possible along that vertical segment, nor is any trade-off possible, so we have a corner solution (Fig. 2b). The household consumes M_1 up to m and then selects the optimal amounts of M_2 and C given m (E_1 in Fig. 2b). In an unconstrained setting, the household would have perhaps selected E_2. Note that the household can still trade-off M_2 against other inputs in the production of A. An increase in the subsidy, s, would alter the slope of the isocost line (Fig. 2c). The new point of intersection E_1' is associated with $M_1 = m$ and a higher amount of M_2. While these insights regarding changes in s are interesting to consider, they will ultimately be un-testable in our empirical section due to data limitations.

Thus far we have not dealt with the issue of eligibility for publicly funded home care services. Since an individual qualifies for publicly funded home care services when their level of ability A, as assessed by a case manager or other health care professional falls below a threshold level $A_{\min}$, the eligibility requirement may be thought of as exogenously determined. An ineligible household can only choose M_2; changes in s and m will therefore have no impact on its choice of M and the household will optimize in C, M_2 space. If the household becomes eligible ($A < A_{\min}$) then one of the several cases discussed above would apply.

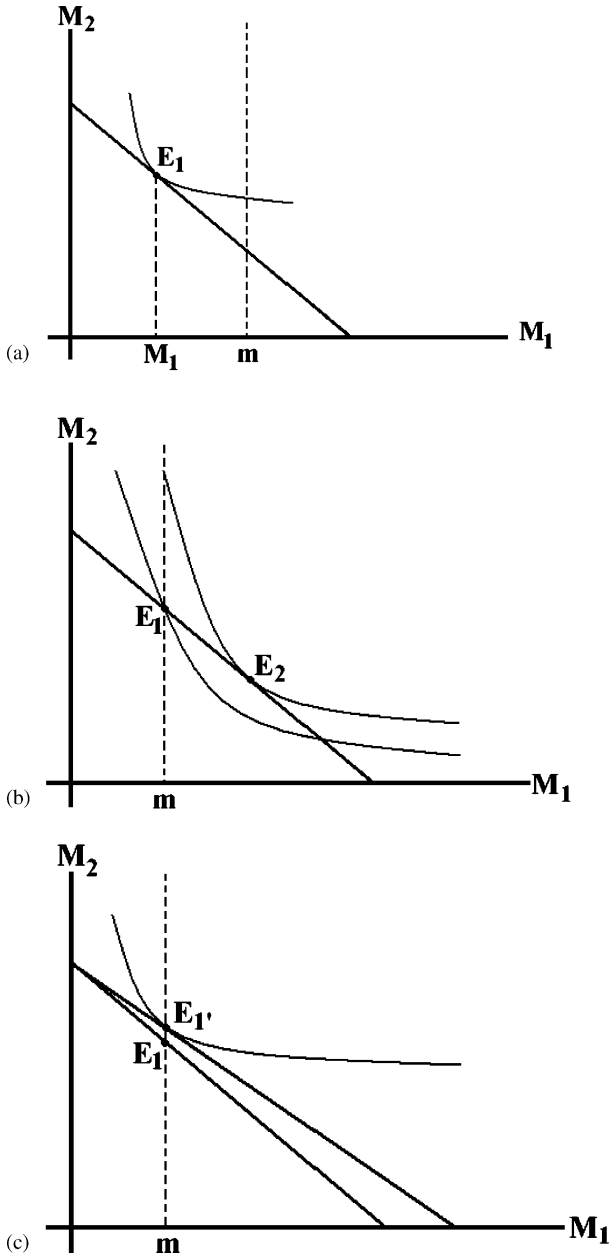

Fig. 2. The impact of changes in s when M_1 and M_2 are not perfect substitutes.

Overall our model has the following testable implications: (1) if households supplement publicly financed home care with private care, an increase in the public allocation (m) yields an income effect that increases care-giving activities (C). (2) If households fully exhaust, but do not supplement the public allocation of care (m), an increase in that allocation results in a price effect that lowers care-giving activities (C). (3) Increases in the public allocation of care (m) increases

care recipients performance ability (A) regardless of whether households fully exhaust their public allotment. (4) Increases in public allocation of care (m) increase the utilization of formal care (M) regardless of whether households supplement their allotment of public care with private care. The remainder of the paper turns to testing these implications using data on public home care provision and use in Canada.

4. Public home care in Canada

Home care in Canada is administered at the provincial level. Provinces are not obligated to provide home care under the *Canada Health Act*, but every province provides some amount of public home care to its residents. All provinces offer a similar basic range of services, including nursing services and personal support. Other services are offered to varying degrees across the country. In this section, some inter-provincial differences in home care programs are sketched. A more detailed description can be found in Health Canada (1998).

The provinces differ in the eligibility requirements for home care services. While all provinces offer a similar range of basic services, different provincial legislatures have adopted differing measures to allocate home care resources. Seven provinces have income tests to determine co-payments for personal support services. Two other provinces, Quebec and Manitoba, do not have a formal income cutoff, but do prioritize service provision based on a household's available private alternatives, be they formal or informal care. The remaining province, Ontario, has no formal income assessment program. These differences in assessment may have arisen, in part, due to the differences in governing parties at the time. For example, the development of the Ontario home care program began in the 1950s, and was fully established in the 1980s when there were both conservative and liberal governments. The lack of income assessment in Ontario may have been, in part, a function of a more liberal government at the time. However, subsequent conservative governments have not instated any income assessments despite changes in both the demand for home care and the age distribution of the population. Provinces also differ in the maximum amount of publicly insured home care provided to an individual. For example, Alberta has an upper limit of $3000 per month and Nova Scotia has an upper limit of $2200 per month. Some provinces impose restrictions on the maximum number of hours for home personal support, such as Quebec at 40 h per week, and Ontario at 80 h in the first month of service and 60 h per month thereafter. While these differences do correlate with provincial wealth, the time frame of our study is too short for any relative change in provincial wealth and we control for fixed provincial differences in all of our analyses.

The method by which individuals gain access to home care also varies across provinces. While many provinces have moved towards a standard assessment tool, the tools vary from province to province. Physician referrals are required in some, but not all provinces. In some provinces nurses can request access to home care services and in others care recipients may self-refer. These differences are frequently determined at the bargaining table between the provincial medical associations and the governments and are part of a much larger bargaining process that reviews what services should and should not be funded by provincial health plans. These negotiations are conducted behind closed doors and it is unlikely that small yearly changes in the demand for home care services at the patient level would provide much input into negotiations (Flood et al., 2003).

We therefore believe that differences in funding at the provincial level at a point in time are not entirely a function of the demands on government at the time, or a function of the individual demand for home care services in that year. However, we support these assertions with tests of

Table 1a
Spending per individual 65 years of age and older (in $)

Province	Year			
	1992	1994	1996	1998
Newfoundland	513.35	685.23	735.13	845.76
PEI	240.28	211.47	238.96	261.72
Nova Scotia	204.84	252.09	526.95	616.25
New Brunswick	518.81	676.18	725.63	744.21
Quebec	295.96	288.75	307.91	304.74
Ontario	527.02	728.28	729.47	733.42
Manitoba	493.45	509.74	733.74	668.25
Saskatchewan	263.17	402.04	455.73	473.44
Alberta	327.38	400.51	524.99	520.18
BC	396.38	440.78	477.32	478.73
Canada	378.06	459.51	545.58	564.67

Source: Statistics Canada and CIHI.

