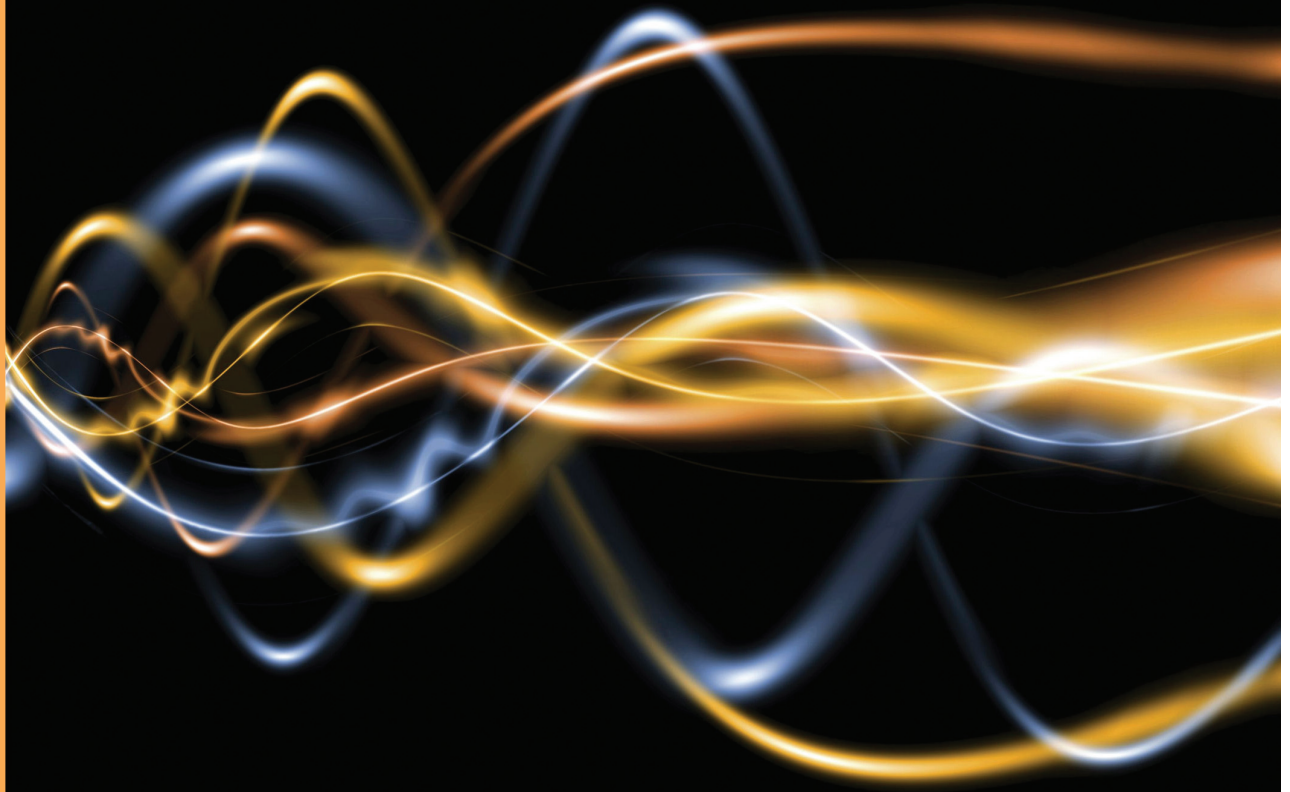# Understanding the link between literacy, health literacy and health

T. Scott Murray

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Understanding the Link Between Literacy, Health Literacy and Health

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Acronynms

ALL	The Adult Literacy and Life Skills Survey
CCHS	Canadian Community Health Survey
CIHI	The Canadian Institute for Health Information
CPHA	Canadian Public Health Association
CLLN	Canadian Literacy and Learning Network
ETS	Educational Testing Service
HALS	Health Activities Literacy Scale
IALS	The International Adult Literacy Survey
IALSS	The International Adult Literacy and Skills Survey
ICT	Information and Communication Technologies
IRT	Item response theory
ISRS	The International Survey of Reading Skill
NAEP	National Assessment of Educational Progress
NALS	The US National Adult Literacy Survey
NCES	National Center for Education Statistics of the United States Department of Education
NLSCY	Statistics Canada's National Longitudinal Survey of Children and Youth
OECD	The Organisation for Economic Cooperation and Development
OLS	Ordinary Least Squares
OREALC	The UNESCO Regional Office for Latin America and the Caribbean
SES	Socio-economic Status
SLID	Survey of Labour and Income Dynmic
PISA	The OECD's Programme for International Student Assessment
UNESCO	The United Nations Educational, Scientific and Cultural Organisation

Acronynms

UIS   The UNESCO Institute for Statistics

WHO   World Health Organization

Chapter 1

Introduction

Researchers have long known that education influences health. More specifically, higher levels of education have a marked positive impact on a range of individual health outcomes. Somewhat surprisingly, relatively little is known about the social, psychological and economic mechanisms that underlie this relationship. The analyses undertaken for this report were designed to shed light on these mechanisms, particularly on how health literacy influences individual health outcomes, the utilization of health services and health costs.

Ideally, such an analysis would be based upon a longitudinal dataset that contains measures of individual health status, health utilization, health costs, health literacy and other variables identified in the literature as determinants of health, including educational attainment, income, time preference and risk preference. The Canadian Community Health Survey (CCHS), described in the text box below, provides many, but not all, of the requisite variables. Of particular concern for the present analysis is the fact that the CCHS does not provide any measure of health literacy skill. Health literacy generally refers to the ability of individuals to access and use health information to make appropriate health decisions and maintain basic health. For health and education researchers, the concept is a broad one. It includes whether individuals can read and act upon written health information, as well as whether they possess the speaking skills to communicate their health needs to physicians and the listening skills to understand and act on the instructions they receive.

The Canadian Community Health Survey

The CCHS is a cross-sectional survey that has collected information related to health status, health care utilization and health determinants for the Canadian population since 2001. It relies upon a large sample of respondents and is designed to provide reliable estimates at the health region level. The CCHS has the following objectives:

- Support health surveillance programs by providing health data at the national, provincial and intra-provincial levels;

- Provide a single data source for health research on small populations and rare characteristics;

- Timely release of information easily accessible to a diverse community of users;

- • Create a flexible survey instrument that includes a rapid response option to address emerging issues related to the health of the population.

Prior to 2007, data collection occurred every two years on an annual period. Data are available for the 2001, 2003 and 2005 periods. In 2007, major changes were made to the survey design with the goal of improving its effectiveness and flexibility through data collection on an ongoing basis. Data collection now occurs every year, rather than every two years as was the case prior to 2007.

Analysts generally rely on indirect proxies of skill, such as years of education and educational attainment. The skill measures described in this report are based on the direct measures of skill derived through the testing of representative samples of the adult population in the International Adult Literacy and Skills Survey (IALSS), the Canadian component of the Adult Literacy and Life Skills Survey (ALL) (see text box). The test scores and associated proficiency levels have been shown to be valid, reliable, comparable and interpretable reflections of how people deal with unfamiliar tasks. Analysis has revealed that these measures provide a much more reliable indication of what people can and can't do.

The International Adult Literacy and Skills Survey (IALSS) provides most of the requisite measures, including robust measures of prose literacy, document literacy, numeracy, and problem solving in association with an extensive background questionnaire, including educational attainment, occupation and income. More importantly for the current analysis, the IALSS also provides a robust measure of health literacy. Also of interest for the current analysis, the IALSS file also includes a measure of physical and mental health status. Analysis of these data reveal a strong relationship between health literacy and health status.

The International Adult Literacy and Life Skills Survey

The International Adult Literacy and Life Skills Survey (IALSS) is a large-scale co-operative effort undertaken in 2003 by governments, national statistics agencies, research institutions and multi-lateral agencies. The IALSS study builds on the International Adult Literacy Survey (IALS), the world's first internationally comparative survey of adult skills undertaken in three rounds of data collection between 1994 and 1998.

The foundation skills measured in the IALSS survey include prose literacy, document literacy, numeracy, and problem solving. The study also developed a health literacy scale using those prose literacy, document literacy and numeracy items that included health content. Additional skills assessed indirectly include familiarity with and use of information and communication technologies. Kirsch, Rudd and Yamamoto created a composite health literacy measure using a subset of IALSS test items.

The development and management of the study were co-ordinated by Statistics Canada and the Educational Testing Service (ETS) in collaboration with the National Center for Education Statistics (NCES) of the United States Department of Education, the Organisation for Economic Cooperation and Development (OECD), the Regional Office for Latin America and the Caribbean (OREALC) and the Institute for Statistics (UIS) of the United Nations Educational, Scientific and Cultural Organisation (UNESCO).

Apart from providing a measure of health literacy based on actual task performance the IALSS also provides a measure of physical and mental health status. More specifically, the background questionnaire that was administered as part of the 2003 IALSS assessment included the SF-12® Health Survey to provide a compact measure of overall physical and mental health outcomes. The SF-12 instrument is a 12-item short form of the SF-36® physical and mental component summary scales (referred to as PCS-36 and MCS-36, respectively). The twelve SF-36® items and improved scoring algorithms reproduce at least 90% of the variance in PCS-36 and MCS-36 in both general and patient populations, and reproduce the profile of eight SF-36® health concepts sufficiently for use in large sample studies.

The SF-12 is accurate enough to use published norms for SF-36® summary measures in interpreting SF-12® summary measures.

However, the SF-12 reproduces the eight-scale profile with fewer levels than SF-36® scales and yields less precise scores, as would be expected for single-item and two-item scales. For large group studies, these differences are not as important, because confidence intervals for group averages in health scores are largely determined by sample size.

The SF-12 yields an overall health status scale, a physical health and a mental health scales. Scale scores are divided into levels.

For additional information on the SF-12 see *Ware JE, Kosinski M, and Keller SD. A 12–Item Short–Form Health Survey: Construction of scales and preliminary tests of reliability and validity. Medical Care, 1996;34(3):220-233.*

Report objectives

This report has been designed to serve six linked goals.

First, a conceptual framework of health literacy determinants and outcomes will be set out to provide context for interpreting the subsequent statistical analysis.

The findings presented in this report are based upon a probabilistic match of individual records from the CCHS and IALSS. While such methods cannot provide a definitive picture they can reveal average relationships between health literacy and health while controlling for a broad range of covariates. The findings presented in this volume are judged to be good enough to inform policy and to identify and focus related research in the future.

Second, the report attempts to understand the social distribution of health literacy, what factors predict the observed differences in health literacy among groups and how health literacy is related to other outcomes.

Third, the report seeks to understand the relationships between health literacy level, health status, income and education.

Fourth, the report explores the economic impact of inequalities in health literacy, including the implied impact on health care expenditures, service utilization and productivity.

Finally, the report recommends a program of research to follow-up on interesting findings.

The organization of the report

In order to respond to the objectives set out above the report is organized in seven chapters.

Chapter 1 introduces the report, its data sources and objectives.

Chapter 2 provides an overview of the conceptual framework that guided and informed the analysis.

Chapter 3 documents the results of an analysis designed to reveal the social distribution of health literacy, the determinants of health literacy and how inequalities in health literacy are related to inequalities in other outcomes.

The goal of this analysis is to increase understanding of which population subgroups are at greatest risk and why. A secondary goal of this analysis will be to identify the most appropriate statistical modeling technique for examining multiple concurrent inequalities.

Chapter 4 documents the impact that health literacy has on health status at different income and education levels.

Chapter 5 studies the impact that health literacy has on health practices, health outcomes and the utilization of key health services.

Chapter 6 explores the costs of raising health literacy levels to a level that confers the ability to cope with most everyday health literacy tasks and presents estimates of the impact on health care expenditures and service utilization for a subset of key services. The chapter also provides estimates of the increase in earnings, and concomitant reductions in income support payments, that would be precipitated by such an investment.

Chapter 7 summarizes the findings presented in the report, highlights their implications for policy and recommends research that might be undertaken to confirm key findings.

The report is supported by three annexes.

Annex A provides references for the research cited in the body of the report.

Annex B presents statistical tables that were used to generate the figures presented in the body of the report.

Annex C documents the methods that were used to link the CCHS and IALSS files and provides readers with the result of a split sample reliability analysis.

Caveats

As noted above the findings presented in this report are based upon a probabilistic linkage of individual survey records from the CCHS and IALSS datasets. The linked data provide reliable indications of average relationships between health status, utilization and the health costs implied by use of health services within the matrix of variables used to link the dataset. While this type of analysis cannot provide definitive results it can provide indications of the strength of the true relationships that exist. Experience suggests that such indications are useful for informing both policy and the design of research studies aimed at establishing individual level causality.

