Health and Social Care in the Community (2008) **16**(2), 126–136 doi: 10.1111/j.1365-2524.2007.00732.x

Costs and determinants of privately financed home-based health care in Ontario, Canada

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Abstract

The Canadian context in which home-based healthcare services are delivered is characterised by limited resources and escalating healthcare costs. As a result, a financing shift has occurred, whereby care recipients receive a mixture of publicly and privately financed home-based services. Although ensuring that care recipients receive efficient and equitable care is crucial, a limited understanding of the economic outcomes and determinants of privately financed services exists. The purposes of this study were (i) to determine costs incurred by families and the healthcare system; (ii) to assess the determinants of privately financed home-based care; and (iii) to identify whether public and private expenditures are complements or substitutes. Two hundred and fifty-eight short-term clients (< 90 days of service utilisation) and 256 continuing care clients (> 90 days of utilisation) were recruited from six regions across the province of Ontario, Canada, from November 2003 to August 2004. Participants were interviewed by telephone once a week for 4 weeks and asked to provide information about time and monetary costs of care, activities of daily living (ADL), and chronic conditions. The mean total cost of care for a 4-week period was $7670.67 (in 2004 Canadian dollars), with the overwhelming majority of these costs (75%) associated with private expenditures. Higher age, ADL impairment, being female, and a having four or more chronic conditions predicted higher private expenditures. While private and public expenditures were complementary, private expenditures were somewhat inelastic to changes in public expenditures. A 10% increase in public expenditures was associated with a 6% increase in private expenditures. A greater appreciation of the financing of home-based care is necessary for practitioners, health managers and policy decision-makers to ensure that critical issues such as inequalities in access to care and financial burden on care recipients and families are addressed.

Keywords: home-based care, predictors of care, private/public expenditures

Accepted for publication 18 July 2007

Introduction

In Canada, the site for the delivery of health care continues to shift from institution to home (Coyte & McKeever 2001). Home-based services such as medicine, nursing and personal support are financed by the government and provided to individuals following an acute hospital episode and to individuals who have long-term care needs. Although these publicly financed services are allocated to care recipients based partially on healthcare needs, decisions regarding the amount of services provided to recipients are constrained by limited resources, escalating healthcare costs and personnel shortages. In addition, allocation may also be based on the assumption that recipients have available family and friends to supplement the care provided by the public sector (Coyte & McKeever 2001).

The current emphasis on the home as a care setting has modified the financing arrangements for health care as recipients receive a mixture of both publicly and privately financed home-based services. Because privately financed care includes time devoted by family caregivers, as well as out-of-pocket expenditures for medications and services, considerable economic demands may be imposed on care recipients and their families. However, despite the need for the delivery of efficient and effective home-based care, a limited understanding of the costs of care within the private sector exists. The extent to which the economic burden is experienced by care recipients and their families and how demographic and clinical characteristics relate to privately financed care remains unknown. Without an appreciation of the magnitude and determinants of private expenditure, decision-making by practitioners, managers and policy decision-makers regarding allocation of resources and financial support for care recipients and families is impeded.

Several studies have evaluated the cost implications associated with delivering home-based services within the context of evaluating a particular service (Fields *et al.* 1991, Knoweldon *et al.* 1991, Kriel *et al.* 1991, New *et al.* 1991, Wiernikowski *et al.* 1991, Hollingworth *et al.* 1993, Wolf *et al.* 1993, O'Cathain 1994, Donald *et al.* 1995, Hodsworth *et al.* 1997). However, the majority of these studies focused on publicly financed services and devoted little or no attention to private expenditures. More specifically, time spent by family caregivers to provide care and to travel to and from ambulatory-based consultations as well as out-of-pocket expenditures on medications and supplies, were not considered. Of the few economic evaluations of home-based services that have assessed time costs (Browne *et al.* 1990, Sevick & Bradham 1997, Shepperd *et al.* 1998), only time missed from work in the labour market was measured. Only two studies have comprehensively measured time costs by considering all components of caregiving time; that is, time lost from both market labour and leisure and household work are considered (Stommel *et al.* 1992, Guerriere *et al.* 2006a). Finally, none of these studies considered the relationship between private and public expenditure.

Although many researchers have assessed the demographic and clinical determinants of home-based care, conflicting results have been reported for most determinants, and many determinants, such as income and education level and duration of home-based care (long-term vs. short-term) have been ignored. Furthermore, because the majority of studies were conducted with elderly care recipients (Miller & Mcfall 1991, Coughlin *et al.* 1992, Stoller & Cutler 1993, Tennstedt *et al.* 1993, Logan & Spitze 1994, Manheim *et al.* 1995, Penning 1995, Diwan *et al.* 1997, Herlitz 1997, Houde 1998, Katz *et al.* 2000, McCann *et al.* 2000, Hawranik & Strain 2001), an appreciation of the determinants of use for younger, and most likely shorter-term, care recipients does not exist. Finally, although some studies have focused on determinants of nursing or personal support services (Penning 1995, Coenen *et al.* 1996, Dorman 1996, Diwan *et al.* 1997, Alcock *et al.* 1998, Lee & Mills 2000, Adams *et al.* 2001, Hawranik & Strain 2001), several did not distinguish between each type of service (Miller & Mcfall 1991, Coughlin *et al.* 1992, Tennstedt *et al.* 1993, Herlitz 1997, Houde 1998, Wilkins & Park 1998, Katz *et al.* 2000, Hall & Coyte 2001), and moreover, none considered the relationship between home-based utilisation and costs. Because most studies only assessed determinants of publicly financed services and/or did not distinguish between privately and publicly financed services, an inaccurate representation of determinants may result, particularly if privately financed services represent a large portion of overall resource utilisation.

The primary objectives of this study were to assess the costs of privately and publicly financed home-based care from a societal perspective and to assess the determinants of private expenditure across the province of Ontario, Canada. While public sector services include all appointments, medications and supplies that are financed by the provincial government, privately financed expenditures are those incurred by care recipients and their family caregivers in the form of caregiving and care-receiving time (valued in dollars) and out-of-pocket costs. Time devoted by caregivers (and those in receipt of care) is considered an opportunity cost because it is time that was taken from other activities such as labour market work, household work or leisure (Gold *et al.* 1996, Yates 1997, Guerriere *et al.* 2006a). By valuing this time in dollars, caregiving by family members is described in a unit of measurement that can then be compared to or combined with out-of-pocket costs and publicly financed costs associated with home-based care.