Table 1b
Fraction of provincial health care budget devoted to home care (in %)

Province	Year			
	1992	1994	1996	1998
Newfoundland	3.1	4.1	4.4	5.2
PEI	2.0	1.7	2.1	2.3
Nova Scotia	1.5	2.0	4.3	5.1
New Brunswick	4.0	5.1	5.5	5.8
Quebec	1.9	1.9	2.2	2.4
Ontario	3.3	4.8	5.0	5.3
Manitoba	3.5	3.7	5.4	5.0
Saskatchewan	2.2	3.4	3.9	3.9
Alberta	1.6	2.2	2.8	2.8
BC	2.7	2.9	3.1	3.1

Source: Statistics Canada and CIHI.

exogeneity and comparisons between OLS and IV estimation results that we explain in more detail below.

One way of summarizing the varying degrees of generosity in home care programs is by examining differences in provincial public home care spending per individual age 65 and older. Table 1a shows this for selected years between 1992 and 1998. While there has been an upward trend in the spending per elderly person on home care, the level and its rate of growth differ significantly across provinces. In 1998, Ontario spent $733 and New Brunswick spent $744, while Prince Edward Island (PEI) spent $261. Expenditure increased dramatically in Nova Scotia (from $204 to $616) compared with provinces such as British Columbia and PEI. For comparative purposes, Table 1b reports inter-provincial variation in the share of total public health expenditures allocated to home care. Trends in the share of public health care money devoted to home care are similar to the trends in spending per elderly individual. Other measures are reported in Appendix B.

5. Data

We use two data sources for our analysis. The first data source is the public use file from the National Population Health Survey (NPHS). The NPHS collects family and individual information on health status and utilization as well as demographic data. The survey was conducted in 1994/1995, 1996/1997, and 1998/1999 and all three rounds are used in our analysis. For a single-family member, 12 years of age and older, a more detailed survey of health and use of health care is conducted. We use this "health file" and examine individuals aged 55 years and older to focus our analysis on the age group most likely to require home care. The NPHS asks two series of questions that are particularly useful for our analysis. The first inquires whether an individual needed various forms of care at home over the past 12 months. Questions pertain to the need for help with daily activities and to the need for more specialized home care. A second set of questions ask whether individuals received home care over the past 12 months. This home care is specified to be formal, and the question stipulates that the cost should be partially or fully paid for by the government. Again, the questions range from receiving help with meals to help from medical professionals. The data are at the individual level but contain some family information. For example, we observe the individual's health status, demographics, and potential use of home care, but we also have information on family level income. We use these questions as well as the other information on health and demographics to examine differences in the need and use of home care by provinces over time in Canada between 1994 and 1998.

The second set of data used were derived from the General Social Survey (GSS) for 1992, 1994, and 1996. Again, this is a national survey that asks a series of questions to a random sample of Canadians. The 1992 survey focused on the use of time, the 1994 survey on education, work and retirement, and the 1996 survey on social and community support. While the surveys did not ask the same set of questions from year to year, in each year the surveys asked individuals about whether or not they provided informal home care. These surveys also collect demographic information about the respondent. Unfortunately the data do not contain any information about the individual for which care was provided. Therefore while we are able to observe whether an individual provided informal care, we are not able to observe any outcomes for the person who received the care. We use these surveys to examine differences in delivery of informal home care by households by province and over time between 1992 and 1996. Means and standard deviations for the main variables used are presented in Table 2.

Information on the generosity of public home care programs by province was added to both of these data sets. Because the methods by which provinces define program generosity differ significantly across provinces, we use public home care spending by province and year per individual aged 65 and older as our measure of public home care generosity. One potential concern with this measure is that the supply of public home care measured in this fashion is not completely exogenous if local governments differ in their public home care generosity based on some aggregate of the need in their local population. Although no one family's demand for care will affect aggregate spending levels, and many of the potential differences across provinces will be picked up by the provincial dummy variables included in our analysis, we nevertheless, attempt to address concerns over the potential endgoenity of this measure of public generosity by also presenting our results using instrumental variables for comparative purposes. Three exogenous variables are used as instruments. These are correlated with the generosity of the public home care program, but not with decisions to use or need care: the share of the population aged 65 and older in each province over time; the level of provincial spending on education in each province

Table 2
Means and standard deviations of primary explanatory variables

Variable	NPHS	GSS
Number of observation	46924	34447
Age: 15–24	–	0.12 (0.33)
Age: 25–34	–	0.19 (0.39)
Age: 35–44	–	0.17 (0.38)
Age: 45–54	–	0.11 (0.32)
Age: 55–64	0.38 (0.49)	0.11 (0.31)
Age: 65–69 (NPHS), 65–74 (GSS)	0.18 (0.39)	0.18 (0.38)
Age: 70+ (NPHS), 75+ (GSS)	0.43 (0.49)	0.11 (0.31)
Less than high school	0.46 (0.50)	0.34 (0.48)
High school	0.15 (0.36)	0.19 (0.39)
Some college	0.27 (0.44)	0.33 (0.47)
College	0.11 (0.31)	0.14 (0.34)
Income (in 000): 0	0.01 (0.08)	–
Income: 0–5	0.01 (0.08)	0.01 (0.07)
Income: 5–10	0.05 (0.22)	0.03 (0.16)
Income 10–15	0.14 (0.35)	0.07 (0.25)
Income: 15–20	0.15 (0.36)	0.07 (0.25)
Income: 20–30	0.22 (0.41)	0.12 (0.32)
Income: 30–40	0.15 (0.35)	0.16 (0.37)
Income: 40–50	0.09 (0.28)	0.14 (0.35)
Income: 50–60	0.06 (0.24)	0.11 (0.32)
Income: 60–80	0.05 (0.22)	0.10 (0.30)
Income: 80+ (NPHS), 80–100 (GSS)	0.05 (0.22)	0.08 (0.27)
Income 100+	–	0.07 (0.27)
Male	0.43 (0.49)	0.44 (0.50)
Married	0.56 (0.50)	0.66 (0.47)

Notes: Source is NPHS 1994, 1996, 1998 and GSS 1992, 1994, 1996. Means are pooled across three sample years for both NPHS and GSS. All variables represent the proportion of individuals in each category. The sample for the NPHS contains individuals 55 years and older only. The sample for the GSS contains individuals ages 15 years and older. Categories may not sum to 1 due to rounding.

over time; and the provincial tax rate as a share of federal taxes in each province over time.[7] Our instruments capture some of the variation across provinces in budgeting decisions that are correlated with home care spending. The *F*-statistic on the excluded instruments (proportion of the population over 65 years, per capita education spending, and average provincial tax rate) after cluster correcting the standard errors at the provincial level is 5.97. We perform Durban, Wu, Hausman tests for the endogeneity of our generosity measure. In almost all cases we cannot reject that our generosity measure is exogenous. Further, we perform over identification tests on the instruments to confirm that our exclusion restrictions are valid. In most specifications our test-statistics are quite small, suggesting that our additional instruments are valid. The complete first stage results and appropriate test statistics are reported in Appendix C. As a specification check, we repeated all analyses (both the single equation and IV) using the share of the public health care budget devoted to home care as our measure of program generosity. Our results are not sensitive to this alternative measure of generosity, although the instruments do not perform as

[7] For Quebec, which administers its own provincial tax system, we use the top marginal rate in the province for each year.

well in specification tests with the shares data. As such, we only report the results using spending on home care for individuals ages 65 and older.