Chapter 2

What Theory and the Research Literature Say About the Link Between Literacy, Health Literacy and Health

The research literature establishes a large and persistent association between education and health. This relationship has been observed in many countries and time periods, and for a wide variety of health measures. Substantial attention has been paid to these "health inequalities." Gradients in health by education are now being systematically monitored in many countries including Canada (DataAngel, 2010). Yet very little research has been done to identify the social, psychological and economic mechanisms that underlie the observed relationship, nor to quantify their relative impact.

Cutler and Lleras-Muney have reviewed what is known about the relationship between education and health, in particular about the possible causal relationships between education and health and the mechanisms that mediate them (Cutler and Lleras-Muney, 2006). They note that work on the mechanisms underlying the link between health and education has not been conclusive, concluding that not all relevant theories have been tested, and when they have, studies often conflict with each other.

2.1   The pathways that link literacy, health literacy and health

The research literature suggests three possible reasons for the link between health and education:

- Poor health might lead to low levels of schooling.
- Higher levels of education might improve health.
- Other factors might increase both schooling and health.

It is important for policy to understand how much of the observed correlation between education and health can be explained by each of these explanations. Subsidies for schooling would only be effective in improving the health of the population if, in fact, education causes health.

Cutler and Lleras-Muney speculate that a causal relationship from health to education could result from experiences during childhood, if children in poor health obtain less schooling and they are also more likely to be unhealthy adults. In our judgment this supposition suffers from two weaknesses. First, while some diseases might limit some children's educational participation and learning the proportion of children involved is far too small to explain the large differences in health that exist. Cutler and Lleras-Muney correctly identify that unobserved factors such as family background, genetic traits or other individual differences, such as the ability to delay gratification, could also explain why the more educated are healthier. In Cutler and Lleras-Muney's analysis, adding measures of family background and individual characteristics such as Hispanic ethnicity, family income, family size, major activity, region, metropolitan area, marital status, and health insurance coverage to their NHIS results lowers the effect of education – on average the effect of education declines by about 38% for health measures, and about 28% for health behaviors– but it generally remains large and significant.

A more convincing possibility is that more/better education leads to improved health. Cutler and Lleras-Muney cite recent evidence from quasi-natural experiments that suggests that at least part of the correlation between education and health is indeed causal but note that the studies in question use measures of the quantity of schooling rather than the quality of education.

Our own research has focused on understanding the impact that the quality of education has on a broad range of individual outcomes, including health outcomes. This leads us to believe that skills play a much more important role in mediating outcomes that previously believed, specifically health literacy skill.

The central question raised by these results is why education affects health. Without a clear understanding why, it is difficult to know what interventions might yield the most rapid increases in population health and which measures might be the most efficient at doing so.

Cutler and Lleras-Muney identify six possible pathways that might mediate the relationship between education and health, each of which is decribed below. Where possible Canadian data is used to test whether the hypothesized relationship exists.

Income and access to health care

Education may improve health simply because it results in greater resources that might be used to purchase health care and health-promoting goods and services. Ashenfelter has reviewed the evidence that links education and income and concludes that schooling does increase incomes and that earlier studies may have under-estimated the role of schooling in determining incomes (Ashenfelter, 1991). The following figure reveals the simple relationship between education and income.

Figure 2.1

The relationship between educational attainment and health status, Canada, 2003
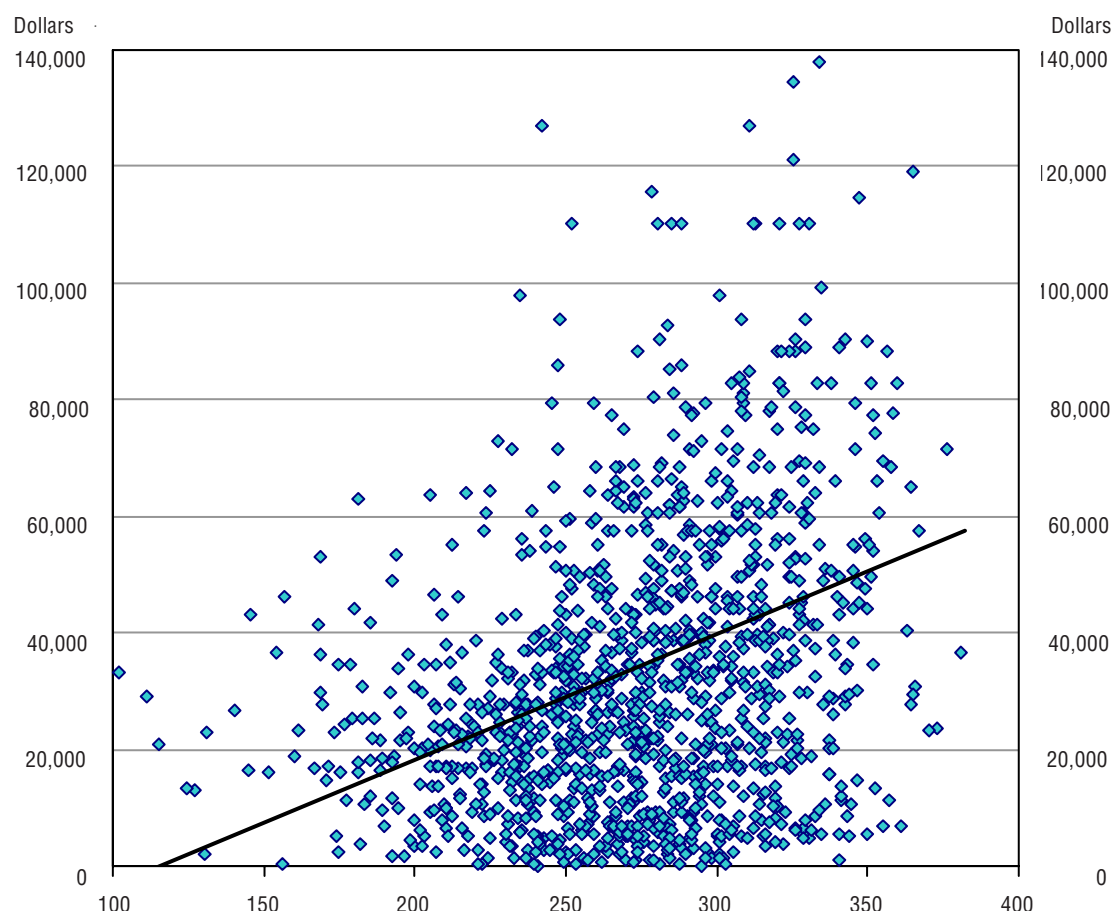
Source: IALSS 2003.

The figure reveals a strong relationship between education and income. Thus, it is reasonable to assume that people with higher levels of education earn more on average and that some of this additional income might be devoted to the purchase of additional health care and health promoting goods and services. It would be easy to assume that these effects would be somewhat muted in Canada given that most primary health care is provided as a public good. Recently published research suggests a significant proportion of low-income Canadian adults forego doses or fail to take prescribed medications because of cost (Statistics Canada, 2012)

In order to better understand the relationship between education and income it is necessary to explore the impact that education has on skill and then the impact that skill has on the quantity, quality and stability of work obtained by adults at different skill levels.

Impact of literacy skill on participation rates

The first and most important impact that literacy has on individuals' labour market outcomes is on the probability that they will be in the labour market. Individuals with low levels of literacy skill are much less likely to be employed at some point in the course of a year than their more skilled peers. Figure 2.2 plots the rate of labour market participation by literacy skill proficiency level.

Figure 2.2

Labour market participation rate by literacy skill proficiency level, adults aged 16 to 65, Canada, 2003

Percent   Percent

Chart showing labour market participation rate by literacy level (vertical bars):

Literacy level	Percent
Level 1	~69
Level 2	~79
Level 3	~82
Level 4	~84
Level 5	~87
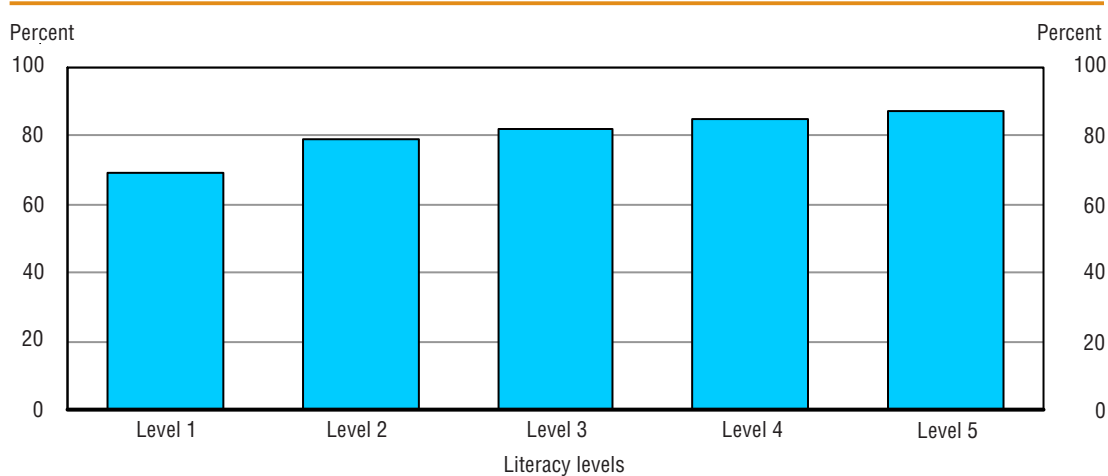
Literacy levels

Source: IALSS 2003.

The chart reveals that adults with Level 1 and 2 literacy skills appear to be systematically excluded from paid employment. This finding suggests that they are likely to have lower incomes that provide less room to purchase health care or health promoting goods and services. These adults are also likely to be more dependent on income support, something that has been shown to induce stress.

The impact of literacy on the quantity of labour supplied

Literacy skill also influences the amount of work adults are able to find. Individuals with low levels of literacy skill work fewer weeks on average, are more likely to experience periods of unemployment and remain unemployed for much longer periods. Figure 2.3 plots the relationship between prose literacy skill and the number of weeks worked in the course of a year for adults that were employed at some point in the year.

Figure 2.3

Average weeks worked per year by prose literacy level, adults aged 16 and over who were employed at some in the year, Canada, 2003

Percent   Percent

Chart showing average weeks worked per year by prose literacy level (vertical bars):

Literacy level	Weeks
Level 1	~45.0
Level 2	~46.3
Level 3	~46.7
Level 4	~47.1
Level 5	~47.7
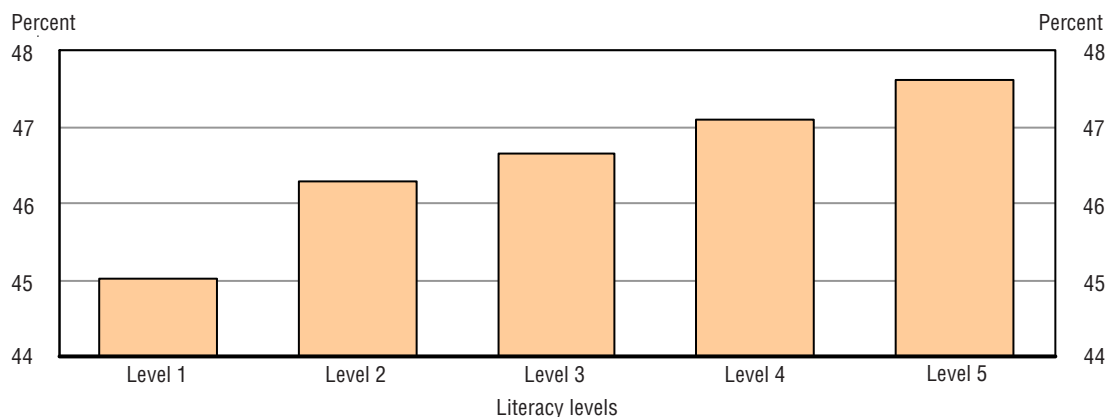
Literacy levels

Source: IALSS 2003.

The figure reveals that the number of weeks of employment increases steadily with skill level. Adults with Level 1 prose literacy skills appear to be at a particular disadvantage in this regard – they work an average of 21 fewer weeks per year when looking at all adults and of adults that work, 3 fewer weeks per year than adults at Level 5. These data show that the primary effect of skill on labour market success is to reduce the quantity of labour supplied by low skilled workers. This relationship suggests that low skilled adults will have lower incomes to devote to purchasing health care and health-promoting goods and services, and will face higher levels of stress associated with job loss, fluctuating income, unemployment and job search.

Figure 2.4 plots the average hours worked in the course of a year.

