Aging, Social Capital and Utilization of Health Services:

A Lagged Analysis

Eric Nauenberg, PhD[1]
Associate Professor
Department of Health Policy, Management and Evaluation
University of Toronto
155 College Street, 4th floor
Toronto, Ontario
M5S 3M6
E-mail: eric.nauenberg@utoronto.ca

Audrey Laporte, PhD
Associate Professor
Department of Health Policy, Management and Evaluation
University of Toronto
Phone: 416-946-7386
E-mail: audrey.laporte@utoronto.ca
Fax: 416-978-7350

Leilei Shen, MA
Department of Economics
University of Toronto
E-mail: s_leilei@hotmail.com

Draft paper -- Do not quote or cite without permission

December 7, 2009

Grant Support: This work was supported by the CIHR Institute for Health and Aging, Grant #: 82642

[1]corresponding author

Word Count, 3,438

Key words: social capital, utilization, urban, health status, age

Abstract: This paper examines relationships between aging, social capital, and healthcare utilization. Survey data from the 2002 Canadian Community Health Survey (wave 1.2) and the 2001 Canadian Census are merged with GP visit data from the Ontario Ministry of Health and Long Term Care for FY 2006 to estimate a negative binomial regression model focusing on the impact of community- (CSC) and individual-level social capital (ISC). CSC is measured using the Petris Social Capital Index (PSCI) based on employment levels in religious and community-based organizations [NAICS 813XX] and three different measures used for ISC. The regression results indicate differential results based on whether a person lives in a census metropolitan area (>100,000) or a smaller community (population 10,000 – 100,000). A one standard deviation increase (0.08%) in the PSCI index in these larger communities leads to a 2.6% decrease in GP visits and an annual offset in Ontario of approximately $62.3 M. In smaller communities, CSC exhibited no significant impact upon utilization, but higher levels of ISC were associated with fewer annual GP visits. Each form of social capital likely operates through a different mechanism and differentially by community size. Stronger CSC likely obviates some physician visits in larger communities that may involve counseling/caring services while some forms of ISC may act similarly in smaller communities. Policy implications of these results are discussed herein.

Introduction:

Recent articles have raised concerns that the observed effect of social capital on health and health care utilization are potentially spurious if social capital is in fact endogenous (Laporte, Nauenberg, and Shen, 2008, Petrou and Kupek, 2008; d'Hombres Rocco, Suhrcke et al., 2006; Yip Subramanian and Mitchell, 2007, Scheffler Brown and Syme, 2008). Inevitably there is concern as to whether social capital impacts upon health care utilization or whether restrictions in access to care—e.g., a shortage of family physicians--may have an impact upon an individual's reported level of social capital. Often social capital and aspects of health and health care are examined in cross-section in available studies rather than longitudinally through repeated data panels. Panel data--such as available in the Canadian Community Health Survey, U.S.'s National Health Insurance Survey and the Health Survey for England—modify the questions and modules included over time such that it is difficult to obtain true longitudinal data to better examine the direction of causality. One possible solution is to combine survey data on social capital and health status from a prior date with current administrative data on health care utilization. While this method may lead to some bias due to under-representation of new immigrants and potential data truncation for the deceased, the information gathered will still be valuable in better establishing the direction of causality.

Social capital has been described as either a community-level collective resource used to achieve common goals that could not be achieved by individuals operating alone or at an individual-level in which personal social networks are used to strengthen social support, social influence, social engagement and attachment (i.e., interpersonal bonding), and access to scarce resources (Macinko and Starfield, 2001; Portes, 1998; Berkman and

Glass, 2000). At the community level, Putnam (2000) developed an index using per capita membership rates in voluntary organizations to measure civic participation levels. Another measure of community social capital (CSC), the Petris Social Capital Index (PSCI), measures per capita employment in a range of community and social service organizations and the better measures the extent of CSC infrastructure (Petris Center on Health Care Markets and Consumer Welfare, 2004). Both measures are negatively associated with both adverse health behaviours and mortality (Folland, 2006; Brown, Scheffler and Seo, 2006).

Individual social capital (ISC) has been measured in various ways: number or presence of friends (Rose, 2000; Hyyppä and Mäki, 2001), membership in a formal or informal group (Rose, 2000; Hyyppä and Mäki, 2001), trust (Veenstra, 2000; Rose, 2000; Barefoot et al., 1998), and sense of control over one's life (Rose, 2000). Much evidence shows that ISC has a positive impact on physical and mental health (Hawe and Schiell, 2000; Kawachi, Kennedy and Glass, 1999; Lomas, 1998; Subramanian, Kim. and Kawachi, 2002).