6. Home care trends across Canada

The NPHS was used to demonstrate differences in home care needs and use across Canada in 1994, 1996 and 1998 (see Table 3). Two features are immediately clear. First, self-reported rates of need exceed the self-reported rates of use for all provinces over the study period. While approximately 6% of the population over 45 years of age received home care, the proportion reporting need for such services was about 20%. Second, there were wide inter-provincial variations in self-reported need and use of home care. While there was a threefold variation in the use of home care over the study period, variation in the need for home care fell from about 2.0 to 1.5% between 1994 and 1998.

Given the differences across provinces in both the perceived need for and use of home care, it is important to control for provincial differences when assessing the impact of home care program generosity on household behavior. We examine the correlates of the probability of use of home care across Canada. Our dependent variable is whether individuals reported home care service use in the given year and is specified as

$$\text{home care}_{ijt} = \beta_0 + \beta_1 \text{pubprog}_{jt} + \beta_2 X_{ijt} + \beta_3 \text{year}_t + \beta_4 \text{prov}_j + \varepsilon_{ijt} \quad (6)$$

where individuals are indexed by i, time by t, and provinces by j. Pubprog measures the generosity of provincial public home care programs, X is a vector of demographic characteristics, including age, sex, marital status, family income, education, home ownership, and self-reported health status. Dummy variables are also included for year, year, and province, prov. Note that our data allow us to look only at the extensive margin of whether people used home care or not, and do not allow us to examine the amount of use conditional on positive use.

The results from examining the determinants of home care use are reported in Table 4. The first column reports linear probability estimates of the probability of using home care. We have repeated our analysis using probit and logit models to test whether our results are sensitive to the

Table 3
Home care need and use by province (in percent)

Province	Year					
	1994		1996		1998	
	Need	Use	Need	Use	Need	Use
Newfoundland	16.6	3.0	20.0	2.7	22.5	3.8
PEI	25.1	6.8	32.3	6.6	26.5	3.9
Nova Scotia	27.6	5.0	28.6	7.3	30.7	8.7
New Brunswick	20.1	7.2	27.8	6.8	26.1	6.1
Quebec	14.1	4.1	19.1	3.7	21.2	4.3
Ontario	20.0	6.9	19.6	6.3	26.1	7.7
Manitoba	18.7	5.1	22.1	5.9	26.8	6.9
Saskatchewan	26.3	10.8	26.8	9.4	26.6	9.0
Alberta	16.3	4.1	19.5	5.0	21.2	3.6
BC	19.8	8.8	25.4	7.7	25.6	6.1
Canada	19.8	6.4	20.6	6.0	25.1	6.1

Source: NPHS 1994, 1996, and 1998.

Table 4
Determinants of any use of home care

	Use	
	(1) OLS	(2) IV
Public program generosity (in 1000)	0.128 (0.034)**	0.090 (0.048)*
Male	−0.014 (0.003)**	−0.014 (0.003)**
Married	0.008 (0.007)	0.008 (0.007)
Income (in 000): 0	−0.015 (0.011)	−0.015 (0.011)
Income: 0–5	−0.043 (0.028)	−0.043 (0.028)
Income: 5–10	−0.014 (0.005)*	−0.014 (0.005)*
Income: 15–20	−0.037 (0.008)**	−0.037 (0.008)**
Income: 20–30	−0.048 (0.006)**	−0.048 (0.006)**
Income: 30–40	−0.050 (0.009)**	−0.050 (0.009)**
Income: 40–50	−0.051 (0.008)**	−0.051 (0.008)**
Income: 50–60	−0.052 (0.007)**	−0.052 (0.007)**
Income: 60–80	−0.047 (0.010)**	−0.047 (0.010)**
Income: 80+	−0.048 (0.008)**	−0.048 (0.007)**
High school	0.012 (0.004)**	0.012 (0.004)**
Some college	0.011 (0.003)**	0.011 (0.003)**
College	0.021 (0.007)*	0.021 (0.007)*
Age: 65–69	0.016 (0.003)**	0.016 (0.003)**
Age: 70+	0.096 (0.004)**	0.096 (0.004)**
Health: v. good	0.015 (0.003)**	0.015 (0.003)**
Health: good	0.038 (0.006)**	0.038 (0.006)**
Health: fair	0.106 (0.008)**	0.106 (0.008)**
Health: poor	0.264 (0.015)**	0.264 (0.015)**
Own dwelling	−0.027 (0.009)*	−0.027 (0.009)*
Live alone	0.036 (0.008)**	0.036 (0.008)**
Constant	−0.009 (0.043)	−0.066 (0.032)
Observations	25148	25148
R-squared	0.12	0.12

Source: 1994/1996/1998 NPHS. Robust, cluster corrected standard errors in parentheses. All specifications include province and year fixed effects. Sample includes individuals ages 55 and older. Test statistic for over-identification test: 7.54. Test statistic for DURBIN, WU, HAUSMAN endogeneity test: 0.81.

** Significant at 1% level.

* Significant at 10% level.

choice of functional form and they are not. Many of the demographic variables influence the use of home care as anticipated. Estimates suggest that men are less likely to use home care than women. While individuals with higher family income are less likely to use home care, those with more education are more likely to use home care. One possible explanation for this result is that income is picking up the income cutoff in many provinces, and that conditional on income, individuals with more education are likely to be more aware of publicly available services. Older individuals and individuals who report lower health status are more likely to use home care.[8] Home ownership

[8] We also estimate models using lagged per capita public health care spending to help control for changes in the overall level of spending on health care in a province over time. We wish to include some measure of the overall generosity of health care spending, to separately identify changes in home care spending from an overall change in health care spending. The coefficient on lagged per capita health care spending is not significant and our other results are not sensitive to its inclusion.

is negatively correlated with the use of home care. This may be picking up residual wealth effects not captured by our income measures.[9] Previous literature examining the tradeoffs between home care and nursing homes have found that home ownership is a strong predictor for receipt of home care (Cutler and Sheiner, 1993). However, our sample does not include institutionalized individuals, and hence, the tradeoff being examined here is between receiving care at home or not receiving care at all.[10] Living alone is positively correlated with receiving care. This is consistent with previous literature as well as with home care programs that prioritize care allocations based on the recipients available informal care network.[11]

The generosity of the public program is positively and significantly correlated with the probability of using home care. Again, the identifying variation in public program generosity is within provinces over time since the regression includes both province and year dummies. A $100 increase in spending per individual 65 plus is associated with a 1.3% point increase in the probability of using home care, or an increase of 15%. That more individuals receive care when public program generosity increases is not particularly surprising and is consistent with the model outlined above.[12]

We perform Durbin, Wu, Hausman tests on public program generosity and cannot reject that OLS is consistent (the test statistics are included in the notes for the table). However, we also present IV results in the second column of Table 4 for comparative purposes. The IV results are similar in sign and significance to the OLS results. The coefficient for the public generosity variable is still significant and slightly smaller than the OLS coefficient.