Figure 2.4
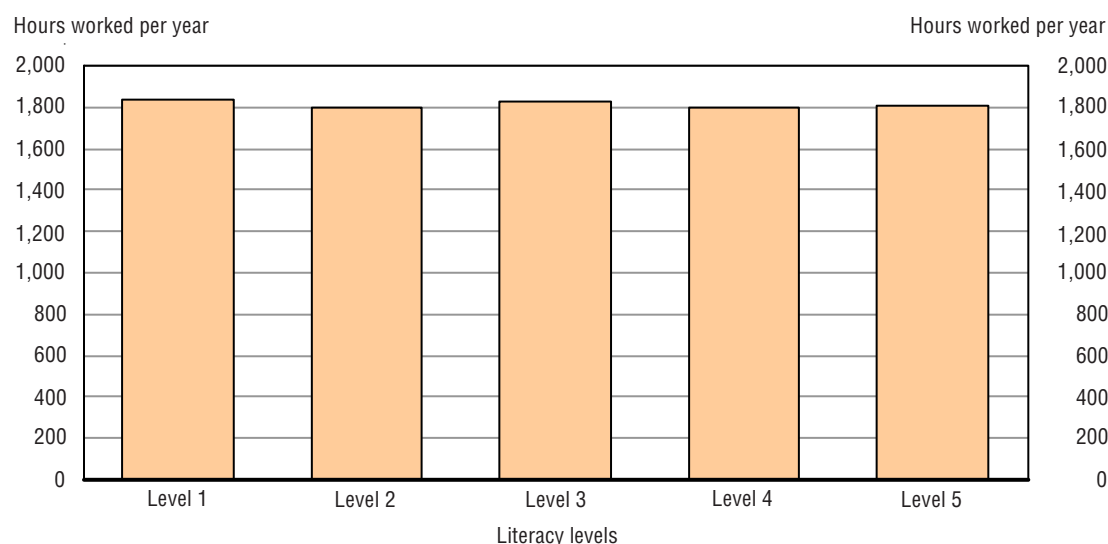
Average hours worked per year, adults aged 16 and over who were employed at some time in the year, Canada, 2003

This chart reveals a different relationship between literacy skill and hours worked.

The number of hours worked per year drops slightly with rising prose literacy skill level. Adults with Level 1 prose skills work an average of 22 more hours per year than their Level 5 peers.

It is important to put these results in international context. Notwithstanding the strong relationship between skills and hours worked within Canada, one of the most striking IALS finding is that the overall average hours worked per year at the country level falls with rising average prose skill scores. More skilled workforces actually work fewer hours than their less skilled peers. Economists interpret this as a sign that more skilled workers are able to take some of the collective productivity benefits that accrue to skill in the form of shorter work hours.

Figure 2.5 plots the average number of weeks it takes for half of individuals in two skill levels to exit unemployment, once unemployed. This analysis groups and compares those in prose literacy Levels 1 and 2 to those in Levels 3, 4 and 5.

Figure 2.5

Average half-life of unemployment, by skill level, adults aged 50 to 65 Canada, 2003
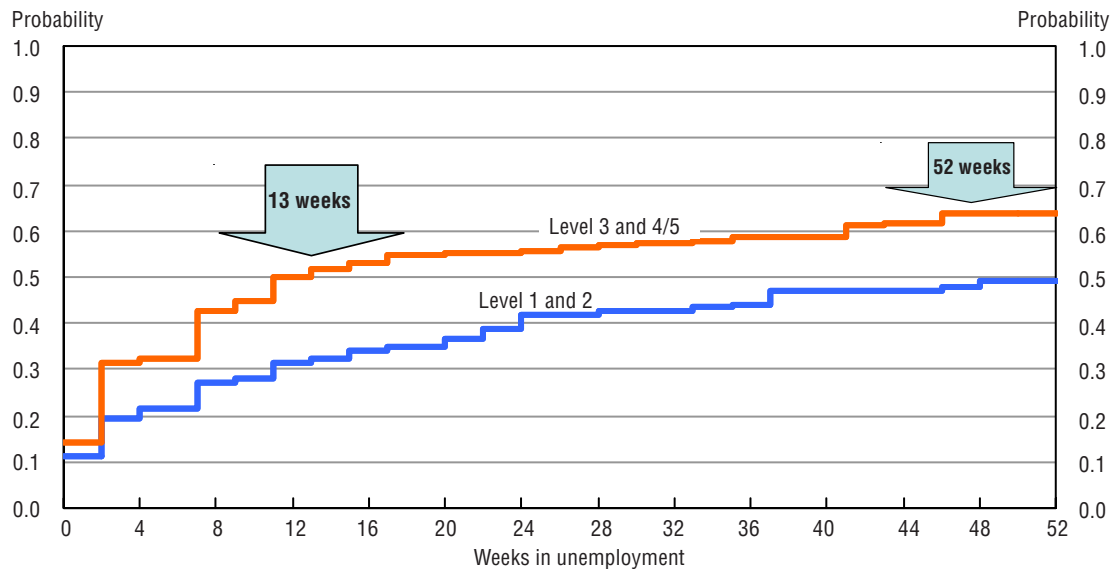
Source: IALSS 2003.

The figure shows that the low skilled group of older workers bears a disproportionate share of unemployment. It takes an average of 52 weeks for half of low skilled workers to find a job compared to 13 weeks for high skilled workers, over 4 times longer.

Collectively, these charts show that prose literacy skill has a marked influence on the amount of work that workers are able to find.

The impact of literacy skill on wage rates

Literacy also has a marked impact on adults' wage rates, a finding that economists interpret as an indication of higher skills on worker's productivity.

Figure 2.6

Average hourly earnings by prose literacy level, adults aged 16 and over who were employed at some in the year, Canada, 2003
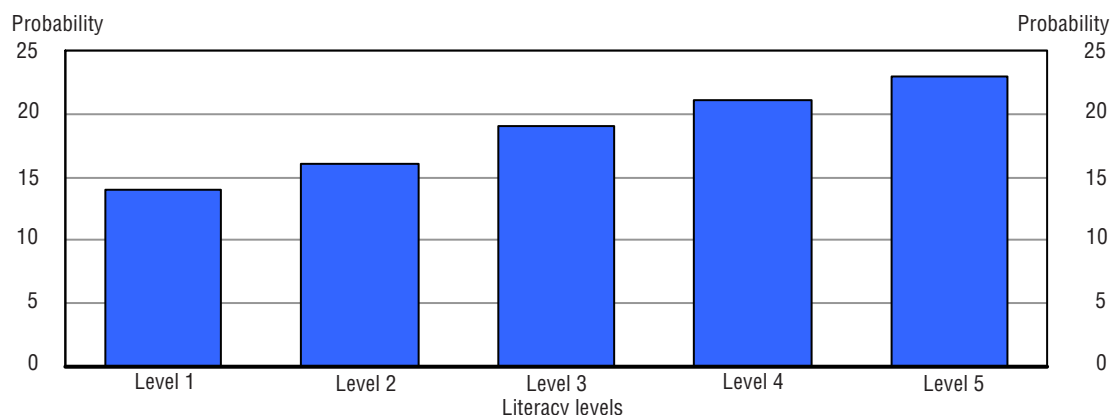
Source: IALSS 2003.

The figure shows that wage rates are highly correlated with literacy skill. Adults with Level 5 skills earn $9 more per hour, or roughly 68% more than their Level 1 peers do. These differences in average wage will tend to amplify the income disadvantage associated with fewer hours worked by low skilled adults.

Figure 2.7 documents the significant effect that literacy has on earnings.

Figure 2.7

Percent increase in weekly earnings per increase of 10-percentiles on the document literacy scale, and per increase of additional year of schooling, adjusted three stage least squares model, labour force populations aged 16 to 65, 2003

Document literacy

The figure shows that a 10% increase in skill yields an average of a 7% increase in annual earnings
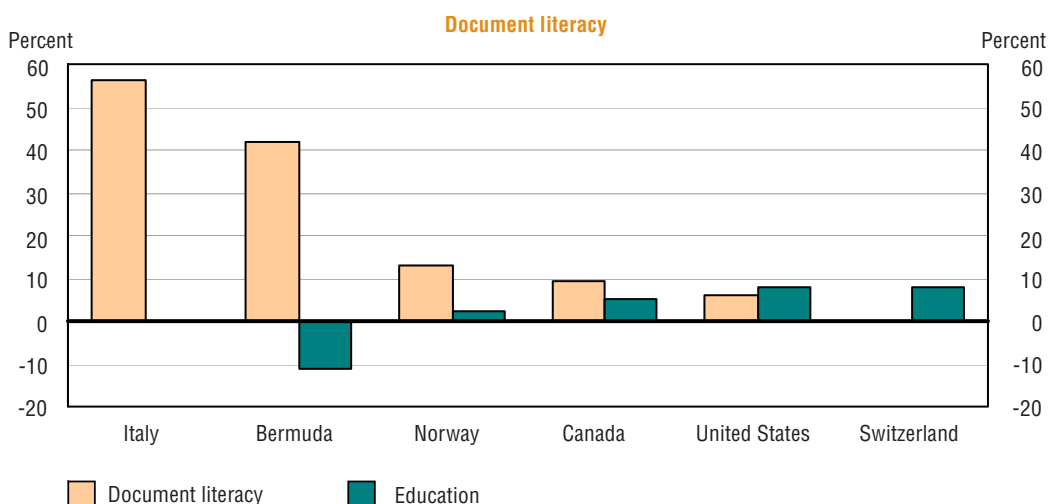
The figure shows that a 10% increase in skill yields an average of a 7% increase in annual earnings (Green and Riddell, 2007). Some of the observed wage differences are attributable to the selection of higher skilled workers into higher paid occupations, with the balance being attributed to higher skilled workers being more productive than their peers within their occupations.

Figure 2.8 decomposes the unique contribution that literacy skill, education and work experience have on earnings from employment.

Figure 2.8

The impact of skill on individual labour market outcomes, earnings and literacy proficiency, controlling for education and labour force experience

Standardised regression weights x 100

Education attainment   Literacy proficiency   Experience
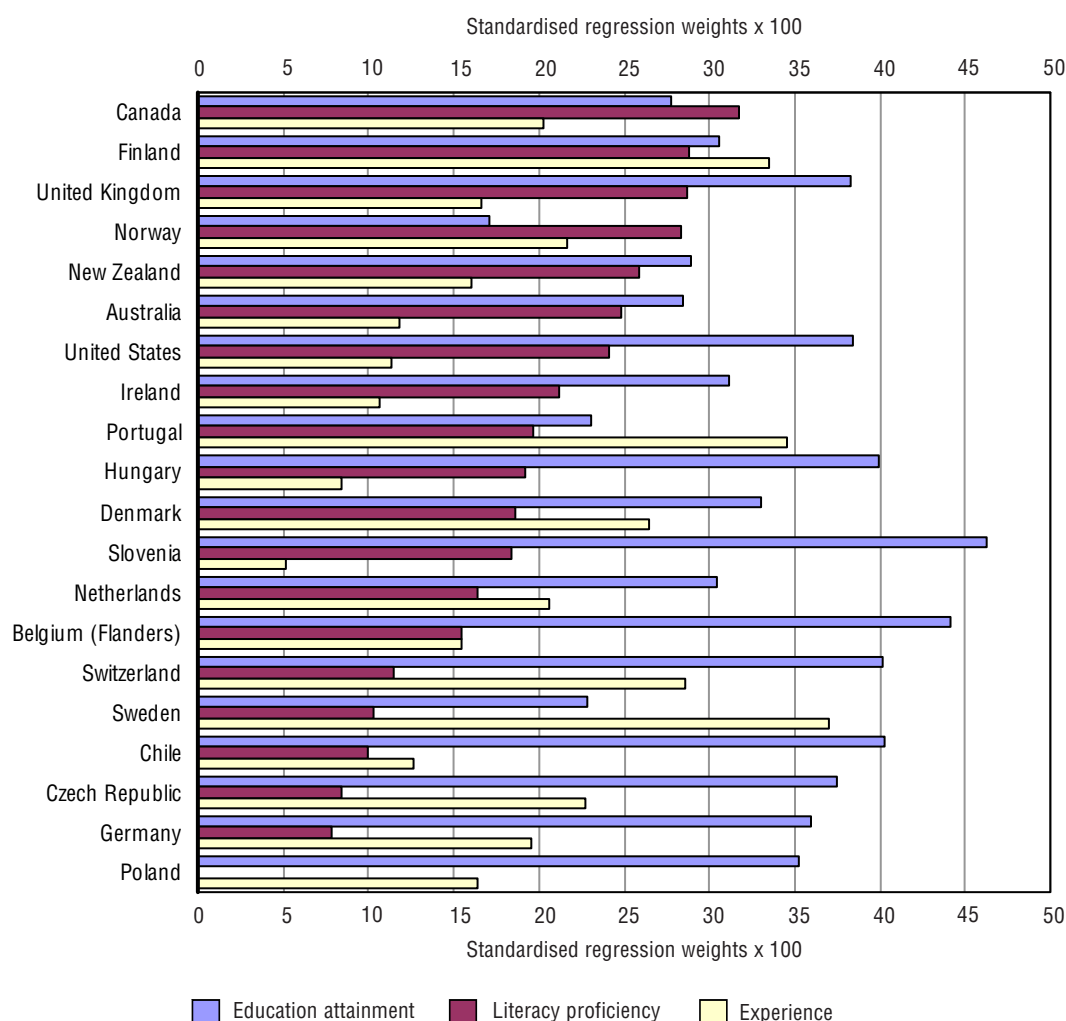
Countries are ranked by the magnitude of the effect parameter associated with literacy proficiency.
Source: International Adult Literacy Survey, 1994 and 1998.