While the impact of social capital on health has been studied extensively, the pathway by which this occurs has been less so. As suggested by Scheffler (2008), one of the mechanisms through which this occurs is health service utilization. A slightly revised version of his model is presented below:

Insert Figure 1

ISC in the form of neighbors and friends may improve knowledge about available health resources or increase awareness that treatment is needed (Deri, 2005; Aizer and Currie,

2004; Hendryx et al., 2002). These links may also provide transportation that can increase access to the health system.[1] Increases in the supply of CSC—as measured by the PSCI--may reduce utilization if these resources substitute for formal health services (Laporte, Nauenberg, and Shen, 2008).

Other issues to be examined include the impact of social capital by different levels of urbanization and the interaction between age and social capital. Regarding the former, the evidence is mixed as to whether the impact of CSC differs by degree of urbanization. (van Hooijdonk, Droomers and Deerenberg, 2008; Greiner, Li, and Kawachi et al. 2004). Regarding the latter issue, the impact of social capital may differ by age group because seniors may be more likely to live alone. According to the 1971 Canadian Census, the average household size was 3.7. This average declines to 3.0 by 2006 with over 26% of households—1/3 of them seniors—containing an individual living alone. Further, lone-person households increased by approximately 25% from 1996-2006 (Statistics Canada, 1971-2006; Canadian Community Health Survey 1.1, 2000-2001) Since interactions between individuals and others becomes more paramount for health the more isolated the living situation, we might expect the impact of social capital to be strongest among seniors even though social isolation can occur at various stages of life including marital breakup, the death of a spouse, or when children first leave home.

This study aims to provide further insight into how both community- and individual-level social capital affect utilization of health services (primary care physician visits) and in particular whether these effects differ by age and level of urbanization.. To address the potential endogeneity of social capital we estimate a lagged model based on specialized link files between the Canadian Community Health Survey wave 1.2 (2002),

the 2001 Canadian Census, and the Ontario Ministry of Health and Long Term Care's administrative data for FY 2006.

Data Sources

The Canadian Community Health Survey (CCHS) is a cross-sectional survey produced by Statistics Canada with 13,184 individuals residing in Ontario (73.4% response rate). For this study, data from wave 1.2 (2002) are used because they contain the most extensive information on individual-level social capital. The survey used the Canadian Labour Force Survey (LFS) sampling frame for persons age ≥ 15 excluding residents of institutions, the homeless, full-time members of the Canadian armed forces, residents of Indian reserves and of Crown lands, and residents of a few remote areas. CCHS sampling master weights were used to simulate results at the population level.

The survey includes data on the economic, social, demographic, occupational and environmental correlates of health. This includes information regarding age, gender, income, labor force participation, education, living arrangements, drinking habits, nutrition, and health status.

Individual social capital (ISC) was measured by responses to either of three questions:

1. Faith-based question: Frequency of religious service attendance over past year
   -Binary: 1 for at least weekly, 0 otherwise
2. Tangible social support question: a derived variable from respondent answers to questions about whether they have someone to help if they are confined to bed, take them to the doctor, prepare meals or do chores.
   -Scaled from 0 to 16

3. Affection question: a derived variable from respondent answers to questions about whether respondent receives affection, feels wanted or included.

-Scaled from 0 to 12

We conducted a factor analysis to determine if these measures could be combined in any statistically meaningful way; however, we were unsuccessful in this regard.

We measure community social capital (CSC) using the Petris Social Capital Index (PSCI). This validated index uses the percentage employed in religious and community-based organizations within a defined geographic area to measure supply-side community-level social capital[2] (Brown, Scheffler, and Seo et al., 2006). Data were obtained on paid employment in these organizations (North American Industry Classification System [NAICS] codes: 8131-8139) from the 20% of the population asked to complete the long form of the 2001 Canadian Census. The categories of organizations used in constructing the PSCI include:

8131: Religious organizations
8132: Grant-making and giving organizations
8133: Social advocacy organizations
8134: Civic and social organizations
8139: Business, professional, labor and other membership organizations

Of importance is that there was a disproportionate percentage (0.60% vs. provincial average of 0.32%) of the work force employed in NAICS 8139 residing in Ottawa—the nation's capital. We surmised that there may be a variety of non-government lobbying organizations being represented under this code, and since they generally do not provide direct health-related services to the local population, we substituted the expected number

of people in Ottawa employed under this code based on the average percentages in other census metropolitan areas (CMAs) in the province. Our results were robust to both specifications of the PSCI.