The secondary objective of this study was to identify whether public and private expenditures were complements or substitutes for each other. This would provide information on how private expenditure behaves (increase or decrease) in response to an increase in public expenditure. Such information offers the potential to gauge the relationship between family caregiving activities and various other cost components within the home setting. These findings may identify a role for caregiving allowances and other forms of caregiver support whereby the government would provide financial assistance to families who are supporting care recipients at home.

Methods

Study context

A purposive sample was recruited from six government-funded home and community care centres, representing the six geographical regions across the province of Ontario from November 2003 to August 2004. Participants were eligible if they were current recipients of publicly financed home-based nursing services, fluent in English (or had a caregiver fluent in English), and at least 18 years of age; those receiving palliative care were not eligible to participate. Family caregivers participated as proxy respondents when care recipients were cognitively or physically incapable and/or not fluent in English. Two groups of participants were recruited: (i) care recipients who were expected to receive *short-term* nursing and/or personal support services (i.e. < 90 days) (Group S), and (ii) those who were receiving such care on a *continuing* basis (i.e. > 90 days with no more than a 1-week break in servicing within the 90-day period) (Group C). These two groups were sampled as they were expected to differ in terms of their utilisation rates and total costs; accordingly, the extent to which group membership (S or C) predicted private expenditure was assessed.

Potential participants who met the eligibility criteria were identified by a manager at each of the six centres from a referral list, consisting of new clients (for Group S) and from a list of current clients (for Group C). Potential participants were then telephoned to determine if they would be interested in learning about the study from the research assistant. The research assistant contacted those who agreed and verbal consent was obtained over the telephone. In addition, consent forms were mailed to participants, which they signed and returned in a postage-paid envelope. Ethics approval was obtained from the University of Toronto and each of the six participating centres.

Determinants of privately financed home-based care were selected based on Andersen & Newman's (2005) Behavioral Model of Health Services Use; this model has been used extensively in the research literature for the selection of determinants of ambulatory and home-based services (Forbes & Janzen 2004, Andersen & Newman 2005, Davin *et al*. 2005, Forbes *et al*. 2005, 2006, Thind 2005, Thode *et al*. 2005). Accordingly, age, sex, marital status, education, employment status, income, activity of daily living (ADL) abilities, length of home care use (short-term vs. continuing care), rurality (postal code), and number of chronic conditions were assessed. These variables were chosen because they had been identified in previous studies as predicting use of home-based services.

Weekly telephone interviews were conducted with participants over four consecutive weeks. For those who were in the short-term group, this time period allowed for the capturing of the period in which services were provided at the greatest intensity after a hospital admission, and for those in the continuing care group, because there is relatively little change in utilisation rates, this time period was sufficient. To measure private and public expenditures, participants were asked to recall their resource use over the previous week while completing the Ambulatory and Home Care Record (AHCR) (© Coyte & Guerriere, 1998) (Guerriere *et al*. 2006b) in each interview. Research evaluating the psychometric properties of the AHCR has shown good to excellent agreement between participants' reports, and administrative data (kappa ranging from 0.41 to 1.00) (Guerriere *et al*. 2006b). For public expenditures, all services financed by the government were included: ambulatory and home-based consultations with healthcare providers, laboratory and diagnostic tests, medications covered by government-sponsored drug programmes, and equipment and supplies provided by home care programmes. Private expenditures included money paid out-of-pocket by care recipients and/or their family caregivers, time costs, and third-party insurance. Out-of-pocket costs included the amount of money spent by care recipients and their families for consultations with healthcare professionals, household help, medications, supplies, and travel expenses to attend appointments. Time costs refer to the monetary value assigned to the time dedicated to receiving and providing care by care recipients and their family caregivers, respectively. Finally, third-party insurance included the amount of money paid by insurance companies to cover any healthcare service.

A subscale of the Older Americans' Resources and Services, the Activities of Daily Living Scale, was used to measure participants' ability to perform ADLs (Fillenbaum & Smyer 1981). The Activities of Daily Living Scale consists of 15 items assessing the level of functioning for individuals who live at home. It provides a total score ranging from 1 (outstanding functioning) to 6 (complete impairment). The Activities of Daily Living Scale has been used widely in a variety of research studies with diverse populations. Testing of its psychometric properties has indicated that it has demonstrated good inter-rater reliability (intraclass correlation coefficient ranged from 0.662 to 0.865) and content validity (Spearman's $r = 0.89$; $P = 0.001$) (Fillenbaum & Smyer 1981, Fillenbaum 1988).

The Canadian Community Health Survey's Chronic Conditions module assessed comorbidity status (Statistics Canada, 2003). It consists of 33 questions surveying individuals with long-term conditions that have persisted for 6 months or longer and that have been diagnosed by a health professional. It yields a total number of chronic conditions. The Rurality Index was calculated using a computer program which computes the index using postal codes and the distance to medical care (Kralj 2000). Finally, age sex, marital status, cohabitation status and socioeconomic status (level of education and income) were assessed using a demographic form in the first interview.

The sample size calculation was based on performance of ADLs because this determinant, unlike the other determinants, had been consistently reported in the literature as a predictor of home-based service utilisation (Coughlin *et al*. 1992, Tennstedt *et al*. 1993, Logan & Spitze 1994, Manheim *et al*. 1995, Penning 1995, Dorman 1996, Herlitz 1997, Riemsma *et al*. 1998, Houde 1998, Lee & Mills 2000, Adams *et al*. 2001, Hall & Coyte 2001). To detect a correlation between level of performance on ADLs and utilisation of home-based care of 0.25 (*r*) (explaining 6.25% of variance), while adjusting for age and sex, and with 90% power, 164 participants were required within both Groups S and C. This sample size was also more than sufficient to examine the determinants (9) within a regression model; this is based on a statistical rule that 10 observations are required for each factor entered into the model (Norman & Streiner 1986).