The figure reveals that literacy skill explains more of the observed variance in earnings in Canada than any other factor, even after controlling for a host of background variables.

The inescapable conclusion is that lower skilled adults work less and earn less when they do work, effects that greatly increase their probability of finding themselves in poverty. Low skilled adults will, by definition, have fewer resources to devote to purchasing health care and health-promoting goods and services.

As strong as this conclusion is it is important to recognize that there remains a significant amount of variation in income by skill level, enough, in fact, to provide room for other, less obvious determinants. Figure 2.9 shows the unadjusted relationship between literacy skill and earnings.

Figure 2.9

The relationship between prose literacy skill and earnings, Canada, 2003
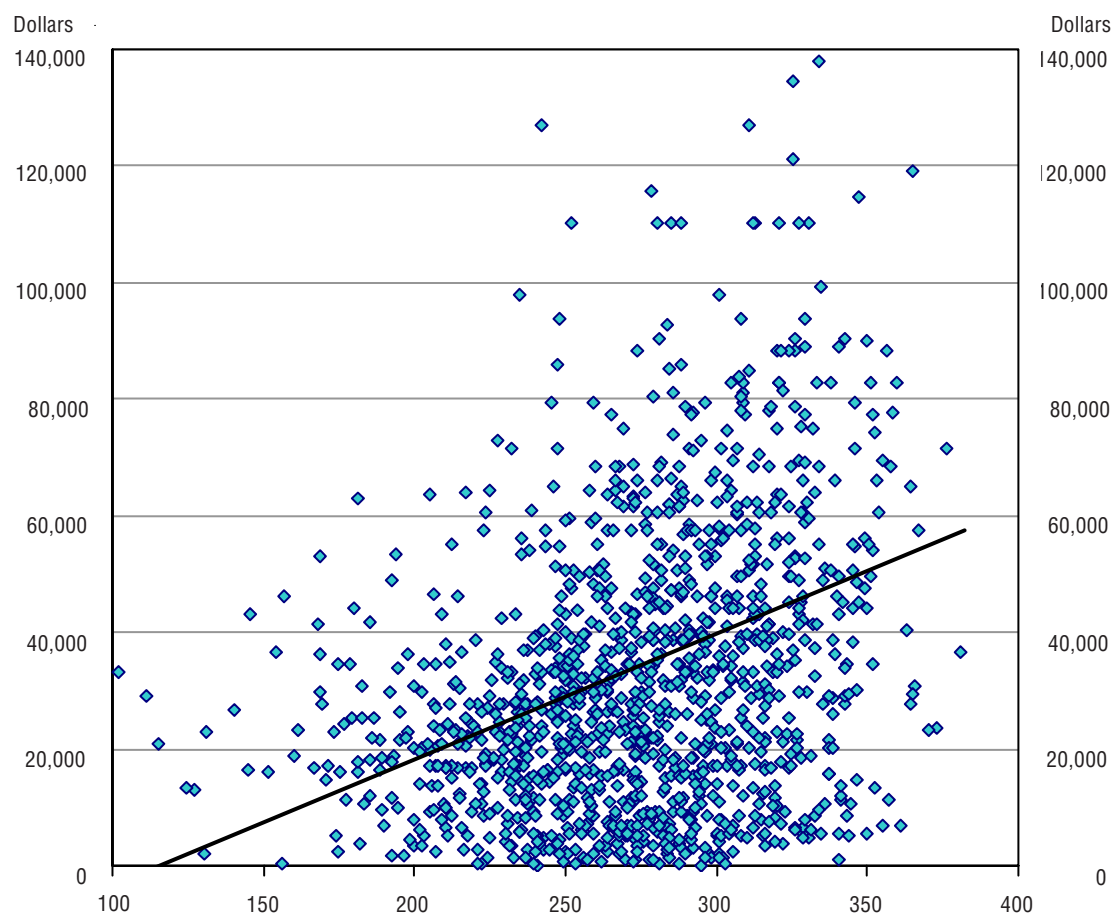
Source: IALSS 2003.

As expected the figure shows what appears to be a strong linear relationship between document literacy skill across the entire range of skill.

Labour market

We have already seen that literacy skill exerts a profound impact on a range of labour market outcomes that translate into large differences in income. Cutler and Lleras-Muney also suggest that more highly educated individuals may have "better" jobs that, in addition to paying higher incomes and providing better health insurance, offer safer work environments. They conclude that education's impact on an individual's labour market experience appear to be the main mechanism by which education results in better health. Raudenbush and Kasim have shown that literacy skill plays a significant role in the process of occupational segregation. More skilled workers are systematically selected into higher paying occupations and then rewarded within their occupation for their skill (Raudenbush and Kasim, 1998). The same authors have shown that these selection effects are particularly pronounced in the knowledge and information rich jobs being created by the emergence of the knowledge economy (Raudenbush and Kasim, 2000). As expected such jobs pay a premium for skill. Less obvious is that fact that such jobs expose workers to far lower risks of workplace illness and accident and offer workers a far greater degree of self-direction than the more traditional "blue collar" jobs they are replacing.

Using longitudinal data Kohn and Schooler (1973 and 1982) identify just how important the nature of the job is to the psychological functioning of workers, particularly the substantive complexity of the job. They conclude that the job has a far greater effect on the worker than the worker does on the job and the effects are far from trivial. More specifically, they find the degree of occupational self-direction to have the single most important impact. They conclude that it is the opportunity to use initiative, thought and independent judgment in one's work – to direct one's own occupational activities - that matters. In our view this suggests a larger role for cognition and information, the tools that provide workers with the ability to cope efficiently with the problem-solving demands of their jobs. Kohn and Schooler are also among the first to identify three features that figure prominently in our own conceptual framework – the presence of strong reciprocal effects in which personality influences the job, the impact that the job has on life outside of work and the impact that a lack of self-directedness has on distress levels.

Value of the future.

Cutler and Lleras-Muney assert that although income, health insurance and other resource factors may not affect health per se, they may change an individual's incentives to invest in health: if education provides individuals with a better future along several dimensions—because it gives access to more income, it makes one happier, and generally improves one's outlook on the future (in economic terms it increases the present discounted value of future lifetime utility), people may be more likely to invest in protecting that future.

Information and cognitive skills.

Cutler and Lleras-Muney suggest that education can also provide individuals with better access to information and improved critical thinking skills (although of course note that those with higher skills may also be more likely to get more education). The more educated do appear to be better informed, and appear to make use of new health related information first.

According to Cutler these results do not imply health education should not be undertaken; reducing education gradients is only one of many possible objectives of policy interventions. Rather, it suggests that health education programs will not diminish education gradients in health, indeed they may increase gradients, at least for several decades.

Cutler also correctly points out that how information is used and the manner in which it is received matters. The more educated are more likely to trust science: According to a 1999 National Science Foundation survey (National Science Foundation 2000), 71 percent of those with a college degree or higher thought that the benefits of new technologies strongly outweigh the harmful results, whereas only 25 percent of those with less than a high school degree thought so. This may be due in part to the fact that they are more likely to understand the nature of scientific inquiry.

Mustard goes even further. He asserts that institutional arrangements have to be created to ensure that populations throughout the world can easily communicate with each other, and understand the implications of the new knowledge for our continuing experiments in civilizations. He asserts that the wide diversity in the quality of human development within countries and different regions of the world poses a massive challenge to bring all members of the human species up to the same level of well-being and competence. The inequities in health, development, income, literacy, and the social instability and violence in different parts of the world are a serious problem for our continuing experiments in civilizations (Mustard, J.F. 2006).

Viewed from the perspective of the low-skilled individual these inequities are bound to increase stress levels associated with uncertainty.

According to Cutler and Lleras- Muney education might matter for health not just because of the specific knowledge one obtains in school, but rather because education improves general skills, including critical thinking skills and decision-making abilities. Higher reading and mathematics skills have been shown to have a marked positive impact on problem solving skill (Statistics Canada and OECD, 2011).

Our research suggests that part of the gradient between education and health is a result of the cognitive skills that come with education. More specifically, attaining Level 3 skill is seen as particularly important as this is the point where processing moves from the recall processes at the back of the brain to reasoning in the pre-frontal cortex.

It is important at this stage to clarify the theory that allows us to predict the relative difficulty of health literacy tasks to a high degree of precision.

At its most basic the relative difficulty of health literacy tasks is determined by the same set of attributes that define the relative difficulty of reading and numeracy tasks. Great strides have been made over the past two decades in understanding what determines task difficulty to the point that current models explain a minimum of 90% of observed variance (Murray, Binkley and Clermont, 2005). The current theory identifies four determinants of task difficulty in reading:

- The type of requested information
- The type of processing required of the reader
- The type of match required
- The presence of competing information

These variables have been used to define five ascending levels of proficiency along the 500 point proficiency scale. Respondents are placed at a level when they demonstrate an 80% or better probability of getting items correct at that level. Key to the current analysis, tasks in the two lowest levels involve locating single pieces of information or cycling through a document to locate multiple pieces of information. F-MRI scans confirm that reading tasks at these levels require activation of brain's recall processes in the parietal lobe, the same processes that are used to remember any fact. Thus, adults can rely on two distinct processes to cope with tasks at these levels. They can actively acquire the information by processing a text or can draw on memory for an answer. While both strategies are equally effective, relying on long term memory is more efficient because it avoids the energy expenditure associated with reading the text, with the important proviso that what is held in long term memory is reliable. Unfortunately, given the ephemeral and conditional nature of much health information this latter condition does not apply in many cases.

Preferences

According to Cutler and Lleras-Muney education may alter other important individual characteristics that affect health investments and ultimately health. They cite Becker and Mulligan (1997) who suggest that higher schooling causes lower discount rates. One possible mechanism is that education raises future income, thus encouraging individuals to invest in lowering their discount rate. Going to school is in itself an exercise in delaying gratification, so it may contribute to lower discount rates that way.

Alternatively Cutler and Lleras-Muney suggest that education could affect health through risk aversion but dismiss this as a very big contributor.

Other research suggests otherwise. Recent work confirms the presence of large differences among social groups in their risk and time preferences. For example, randomized controlled trials testing incentives to induce youth from disadvantaged socio-economic backgrounds to participate in, and to persist to the point of graduation, in post-secondary education suggests

that low SES youth have quite different patterns of risk and time preference that tend to lead them to riskier behaviours and more immediate gratification (SRDC, 2008).

More interestingly in the current context recent research suggests that risk aversion and impatience depend on cognitive ability (Dohmen, Thomas, Falk, Huffman and Sunde, 2010)

Rank

Cutler and Lleras-Muney identify the fact that education might matter for health because it changes one's relative position or rank in society, and rank by itself might affect health. The Whitehall study suggests that health in humans (Marmot 2002) depends on the relative position one has in the social distribution. It is hypothesized that this relationship emerges because individuals at the lower end of the hierarchy have lower control over their lives and are constantly subjected to arbitrary demands by others, causing increases in stress and subsequently resulting in stress-related diseases. Cutler and Lleras-Muney assert that it is not clear whether education leads to changes in rank, which in turn affects self-control, or whether self control affects education and rank. The work of Kohn and Schooler and Raudenbush and Kasim cited above suggests a causal pathway in which skill leads to education that begets more skill that provides access to jobs that are safer, pay more and that offer more control.

Social networks

Cutler and Lleras-Muney identify an alternate theory that stresses social support systems: the more educated have larger social networks which provide financial, physical and emotional support, and may in turn have a causal effect on health (Berkman 1995). The available evidence suggests that even though the more educated are overall more socially connected (for example they have more friends and are more likely to be married), social networks do not appear to explain the association between health and measures of SES (Berkman and Syme 1979). Beyond support, friends and family provide peer recognition or disapproval. Through that mechanism, peers can also have a large influence on negative behaviors, such as drinking and smoking. According to Cultler and Lleras-Muney a large literature shows that individuals with friends who smoke, drink, do drugs, or commit suicide are more likely to engage in the same activities. If more educated people have more educated friends, who are more likely to behave healthily and value health, the peer effects of networks exacerbate the effects of one's own education. Although this does not explain why the more educated behave differently to begin with, it is important for policy to know whether there are indeed multiplier effects. We tend to think of this interpretation as a empirical fallacy. Adults with low health literacy skills lack the skills to cope independently so are forced to rely on others, who just happen to share their characteristics.