The CCHS and the Census data were merged based on two geographic area variables: either the CMA (population > 100,000) or the census agglomeration area (CA) (population 10,000 – 100,000) that a person resided in. (In the data, there are 10 CMAs and 23 CAs (of 31 total CAs) across Ontario). These data were then merged with the Ontario Ministry of Health and Long Term Care's (MOHLTC's) primary care/general practitioner (GP) physician visit records for FY 2006 based on encrypted health card numbers.[3] GP visits were the primary measure of utilization because they are driven by both patient choice (behavioural factors) and biomedical factors (illness/physician clinical judgment). Specialist visits were excluded because GPs function as gatekeepers to specialty care in Canada limiting the ability to discern the impact—if any—of social capital on utilization of such services.

Since not all respondents lived in a CMA or CA, there was some loss in the sample size from the merging process as well as from the elimination of observations with missing responses for the survey questions used in the analysis. In addition, given the four year lag-structure between the survey data and the administrative data, there were some recent immigrants in the MOHLTC's data for FY 2006 that were not sampled in 2002 and conversely there were people who appeared to have no physician visits but, in reality, had passed away in the intervening four years and the families had not reported the death to the Ministry. From an original sample size of 13,184, 10,662 respondents gave permission for their survey information to be linked to the MOHLTC's

administrative data. A total of 8,778 Ontarians surveyed lived in either a CMA (6,303) or a CA (1,408). Missing data regarding individual social capital, gender, and health status further reduced the sample size to 7,711—approximately 58.5% of the original CCHS sample size—with 6,042 having at least one GP physician visit.

Methods

For count data, such as analyzed here, the negative binomial model is preferred both to Poisson regression and the two-part model frequently used in such analyses (Greene, 2008). In comparison to the former, the negative binomial does not require equality of the conditional mean and variance functions, and in comparison to the latter, the negative binomial is a unified regression model that incorporates the variation in the value of the dependent variable from 0 to 1 with the rest of the distribution under a single regression. In the two-part model, this variation may not be fully measured. Further, there may be an issue of persistent non-use (zero use) for which adjustments to the model are necessary. For instance, since we believed that a substantial number of subjects with no reported utilization were actually unreported cases of those dying in the intervening four years, we employed a zero-inflated negative binomial regression model to adjust for this overrepresentation of nonutilizers (Vuong, 1989).

In addition to ISC and CSC, the explanatory variables in the model included age, gender, education, income (household and CMA), marital status, labor force participation, living arrangements (e.g., living alone), health status (self declared health status, having at least one chronic health condition [including potentially minor ones like backaches, food allergies, and arthritis]), immigrant status, and city population size ($<$ 100,000 vs. $\geq$ 100,000), Alcohol consumption was included as a behavioral risk factor

since it has been found to influence utilization of physician services (Sturm, 2002). Unfortunately, no question on smoking habits was included in this wave of the survey. ISC variables were also interacted with age to determine if the impact of social capital varied by age while holding health status and the other explanatory variables constant. While this interaction was possible with ISC—given that the unit of analysis was the individual—doing the same for CSC was econometrically improper given that the PSCI was defined over large geographic areas. In this instance, the degrees of freedom for age would far exceed those for the PSCI putting the statistical meaning of such an interaction in doubt.

Statistical analyses were performed using SAS v9.1 and STATA v8.0.

Results

The average number of annual physician visits for the sample is 4.00 in CAs and 4.70 in CMAs—both greater than the reported provincial average of 3.35. (MOHLTC, Provider Services Branch 2006) This difference may reflect the subset of records that could be matched to the CCHS data in which notable population groups are excluded as described above. When adjusting for the suspected overvaluation in Ottawa for one of the NAICS codes, the PSCI indicated an average of 1.04% in CAs and 1.11% in CMAs of the employed workforce in the listed CSC occupations although the variation was wider in the former. A lower percentage (21.95%) of the CA sample attended religious services at least weekly than did those in CMAs (25.84%) and average tangible support and affection appeared to be skewed to the upper end of the distribution with averages of over 13 and 10 in both types of communities. This skew may be due to the exclusion of

the homeless from the survey sample—those with the lowest levels of ISC. Average age in both types of communities is between 45 and 50, and over 60% of the sample is married. Over 2/3 of the sample surveyed indicated at least one chronic condition, but almost as many (62%) reported good or very good health. A higher percentage of CA residents reported living alone (12.1%) than those living in CMAs (9.7%); however, both these percentages are comparable to what is reported in the 2001 Canadian census (10%) (Statistics Canada, 2001). Average income in CAs was substantially lower ($39,000 compared to $52,000 in CMAs) but this is to be expected and is also consistent with Canadian census data (Statistics Canada, 2001). While over 1/3 of the CMA sample immigrated to Canada only 12.3% of the CA sample did so. This confirms well known immigration patterns in Ontario (Ibid).