Data analysis

Physician and laboratory unit prices were determined using the provincial fee-for-service rate schedule (Ministry of Health & Long-Term Care 2004). The costs of clinic and emergency room visits were estimated using data from hospital or clinic cost accounting systems. All home care services (nursing, personal support consultations, supplies, equipment) were based on home care agency rates; nursing visits were valued at $62.30/hour, and personal support consultations at $32.04/hour. Medication costs were derived using a government-sponsored drug benefit formulary rate (Ministry of Health & Long-Term Care 2004). Although these prices may have been determined through regulatory and bargaining arrangements, and may therefore represent an imperfect measure of 'true' costs, these prices are utilised because they are readily available. All costs were reported in 2004 Canadian dollars.

For out-of-pocket costs, the cost of travel by car was calculated using the cost per kilometre ($0.43/km) as reported by the Canadian Automobile Association. The cost of all of the remaining out-of-pocket expenses (over-the-counter medications, supplies, other travel costs, privately financed healthcare appointments, and household help) was determined using the self-reported dollar value on the AHCR. A total out-of-pocket cost was calculated for each participant by summing the amounts reported and then subtracting any reimbursements received by the care recipient or the family from drug plans or medical insurance.

Time costs were determined by assigning a monetary value to each unit of time. Although there are various approaches to valuing time losses, time lost from paid labour was valued in our study using the human capital approach (Rice & Mackenzie 1989, Torgerson *et al*. 1994). This approach applies current average earnings by age and gender to lost time. To value time lost from market labour, age-/sex-based earnings estimates from the 2001 Census were adjusted for 15% nominal earnings growth to 2004 (*The Economist* 2001), multiplied by 1.20 for employer paid benefits (Chan *et al*. 1996), and further multiplied by 52/46 to account for vacation days and holidays. Time lost from unpaid labour/leisure time was valued using the estimated earnings of a homemaker from the 2001 Census, and adjusted for earnings growth, fringe benefits, and vacation days and holidays. For each care recipient, the total time cost was computed as the product between the monetary value assigned to one unit of time and the total time lost to caregiving-related activities.

All data were entered into Excel XP (Microsoft Corporation, Redmond, WA), and analysed using SAS (version 9.1.3, SAS Institute Inc., Cary, NC). To determine the cost of care, three distributions of resource expenditures covering publicly financed, privately financed and total care were computed. Appropriate measures of central tendency and dispersion were computed to describe the distributions, and 95% confidence intervals were derived.

Because the distributions for private and public expenditures were skewed, the cost data were log-transformed using log to the base 10, for the regression analysis. A backward, stepwise regression was used to determine the extent to which each variable predicted private expenditure. The following determinants were considered for the regression: age, gender, income, education level, marital status, employment status, rurality index, number of chronic conditions, ADL level, group membership (S or C), and public expenditure ($, log transformed).

Results

Of the 869 individuals identified as being eligible, 612 (70%) agreed to participate, and of these, 514 (84%) completed the study (*n* = 258 for Group S and *n* = 256

Table 1 Demographic and clinical characteristics of care recipients ($n = 514$)

Mean age (range)	65 (20–99)
Male	211 (41%)
Marital status (NA: $n = 1$)	
Married	286 (55%)
Never married	59 (11%)
Divorced/separated	54 (10%)
Widowed	114 (22%)
Employment status	
Paid employment	98 (19%)
Retired/disability	377 (73%)
Not employed outside of home	39 (8%)
Education (NA: $n = 9$)	
Less than high school	75 (15%)
High school – some or completed	237 (46%)
College/vocational school – some or completed	98 (19%)
Undergraduate and/or postgraduate degree	95 (18%)
Household income (NA: $n = 141$)	
\$25 000 or less	164 (44%)
\$25 001–45 000	99 (26%)
\$45 001–65 000	47 (13%)
\$65 001 or more	63 (17%)
Mean ADL functioning (NA: $n = 9$)	4.1* (SD = 1.3)
Mean number of chronic conditions (NA: $n = 2$)	4.6 (SD = 2.9)
Service type	
Nursing only	324 (63%)
Personal support worker only	88 (17%)
Nursing and personal support worker	102 (20%)

* Moderate impairment. NA, not available.

for Group C). Of the 98 who did not complete the study, 80 (81%) withdrew and 18 (19%) became ineligible at the time of the first interview. Reasons for withdrawal were attributable to: a change of mind ($n = 27$), health deterioration ($n = 12$), busy schedule ($n = 7$), death ($n = 2$), and unreachable for interviews ($n = 32$). Other than being older than participants ($P = 0.01$), the withdrawals were not different than those who completed the study, in terms of gender, marital status, education, employment and household income. The study participants were distributed equally across each of the six geographical regions in Ontario. Table 1 presents the demographic and clinical characteristics of study participants.

Participants did not differ across the six recruiting centres in terms of age, gender, annual household income, employment status, ADL score and number of chronic conditions. In Group S, three centres had a higher proportion of individuals who had received some university education compared to the other three centres ($\chi^2 = 27.2$, d.f. = 15, $P = 0.03$), and in Group C, three centres had a higher proportion of individuals who had less than high school education ($\chi^2 = 29.5$, d.f. = 15, $P = 0.01$). Within Group C, a greater proportion of individuals from one centre were married ($\chi^2 = 13.7$, d.f. = 5, $P = 0.01$), while there were no differences in marital status in Group S.

Although there were some variations among service centres in terms of demographic characteristics, there was no interaction between service centre and the demographic variables in the regression model, indicating that the effect of the other variables in predicting private expenditures was uniform and consistent across the six centres. This in turn, suggests that our results may be generalised to other jurisdictions within Ontario.