The model outlined above predicts that more generous public programs will increase the amount of formally provided care, M, regardless of whether individuals are initially using both publicly and privately financed care, $M > m$, or only using publicly financed care, $M = m$. In this case, if provinces increase the generosity of their public programs, more individuals in need of care should receive publicly funded care. That is, conditional on claiming to need care, the generosity of the public program should have a positive effect on the probability of receiving care. To test this hypothesis, we condition the sample on those individuals who claim to need care and generate a dependent variable equal to 1 if the respondent received care. We then estimate the following equation:

$$(\text{receive} = 1|\text{need} = 1)_{ijt} = \gamma_0 + \gamma_1 \text{pubprog}_{jt} + \gamma_2 X_{ijt} + \gamma_3 \text{year}_t + \gamma_4 \text{prov}_j + \varepsilon_{ijt} \quad (7)$$

The results from estimating equation (7) are reported in Table 5. More generous public programs are positively and significantly correlated with receiving care conditional on needing care, as predicted by the model. When we instrument for the generosity of the public home care program the coefficient is similar, but the standard error is large and therefore the coefficient is no longer significantly different from zero. Endogeneity tests once again suggest, however, that our OLS

[9] We thank an anonymous referee for pointing this out.

[10] As noted above, previous literature has found that more generous in-home care leads to less nursing care use and higher rates of formal home care (Ettner, 1994).

[11] We re-estimate Eq. (4) excluding income to investigate whether our primary variable of interest is sensitive to the inclusion of income, and out of concern that income is also potentially endogenous. Our results are qualitatively similar with and without income.

[12] We test whether higher income individuals have a different response to increases in generosity by interacting a dummy variable for income over $50,000 with public generosity. As we describe later in the paper this is a proxy for whether individuals are constrained in their ability to use care or not. We find no difference in the effect of public generosity on the extensive marginal for home care use by income.

Table 5
Receiving home care conditional on needing care

	Care|need	
	(1) OLS	(2) IV
Public program generosity (in 1000)	0.310 (0.089)**	0.128 (0.186)
Male	0.047 (0.014)**	0.047 (0.014)**
Married	0.016 (0.021)	0.016 (0.021)
Income (in 000): 0	0.031 (0.057)	0.031 (0.057)
Income: 0–5	−0.035 (0.072)	−0.035 (0.071)
Income: 5–10	−0.019 (0.017)	−0.019 (0.017)
Income: 15–20	−0.069 (0.019)**	−0.069 (0.019)**
Income: 20–30	−0.100 (0.013)**	−0.100 (0.013)**
Income: 30–40	−0.120 (0.034)**	−0.121 (0.034)**
Income: 40–50	−0.121 (0.029)**	−0.122 (0.029)**
Income: 50–60	−0.179 (0.024)**	−0.179 (0.023)**
Income: 60–80	−0.171 (0.032)**	−0.171 (0.032)**
Income: 80+	−0.163 (0.025)**	−0.163 (0.025)**
High school	0.012 (0.017)	0.013 (0.017)
Some college	−0.004 (0.008)	−0.004 (0.008)
College	0.006 (0.030)	0.006 (0.030)
Age: 65–69	0.062 (0.015)**	0.062 (0.015)**
Age: 70+	0.183 (0.015)**	0.183 (0.015)**
Own dwelling	−0.049 (0.017)*	−0.049 (0.017)*
Live alone	0.050 (0.019)*	0.049 (0.020)*
Constant	0.148 (0.175)	−0.014 (0.135)
Observations	6811	6811
R-squared	0.08	0.08

Source: 1994/1996/1998 NPHS. Robust, cluster corrected standard errors in parentheses. All specifications include province and year fixed effects. Sample includes men and women ages 55 and older. Test statistic for over-identification test: 204.33. Test statistic for DURBIN, WU, HAUSMAN endogeneity test: 0.73.

** Significant at 1% level.

* Significant at 10% level.

estimates are consistent. The effects of some of the other covariates are also worth noting. Higher income individuals are less likely to receive care conditional on needing it. This may reflect differences in perceived need, although we do not find that individuals with more education have the same result. As noted above, this may also reflect some of the income restrictions in certain provinces. Home ownership is negatively correlated with receiving care conditional on needing care, and living alone is again positively related to receiving care conditional on need.

7. Health status and public home care programs

A further prediction from the model is that an increase in the generosity of public home care programs will result in an increase in a care recipient's "performance ability" (A). While we are unable to fully measure performance ability using the NPHS, we can measure the recipient's self-reported health status. To do this we create a dichotomous variable equal to one if the respondent claims that they are in good health or better (the first three categories on the five category scale) and zero otherwise. We then regress self-reported health status on the set of demographic controls,

Table 6
Self-reporting good health or better, only those individuals receiving home care

	Health	
	(1) OLS	(2) IV
Public program generosity (in 1000)	0.212 (0.119)*	0.032 (0.247)
Male	0.007 (0.020)	0.006 (0.020)
Married	0.062 (0.037)	0.062 (0.038)
Income (in 000): 0	−0.102 (0.073)	−0.102 (0.073)
Income: 0–5	−0.004 (0.181)	−0.005 (0.179)
Income: 5–10	−0.069 (0.050)	−0.070 (0.050)
Income: 15–20	0.012 (0.034)	0.012 (0.034)
Income: 20–30	−0.009 (0.028)	−0.010 (0.028)
Income: 30–40	0.091 (0.031)*	0.091 (0.031)*
Income: 40–50	0.095 (0.040)*	0.093 (0.040)*
Income: 50–60	0.026 (0.039)	0.025 (0.040)
Income: 60–80	0.134 (0.111)	0.134 (0.110)
Income: 80+	0.156 (0.059)*	0.158 (0.059)*
High school	0.067 (0.030)	0.067 (0.030)
Some college	0.071 (0.027)*	0.070 (0.027)*
College	0.137 (0.042)*	0.137 (0.042)**
Age: 65–69	−0.014 (0.062)	−0.013 (0.064)
Age: 70+	0.047 (0.039)	0.048 (0.040)
Own dwelling	0.021 (0.016)	0.021 (0.016)
Live alone	0.192 (0.037)**	0.192 (0.037)**
Constant	0.598 (0.223)*	0.297 (0.201)
Observations	2077	2077
R-squared	0.04	0.04

Source: 1994/1996/1998 NPHS. Robust, cluster corrected standard errors in parentheses. All specifications include province and year fixed effects. Sample includes men and women ages 55 and older who report to receive care. Test statistic for over-identification test: 0.42. Test statistic for DURBIN, WU, HAUSMAN endogeneity test: 0.73.

** Significance at 1% level.

* Significance at 10% level.

outlined above, and the generosity of public home care programs.[13] We restrict our sample to only those respondents who claim to have used home care since this is the population in which we expect any changes in health status to occur. Our results are summarized in Table 6. Here our OLS estimates confirm that increases in the generosity of public home care programs are positively correlated with increases in the probability of reporting good self assessed health or better. The estimates indicate that a $100 increase in spending per elderly individual is correlated with a 2.1% point increase in the probability of reporting good health. Our IV estimates are still positive, but the coefficient estimate is considerably smaller (with a 100% larger standard error). Among this population many of the other covariates that were significantly correlated with good health are no longer significant. For example, there are no longer significant correlations between being male or married and reporting good health. Further, the age dummies are no longer significant. One

[13] While other measures of health status such as activities of daily living are available, it is not clear how increases in home care will affect the way individuals report such measures. As noted in Cutler (2001) a person who once managed tasks with some difficulty and now has a handrail to make these tasks easier will report himself as receiving assistance with ADLs where previously he would not.

potential explanation for this is that home care is being directed at very needy individuals and among this population other characteristics are of less significance.