Insert Table 1a and 1b

Diagnostic tests for dispersion (alpha) and the Vuong Test both indicate that the negative binomial model was preferred to Poisson regression and that the zero-inflated negative binomial model was preferred to the standard negative binomial regression model (both tests $p < 0.01$). (Greene, 2008; Vuong 1989)

The results indicate that every one percent increase in the PSCI in 2001 is associated with 36% fewer physician visits in FY 2006 when examining CMAs. There was no statistically significant impact of the PSCI on physician utilization in CAs. With regard to changes in ISC, only CAs experienced an impact and most strongly in the area of attendance at religious services (IRR = 0.52, $p < 0.01$).

Other regressors of note include the health status measures—including the chronic condition dummy—that all indicate that people in poorer health tend to have more GP

visits than healthier individuals. Also, immigrants in CMAs tend to have more visits than non-immigrants, and females have more visits than do males. Also curious was an age gradient regarding annual GP visits that was evident only in CMAs (IRR = 1.02 ($p < 0.05$).

Insert Table 2a and 2b

Discussion

The results of this study largely confirm the inverse association between CSC capital and GP physician visits in CMAs reported in previously published cross-sectional analysis (Laporte, Nauenberg, and Shen, 2008). The results reported here appear to be of similar magnitude to the cross-section results but are more convincing given the lag structure of the analysis. Social capital in 2001-2002 impacts upon physician visits reported in FY 2006. Increased CSC had the largest impact—though only in CMAs. For these larger communities, a one standard deviation increase in the PSCI (0.08%) is associated with a 2.6% (=[1- 0.67] * 0.08%) decrease in physician visits averaged over all ages leading to a $62.3 M annual offset for the province.[4] While the earlier study did not have access to data on CAs, the differential impact noted for CSC in different size communities merits future investigation. One possible explanation is that economies of scale in larger communities may allow them to more readily open community centers and other services substituting for physician visits as compared to smaller communities. In other words, the nature of CSC and the types of CSC offered may differ substantially depending on population density.

Since the PSCI captures the structural aspects of social capital (Petris Center on Health Care Markets and Consumer Welfare, 2004), it seems reasonable that more structural CSC would act to reduce the need for primary care in CMAs. For example, "Meals-on-Wheels' programs, by keeping seniors properly fed may improve or maintain their health and reduce their need for GP visits. However, it is possible that the coefficients on the PSCI may have been affected by selectivity bias if relatively ill people move to an area with high CSC. Two lagged measures of health status (self-report and presence of chronic conditions) were therefore included to address this concern.

The positive association between ISC and physician visits reported in previous work was not confirmed by the results of this study although significant effects of ISC were noted only in CAs not studied earlier (Laporte, Nauenberg, and Shen, 2008). The religious measure of ISC showed strong negative impacts on GP visits in CAs only. One key insignificant result was that living alone, in itself, is not determinative of GP utilization even when interactions with age were included. In general, the issue of social isolation and health care utilization is more complex than inquiries regarding somebody's living situation. With regard to age, it appears that there is little difference between younger and older groups when interacted with ISC.

There are some important limitations to this study. First, this was not a true longitudinal study since it did not involve repeated measures of social capital and physician utilization over numerous years as in a pooled cross-sectional study reminiscent of the Health Survey for England (Petrou and Kupek, 2008). Second, there is no link between the MOHLTC's administrative data and death records. Therefore, we estimate that approximately 5% of the sample died during the period 2002-2006 but

perhaps remained in the data. Unless a family made a voluntary effort to report this to the MOHTLC, zero utilization is reported in FY 2006. The zero-inflated negative binomial regression model tries to adjust for this phenomenon. Thirdly, there is an undercount of immigrants in the data. Given a ≥1% annual immigration rate to Ontario, the CCHS wave 1.2 (2002) survey data are not linkable with upward of 4% of the people contained in the FY2006 administrative data as a result of immigration from elsewhere in Canada and internationally. Fourth, this paper did not have an alternative measure of utilization like in previous work that used annual hospital inpatient nights due to sample size limitations. Lastly and significantly, the survey excludes the homeless—often those with the lowest levels of ISC.

With regard to policy matters, governments may consider a number of options in response to these results While the tendency has been for increased funding of home care and institutional care in Western societies over the last number of years, an important adjunct to that might involve support for community-based programs that might assist individuals who otherwise might rely on a physician for social support. Recognition that community-based programs and informal care providers constitute an important part of the health care continuum may offer some additional policy remedies to dealing with an increasingly aged population.