Costs of privately and publicly financed care

Table 2 presents costs, by expenditure category, over the 4-week data collection period. Overall, the mean total cost of care for a 4-week period was \$7670.67

Table 2 Costs by expenditure category (4-week period) per care recipient

Expenditure category	N*	Mean† (for those reporting costs)	Mean‡ (for total sample)	Median	Lower quartile	Upper quartile
Public						
Home-based healthcare professional appointments	514	696.52	696.52	498.40	249.20	996.80
Ambulatory healthcare professional appointments	425	289.05	239.05	85.50	40.40	173.07
Medication, supplies and equipment	351	328.39	224.25	162.81	41.44	470.03
Total public expenditures	514	1159.77	1159.77	874.78	473.00	1551.83
Private						
Time costs	514	6254.68	6254.68	3718.21	1387.98	8970.78
Out-of-pocket	481	186.84	174.84	89.93	31.23	206.00
Third-party insurance	125	334.63	81.38	107.12	30.00	321.60
Total private expenditures	514	6510.90	6510.90	4063.44	1579.20	9520.34
Total overall	514	7670.67	7670.67	5108.31	2434.00	11 072.56

* Number of participants reporting in Expenditure category.
† Mean cost for participants who reported costs within each of the relevant categories.
‡ Mean cost within each cost category calculated using the total sample (514).

Table 3 Relationships between individual determinants and private expenditure

Determinant	Spearman correlation	*P*-value
Age	0.043	0.33
Female	−0.141	0.0013
Marital status	−0.094	0.033
Education level	−0.052	0.24
Employment status	0.020	0.65
Income	−0.022	0.67
Group (short-term vs. continuing care)	0.095	0.031
ADL level	0.516	< 0.0001
Number of chronic conditions	0.240	< 0.0001
Rurality (postal code)	0.016	0.72
Public expenditure	0.291	< 0.0001

(CDN). Eighty-five per cent of total expenditures were privately financed ($6510.90), while only 15% were public ($1159.77). The majority of total public expenditures (60%) were attributable to home-based healthcare appointments, while 28% and 25% were comprised of ambulatory healthcare appointments and medical supplies/equipment, respectively. Almost all of the total private expenditures (96%) were comprised of time costs.

Determinants of private expenditures

A univariate analysis was conducted to determine the relationship between each of the individual determinants and private expenditure (see Table 3). For the multivariate analysis, the following variables did not make a statistically significant contribution to the regression model: employment status, income, education level, marital status, rurality index and group membership (S or C). The final regression model consisted of four determinants and two interaction terms: age, gender, ADL level, number of chronic conditions and the interactions between age and number of chronic conditions and between public expenditure and ADL level (see Table 4). This model explained 42% of the variance in private expenditure ($P < 0.001$). The residuals from the backward regression analysis were random and, thus, were not in violation of the homoskedasticity assumption underlying regression analyses.

Effect of demographic and health characteristics on private expenditures

Private expenditures were higher for the very elderly, and female care recipients had higher private expenditures than males. Private expenditures increased by threefold for each additional ADL level and were high for care recipients with four or more chronic conditions.

For younger care recipients, an increase in the number of chronic conditions was associated with higher private expenditures (see Figure 1). With increasing age, the effect of chronic conditions on private expenditure became smaller. More specifically, at younger ages, private expenditures increased as the number of chronic conditions increased, while care recipients who were 80 years or older, had high private expenditure, regardless of the number of chronic conditions. For care recipients with a high number of chronic conditions (four or more), private expenditures were high and did not depend on age. For those with no chronic conditions, private expenditures increased as age increased, at a rate of approximately 10% per decade of age.

Effect of public expenditure on private expenditure

The relationship between private expenditures and public expenditures was somewhat unresponsive to changes in public expenditures. Specifically, a 10-fold increase in public expenditure was associated with a six-fold increase in private expenditures. This is equivalent to a 10% increase in public expenditures being associated

Table 4 Determinants of private expenditure: regression model results

Determinant	Parameter estimate	Multiplier of outcome*	*P*-value	95% CI for multiplier of outcome
Age (per 10 years)	0.040	1.10	0.04	(1.01, 1.20)
Male	−0.172	0.67	< 0.0001	(0.57, 0.79)
ADL level (per additional level)	0.509	3.23	< 0.0001	(1.94, 5.38)
Number of chronic conditions (per additional condition)	0.109	1.29	0.0001	(1.13, 1.46)
Age (per 10 years)* Number of chronic conditions	−0.001	0.98	0.0008	(0.995, 0.999)
Public expenditure (per 10-fold increase)	0.774	5.90	0.0001	(2.89, 12.23)
Public expenditure* ADL level	−0.110	0.78	0.004	(0.66, 0.92)

* Multiplier of outcome = 10 raised to the power of parameter estimate (e.g. for Age, 1.10 = $10^{0.040}$; private expenditure is estimated to increase by a factor of 1.10 for each increment of 10 years with other variables held constant).

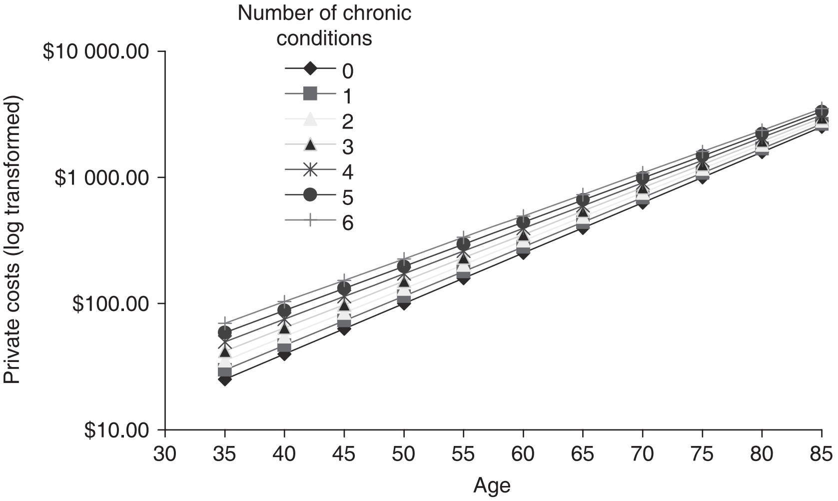

Figure 1 The effect of interaction between number of chronic conditions and age on private costs.