8. Informal care givers and public home care programs

In this section, we examine whether the generosity of public home care programs affect household time allocations between informal care giving, leisure and labour market activities. The general social survey (GSS) yields data on the incidence of informal care giving, however, the questions posed in each study year are not identical. In 1992, the survey asked whether respondents provided care for someone ill in the last month. The 1994 survey asked about providing unpaid care to seniors or others who are not the respondent's children, and the 1996 survey asked whether the respondent gave any informal care to others in the past 12 months. As such, there may be shifts in the level of care giving across years due to the domains assessed by each question. The regression analysis controlled for these shifts through use of year effects.

Wide inter-provincial variation in care giving over the study period is reported in Table 7. While 7.9% of Quebecers reported care-giving activities in 1992, 13.3% of Ontarians and 22.4% of Newfoundlanders reported such activities. The provincial dummies in our regression analysis pick up the differences that are constant over time.

The simple theoretical model suggests that a household's care-giving response to changes in the allocation of public home care is contingent on its resource base. If the household fully exhausts its allocation of public home care and supplements such care with private home care ($M_1 = m$; $M_2 > 0$), an increase in the generosity of the public home care program would yield an income effect that results in a complementary increase in informal care-giving activities. However, if a household did not supplement its public allocation ($M_1 = m$; $M_2 = 0$), an increase in the generosity of the public home care program would yield a substitution effect that lowers informal care-giving activities.

We use the GSS surveys and a regression specification similar to the ones outlined above to assess the determinants of care-giving activities after controlling for underlying demographic

Table 7
Percentage of respondents reporting to provide informal care giving by province

Province	Year		
	1992	1994	1996
Newfoundland	22.4	33.7	18.9
PEI	15.7	33.8	23.6
Nova Scotia	18.4	31.7	19.8
New Brunswick	14.1	24.1	11.4
Quebec	7.9	14.8	11.5
Ontario	13.3	15.2	11.8
Manitoba	12.7	19.2	13.3
Saskatchewan	13.8	22.9	12.3
Alberta	13.0	16.9	12.1
BC	9.5	20.0	13.4
Canada	12.7	20.0	13.2

Source: 1992/1994/1996 GSS.

characteristics and the generosity of public home care programs. Our dependent variable is a dichotomous variable equal to one if the individual reports providing informal care giving and zero otherwise. To account for the hypothesized differential effect of public programs on care-giving activities depending on whether $M = m$ or $M > m$, we would ideally like to include an interaction term in the regression equal to the product of the generosity of the public home care program and a dummy variable indicating whether the family currently consumed $M = m$ or $M > m$. Unfortunately we do not have information on the amount of formal home care consumed. Therefore, we proxy for the likelihood of consuming privately funded formal home care using both family income greater than or equal to $50,000 and having a college education. While we would expect that both would be correlated with the probability of purchasing private care, family income may be endogenously related to providing care and so we also use education to attempt to circumvent this problem.[14]

The regression results are reported in Tables 8a and 8b. Table 8a reports results using income as a proxy for consuming private formal care. Consistent with previous literature, the estimates suggest women are more likely to engage in care-giving activities than men. To investigate this more closely we repeat our analysis for women only (column 3 of both tables). The relationship between care-giving activities and the respondent's age follows an inverted U-shaped relationship, peaking at age 75. Interestingly, there does not appear to be a clear relationship between household income and providing informal care, however, individuals with more than a high school education or working fewer hours are more likely to engage in care-giving activities. We control for the number of income earners in the family by including a dummy variable for whether or not there is a working spouse. We do not find a significant correlation between having a working spouse and providing informal care giving.

Our model suggests that an increase in the generosity of public home care programs will increase care-giving activities for households who were previously exceeding the public allocation of care and decrease such care-giving activities for households that were exactly consuming the public allocation of care. This occurs because an increase in the generosity of public home care programs yields an income effect for those who supplement public care with private care, and a substitution effect only for those who do not consume more than their allocation of public care. In our OLS results on the entire sample, public program generosity is negatively and significantly correlated with care-giving activities and the interaction effect is positive but not significant. A $100 increase in spending per individual aged 65 plus is associated with a decrease in the probability of informal care giving of 1.9% points or 12.7%. When we limit the sample to only women, the effects are similar, but the coefficients larger. Our IV results (column 2) are less promising. Neither the public program generosity nor the interaction term is significant.[15] However, as with earlier results, we cannot reject the consistency of our OLS estimates using the DWH test. Our results suggest that households who are not likely to supplement public care with privately purchased care reduce their care-giving activities as a result of increases in generosity. However, we find only weak evidence to suggest that households who were previously exceeding the public allocation of care respond differently than those who were not. This finding is consistent with an initial equilibrium in which care recipients fully exhaust

[14] We also estimate all models of informal care giving excluding income controls out of concern that income might be endogenous. Excluding these controls does not qualitatively change the coefficients on the generosity of the public program.

[15] Here our instruments include the three instruments outlined above as well as interactions between the instruments and the dummy variable which proxies for consuming private formal care.

their public allocation of care without supplementing such care with services from the private sector.

In Table 8b, we use education instead of income as a proxy for the family consuming formal private home care. The results here are quite similar to those in the

Table 8a
Determinants of any care giving using family income as a proxy for $M > m$

	Care giving		
	(1) OLS	(2) IV	(3) OLS – women only
Public program generosity (in 1000)	−0.194 (0.079)*	0.021 (0.221)	−0.254 (0.078)*
Public program generosity × income > 50000	0.025 (0.035)	0.005 (0.027)	0.054 (0.085)
Age: 25–34	0.013 (0.008)	0.013 (0.008)	0.019 (0.007)*
Age: 35–44	0.064 (0.008)**	0.064 (0.008)**	0.087 (0.012)**
Age: 45–54	0.085 (0.010)**	0.085 (0.010)**	0.123 (0.012)**
Age: 55–64	0.079 (0.010)**	0.078 (0.010)**	0.103 (0.014)**
Age: 65–74	0.040 (0.009)**	0.041 (0.009)**	0.053 (0.018)*
Age: 75+	−0.011 (0.016)	−0.011 (0.016)	−0.015 (0.016)
High school	0.017 (0.006)*	0.017 (0.006)*	0.018 (0.011)
Some college	0.052 (0.010)**	0.052 (0.010)**	0.068 (0.011)**
College	0.043 (0.010)**	0.043 (0.010)**	0.039 (0.015)*
Male	−0.043 (0.006)**	−0.043 (0.006)**	
HH income: <5 (in $000)	−0.028 (0.048)	−0.028 (0.048)	−0.024 (0.057)
HH income: 5–10	0.005 (0.012)	0.004 (0.012)	0.016 (0.026)
HH income: 15–20	0.031 (0.017)	0.031 (0.018)	0.049 (0.024)
HH income: 20–30	0.024 (0.012)	0.024 (0.012)	0.034 (0.023)
HH income: 30–40	0.020 (0.011)	0.020 (0.011)	0.022 (0.016)
HH income: 40–50	0.030 (0.014)	0.030 (0.015)	0.046 (0.018)*
HH income: 50–60	0.013 (0.015)	0.012 (0.015)	0.029 (0.018)
HH income: 60–80	0.012 (0.018)	0.021 (0.017)	0.004 (0.041)
HH income: 80–100	0.024 (0.028)	0.032 (0.027)	−0.009 (0.048)
HH income: 100+	0.024 (0.024)	0.033 (0.024)	−0.005 (0.042)
Per income: <5 (in $000)	0.006 (0.011)	0.006 (0.011)	−0.019 (0.013)
Per income: 5–9	0.001 (0.014)	0.003 (0.014)	0.008 (0.017)
Per income: 15–20	0.010 (0.013)	0.011 (0.013)	0.003 (0.015)
Per income: 20–30	−0.007 (0.012)	−0.007 (0.012)	−0.015 (0.018)
Per income: 30–40	0.010 (0.011)	0.011 (0.011)	0.017 (0.016)
Per income: 40–50	0.006 (0.015)	0.006 (0.015)	0.013 (0.017)
Per income: 50–60	0.004 (0.012)	0.004 (0.012)	0.027 (0.013)
Per income: 60–80	−0.020 (0.022)	−0.019 (0.022)	0.004 (0.036)
Per income: 80–100	−0.037 (0.022)	−0.035 (0.022)	0.058 (0.032)
Per income: 100+	−0.023 (0.033)	−0.023 (0.033)	0.017 (0.043)
Hours worked	−0.001 (0.000)	−0.001 (0.000)	−0.001 (0.000)
Married	0.001 (0.006)	0.001 (0.006)	0.005 (0.009)
Spouse works	−0.013 (0.008)	−0.013 (0.008)	−0.014 (0.009)
Constant	0.279 (0.049)**	0.157 (0.130)	0.304 (0.052)**
Observations	22124	22124	11930
R-squared	0.04	0.04	0.05