Recently, many jurisdictions have sought to make health care provision more flexible by increasing choice among alternative providers. Cash- benefit programs have been developed in various European countries in the form of personal budgets, consumer-directed employment of caregivers, and direct payments to caregivers or care recipients to improve individual social capital. (Glendinning, Davies and Pickard, 2004). There are

also tax breaks for informal care providers (ISC) and community-based organizations (CSC) as an incentive to locate in certain underserved areas—akin to free-enterprise zones—as available policy options. As well, improved navigation tools, such as "211" telephone numbers introduced in Toronto, will help to make better use of whatever supply of services is currently available. These initiatives may prove warranted if, as we have found here, social capital is an important factor affecting not only health, but also upstream in the process-at the level of service utilization. This relationship was evident in cross-section and has been reconfirmed in this study involving lagged measures of social capital. It appears from the results with regard to urban status and social capital that context matters in terms of how social capital mediates individuals' interactions with the health care system. Future qualitative research is needed to better understand the precise relationship between ISC and CSC, health service utilization and geographic location.

Endnotes:

[1] Deri (2005) cautions that greater social capital may lead to decreased utilization if reliance on the formal health care system is not part of the norms of one's social network.

[1] We used a variant of this index that models employment in these organizations as a percent of the full-time equivalent employed population age > 15 rather than as a percent of the total population--as used in Brown et al. (2006)--to avoid bias from varying economic conditions across the country. In our formulation, local economic conditions will similarly impact the numerator and denominator of the proportion whereas in the original formulation, the numerator is solely impacted.

[1] Primary care GP visits were defined based on having a visit with at least one fee service code attached to it from a list of 57 fee service codes used to define the basket of services that is to be provided by a capitated primary care physician under the family health network model in Ontario.

[1] There were in 2001 approximately 6.5 M Ontarians over the age of 15 (corresponding to CCHS sample—approx. 58.5% of the total CCHS survey sample) living in CMAs with an average of 4.27 annual GP physician visits (47.2 million annual visits). Assuming that the average GP visit costs approximately $50, a 2.6 % reduction in overall visits leads to an annual offset of approximately $62.3 M.

References:

Aizer A., Currie J. (2004) Competition in Imperfect Markets: Does it Help California's Medicaid Mothers? NBER working paper.

Barefoot, J.C., Maynard, K.E., Beckam, J.C., Brummett, B.H., Hooker, K. Siegler, I.C., (1998), 'Trust, health, and longevity'. *Journal of Behavioral Medicine*, 21: 517-526.

Berkman LF, Glass TA, (2000) 'Social Integration, Social Networks, Social Support, and Health', in Berkman and Kawachi (eds.) Social Epidemiology, New York: Oxford University Press.

Brown, T., Scheffler, R., Seo S. et al., (2006), 'The empirical relationship between community social capital and the demand for cigarettes', *Health Economics*, 15(11): 1159-1172.

Deri C. (2005) Social Networks and Health Service Utilization, *Journal of Health Economics*, 24: 1076-1107.

d'Hombres B, Rocco L, Suhrcke M, et al. (2007) Does social capital determine health? Evidence from eight transition countries. Online at http:// mpra.ub.uni-muenchen.de/ 1862/MPRA Paper No. 1862, posted 20.

Folland, S. (2006), 'Value of life and behavior toward health risks: an interpretation of social capital', *Health Economics*, 15:159-171.

Glendinning C, Davies B, Pickard L,. and Comas-Herrera A. (2004) Funding long-term care for older people. Lessons from other countries. Joseph Rowntree Foundation, York.

Greene, W (2008), *Econometric Analysis. (6th ed.)* Prentice Hall: Upper saddle River, New Jersey.

Greiner KA, Li C, Kawachi I, Hunt DC, Ahluwalia JS. The relationships of social participation and community ratings to health and health behaviors in areas with high and low population density. *Social Science & Medicine.* 2004; 59:2303–12.

Hawe P., Schiell, A. (2000) Social Capital and Health Promotion: A review. *Social Science & Medicine.* 51: 871-885.

Hendryx, MS; et al. (2002) Access to Health Care and Community Social Capital, *Health Services Research*, 37: 87-103

Hyyppä, M., Mäki J (2001) Why do Swedish-speaking Finns have longer active life? An area for social capital research. Health Promotion International. 16: 55-64

Kawachi, I., Kennedy, B. P., & Glass, R. (1999) Social capital and self-rated health: A contextual analysis. *American Journal of Public Health*, 89: 1187–1193.

Laporte A, Nauenberg E. Shen L. (2008) Aging, Social Capital and Health Care Utilisation in Canada. *Health Economics, Policy and Law*. 3: 393-411.