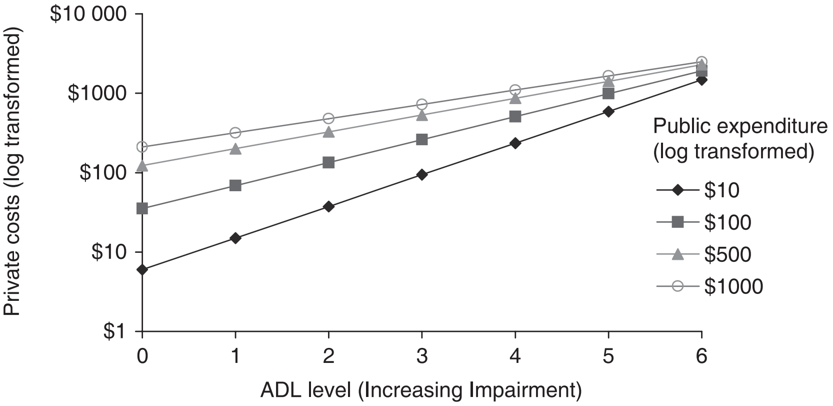

Figure 2 The effect of interaction between activities of daily living (ADL) level and public expenditures on private costs.

with a 6% increase in private expenditures, thereby resulting in a 6.6% increase in total expenditures when public expenditures account for 15% of total expenditures.

Private expenditures increased as public expenditures increased, but this effect was modulated by the number of ADLs (Figure 2). As the number of ADLs increased, the effect of public expenditures became smaller. For example, for a care recipient with two ADLs and for a care recipient with four ADLs, each 10-fold increase in public expenditure was accompanied by an increase in private expenditure by 3.6-fold and 2.2-fold, respectively. The relationship between private and public was the same for both continuing care and short-term care recipients.

Discussion

This study assessed the costs and determinants of privately financed home-based health care, and the relationship between public and private expenditures. The regression model indicated that age, gender, ADLs, number of chronic conditions, and the interaction between both public expenditure and ADL level, and age and number of chronic conditions increased private expenditure. Analysis of the relationship between private and public expenditure indicated that increase public expenditures were associated with increased private expenditures, indicating that the two types of expenditures complemented each another. While this finding contrasts with the dominant view in the empirical literature that focuses on the narrower question of the relationship between public funding for home care and its impact on caregiving time, the possibility of a complementary relationship has been shown to be possible theoretically (Stabile *et al.* 2006).

By assessing costs and determinants of privately and publicly financed home-based services, issues concerning access to services and societal costs may be addressed. Decision-making around the allocation of resources in a financially constrained environment may be facilitated through an accurate depiction of the homecare context in which healthcare services are provided. Furthermore, to be in a position to assess the relative effects of health reforms, an accurate depiction of the financing and caregiving responsibilities assigned to care recipients and their families is required.

Our study found that the overwhelming majority (85%) of total costs were private expenditures. Because most studies to date have assessed only the determinants of publicly financed services, an inaccurate assessment of the setting in which home-based care is received and provided may have been generated. In our study, private and public expenditures complemented one another. Since private expenditures increased as public expenditures increased, publicly funded care was associated with a multiplier effect. Two previous studies also assessed the relationship between publicly financed and privately financed care in the USA (Edelman & Hughes 1990, Van Houtven & Norton 2004). In one study (Van Houtven & Norton 2004) privately financed care reduced the probability of receiving publicly funded home-based care; a 10% increase in private care led to a 0.87% point reduction in the probability of receiving publicly funded home-based care. In the other study, an increase in publicly financed care was associated with an extremely small decrease in privately financed care (2%) (Edelman & Hughes 1990). Although in these studies privately financed care and publicly financed care were found to be substitutes, they had several noteworthy differences from our study, making comparisons difficult. In these studies, privately financed care was defined as care provided by family, but out-of-pocket and third-party insurance costs were not captured. Furthermore, services were not measured in dollars, but rather in hours, making comparisons with our study difficult. Finally, these studies were conducted only with elderly care recipients.

Our study found that females had higher private expenditures than males. Studies on the effect of gender on privately financed home-based care have produced mixed results. One previous study also found that females had higher private costs; however, private costs consisted only of out-of-pocket expenditures, while care provided by family caregivers was not measured (Stoddart *et al*. 2002). Gender has been found to have no effect on public or privately financed care (Bass & Noelker 1987, Logan & Spitze 1994, Penning 1995, Hawranik & Strain 2001, Emlet & Farkas 2002, Brega *et al*. 2003, Jenkins & Laditka 2003). Conversely, in two studies, being male was positively associated with an increase in caregiving by family members (Kemper 1992, Herlitz 1997); these two studies did not measure out-of-pocket expenditures.

In the current study, higher age predicted higher private expenditures. It would be expected that caregivers of older clients would be required to spend more time travelling to appointments, waiting for services and providing more care at home because older care recipients would have relatively more healthcare needs. Many studies have found older age to be positively associated with home care use (Logan & Spitze 1994, Houde 1998, Hall & Coyte 2001, Hawranik & Strain 2001, Aykan 2003, Jenkins & Laditka 2003, Litwin 2004, Stewart 2004, Van Houtven & Norton 2004); however, the majority of these focused on utilisation of public services and privately financed services were not considered. Because the majority of studies have focused on elderly care recipients, the difference in utilisation of home-based services across various age groups was not assessed (Bass & Noelker 1987, Coward *et al*. 1990, Miller & Mcfall 1991, Coughlin *et al*. 1992, Kemper 1992, Stoller & Cutler 1993, Logan & Spitze 1994, Manheim *et al*. 1995, Penning 1995, Diwan *et al*. 1997, Herlitz 1997, Hawranik 1998, Houde 1998, Avlund *et al*. 2001, Burns *et al*. 2001, Hawranik & Strain 2001, Henton *et al*. 2002, Aykan 2003, Brega *et al*. 2003, Jenkins & Laditka 2003, Katz *et al*. 2000, Langa *et al*. 2001, Shyu & Lee 2002, Stoddart *et al*. 2002, Knol *et al*. 2003, McAuley 2004, Van Houtven & Norton 2004).