Other theories

Cutler, Deaton and Lleras-Muney (2006) proposed that gradients in health arise or increase when there is knowledge and technology available to prevent or treat disease because there is a universal demand for better health, and those with more education (or more income, or more power) are likely to use new knowledge and new techniques more rapidly and more effectively. This idea is consistent with the fundamental causes of disease hypothesis (Link and Phelan 1995) that suggests that education gives an individual "a wide range of serviceable resources, including money, knowledge, prestige, power and beneficial social conditions, that can be used to one's health advantage". In the absence of knowledge and technology, gradients may exist for other reasons (such as stress), or even be reversed (as is the case with cancers of the reproductive system among women).

Cutler, Deaton and Lleras-Muney go on to suggest, however that, in the absence of policies that specifically address health inequalities, increases in medical innovation will result in larger, not smaller, gradients (see also van Doorslaer, 1997). This theory is consistent with the evidence that health is improving for all education groups but more so for the more educated. However this theory does not explain why there are gradients in diseases with no treatment; or why differences in smoking and seat belt use have persisted so long.

The term "serviceable" is important in the current context. In his Nobel prize winning work Sen distinguishes between capacities and functionings (Sen, 2000). Capacities are the product of knowledge and skill whereas functionings are the application of capacities. Sen points out that systems may both impair the ability of people to function and reduce their incentives to do so. We believe that the health care system, by providing unconditional access, paradoxically creates strong disincentives for people to acquire, maintain and apply their health literacy skills.

Cutler and Lleras-Muney conclude that several mechanisms are likely to be involved in better health to some degree and for at least some outcomes, though the relative magnitude of different explanations is unknown. According to their analysis some hypotheses seem unlikely to be very important: presence of health insurance, and preferences over time and risk do not appear to account for a good part of the association between education and health. They suggest that differences in information and cognition, especially in the presence of medical innovations may matter quite a bit. They conclude that the role of stress is uncertain.

According to Desjardins (2004), Feinstein (2002), distilled three sets of factors that form distinct channels for the effects of education on health: economic factors, health-related behaviours, and psychosocial factors (e.g. self-esteem and empowerment). The latter is linked with one's well-being and ability to cope with adverse life conditions. There is strong interplay among these factors, not least with health related knowledge and competencies, the subject of the current analysis. Additionally, there is an intergenerational link whereby parents' education can have a substantial impact on the health of their children as well as their educational attainment (e.g., see Currie & Moretti, 2002; Haveman & Wolfe, 1995).

Desjardins also reports that health economists suggest that more educated persons are more efficient producers of health (see Grossman & Kaestner, 1997). First, by improving allocative efficiency, education can influence preferences and hence lifestyle behaviours and choices. As an example, an improved knowledge base of the consequences of risky health-related behaviours may help people choose healthier lifestyles. Second, education can influence productive efficiency by having an impact on individuals' abilities to cope with the situation they find themselves in, such as ill health. For example, skills imparted by education can increase one's efficiency in gathering and interpreting health-related information and solving problems. Education can also develop self-confidence and communication skills that can affect one's ability to reach out to others, such as to communicate with health professionals and obtain social support. Sabates and Feinstein (2006) found that education may improve the ways in which individuals understand information regarding periodical tests, communicate with the health practitioners, interpret results and elicit their help.

Overall, we tend to agree with Grossman, responsible for the National Bureau of Economic Research's health economics program:

- "An individual's level of health literacy is likely to be a very important determinant of their health capital production"

2.2 DataAngel's framework for understanding literacy, health literacy, education, income and health

With this background as context we now turn to set out key aspects of our own theory. Our own work has focused on elucidating the impact of a range of skills upon outcomes realized by individuals, by the social institutions with which they interact and at the macro-level.

We propose a complex model which is rooted in behavioural and market economics, that simultaneously provides a means to understand and explain the observed relationships between skill and health and to identify where policy intervention might serve to increase or decrease skill demand, to create new skill supply or to improve the efficiency of the markets that mediate skill supply and demand.

We begin by presenting our model from the perspective of the individual.

Figure 2.10

A behavioural model of skill demand, skill supply and market efficiency

PROSE SCORE		Changing skill demand	Coping mechanisms	Individual outcomes	Institutional outcomes	Macro outcomes
		The causal links between essential skills and outcomes				
		Adults face change impacts the skill demands they face Some Increase skill demand	Adults with higher skills are more likely to rely on their skills	Adults with higher skills realize better individual outcomes	Social institutions transacting with more skilled individuals realize better outcomes	Economies and societies with more skilled individuals realize better macro outcomes
		+	+	+	+	+
High Skill Level	500 5 4	Technical change, social change, life course events and personal choices that increase skill demand	More reliance on fluid and creative cognitive tools	More able to function in socially heterogeneous groups to act autonomously and to use tools	More successful • Institutions • Firms • Families • Communities • Schools	Higher productivity and GDP growth personal choices Better population health Lower social inequality
	3 2	Technical change, social change, life course events and personal choices that decrease skill demand	More reliance on practical and crystallized cognitive tools More reliance on others	Less able to function socially heterogeneous groups to act autonomously and to use tools	Less successful • Institutions • Firms • Families • Communities • Schools	Lower productivity and GDP growth Lower population health Higher social inequality
Low Skill Level	1		More avoidance			
		—	—	—	—	—
	0	Some changes decrease skill demand	Adults with lower skills are less likely to rely on their skills	Adults with lower skills realize worse individual outcomes	Social Institutions transacting with less skilled individuals realize worse macro outcomes	Economies and societies with less skilled individuals realize worse macro outcomes

The basic story is simple. The left-most column (**Changing skill demand**) points to situations in which individuals face changes in the demand for skills. These may be traceable to external changes (in the products and services on offer, in the external economic environment, in the tax treatment of various investment alternatives, changes in how health information can be accessed, etc.) or to internal changes (changes in individual circumstances, the manifestation of a disease or chronic condition, etc.). Changes in demand can increase the level of skill demand, or attenuate demand.

The next column (**Coping Mechanisms)** shows the range of strategies that individuals can choose in order to adapt to or resolve these changes in the demand for skill. They can ignore the changes and suffer any negative consequences that ensue. They can rely on the advice of family members, neighbours or colleagues at work. They can consult with professionals. Or they can rely on their own knowledge and skill to respond to changing demand. In reality, the majority of adults rely on multiple sources of information in arriving at a decision of how to proceed, and they implicitly assign weights to different information sources. Importantly for the current analysis, the relative weights assigned to these different resolution processes by individuals vary enormously by skill level. This would not matter were it not for the fact that the choice of resolution processes influences outcomes. Adults who have high levels of skill, or who rely on knowledgeable individuals for advice, will realize better outcomes than those who ignore the problem or who largely rely on unreliable sources for their advice.

At its most basic the goal of public policy is to recommend measures that reduce the probability that low-skilled adults will ignore their demands or that they will rely disproportionately on unreliable advisors.

The three right-hand boxes (**Outcomes for Individuals, Outcomes for Social Institutions** and **Macro Outcomes**) show how individuals response to changing skill demands influences their own outcomes, the outcomes of the institutions with which they interact, and ultimately the health and welfare of Canadians.

The chart raises an interesting dilemma for the definition of health literacy itself. The international work on skill treats skills as individual attributes that confer agency, i.e., they are something that allow an individual to act alone. A worker with low literacy skills who depends on co-workers to help deal with reading demands on the job can cope but cannot be deemed to be literate. Applying this notion to health literacy, we should separate an individual's health literacy skill from their health literacy decisions. Individuals with a very low level of health literacy might realize good outcomes if they choose to compensate for their weak skills by relying on a reliable source for health advice. Such reliance, however, creates a level of dependence and joint responsibility that presumes that the advice given is indeed reliable and is communicated in a form that can be understood. Sadly, despite the strides made to improve the clarity of health information much oral and written communication related to health is beyond the skills of many adults to comprehend.

As noted earlier, Sen distinguishes between "capabilities" i.e knowing how to do something and "functionings" i.e. finding oneself in a context in which one is able to apply ones skills to improve one's outcomes (Sen, 1980). Sen identifies the fact that many people with capability either chose not to apply their skill (because of a lack of self-confidence) or are actively discouraged by social actors from applying their skill. The structure of the health care system itself, might, therefore, serve to discourage adults from acquiring, applying and maintaining health literacy skill.

It is also worth noting at this point that many health literacy tasks are inherently difficult, requiring the reader to integrate information from multiple sources, to deal with conditional information and to make high level inferences from a text, often by using advanced numeracy skills. No amount of plain language can reduce such tasks below their natural Level 3, 4 or 5 difficulty. Adults with skills below the level demanded by such tasks must seek reliable advice if they are to cope. Unfortunately, these adults often get their advice from unreliable sources or chose to ignore the demand, both strategies that lead to poorer health outcomes on average. The low skilled adults that do seek out reliable advice tend to get their information from relatively expensive doctors, nurses and pharmcists.

The currency of health information

Health systems rely heavily on social marketing designed to alter the health behaviour of Canadians. While such a strategy is well justified, it is important to appreciate its limits. One of the defining features of health information is that it changes over time. Change in information can be traced back to several sources, the most obvious of which is change in the therapeutic regimes that are available. The emergence of new drug therapies and surgical procedures force change on the system. Knowledge must also be updated as the offering of products and services varies with time. Knowledge can also become stale in response to changes in the tax treatment of different investments that influence the after-tax rates of return to different "health" investments.

A large proportion of adult Canadians do not possess the health literacy skill to cope with many common health literacy tasks and thus to independently understand and apply new information as it becomes available. Thus, once one is past the nostrums of "eat your leafy green vegetables", "don't smoke", "get exercise" and "don't drink too much", the "shelf life" of health knowledge will limit the effectiveness of measures designed to increase Canadians' collective health literacy through social marketing. The only durable message for individuals with low levels of health literacy is to "Consult a health professional whose knowledge is current and generally reliable".[1] Adults with higher levels of health literacy will be able to weigh their options more carefully and evaluate new information as it becomes available.

Barriers to access

Economic theory that describes the functioning of markets identifies price as a significant barrier to accessing goods and services for low income Canadians. However, price-related barriers to access may manifest themselves in many ways. Costs for many goods and services offered by health providers are provided at no cost to the user so consumers are deprived of the price signals that play a central role in other markets. Thus, price cannot be considered to be a significant barrier to obtaining health information in person from doctors, nurses or pharmacists, except where poor adults face child care or transportation barriers.

A more important set of price barriers is associated with the costs of accessing health advice on the internet. Although Canada has one of the highest levels of household internet access, adults with low levels of income, education and, by extension, health literacy, are much less likely to report having access. The fact that free access can be arranged through public libraries, community access sites and a broad range of public service organizations suggests that price does not represent a significant barrier to access of health information over the internet. It is also important to note that, as computer interfaces become more intuitive, the relative difficulty of ICT-based tasks will be dominated by the difficulty of the underlying cognitive tasks rather than the syntax of the interface. Thus, the cognitive skills that underpin health literacy skill will become more important barriers than either physical access, price or the technical skills associated with using technologies. The emergence of tele-health initiatives will further reduce cognitive, physical and technical barriers to access of health information.

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1. Some would argue with this latter assertion. Many doctors have a vested interest in the products that they promote so can be far from impartial. Were it not so drug companies would not spend more on marketing drugs than they do on developing them.

Health literacy as a barrier to coping

The key barrier keeping individuals from coping with everyday health literacy demands is health literacy skill itself. The theory developed in support of IALS incorporates insights from cognitive science, educational theory, sociology and economics into an overarching economic framework that serves as the basis for the current analysis.

A typology of skill

The basic elements of the IALS theoretical framework are illustrated in the following series of charts.

The first chart captures what the theory says about the skills that actually exist and how they relate to each other.