Source: 1992/1994/1996 GSS. Robust, cluster corrected standard errors in parentheses. All specifications include province and year fixed effects. Sample includes all individuals ages 15–75+ (ages are grouped). Column three includes only women. Test statistic for over-identification test: 4.42. Test statistic for DURBIN, WU, HAUSMAN endogeneity test: 1.47.

** Significant at 1% level.

* Significant at 1% level.

Table 8b
Determinants of any care giving using education as a proxy for $M > m$

	Care giving		
	(1) OLS	(2) IV	(3) OLS – women only
Public program generosity (in 1000)	−0.195 (0.076)*	0.013 (0.221)	−0.257 (0.078)**
Public program generosity × Edu = college	0.039 (0.070)	0.018 (0.049)	0.085 (0.107)
Age: 25–34	0.013 (0.008)	0.013 (0.008)	0.019 (0.007)*
Age: 35–44	0.064 (0.008)**	0.064 (0.008)**	0.087 (0.012)**
Age: 45–54	0.085 (0.010)**	0.085 (0.010)**	0.123 (0.012)**
Age: 55–64	0.079 (0.010)**	0.078 (0.010)**	0.103 (0.014)**
Age: 65–74	0.040 (0.009)**	0.041 (0.009)**	0.053 (0.018)*
Age: 75+	−0.011 (0.016)	−0.011 (0.016)	−0.015 (0.016)
High school	0.017 (0.007)*	0.018 (0.006)*	0.018 (0.011)
Some college	0.052 (0.010)**	0.052 (0.010)**	0.068 (0.011)**
College	0.025 (0.032)	0.035 (0.024)	−0.001 (0.049)
Male	−0.043 (0.006)**	−0.043 (0.006)**	
HH income: <5 ($000)	−0.028 (0.048)	−0.027 (0.048)	−0.023 (0.056)
HH income: 5–10	0.005 (0.012)	0.004 (0.012)	0.016 (0.026)
HH income: 15–20	0.031 (0.017)	0.031 (0.018)	0.049 (0.024)
HH income: 20–30	0.024 (0.012)	0.024 (0.012)	0.033 (0.023)
HH income: 30–40	0.020 (0.011)	0.020 (0.011)	0.022 (0.016)
HH income: 40–50	0.030 (0.014)	0.030 (0.015)	0.046 (0.018)*
HH income: 50–60	0.013 (0.015)	0.012 (0.015)	0.029 (0.018)
HH income: 60–80	0.024 (0.011)*	0.023 (0.011)	0.029 (0.020)
HH income: 80–100	0.036 (0.018)	0.035 (0.018)	0.017 (0.021)
HH income: 100+	0.036 (0.020)	0.036 (0.020)	0.021 (0.025)
Per income: <5 (IN $000)	0.006 (0.011)	0.006 (0.011)	−0.019 (0.013)
Per income: 5–9	0.002 (0.014)	0.003 (0.014)	0.008 (0.017)
Per income: 15–20	0.010 (0.013)	0.011 (0.013)	0.003 (0.015)
Per income: 20–30	−0.007 (0.012)	−0.007 (0.012)	−0.015 (0.018)
Per income: 30–40	0.011 (0.011)	0.011 (0.011)	0.018 (0.016)
Per income: 40–50	0.006 (0.015)	0.006 (0.015)	0.014 (0.017)
Per income: 50–60	0.004 (0.012)	0.004 (0.012)	0.028 (0.013)
Per income: 60–80	−0.020 (0.022)	−0.019 (0.022)	0.004 (0.036)
Per income: 80–100	−0.037 (0.022)	−0.036 (0.022)	0.059 (0.032)
Per income: 100+	−0.024 (0.033)	−0.023 (0.033)	0.017 (0.042)
Hours worked	−0.001 (0.000)	−0.001 (0.000)	−0.001 (0.000)
Married	0.001 (0.006)	0.001 (0.006)	0.005 (0.009)
Spouse works	−0.013 (0.008)	−0.013 (0.008)	−0.014 (0.009)
Constant	0.279 (0.047)**	0.161 (0.130)	0.305 (0.052)**
Observations	22124	22124	11930
R-squared	0.04	0.04	0.05

Source: 1992/1994/1996 GSS. Robust, cluster corrected standard errors in parentheses. All specifications include province and year fixed effects. Sample includes all individuals ages 15–75+ (ages are grouped). Column three includes only women. Test statistic for over-identification test: 4.42. Test statistic for DURBIN, WU, HAUSMAN endogeneity test: 1.44.

** Significant at 1% level.

* Significance at 10% level.

previous table. While we do find that increases in the generosity of public home care programs (m) result in a decline in informal care giving activities (C), we do not find significant estimates of this effect being less pronounced among more highly educated individuals.

In sum, variations in the generosity of the public home care program affect care-giving activities. Our estimates suggest that there is an inverse relationship between household care-giving activities and the generosity of public home care programs. While we estimate positive coefficients on the interaction between higher income or more highly educated households and program generosity, our results here are not statistically significant. As noted in our theoretical analysis, because the cost of publicly financed care is relatively low and the cost of private care is relatively large, it is likely that most Canadians fully exhaust their public allocation without supplementing such care with services from the private sector, $M = m$. This may explain why we do not find any significant interaction effects. Our estimates differ from those of Pezzin et al. (1996) and Christianson (1988) who find only very small reductions in the overall amount of care provided by informal caregivers. Our results are, however, fairly consistent with those reported by Ettner (1994) who finds that increases in home care benefits promote substitution of care rather than increasing the total amount of care received. Ettner's findings suggest that total care remains virtually unchanged. While our results do not allow us to measure the exact amount of each type of care received, we find that a $100 increase in program generosity for the elderly is associated with a 15% increase in the probability of using formal care and a 13% decline in the probability of informal care, confirming Ettner's findings that there is considerable substitution from informal to formal care.

9. Summary and conclusions

We present a simple model of household decision-making to better understand how households respond to changes in publicly provided home care services. We then test the predictions of that model using data on home care use and care giving in Canada.