In our study, private expenditures escalated as ADL impairment increased and when the number of chronic conditions increased. This observation is expected given that individuals with more impairment tend to require more health appointments, medications and caregiving by family members. This is an important finding because it may indicate that as care recipients become more impaired, their needs are not being met by the public sector, requiring them to rely more heavily on family caregivers. Other researchers have also found that limitations in ADLs are associated with high amounts of family caregiving (Kemper 1992, Fleishman 1997, Herlitz 1997, Hawranik & Strain 2001, Laplante *et al*. 2002). In one American study, although the number of ADL limitations predicted privately financed home-based services, the number of chronic illnesses had no effect on use of private services (McAuley & Arling 1984).

For care recipients who received small amounts of publicly financed care, the effect of increasing ADLs (increasing impairment) was dramatic – approximately a threefold increase in private costs per additional ADL level was observed. However, for care recipients who received large amounts of publicly financed care, the effect of increasing impairment (or ADL level) on private costs disappears (see Figure 2). As the number of ADLs increased, the effect of increased public spending became smaller. Therefore, private expenditures increased dramatically with additional ADL impairment, but this was modulated by increases in public expenditures. At higher levels of ADL, there is almost no difference in private costs between individuals with small amounts of publicly financed care and those with large amounts of publicly financed care. This demonstrates that those who are most in need of care, also incur the greatest private expenditures. For example, at high levels of public expenditure, there is almost no difference in private costs for a care recipient with an ADL level of 2 compared to someone with an ADL level of 4. Therefore, among care recipients who receive relatively small amounts of public home care, the public sector is not meeting the needs of those higher impairment levels. In contrast, at the high end of public expenditure, this inequity disappears.

Limitations

The collection of data in this study relied on the self-reports of respondents with telephone interviews and therefore may be influenced by social desirability bias (Norman & Streiner 1986). However, the benefit of conducting telephone interviews, rather than distributing mailed questionnaires, was that the chances of having missing data were minimised and the dropout rate was diminished.

The accuracy of the methods used for deriving costs may be questioned. The methods used for assigning a monetary value to time losses may be biased. For example, societal biases related to equity may place a higher monetary value on one unit of lost time for a male compared to the same unit of lost time for a female.

The study findings cannot be generalised to non-English-speaking families. In addition, because the study was conducted with a sample of individuals who were in receipt of publicly financed services, the results may not be generalised to individuals who receive only privately financed services. Finally, because the non-participants were older than the participants and because our regression model indicated that older individuals have higher costs, overall costs may have been underestimated.

Conclusion

This study determined that public and private expenditures for home-based care were complementary. Exploring the determinants of private expenditures revealed that care recipients who were in greatest need of care (i.e. had a large number of chronic conditions and high ADL needs) also incurred the greatest private costs compared to the other care recipients. This has implications particularly when publicly financed care is intended to be based on need rather than other variables. The observation that private and public expenditures are complements has important implications for decision-making. The burden of care is not experienced exclusively by the public sector, but rather in combination with care recipients and families. Family caregivers play a vital role in delivering home-based health care. When decisions regarding resource allocation are being made, it is essential to consider the care provided by families.

The results of this study could be used to develop a systematic measurement strategy, which could be used to evaluate predictors and outcomes of home-based care. This strategy can then be used to assess the relative effects of health reforms on financing and caregiving responsibilities. The characterisation of the distribution of publicly and privately financed care provides the opportunity for critical issues such as economic burden experienced by families and inequalities in receipt of home care to be addressed.

Acknowledgements

The authors would like to acknowledge funding from CHSRF/CIHR (Grant # RC1-0875–06) and the Ontario Ministry of Health and Long-Term Care. Dr Coyte is supported by funds from the Canadian Health Services Research Foundation, the Canadian Institutes of Health Research, and the Ontario Ministry of Health and Long-Term Care for his Chair in Health Care Settings and Canadians.

References

Adams C.E., Michel Y., Defrates D. & Corbett C. (2001) Effect of locale on health status and direct care time of rural versus urban home health patients. *Journal of Nursing Administration* **31** (5), 244–251.

Alcock D., Danbrook C., Walker D. & Hunt C. (1998) Home care clients, providers and costs. *Canadian Journal of Public Health* **89** (5), 297–300.

Andersen R. & Newman J.F. (2005) Societal and individual determinants of medical care utilization in the United States. *Milbank Quarterly* **83** (4), 1–28.

Avlund K., Damsgaard M.T. & Schroll M. (2001) Tiredness as determinant of subsequent use of health and social services among nondisabled elderly people. *Journal of Aging and Health* **13** (2), 267–286.

Aykan H. (2003) Effect of childlessness on nursing home and health care use. *Journal of Aging and Social Policy* **15** (1), 33–53.

Bass D.M. & Noelker L.S. (1987) The influence of family caregivers on elder's use of in-home services: an expanded conceptual framework. *Journal of Health and Social Behavior* **28** (2), 184–196.

Brega A.G., Jordan A.K. & Schlenker R.E. (2003) Practice variations in home health care. *Home Health Care Services Quarterly* **22** (3), 41–64.

Browne G., Arpin K., Corey P., Fitch M. & Gafni A. (1990) Individual correlates of health service utilization and the cost of poor adjustment to chronic illness. *Medical Care* **28**, 43–58.

Burns M.J., Cain V.A. & Husaini B.A. (2001) Depression, service utilization, and treatment costs among Medicare elderly: gender differences. *Home Health Care Services Quarterly* **19** (3), 35–44.

Chan B., Coyte P.C. & Heick C. (1996) Economic impact of cardiovascular disease in Canada. *Canadian Journal of Cardiology* **12** (10), 1000–1006.

Coenen A., Marek K.D., Lundeen S.P. (1996) Using nursing diagnoses to explain utilization in a Community Nursing Center. *Research in Nursing and Health* **19**, 441–445.

Coughlin T.A., Mcbride T.D., Perozek M. & Liu K. (1992) Home care for disabled elderly: predictors and expected costs. *Health Service Research* **27** (4), 453–479.

Coward R.T., Cutler S.J. & Mullens R.A. (1990) Residential differences in the composition of the helping networks of impaired elders. *Family Relations* **39** (1), 44–50.