Lomas, J. (1998). Social capital and health: implications for public health and epidemiology. *Social Science & Medicine*, 47; 1998: 1181–1188.

Macinko J. Starfield B. (2001), 'The utility of social capital in research on health determinants.' *The Milbank Quarterly*, 79: 387-427.

Petrou S, Kupek E. (2008) Social Capital and its Relationship with Measures of Health Status: Evidence from the Health Survey for England 2003. *Health Economics*. 17: 127-143.

Petris Center on Health Care Markets and Consumer Welfare. Special Interest Project 7-02. Social capital and cardiovascular health in California. Project Final Report. 2004. http://www.petris.org/docs/socail_capital.pdf [15 January 2007].

Portes, A. (1998) 'Social capital: its origins and applications in modern sociology', Annual Review of Sociology, 24(1): 1-24.

Putnam, RD. (2000), *Bowling Alone.* Simon and Schuster: New York, 2000.

Rose, R. (2000), 'How much does social capital add to individual health? A survey study of Russians', *Social Science & Medicine*, 51(9):1421-35

Scheffler, R. (2008) Social Capital, Economics, and Health: New Evidence. *Health Economics, Policy and Law*. 3: 321-331.

Scheffler R, Brown T, Syme L, et al. (2008) Community-level Social Capital and Recurrence of Acute Coronary Syndrome. *Soc Sci Med.* 66: 1603-13.

Statistics Canada, 1971-2006 Censuses: Statistics Canada catalogue nos. 97-553-XCB2006018, 91-213-X, 97-554-XCB2006007.

Subramanian, S., Kim, D. Kawachi, I. (2002) Social trust and self-rated health in US communities: a multilevel analysis. Journal of Urban Health. 79(S1): S21-S34.

Van Hooijdonk C, Droomers M, Deerenberg I et al., (2008) The diversity in associations between community social capital and health per health outcome, population group and location studied. *International Journal of Epidemiology* 2008;37:1384–1392.

Veenstra, G. (2000) Social capital, SES and health: an individual-level analysis . *Soc Sci Med*.. 50: 619-629.

Vuong, Q.H., 1989. Likelihood ratio tests for model selection and non-nested hypotheses. Econometrica 57, 307–333.

Yip W, Subramanian SV, Mitchell AD, Lee DT, Wang J, Kawachi I. (2007) Does social capital enhance health and well-being? Evidence from rural China. *Soc Sci Med.* 64: 35-49.

Figure 1: Mechanisms Linking Social Capital to Health

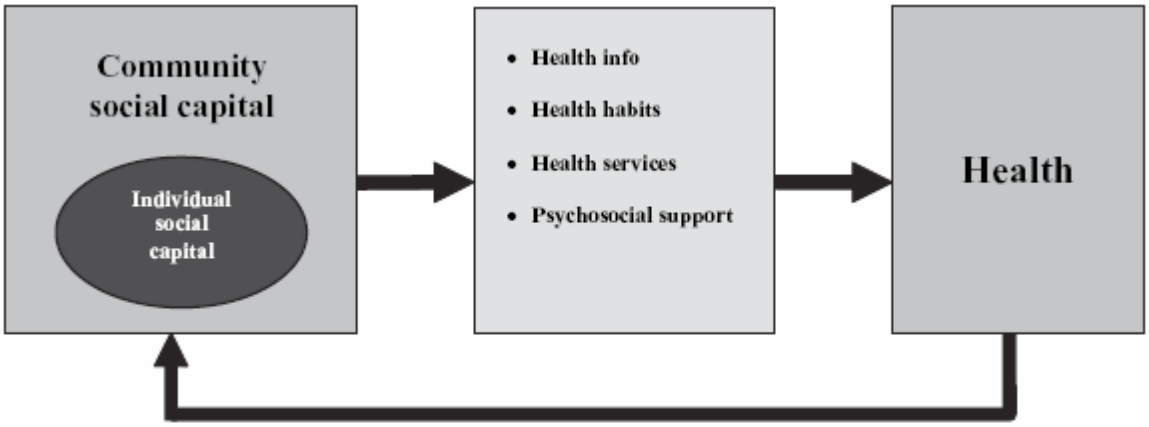

Table 1a: Descriptive Weighted Statistics (CAs)