The theoretical predictions and empirical results are mainly consistent with the anticipated effects of the generosity of public programs on household decision-making. Our results demonstrate that the increased availability of publicly financed home care is associated with an increase in the likelihood of utilization and a decline in the likelihood of informal care giving. While self-reported health status was positively correlated with the increased availability of publicly financed home care, the perceived need for home care was invariant to this change.

The result that an increase in public program generosity leads to an increase in self-reported health status has not, to our knowledge, been reported in the literature. In itself, this result suggests that increased support for the home as a setting for the provision of care may improve health status.

The finding that an increase in the generosity of public programs was correlated with a decline in informal care giving is consistent with an initial equilibrium in which care recipients fully exhaust their public allocation of care without supplementing such care with services from the private sector. The increase in the probability of receiving formal care is largely, though not entirely, offset by a decline in the probability of receiving informal care. These results are consistent with those found by Ettner (1994). From a health policy perspective, however, this response by household care givers undermines, but does not eliminate, the potential benefits derived by care recipients through the increased availability of formal home care. This finding suggests that improvements in the generosity of public home care programs are shared by *all members* of the household, both care giver and care recipient, and are not captured exclusively by the care recipient.

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Appendix A. Household decision-making

To assess the impact of changes in the maximum allotment of publicly financed home care, m, or changes in the public subsidy, s, on household care-giving decisions, we totally differentiate the first order conditions specified in Eqs. (4a)–(4g) with respect to all of the endogenous and exogenous variables to obtain seven linear equations in seven unknown endogenous variables (∂X, ∂L, ∂C, ∂M_1, ∂M_2, $\partial\lambda_1$, $\partial\lambda_2$) and three exogenous variables (∂m, ∂V, ∂s). In matrix notation we have

$$\begin{bmatrix} \ell_{XX} & \ell_{XL} & \ell_{XC} & \ell_{X1} & \ell_{X2} & -P_X & 0 \\ \ell_{LX} & \ell_{LL} & \ell_{LC} & \ell_{L1} & \ell_{L2} & -W & 0 \\ \ell_{CX} & \ell_{CL} & \ell_{CC} & \ell_{C1} & \ell_{C2} & -W & 0 \\ \ell_{1X} & \ell_{1L} & \ell_{1C} & \ell_{11} & \ell_{12} & -(P-s) & -1 \\ \ell_{2X} & \ell_{2L} & \ell_{2C} & \ell_{21} & \ell_{22} & -P & 0 \\ -P_X & -W & -W & -(P-s) & -P & 0 & 0 \\ 0 & 0 & 0 & -1 & 0 & 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} \partial X \\ \partial L \\ \partial C \\ \partial M_1 \\ \partial M_2 \\ \partial\lambda_1 \\ \partial\lambda_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ -1 \end{bmatrix} \partial m + \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ -1 \\ 0 \end{bmatrix} \partial V \begin{bmatrix} 0 \\ 0 \\ 0 \\ -\lambda_1 \\ 0 \\ -M_1 \\ 0 \end{bmatrix} \partial s \tag{A.1}$$

In order to determine the utility maximizing response of M_1 to changes in each independent variable, we apply Cramer's Rule to (A.1). By defining the matrix D as the seven by seven matrix of coefficients on the left-hand side of expression (A.1), letting $|D|$ be the determinant of D, and letting the ℓ variables be the second derivatives of the first-order conditions, where ℓ_{XC} refers to the derivative of the Lagrangian with respect to X and then with respect to C, we may obtain an expression for the effect of an increase in the maximum allotment of publicly financed home care, m, on the use of such care as

$$\partial M_1/\partial m = |D_4|/|D| \tag{A.2}$$

where the matrix D_4 is defined to be identical to the matrix of coefficients, D, except that the fourth column has been replaced by the vector multiplying ∂m in (A.1), thus

$$D_4 = \begin{bmatrix} \ell_{XX} & \ell_{XL} & \ell_{XC} & 0 & \ell_{X2} & -P_X & 0 \\ \ell_{LX} & \ell_{LL} & \ell_{LC} & 0 & \ell_{L2} & -W & 0 \\ \ell_{CX} & \ell_{CL} & \ell_{CC} & 0 & \ell_{C2} & -W & 0 \\ \ell_{1X} & \ell_{1L} & \ell_{1C} & 0 & \ell_{12} & -(P-s) & -1 \\ \ell_{2X} & \ell_{2L} & \ell_{2C} & 0 & \ell_{22} & -P & 0 \\ -P_X & -W & -W & 0 & -P & 0 & 0 \\ 0 & 0 & 0 & -1 & 0 & 0 & 0 \end{bmatrix} \tag{A.3}$$

with $|D_4|$ as the determinant of D_4. Eq. (A.2) may be simplified to be

$$\partial M_1/\partial m = -\{-\ell_{x2}Z_{14} + \ell_{L2}Z_{24} - \ell_{C2}Z_{34} + \ell_{22}Z_{44} + PZ_{54}\}/|D| \tag{A.4}$$

where the Z_{ij} represents the co-factors that correspond to the ith row and jth column of the matrix D_4.

When the constraint is binding (i.e. $M_1 = m$) then an increase of one unit in m results in a one unit increase in M_1 ($\partial M_1/\partial m = 1$). There is no income effect as shown by

$$\partial M_1/\partial V = |D_5|/|D| = 0 \tag{A.5}$$

where

$$D_5 = \begin{bmatrix} \ell_{XX} & \ell_{XL} & \ell_{XC} & 0 & \ell_{X2} & -P_X & 0 \\ \ell_{LX} & \ell_{LL} & \ell_{LC} & 0 & \ell_{L2} & -W & 0 \\ \ell_{CX} & \ell_{CL} & \ell_{CC} & 0 & \ell_{C2} & -W & 0 \\ \ell_{1X} & \ell_{1L} & \ell_{1C} & 0 & \ell_{12} & -(P-s) & -1 \\ \ell_{2X} & \ell_{2L} & \ell_{2C} & 0 & \ell_{22} & -P & 0 \\ -P_X & -W & -W & -1 & -P & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} = 0 \tag{A.6}$$

The impact of a change in m on M_2 is found from

$$\partial M_2/\partial m = |D_6|/|D| = 0 \tag{A.6}$$

where

$$D_6 = \begin{bmatrix} \ell_{XX} & \ell_{XL} & \ell_{XC} & \ell_{X1} & 0 & -P_X & 0 \\ \ell_{LX} & \ell_{LL} & \ell_{LC} & \ell_{L1} & 0 & -W & 0 \\ \ell_{CX} & \ell_{CL} & \ell_{CC} & \ell_{C1} & 0 & -W & 0 \\ \ell_{1X} & \ell_{1L} & \ell_{1C} & \ell_{11} & 0 & -(P-s) & -1 \\ \ell_{2X} & \ell_{2L} & \ell_{2C} & \ell_{21} & 0 & -P & 0 \\ -P_X & -W & -W & -(P-s) & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 & -1 & 0 & 0 \end{bmatrix} \tag{A.7}$$

Expanding the expression (A.6) and assuming M_1 and M_2 are perfect substitutes (i.e. $A_1 = A_2$) we obtain:

$$\begin{aligned}\partial M_2/\partial m &= \{-\ell_{X1}Z_{14} + \ell_{L1}Z_{24} - \ell_{C1}Z_{34} + \ell_{21}Z_{44} + PZ_{54} - sZ_{54}\}/|D| \\ &= -\partial M_1/\partial m - 1/|D|sZ_{54} \end{aligned} \tag{A.8}$$