Coyte P.C. & McKeever P. (2001) Home care in Canada: passing the buck. *Canadian Journal of Nursing Research* **33** (2), 11–25.

Davin B., Paraponaris A. & Verger P. (2005) Demographic and socioeconomic factors associated with needs for home assistance among community-dwelling elderly: a study from the French home survey handicaps-disabilities-dependence. *Revue D'épidémiologie et de Santé Publique* **53** (5), 509–524.

Diwan S., Berger C. & Manns E.K. (1997) Composition of the home care service package: predictors of type, volume, and mix of services provided to poor and frail older people. *Gerontologist* **37** (2), 169–181.

Donald I., Baldwin R. & Bannerjee M. (1995) Gloucester hospital-at-home: a randomized controlled trial. *Age and Aging* **24**, 434–439.

Dorman M.K. (1996) Nursing diagnoses and home care nursing utilization. *Public Health Nursing* **13** (3), 195–200.

Edelman P. & Hughes S. (1990) The impact of community care on provision of informal care to homebound elderly persons. *Journal of Gerontology* **45** (2), S74–S84.

Emlet C.A. & Farkas K.J. (2002) Correlates of service utilization among midlife and older adults with HIV/AIDS: the role of age in the equation. *Journal of Aging and Health* **14** (3), 315–335.

Fields A.I., Rosenblatt A., Pollack M.M. & Kaufman J. (1991) Home care cost-effectiveness for respiratory technology-dependent children. *American Journal of Diseases of Children* **145**, 729–733.

Fillenbaum G. (1988) *The Oars Assessment Methodology: Multi-dimensional Functional Assessment Questionnaire*, 2nd edn. Duke University Centre for the Study of Aging and Human Development, Durham, NC.

Fillenbaum G. & Smyer M. (1981) The development, validity and reliability of the oars multidimensional functional assessment questionnaire. *Journal of Gerontology* **36** (4), 428–434.

Fleishman J.A. (1997) Utilization of home care among people with HIV infection. *Health Services Research* **32** (2), 155–175.

Forbes D.A., Debra D. & Janzen B.L. (2006) Rural and urban Canadians with dementia: use of health care services. *Canadian Journal of Aging* **25** (3), 321–330.

Forbes D.A. & Janzen B.L. (2004) Comparison of rural and urban users and non-users of home care in Canada. *Canadian Journal of Rural Medicine* **9** (4), 227–235.

Forbes D., Stewart N., Morgan D., Anderson M., Parent K. & Janzen B. (2005) Individual determinants of home-care nursing and housework assistance. *Canadian Journal of Nursing Research* **35** (4), 14–36.

Gold M., Siegel J., Russell L. & Weinstein M. (1996) *Cost-Effectiveness in Health and Medicine*. Oxford University Press, New York.

Guerriere D.N., Tullis E., Ungar W.J. *et al.* (2006a) Economic burden of ambulatory and home-based care for adults with cystic fibrosis. *Treatments in Respiratory Medicine* **5** (5), 351–359.

Guerriere D.N., Ungar W.J., Corey M. *et al*. (2006b) Evaluation of the ambulatory and home care record: agreement between self reports and administrative data. *International Journal of Technology Assessment in Health Care* **22** (2), 203–210.

Hall R. & Coyte P.C. (2001) Determinants of home care utilization: who uses home care in Ontario? *Canadian Journal on Aging* **20** (2), 176–192.

Hawranik P. (1998) The role of cognitive status in the use of inhome services: implications for nursing assessment. *Canadian Journal of Nursing Research* **30** (2), 45–65.

Hawranik P.G. & Strain L.A. (2001) Cognitive impairment, disruptive behaviors, and home care utilization. *Western Journal of Nursing Research* **23** (2), 148–162.

Henton F.E., Hays B.J., Walker S.N. & Atwood J.R. (2002) Determinants of medicare home healthcare service use among medicare recipients. *Nursing Research* **51** (6), 355–362.

Herlitz C. (1997) Distribution of informal and formal home help for elderly people in Sweden. *Gerontologist* **37** (1), 117–124.

Hodsworth M.T., Raisch D.W., Chavez C.M., Duncan M.H., Parasuraman T.V. & Cox F.M. (1997) Economic impact with home delivery of chemotherapy to pediatric oncology patients. *Annals of Pharmacotherapy* **31**, 140–148.

Hollingworth W., Todd C., Parker M., Rober J.A. & Williams R. (1993) Cost analysis of early discharge after hip fracture. *British Medical Journal* **9**, 903–906.

Houde S.C. (1998) Predictors of elders' and family caregivers' use of formal home services. *Research in Nursing and Health* **21**, 533–543.

Jenkins C.L. & Laditka S.B. (2003) A comparative analysis of disability measures and their relation to home health care use. *Home Care Services Quarterly* **22** (1), 21–37.

Katz S.J., Kabeto M. & Langa K.M. (2000) Gender disparities in the receipt of home care elderly people with disability in the United States. *Journal of American Medical Association* **284** (23), 3022–3027.

Kemper P. (1992) The use of formal and informal home care by the disabled elderly. *Health Services Research* **27** (4), 421–451.

Knol H., Haken L. & Kempens G. (2003) Disablement process and the utilization of home care among non-institutionalized elderly people: contrasting results between cross-sectional and panel data. *Disability and Rehabilitation* **25** (15), 845–855.

Knoweldon J., Westlake L., Wright K.G. & Clarke S.J. (1991) Peterborough hospital at home: an evaluation. *Journal of Public Health Medicine* **13**, 182–188.

Kralj B. (2000) Measuring 'rurality' for purposes of health-care planning: an empirical measure for Ontario. *Ontario Medical Review* **67** (9), 33–49.

Kriel R.L., Cloyd J.C., Hadsall R.S., Carlson A.M., Floren K.L. & Jones-Saete C.M. (1991) Home use of rectal diazepam for cluster and prolonged seizures. *Pediatric Neurology* **7**, 13–17.

Langa K.M., Kabeto M.U. & Katz S.J. (2001) The explosion in paid home health care in the 1990s: who received the additional services? *Medical Care* **39** (2), 147–157.