	N	Mean / %	Std	5%	95%	99%
GP VISIT	1,408	4.00	4.75	0	13	21
Petris (Ottawa changed)	1,408	1.04%	0.35%	0.68%	1.84%	1.84%
Religious Meetings	1,408	21.95%				
Tangible Social Support	1,408	13.99	2.99	8	16	16
Affection	1,408	10.90	2.15	6	12	12
Age	1,408	48.80	18.51	21	82	90
Female	1,408	51.02%				
Married	1,408	65.55%				
Chronic Condition	1,408	72.79%				
Alone	1,408	12.06%				
College	1,408	52.92%				
Income	1,408	$38,950	$43,350	$0	$120,000	$180,000
Fulltime	1,408	56.01%				
Alcohol	1,408	9.36%				
Immigrant	1,408	12.29%				
HDI Very Poor	1,408	11.68%				
HDI Poor	1,408	25.15%				
HDI Good	1,408	40.29%				
HDI Very Good	1,408	22.88%				

Table 1b: Descriptive Weighted Statistics (CMAs)

	N	Mean / %	Std	5%	95%	99%
GP VISIT	6,303	4.70	5.86	0	15	28
Petris (Ottawa changed)	6,303	1.11%	0.08%	0.94%	1.25%	1.25%
Religious Meetings	6,303	25.84%				
Tangible Social Support	6,303	13.46	3.36	6	16	16
Affection	6,303	10.65	2.23	6	12	12
Age	6,303	46.72	17.49	21	79	88
Female	6,303	50.67%				
Married	6,303	61.34%				
Chronic Condition	6,303	68.32%				
Alone	6,303	9.70%				
College	6,303	58.53%				
Income	6,303	$52,136	$61,751	$0	$150,000	$250,000
Fulltime	6,303	61.41%				
Alcohol	6,303	7.39%				
Immigrant	6,303	36.22%				
HDI Very Poor	6,303	10.32%				
HDI Poor	6,303	27.05%				
HDI Good	6,303	38.54%				
HDI Very Good	6,303	24.09%				

Table 2a: Year 2006-2007 (age+4) Incidence Rate Ratios (IRR) Ottawa adjusted for NAICS 8139 (Zero inflated negative binomial) for CAs (population 10,000-100,000) n=1,408

	ISC #1: Religious Meeting Attendance ≥1 weekly		ISC #2: Tangible Social Support		ISC #3: Affection	
GP visits	IRR	95% CI	IRR	95% CI	IRR	95% CI
Petris	1.19	(0.99,1.38)	1.20	(1.00,1.39)	1.19	(1.00,1.39)
ISC	0.52**	(0.29,0.75)	0.96	(0.91,1.01)	0.91*	(0.84,0.98)
ISC*age	1.01	(1.00,1.02)	1.00	(0.99,1.01)	1.00	(1.00,1.00)
Age	1.01	(0.99,1.03)	0.99	(0.96,1.02)	0.98	(0.96,1.01)
Age^2	1.00	(1.00,1.00)	1.00	(1.00,1.00)	1.00	(1.00,1.00)
Female	1.35**	(1.19,1.51)	1.38**	(1.22,1.55)	1.38**	(1.21,1.54)
Married	0.96	(0.78,1.13)	0.94	(0.77,1.11)	0.93	(0.76,1.11)
Live Alone	1.03	(0.82,1.23)	1.06	(0.85,1.28)	1.04	(0.83,1.25)
Any post-secondary education	1.06	(0.93,1.18)	1.05	(0.93,1.17)	1.06	(0.94,1.19)
Income (in $10,000 increments)	1.01	(0.97,1.05)	1.02	(0.97,1.06)	1.02	(0.97,1.06)
Income^2	1.00	(1.00,1.00)	1.00	(1.00,1.00)	1.00	(1.00,1.00)
Full time employment	0.88	(0.74,1.02)	0.89	(0.75,1.04)	0.89	(0.75,1.04)
≥1 alcoholic drink per day	0.90	(0.73,1.07)	0.91	(0.74,1.09)	0.91	(0.73,1.08)
Immigrant	1.10	(0.91,1.29)	1.05	(0.87,1.23)	1.06	(0.88,1.25)
HDI Poor	0.73**	(0.60,0.87)	0.73**	(0.60,0.87)	0.73**	(0.60,0.87)
HDI Good	0.68**	(0.55,0.80)	0.67**	(0.55,0.79)	0.67**	(0.54,0.79)
HDI Very Good	0.59**	(0.48,0.71)	0.59**	(0.47,0.71)	0.59**	(0.47,0.71)
Inflate						
chronic condition	-0.57*	(-1.10,-0.05)	-0.58*	(-1.12,-0.05)	-0.60*	(-1.13,-0.06)
constant	-1.58**	(-2.06,-1.11)	-1.59**	(-2.08,-1.11)	-1.60**	(-2.09,-1.11)
alpha	0.64**	(0.53,0.75)	0.64**	(0.53,0.75)	0.65**	(0.54,0.76)
zero inflated Poisson Likelihood	-4214.45		--4220.15		-4214.55	
zero inflated Neg Bin Likelihood	-3491.66		-3493.35		-3491.83	
chi-square test statistic	1445.59**		1453.60**		1445.45**	
vuong test (z score)	2.68**		2.62**		2.57**	