A framework for thinking about essential skill:
Profiles of skill supply and demand
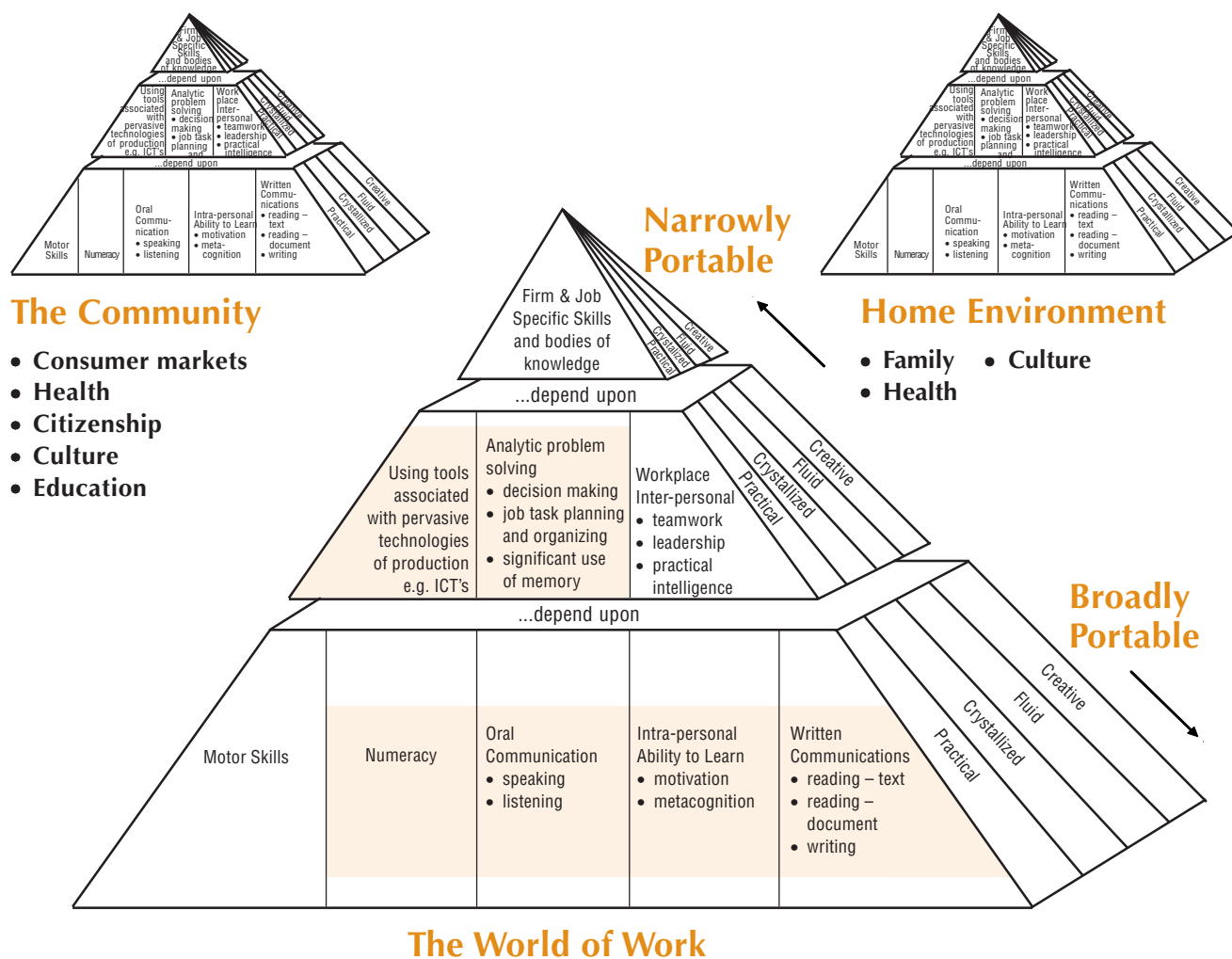
The Community

- **Consumer markets**
- **Health**
- **Citizenship**
- **Culture**
- **Education**

Narrowly Portable

Home Environment

- **Family**   • **Culture**
- **Health**

Broadly Portable

The World of Work

Source: International Adult Literacy Survey: Measuring Adult Literacy and Life Skills: New Frameworks for Assessment (Murray, Clermont, & Binkley, 2005).

A framework for thinking about essential skill: Profiles of skill supply and demand

The Community

ICT Literacy: The key to productivity and innovation and acknowledge economy and for accessing health information

Narrowly Portable

Home Environment
- **Family**
- **Culture**
- **Health**

Broadly Portable

Firm & Job Specific Skills and bodies of knowledge

...depend upon

Using tools associated with pervasive technologies of production e.g. ICT's

Analytic problem solving
- decision making
- job task planning and organizing
- significant use of memory

Workplace Inter-personal
- teamwork
- leadership
- practical intelligence

Creative / Fluid / Crystallized / Practical

...depend upon

Health literacy

Motor Skills

Numeracy

Oral Communication
- speaking
- listening

Intra-personal Ability to Learn
- motivation
- metacognition

Written Communications
- reading – text
- reading – document
- writing

Creative / Fluid / Crystallized / Practical

The World of Work

Source: International Adult Literacy Survey: Measuring Adult Literacy and Life Skills: New Frameworks for Assessment (Murray, Clermont, & Binkley, 2005).

Several aspects of the chart bear comment.

The first is that the same typology can be used to characterize the demand for skill and skill supply in the three domains of life: work, the community and the home environment.

The second notable feature is that there is a hierarchy of skill acquisition and application that demands a strong foundation of basic skills.

The third feature has to do with insights gleaned from cognitive psychology. Current theory posits four levels of function:

- People who function at the practical level by applying knowledge and skill they acquired through means other than a formal educational process

- People who possess crystallized intelligence, who can apply skills acquired through formal education without thinking about the process

- People who possess fluid intelligence, who are capable of applying their cognitive and meta-cognitive skills to novel tasks that they have not previously encountered

- People who possess creative intelligence, who are capable of coming up with novel solutions to tasks that have not previously been encountered

Arguably, most adults rely on their practical and crystallized intelligence to cope with most demand's they encounter in daily life. This works as long as knowledge is static and the world doesn't change. The recent financial meltdown provides ample evidence of the inherent risks associated with this strategy and implies that it would be far better for individuals to be far more self-sufficient and critical consumers of financial advice. Similarly, the rapid rate at which health information becomes out of date argues for more reliance on fluid and creative intelligences, that themselves depend on people having high levels of oral fluency, reading, numeracy and other skills that underpin health literacy.

A markets model of skill

The chart reproduced below reveals the role played by the skills identified in the IALS framework in a market model of skill.

Theoretical framework: A "Markets" model of skill

Skill Demand

Community

Home

Work

Markets for skill:
- Education
- Labour
- Health
- Social

Outcomes

Skill Supply = skill stock + net skill flow from lifelong, life-wide learning

+ quality of early childhood experience
+ quantity of primary and secondary education
+ quantity and quality of tertiary education
+ quantity and quality of adult learning (formal, non-formal, informal)
+/- imigration
+/- emigration
- skill loss associated with insufficient demand
+/- social demand for skill
+/- economic demand for skill

Context	MICRO (Individuals)	MESO (Social Institutions)	MACRO (Systems)
• Economic			
• Social			
• Educational			
• Health			

The key insight afforded by this chart is that one can conceive of health literacy as an economic system that includes elements of the demand for skill, the supply of skill that adults can access to confront the demands they face, and a market that mediates supply and demand. This insight carries implications for policy as well at several levels.

Public policy makers have to optimize demand, supply and market efficiency measures

The display also provides a means of thinking about how public policy might attempt to influence health literacy. Specifically, the display makes it explicit that public policy can attempt to influence the demand for health literacy skill, to influence the supply of health literacy skill, or to improve the efficiency of the health literacy market. More specifically it can:

- Intervene on the demand side to reduce the level of health literacy demand facing adults. Reductions in demand can be realized through the provision of health goods and services that compensate for adults with weak health literacy skills or through the systematic reduction of the difficulty of health information produced for public and patient consumption. For example, governments have reduced the demand for health literacy as it relates to the decision to wear a seatbelt by passing legislation obliging adults to buckle up and by devoting considerable resources to enforcement.

- Intervene on the supply side to facilitate the creation of new adult health literacy skill through instruction. As noted above Sen characterizes this type of intervention as serving to improve adults' "capabilities" (Sen, 1980).

- Intervene to improve the efficiency of markets by reducing psychological, price and physical barriers that impede adults' access to health information. Examples of "market efficiency" measures include the translation of health information into multiple languages, the provision of health information on the internet and social marketing to increase the amount of attention adults devote to acquiring and applying their health literacy skills. In Sen's schema this improves adults "functionings".

The optimal balance to be struck among these measures will depend on the relative importance of efficiency, effectiveness and equity to politicians and policy makers.

Health literacy is a relative concept

The chart shows that the same skill typology can be used to characterize the demand for health literacy faced by adults in life contexts (the workplace, the home and the community) and the supply of health literacy that adults can access to deal with the demands they confront. This opens the way to thinking about health literacy as a relative concept, one in which the adequacy of an individual's health literacy skill can only be judged relatively against the demands they face.

Public policy can also increase the supply of health literacy skill through education and the widespread dissemination of health information.

Public policy can also improve the efficiency of the markets that mediate the supply and demand of health literacy. Government provision of internet accessible health information is one way to reduce cost barriers to access. Similarly, the provision of tele-health services serves to reduce physical barriers and price access to accessing health services associated with transportation.

It is important to note, however, that public policy can have much more subtle impacts on the efficiency of the health literacy market.

By providing relatively free access to primary health care governments serve to reduce individual incentives to invest in health-promoting behaviours, and reduce individual incentives to acquire health literacy skill or to maintain and apply the skill they have. Why should an individual invest such energy when a visit to a doctor can solve the problem? The underlying policy question is "How much could the efficiency of the health system be improved by increasing the efficiency of the health literacy market?

Less obvious is that governments have reduced the demand for health literacy by providing access to primary health services at no cost.

Health literacy Is a composite skill

Perhaps the most perplexing insight to be drawn from the IALS theory is that health literacy does not exist as a fundamental concept on a par with prose literacy, document literacy or numeracy; rather, it is best thought of as a meta-concept or an amalgam of several fundamental concepts. Health literacy involves the application of a diverse skill set in a particular knowledge domain. Thus, coping with the health literacy demands of everyday life involves the activation of a constellation of underlying skills that are themselves fundamental. Specifically, coping with health literacy tasks depends upon how individuals apply, *inter alia*, oral fluency, prose literacy, document literacy, numeracy, problem solving and scientific literacy skills. This insight carries profound implications for health policy.

First, improving the health literacy of Canadian adults will depend upon teaching and learning the constituent skills upon which health literacy proficiency depends rather than health literacy skill directly.

The hierarchical relationship among skill domains implies an instructional sequence

A third insight afforded by the IALS theory is that a hierarchical relationship among the skill domains that underpin health literacy influences both the acquisition of health literacy and its application in the real world. This insight implies two things for policy.

First, because health literacy proficiency depends upon applying a constellation of skills, a weakness in any of the constituent skills will put the individual at risk. Thus, the proportion of adults whose health literacy skill places them at risk is significantly higher than the proportion with, for example, low literacy skill since these individuals may have weakness in a variety of other skills.

Second, the hierarchy of constituent skills means that any remedial intervention requires focusing on skills that are deeper in the hierarchy. Prosaically, it would make no sense to try to teach an immigrant with weak oral fluency in English the advanced document literacy skills they need to cope with a broader range of health literacy tasks. The skill deficiency lower in the hierarchy needs to be remedied first.

We believe that the theory set out above provides a context for thinking about how investments in health literacy might help to improve the efficiency and effectiveness of the health care system. The key question is whether higher health literacy skills might simultaneously reduce the demand for expensive "compensatory" health goods and services, reduce the demand for disease–induced services and reduce the cost of treatment associated with a range of important diseases. The next chapter explores the nature of health literacy and how it is generated.

Chapter 3

Health Literacy, Health Literacy Determinants and the Social Distribution of Health Literacy

A unique feature of the current analysis is its use of a direct measure of health literacy. This chapter begins by defining health literacy and providing readers with an overview of the theory and methods that were used to derive the measure. The chapter then provides readers with a sense of the level and distribution of health literacy in order to provide a context for an analysis of the determinants of health literacy.

3.1   Health literacy defined

The concept of health literacy has evolved considerably over the past couple of decades. Initially conceived simply as the ability to read health information health literacy is now thought to include being able to communicate in a health setting, to evaluate health information critically and to apply health literacy skills in everyday life. A selection of recent definitions is provided in Table 3.1**.**

Evolving concepts and definitions of health literacy

- From the Center for Health Care Strategies, Inc., 1997.

  The ability to read, understand and act on health-care information.

- From the Joint Committee on National, Health Education Standards, 1998.

  The capacity of individuals to obtain, interpret and understand basic health information and services and the competence to use such information and services in ways which enhance health.

- From the World Health Organization (WHO), Health Promotion Glossary of Terms, 1998.

  The cognitive and social skills that determine the motivation and ability of individuals to gain access, to understand and use information in ways which promote and maintain good health.

- From the Ad Hoc Committee on Health Literacy for the Council on Scientific Affairs, American Medical Association, 1999 and Selden et All, 2000.

  A constellation of skills, including the ability of individuals to gain access, to understand and use information in ways which promote and maintain good health.

- From the National Library of Medicine's Health Literacy, Selden, C. et al., 2000.

  The degree to which individuals can obtain, process and understand the basic health information and services they need to make appropriate health decisions. (This definition was used in the Institute of Medicine's report Health Literacy: Prescription to End Confusion (2004) and the U.S. Department of Health and Human Services' Healthy People 2010)

- From *Health Literacy as a Public Health Goal*, Don Nutbeam, 2000.