Laplante M.P., Harrington C. & Kang T. (2002) Estimating paid and unpaid hours of personal assistance services in activities of daily living provided to adults living at home. *Health Services Research* **37** (2), 397–415.

Lee T. & Mills M.E. (2000) Analysis of patient profile in predicting home care resource utilization and outcomes. *Journal of Nursing Administration* **30** (2), 67–75.

Litwin. (2004) Social networks, ethnicity and public home-care utilisation. *Ageing and Society* **24**, 921.

Logan J.R. & Spitze G. (1994) Informal support and the use of formal services by older Americans. *Journal of Gerontology* **49** (1), S25–S34.

Manheim L.M., Guihan M. & Hughes S.L. (1995) Organizational characteristics: clients characteristics, and the delivery of home care services. *Medical Care Research and Review* **52** (4), 517–531.

McAuley W.J. & Arling G. (1984) Use of in-home care by very old people. *Journal of Health and Social Behavior* **25** (1), 54–64.

McAuley W.J., Spector W.D., Van Nostrand J., Shaffer T. (2004) The influence of rural location on utilization of formal home care: the role of Medicaid. *Gerontologist* **44**, 655.

McCann J.J., Hebert L.E., Beckett L.A. & Morris M.C. (2000) Comparison of informal caregiving by black and white older adults in a community population. *Journal of American Geriatric Society* **48** (12), 1612–1617.

Miller B. & Mcfall S. (1991) The effect of caregiver's burden on change in frail older person's use of formal helpers. *Journal of Health and Social Behavior* **32**, 165–179.

Ministry of Health and Long-Term Care. (2004) *Ontario Health Insurance Plan* [WWW document]. URL http://www.health.gov.on.ca/english/public/program/ohip/ohip_mn.html (accessed 8 August 2006).

New P.B., Swanson G.F., Bulich R.G. & Taplin G.C. (1991) Ambulatory antibiotic infusion devices: extending the spectrum of outpatient therapies. *American Journal of Medicine* **91**, 455–461.

Norman G.R. & Streiner D.L. (1986) *PDQ Statistics*. B.C. Decker, Toronto, ON.

O'Cathain A. (1994) Evaluation of a hospital at home scheme for the early discharge of patients with fractured neck of femur. *Journal of Public Health Medicine* **16**, 205–210.

Penning M.J. (1995) Cognitive impairment, caregiver burden, and the utilization of home health services. *Journal of Aging and Health* **7** (2), 233–253.

Rice D. & Mackenzie E. (1989) *Cost of Injury in the United States: A Report to Congress*. Institute for Health and Aging, University of California, San Francisco, CA; and Johns Hopkins University, Baltimore, MD.

Riemsma R.P., Klein G., Rasker J.J., Houtman P.M., Van Paassen H.C. & Wiegman O. (1998) The supply of and demand for informal and professional care for patients with rheumatoid arthritis. *Scandinavian Journal of Rheumatology* **27**, 7–15.

Sevick M.A. & Bradham D.D. (1997) Economic value of caregiver effort in maintaining long-term ventilator assisted individuals at home. *Heart and Lung* **26**, 148–157.

Shepperd S., Harwood D., Gray A., Vessey M. & Morgan P. (1998) Randomised controlled trial comparing hospital at home care with inpatient hospital care. II: cost minimisation analysis. *British Medical Journal* **316**, 1791–1796.

Shyu Y.-I.L. & Lee H.-C. (2002) Predictors of nursing home placement and home nursing services utilization by elderly patients after hospital discharge in Taiwan. *Journal of Advanced Nursing* **38** (4), 398–406.

Stabile M., Laporte A. & Coyte P. (2006) Household responses to public home care programs. *Journal of Health Economics* **25** (4), 674–701.

Statistics Canada. (2003, August 31) *Canadian Community Health Survey – Mental Health and Well-Being (CCHS)* [WWW document]. URL from http://www.statcan.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=5015&lang=en&db=IMDB&dbg=f&adm=8&dis=2 (accessed 25 July 2006).

Stewart S.T. (2004) Do out-of-pocket health expenditures rise with age among older Americans? *Gerontologist* **44** (1), 48–57.

Stoddart H., Whitley E., Harvey I. & Sharp D. (2002) What determines the use of home care services by elderly people? *Health & Social Care in the Community* **10** (5), 348–360.

Stoller E.P. & Cutler S.J. (1993) Predictors of use of paid help among older people living in the community. *Gerontologist* **33** (1), 31–40.

Stommel M., Given C. & Given B. (1992) The cost of cancer home care to families. *Cancer* **71**, 1867–1874.

Tennstedt S.L., Crawford S.L. & Mckinlay J.B. (1993) Is family care on the decline? A longitudinal investigation of the substitution of formal long-term care services for informal care. *Milbank Quarterly* **71** (4), 601–624.

The Economist (2001) Annual earnings data. **361** (824**5**), 100.

Thind A. (2005) Analysis of health services use for respiratory illness in Indonesian children: implications for policy. *Journal of Biosocial Science* **37** (2), 129–142.

Thode N., Bergmann E., Kamtsiuris P. & Kurth B. (2005) Predictors for ambulatory medical care utilization in Germany. *Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz* **48** (3), 296–306.

Torgerson D., Donaldson C. & Reid D. (1994) Private versus social opportunity cost of time: valuing time in the demand for health care. *Health Economics*. **3**, 149–155.

Van Houtven C.H. & Norton E.C. (2004) Informal care and health care use of older adults. *Journal of Health Economics* **23**, 1159–1180.

Wiernikowski J.T., Rothney M., Dawson S. & Andrew M. (1991) Evaluation of a home intravenous antibiotic program in pediatric oncology. *American Journal of Pediatric Hematology/Oncology* **132**, 144–147.

Wilkins K. & Park E. (1998) Home care in Canada. *Health Reports* **10** (1), 29–37.

Wolf E., Penchas S., Werczberger A. *et al*. (1993) Home care therapy for respirator-dependant patients. *Israeli Journal of Medical Science* **29** (10), 617–623.

Yates B. (1997) *Analyzing Costs, Procedures, Processes and Outcomes in Human Services*. Sage Publications, Thousand Oaks, CA.