*p < 0.05
**p < 0.01

Table 2b: Year 2006-2007 (age+4) Incidence Rate Ratios (IRR) Ottawa adjusted for NAICS 8139 (Zero inflated negative binomial) for CMAs n=6,303

	ISC #1: Religious Meeting Attendance ≥1 weekly		ISC #2: Tangible Social Support		ISC #3: Affection	
GP visits	IRR	95% CI	IRR	95% CI	IRR	95% CI
Petris	0.68**	(0.45,0.83)	0.68**	(0.45,0.83)	0.67**	(0.45,0.83)
ISC	1.00	(0.80,1.18)	1.01	(0.99,1.03)	0.99	(0.95,1.03)
ISC*age	1.00	(1.00,1.00)	1.00	(1.00,1.00)	1.00	(1.00,1.00)
Age	1.02*	(1.01,1.03)	1.02*	(1.01,1.04)	1.02*	(1.01,1.03)
Age^2	1.00	(1.00,1.00)	1.00	(1.00,1.00)	1.00	(1.00,1.00)
Female	1.46**	(1.40,1.57)	1.46**	(1.40,1.57)	1.46**	(1.40,1.57)
Married	1.06	(0.99,1.16)	1.06	(0.99,1.16)	1.06	(0.99,1.16)
Live Alone	0.97	(1.30,1.50)	0.97	(1.30,1.50)	0.97	(1.30,1.49)
Any post-secondary education	0.96	(0.86,1.04)	0.96	(0.87,1.05)	0.96	(0.87,1.04)
Income (in $10,000 increments)	1.00	(0.89,1.00)	1.00	(0.89,1.00)	1.00	(0.89,1.00)
Income^2	1.00	(0.99,1.01)	1.00	(0.99,1.01)	1.00	(0.99,1.01)
Full time employment	0.94	(1.00,1.00)	0.94	(1.00,1.00)	0.94	(1.00,1.00)
≥1 alcoholic drink per day	0.96	(0.86,1.01)	0.96	(0.86,1.01)	0.96	(0.86,1.01)
Immigrant	1.08**	(0.87,1.07)	1.08**	(0.86,1.06)	1.08**	(0.86,1.06)
HDI Poor	0.84**	(1.03,1.17)	0.84**	(1.03,1.17)	0.84**	(1.03,1.17)
HDI Good	0.75**	(0.78,0.95)	0.75**	(0.78,0.95)	0.75**	(0.78,0.95)
HDI Very Good	0.68**	(0.73,0.88)	0.68**	(0.72,0.87)	0.68**	(0.72,0.87)
inflate						
≥1 chronic condition	-1.16**	(-1.54,-0.79)	-1.16**	(-1.54,-0.79)	-1.17**	(-1.54,-0.79)
constant	-1.80**	(-2.05,-1.55)	-1.80**	(-2.05,-1.56)	-1.80**	(-2.05,-1.55)
alpha	0.75**	(0.69,0.81)	0.75**	(0.69,0.81)	0.75**	(0.69,0.81)
zero inflated Poisson Likelihood	-16589.95		-16589.95		-16589.95	
zero inflated Neg Bin Likelihood	-16264.59		-16264.29		-16264.25	
chi-square test statistic	650.71**		651.32**		651.40**	
vuong test	4.03**		4.03**		4.05**	

*p < 0.05
**p < 0.01

[1] Deri (2005) cautions that greater social capital may lead to decreased utilization if reliance on the formal health care system is not part of the norms of one's social network.

[2] We used a variant of this index that models employment in these organizations as a percent of the full-time equivalent employed population age > 15 rather than as a percent of the total population--as used in Brown et al. (2006)--to avoid bias from varying economic conditions across the country. In our formulation, local economic conditions will similarly impact the numerator and denominator of the proportion whereas in the original formulation, the numerator is solely impacted.

[3] Primary care GP visits were defined based on having a visit with at least one fee service code attached to it from a list of 57 fee service codes used to define the basket of services that is to be provided by a capitated primary care physician under the family health network model in Ontario.

[4] There were in 2001 approximately 6.5 M Ontarians over the age of 15 (corresponding to CCHS sample—approx. 58.5% of the total CCHS survey sample) living in CMAs with an average of 4.27 annual GP physician visits (47.2 million annual visits). Assuming that the average GP visit costs approximately $50, a 2.6 % reduction in overall visits leads to an annual offset of approximately $62.3 M.