  The personal, cognitive and social skills which determine the ability of individuals to gain access, to understand and use information to promote and maintain good health. Three levels of health literacy were identified:

  1. basic or functional health literacy;

  2. communicative or interactive health literacy; and,

  3. critical health literacy.

- From Understanding Health Literacy, Zarcadoolas, Pleasant and Greer, 2005.

  The wide range of skills and competencies that people develop to seek out, comprehend, evaluate and use health information and concepts to make informed choices, reduce health risks and increase quality of life.

- From *Navigating Health: The Role of Health Literacy*, Kickbusch, Wait and Maag, 2005.

  The ability to make sound health decisions in the context of everyday life—at home, in the community, at the workplace, in the healthcare system, the marketplace and the political arena. It is a critical empowerment strategy to increase peoples' control over their health, their ability to seek out information and their ability to take responsibility.

The Canadian Public Health Association (CPHA) Expert Panel on Health Literacy has incorporated all these elements into its definition:

> *"Health literacy is the ability to access, understand, evaluate and communicate information as a way to promote, maintain and improve health in a variety of settings across the life course."* (Rootman and Gordon-El-Bihbety, 2008).

In other words, while literacy is a necessary foundation for health literacy, health literacy appears to involve more than the ability to read or understand numbers. Context matters, as does the ability to find, understand, evaluate and communicate health-related information.

Although these definitions all seem to make sense little effort has been expended to confront them empirically. Working with Rima Rudd from Harvard University and Irwin Kirsch and Kentaro Yamamoto from the Educational Testing Service, one of the authors (Murray) applied Rudd's health literacy framework to derive a health literacy activities scale using data from a number of large-scale assessments of adult literacy and numeracy skills.

3.2   Rudd's framework for understanding health literacy

The first step undertaken to analyze adults' health literacy skills was to consider a variety of health activities and behaviours related to where and why people take health-related actions. For the initial analysis, Rudd adopted a commonly-used lexicon to differentiate among various health-related activities. The health-related activities undertaken by adults in daily life are divided into the following categories: health promotion, health protection, disease prevention, health care and navigation.

Health promotion

Generally, the emphasis in health promotion is placed on activities undertaken by individuals for their own health and encompasses behaviours related to nutrition, physical activity and other healthy habits.

Health protection

Actions taken in everyday life to preserve and protect health are highlighted in traditional epidemiologic models. These activities include learning about changes in products, improving the design of structures, machines, products, systems or process, and understanding the rules governing details or procedures. In addition, these activities are undertaken to protect the health of groups of people (such as workers or people living in a specific geographic location) and the public at large (all those who purchase food or drink water). The Institute of Medicine issued two reports on the scope of public health and in each highlighted the importance of public engagement in community action to ensure the health of the public (Reder, S.,1994 and OECD, 2007). Included in the report are activities related to occupational health and safety and to safeguarding the environment. These activities are linked to mandates from governmental agencies such as the U.S. Federal Drug Administration, Health Canada, the Public Health Agency of Canada and Environment Canada, or are specified in federal legislation such as the *Right to Know Act* in the U.S. and in federal and provincial occupational health and safety legislation in Canada. Materials coded under *protection* include discourse related to product safety and to health-related social and environmental issues.

Disease prevention

Disease prevention activities include actions undertaken to prevent the onset of an illness or a disease or to detect diseases at early stages. Included here are activities related to immunization, such as those for infants and school children, or influenza and pneumonia inoculations for elders. Screening programs range from routine vision and hearing examinations to prostate or breast cancer tests. In addition, actions such as the use of sunscreen are included.

Health care

Health-care activities focus on learning about an illness or disease, taking action to seek care, complying with the appropriate regimen, monitoring and measuring medicine and symptoms for chronic disease management, and engaging in dialogue and discussion with care providers such as dentists, doctors, pharmacists, mental health professionals and nurses. Patient education brochures, labels for medical and dental products, and directions for care are some of the materials patients and family members must use to understand a disease or illness, follow recommended guidelines, prepare for tests and procedures, engage in self-care and manage a chronic disease.

Navigation

Finally, attention to barriers to programs, services and care has shaped a fifth health-literacy activity: one related to bureaucratic demands and referred to as *navigation*. Navigation of the health-care system encompasses activities related to rights and responsibilities, application for insurance and other coverage plans, and informed consent for procedures and studies.

The schema enabled Rudd, Kirsch and Yamamoto to examine and code all of the materials and tasks used across various assessments of adult literacy skills and to link them to the precursor NALS database. In American research, these results are referred to as the *Health Activities Literacy Scale* (HALS).

The items that were used to create the health activities literacy scale were drawn from the hundreds of literacy tasks that had been developed for various large-scale assessments of adult literacy, all of which used the same definition of literacy and framework for constructing literacy tasks. Table 2 offers a description of the five health activities, with examples of materials adults are expected to use and examples of tasks they are expected to undertake.

The following section provides a brief overview of the coding process and the creation of the new scale for a measure of health-literacy skills (HALS).

3.3   Coding assessment items into the Rudd framework

Three researchers independently coded the materials and questions from previous literacy assessments into one of the five health-related activities identified above; all differences were resolved through discussions and refinement of the coding criteria. Of the 350 unique assessment items, some 191 literacy and numeracy tasks, drawn from the surveys used in the United States, were judged to measure health-related activities. Of those 350 assessment items, some 235 literacy tasks administered for Canada were derived from the Canadian component of the 2003 ALL survey. The 2003 ALL survey offers a representative sample of adult Canadians aged 16 and above living in the ten provinces and three territories. The sample excluded adults living on reserve and non-civilian populations, including members of the Armed Forces and inmates of institutions but included over-samples of official language minorities, recent immigrants and Aboriginal adults. The Canadian data set included sufficient common assessment items to provide a strong psychometric linkage to the NALS/IALS/ALL and HALS scales.

Analyses of the resultant proficiency scales have been published for the U.S. (ETS, 2006). For Canada, initial analyses of the health-literacy scales have been published in Murray, T.S., Hagey, J., Willms, J.D., Shillington, R., and Desjardins, R. (CCL, 2008) and Murray, T.S., Jones, S., Willms, J.D., Shillington, R., McCracken, M. and Glickman, V. (CCL, 2008).

Table 3.2

Categories of health activities with selected examples

HEALTH ACTIVITES	FOCUS	EXAMPLES OF MATERIALS	EXAMPLES OF TASKS
Health Promotion	Enhance and maintain health	Articles in newspapers and magazines, booklets, brochures Charts, graphs, lists Food and product labels	Purchase food Plan exercise regimen
Health Protection	Safeguard heallth of individuals and communities	Articles in newspapers and magazines Postings for health and safety warnings Air and water quality reports Referenda	Decide among product options Use/avoid products Vote
Disease Prevention	Take preventive measures and engage in early detection	News alerts: TV, radio, newspapers Postings for inoculations and screening Letters related to test results Graphs, charts	Determine risk Engage in screening or diagnostic tests Follow up
Health Care and Maintenance	Seek care and form a partnership with health care providers	Health history forms Medicine labels Discharge instructions Education booklets and brochures, heath information on the internet	Describe and measure symptoms Follow directions on medicine labels Calculate timing for medicine Collect information on merits of various treatment regimes for discussion with health professionals
Systems Navigation	Access needed services Understand rights	Maps Application forms Statements of rights and responsibilities, informed consent Heath-benefit packages	Locate facilities Apply for benefits Offer informed consent

3.4 How the Health Activities Literacy Scale (HALS) was derived

The various surveys from which the 191 health-related literacy tasks were selected represent different populations with various demographic characteristics. Current methodologies provide researchers with the tools they need to evaluate the performance of people even when they have been given somewhat different tasks and when they represent different samples and populations studied over time. These methodologies have been used with student surveys such as the National Assessment of Educational Progress (NAEP) and the Programme for International Student Assessment (PISA), as well as the adult skill assessments discussed in this report. Therefore, even though the populations studied varied somewhat across the different surveys, the subsets of literacy tasks and the scoring rubrics common across the surveys were kept constant and their item parameters checked for stability across each survey. Over the years, the same item parameters have been found to fit very well to subpopulations within a country, as well as across countries with different languages. Once the health-related literacy tasks had been scaled, the stability of the new item parameters was verified across each of the surveys to ensure they fit well. More than 58,000 respondents from across the various adult assessments were used to estimate and verify the health-related literacy item parameters.

Because the focus of the current study is the Canadian population, the creation of the health activities literacy scale used only samples from Canada. The scaling model used for the health literacy of the IALS data is the two-parameter logistic (2PL) model from item response theory. Item response theory (IRT) is a mathematical model for the probability that a particular person will respond correctly to a particular item from a domain of items. This probability is given as a function of a parameter characterizing the proficiency of that person, and two parameters—difficulty and discrimination—that characterize the properties of that item. One of the strengths of IRT models is that when their assumptions hold and estimates of the model's item parameters are available for the collections of items that make up the different test forms, all results can be reported directly in terms of the IRT proficiency.

This property of IRT scaling removes the need to establish the comparability of number-correct score scales for different forms of the test or for assessments administered to different samples at different times. The stability of the item parameters must be checked across the various survey populations to ensure the comparability of the data and the stability of the newly established scale. The common item parameters must fit well in order to justify the use of the new item parameters and to establish the stability of the new health-activities literacy scale (HALS). Five approaches were used to evaluate the stability of the item parameters, including: a graphical method that allows one to observe the item characteristic curves for various populations; three statistical indices that estimate the fit of each item for each population against the common item parameter (X2 statistic, the Root Mean Squared Deviation statistic and the Weighted Mean Deviation); and the impact of the item parameter on the overall proficiency estimate of a particular population. Deviations are based on the difference between model-based expected proportions correct and observed proportions correct at 41 equally spaced ability scale values. The fit of the health-related literacy tasks was remarkably good based on any conventional standard. Therefore, a single set of common item parameters could be used to describe all survey samples.

The Health Activities Literacy Scale (HALS) is a new scale. Even though it is based on pre-existing items from various literacy assessments, the properties of this new scale have not been defined. That is, the scale could range from 0 to 100, from 200 to 800 or within some other pre-selected range. The procedure to align the health-literacy activities scale with the NALS scales was based on matching two moments of the proficiency distributions: the mean and standard deviation. In this study, the provisional proficiency distribution based on the health scale was matched to the distribution of means of three NALS scale proficiency values (m = 271.562 and sd = 65.380). This allowed for a linear transformation that defines HALS on a scale ranging from 0 to 500, having the same mean and standard deviation as the three NALS proficiency scales. One of the benefits of HALS is that it uses items from existing large-scale surveys of adults.

Several researchers reviewed each literacy task to determine how well it fit into the health-activities framework described in this report. This adds content relevance to the scale because each item was judged to be representative of a type of health activity, thus focusing the measurement on tasks that broadly define health literacy rather than general literacy. Each of the 191 items that make up HALS has been administered to nationally representative samples of adults. Because a large number of adults responded to each item, we were able to check how well each item behaves psychometrically. For example, each item was checked for differential performance by subsets of samples. In addition, each item was checked to determine how well it fits into the overall scale. Other pieces of information relating to the validity of the HALS stem from our understanding of the construct and what contributes to the difficulty of each item and its position along the health scale.

The IALS database links the HALS to an extensive set of background information. This link also contributes to the validation of the HALS. Using this information, we are able to see the correlations between HALS and a wide range of background characteristics that include age, gender, race/ethnicity, level of education, country of birth, health status and wealth.

3.4   Weakness in the HALS measure of health literacy

The HALS measure employed in this analysis is one of the world's first attempts at generating valid, reliable, comparable and interpretable estimates of the distribution of health literacy and its link to health outcomes. While interesting, the HALS measure is far from perfect. More specifically, the measure suffers from a number of weaknesses that should be taken into account when interpreting the results presented in the balance of this volume. These weaknesses include that the measure:

Was derived from a convenience sample of health literacy tasks included in the national and international assessments. While the available health literacy tasks provide reasonable coverage of the sub-domains identified in Rudd's framework, ideally one would have based the measure on a representative sample of tasks that reflect the natural distribution of health literacy tasks that individual is face. Such a distribution would require the universe of health literacy tasks to be catalogued and classified by item difficulty and importances;

Does not include oral fluency, problem solving nor scientific literacy, all elements that current theory suggests have an important impact on proficiency;

Does not include information on the coping mechanisms employed by low skilled adults, most particularly who they rely on for health advice; and,

The measures relate to official language health literacy. It is possible that adults with mother tongues other than English and French have higher levels of health literacy in their mother tongue. This would only have a significant effect on their ability to cope if equivalent quality health information and health services are available in those languages.