The second term on the right-hand side of Eq. (A.8) represents an income effect since $\partial M_2/\partial V$ may be expressed as follows:

$$\partial M_2/\partial V = |D_7|/|D| = -1/|D|Z_{54} \neq 0 \tag{A.9}$$

where

$$D_7 = \begin{bmatrix} \ell_{XX} & \ell_{XL} & \ell_{XC} & \ell_{X1} & 0 & -P_X & 0 \\ \ell_{LX} & \ell_{LL} & \ell_{LC} & \ell_{L1} & 0 & -W & 0 \\ \ell_{CX} & \ell_{CL} & \ell_{CC} & \ell_{C1} & 0 & -W & 0 \\ \ell_{1X} & \ell_{1L} & \ell_{1C} & \ell_{11} & 0 & -(P-s) & -1 \\ \ell_{2X} & \ell_{2L} & \ell_{2C} & \ell_{21} & 0 & -P & 0 \\ -P_X & -W & -W & -(P-s) & -1 & 0 & 0 \\ 0 & 0 & 0 & -1 & 0 & 0 & 0 \end{bmatrix} \tag{A.10}$$

Eq. (A.8) may now be re-written to yield:

$$\partial M_2/\partial m = -\partial M_1/\partial m + s\partial M_2/\partial V \tag{A.11}$$

The first term on the right-hand side demonstrates that if an individual receives an additional unit of m then she will increase her consumption of M_1 by one unit which will reduce her consumption of M_2 by one unit. The second term represents an income effect that results from the fact that the individual saves s on each additional unit of m. Thus, M_2 will decline by less than one unit in response to a one unit increase in m and M (total public and private consumption of home care) would increase overall.

A change in the subsidy s would have no impact on the amount of M_1 consumed if the constraint is binding as seen from

$$\partial M_1/\partial s = |D_8|/|D| = 0 \tag{A.12}$$

$$D_8 = \begin{bmatrix} \ell_{XX} & \ell_{XL} & \ell_{XC} & 0 & \ell_{X2} & -P_X & 0 \\ \ell_{LX} & \ell_{LL} & \ell_{LC} & 0 & \ell_{L2} & -W & 0 \\ \ell_{CX} & \ell_{CL} & \ell_{CC} & 0 & \ell_{C2} & -W & 0 \\ \ell_{1X} & \ell_{1L} & \ell_{1C} & -\lambda_1 & \ell_{12} & -(P-s) & -1 \\ \ell_{2X} & \ell_{2L} & \ell_{2C} & 0 & \ell_{22} & -P & 0 \\ -P_X & -W & -W & -M_1 & -P & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} = 0 \tag{A.13}$$

However, a change in s does influence the level of M_2 consumed:

$$\partial M_1/\partial S = |D_9|/|D| = -M_1 Z_{54}/|D| = M_1 \partial M_2/\partial V > 0 \tag{A.13}$$

where

$$D_9 = \begin{bmatrix} \ell_{XX} & \ell_{XL} & \ell_{XC} & \ell_{X1} & 0 & -P_X & 0 \\ \ell_{LX} & \ell_{LL} & \ell_{LC} & \ell_{L1} & 0 & -W & 0 \\ \ell_{CX} & \ell_{CL} & \ell_{CC} & \ell_{C1} & 0 & -W & 0 \\ \ell_{1X} & \ell_{1L} & \ell_{1C} & \ell_{11} & -\lambda_1 & -(P-s) & -1 \\ \ell_{2X} & \ell_{2L} & \ell_{2C} & \ell_{21} & 0 & -P & 0 \\ -P_X & -W & -W & -(P-s) & -M_1 & 0 & 0 \\ 0 & 0 & 0 & -1 & 0 & 0 & 0 \end{bmatrix} \tag{A.14}$$

A change in s translates into a pure income effect because the individual is constrained. The term $\partial M_2/\partial V$ in the last line of (A.13) shows how much extra M_2 the individual will purchase when her income increases by one unit, and is multiplied by the number of extra units of income that she now has (M_1).

The above analysis assumed that the constraint was binding but it is also possible for $M_1 < m$ or for $M_1 = m$ and $M_2 = 0$ and for M_1 and M_2 not to be perfect substitutes. The implications of these scenarios and the role of the eligibility constraint ($A < A_{\min}$) are discussed in the body of the paper.

Appendix B

Measures of public home care generosity, 1996–1997

Province	Total home care exp/capita ($)	Home care/public health expenditure (%)	Home care expenditure/care recipient ($)
Newfoundland	78.7	4.4	N/A
PEI	30.8	2.1	1923.9
Nova Scotia	68.2	4.3	3589.2
New Brunswick	90.9	5.5	2273.3
Quebec	36.8	2.2	800.8
Ontario	89.1	5.0	3073.9
Manitoba	99.3	5.3	4136.5
Saskatchewan	66.1	3.9	2359.7
Alberta	51.2	2.8	2226.6
BC	59.8	3.1	1931.1

Source: Statistics Canada and CIHI.

Appendix C

First stage OLS results for the generosity of provincial home care programs

$N = 38153$	Expenditure on home care per individual 65+
Prov tax rate	-1.01^{**} (0.020)
Edu spending/capita	-0.00016^{**} (0.00001)
Pop 65+	0.00000^{**} (0.00000)
PEI	-0.824^{**} (0.011)

Appendix C (*Continued*)

$N = 38153$	Expenditure on home care per individual 65+
NS	−0.324** (0.0074)
NB	−0.082** (0.0058)
QUE	1.19** (0.026)
ONT	3.16** (0.055)
MAN	−0.053** (0.0039)
SAS	−0.328** (0.0043)
ALB	−0.018** (0.0041)
BC	0.597** (0.014)
Year = 1996	0.133** (0.0016)
Year = 1998	0.175** (0.0030)
Male	0.00020 (0.00037)
Married	−0.0014* (0.00074)
Income: 0 (in 000)	−0.0027 (0.0026)
Income: 0–5	−0.0041 (0.0030)
Income: 5–10	−0.00006 (0.0010)
Income: 15–20	0.00042 (0.00067)
Income: 20–30	0.00056 (0.00063)
Income: 30–40	0.00018 (0.00070)
Income: 40–50	0.00092 (0.00078)
Income: 50–60	0.00046 (0.00084)
Income: 60–80	0.00068 (0.00091)
Income: 80+	0.0019** (0.00087)
High school	−0.00030 (0.00050)
Some college	−0.00012 (0.00043)
College	−0.00091 (0.00061)
Age: 65–69	−0.00019 (0.00049)
Age: 70+	−0.00013 (0.00042)
Health: v. Good	0.00031 (0.00053)
Health: good	0.00057 (0.00054)
Health: fair	−0.00089 (0.00067)
Health: poor	0.00046 (0.00090)
Own dwelling	0.00054 (0.00044)
Live alone	−0.00056 (0.00077)
Constant	1.88** (0.040)

Source: 1994–1998 NPHS and provincial level data from Statistics Canada. Robust standard errors in parentheses. The excluded instruments are the average provincial tax rate, per capita provincial educational spending, and the percent of the population ages 65 and over. Sample is all individuals 55 and older. The cluster corrected (by province) F-statistic on the excluded instruments is 5.97.*Significant at the 10% level.**Significant at the 5% level.

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