3.5   The distribution of health literacy

Figure 3.1 plots average health literacy score by jurisdiction in Canada.

Figure 3.1

Average health-literacy scores, population aged 16 and over (including seniors), Canada, provinces and territories
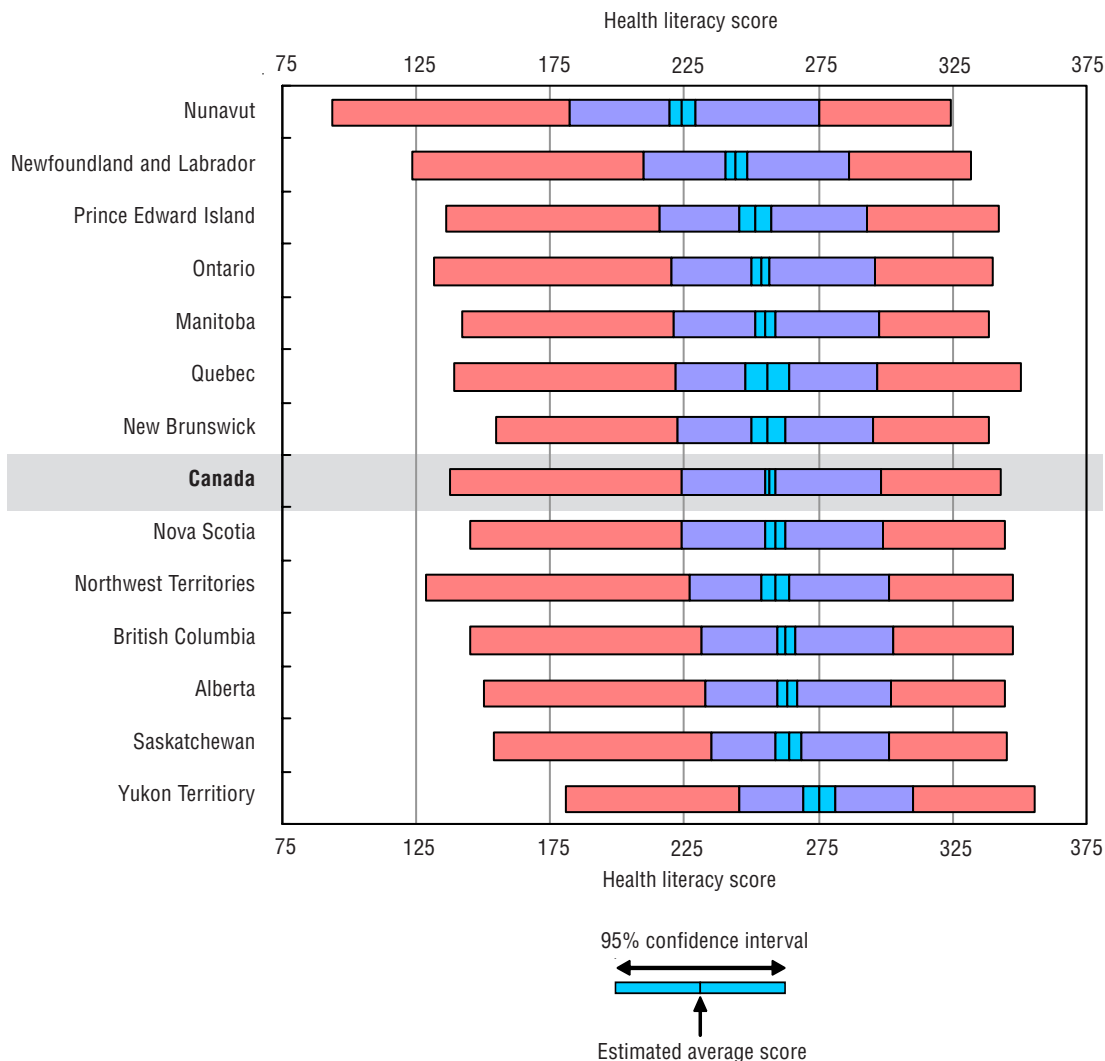
The figure reveals that average health literacy varies significantly by province. The Yukon Territory demonstrates the highest level of official language health literacy and Nunavut the lowest. The gap in average scores between Nunavut and the Yukon is significant—roughly equal to the increase in health literacy associated with two years of additional education. The rank order of jurisdictions by average health-literacy score differs considerably from rankings based on prose literacy, document literacy and numeracy, with several provinces performing well below the national average.

Figure 3.2 presents average health literacy scores by age and education.

Figure 3.2

Average health-literacy score, by age group and education level, Canada, 2003

Health literacy score

Legend:
- Some post-secondary education grade
- Post-secondary education diploma
- Some post-secondary education / Trade
- Secondary grade
- Less than high school

Age group

16 to 25 | 26 to 35 | 36 to 45 | 46 to 55 | 56 to 65 | 66 plus
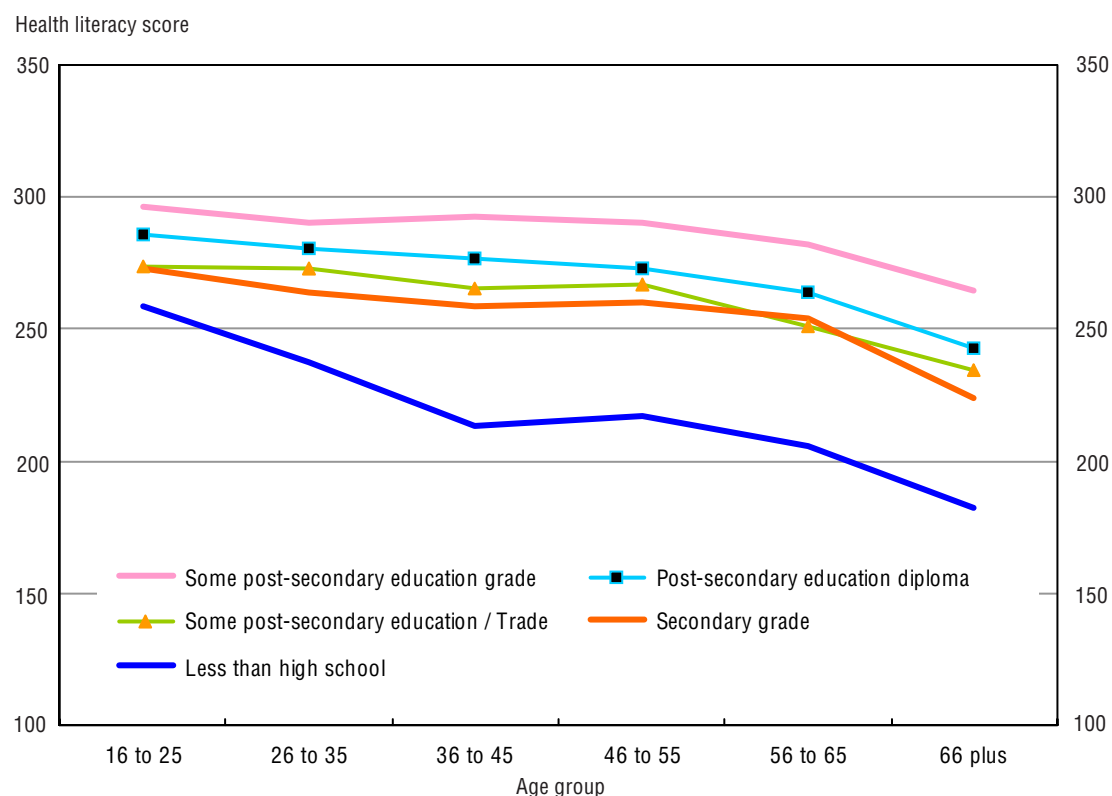
The figure confirms that average health literacy also varies significantly by age and education. As expected, adults with less than a high-school education perform well below adults with higher levels of education. Interestingly, the gap in performance for this group widens with age, a finding that might suggest the aging process amplifies initial levels of education-based inequality. The 70-point gap in average health-literacy scores for the most and the least educated seniors aged 66 and over is roughly equivalent to the health literacy gain associated with three additional years of education.

These data lead us to conclude that there are large enough differences in the distribution of health literacy to justify an exploration of how health literacy might influence health, a subject treated in depth in Chapter 4. The balance of this chapter documents what is known about the determinants of literacy and numeracy skills, how the determinants of health literacy differ and how health literacy is distributed socially.

3.5 The determinants of literacy and numeracy

Research provides a clear picture of how and when literacy and numeracy skill emerge.

The following chart, drawing on longitudinal research conducted in New Zealand, explores the emergence of literacy, numeracy and problem solving skill.

Figure 3.3

Structural equation model describing inter-relationships between competencies at 14, Wellington, New Zealand
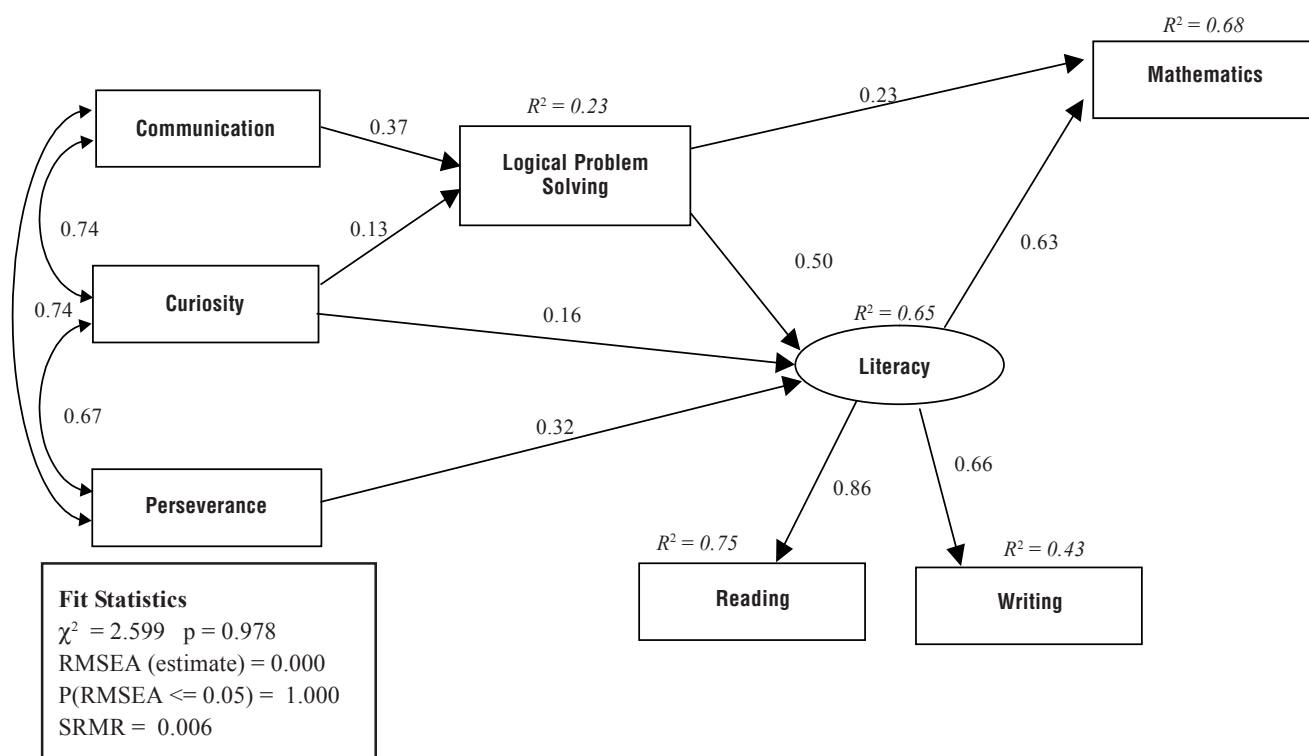
The figure reveals the fundamental determinants of early literacy and mathematics skill to be communication, curiosity and perseverance, mediated in part by logical problem solving (Wylie et al, 2004). These data also provide an interesting way to reflect on the nature of the health literacy measure used in the body of this report. Most importantly, early literacy skill is highly dependent on logical problem solving skill and mathematics skill depends on literacy and to a lesser extent on logical problem solving.

The patterns of results observed at age 14 would appear to hold out beyond early adulthood. Testing with the IALS battery at age 16 reveals that, while average literacy scores continue to increase, the variance in scores also increases with time. Most notably children in the bottom quartile of literacy scores at age 14 appear to fall further and further behind relative to the median.

Research undertaken by Willms with Canada's National Longitudinal Survey of Children and Youth (NLSCY) confirms and extends these results. Willms finds that average reading skill increases with age but that the variance about the mean at any given age increases (Willms, 2007). The underlying mechanism would seem to be a recursive one in which relatively skilled youth reinforce their skill advantage and relatively unskilled youth accumulate disadvantage. Thus, the education system would seem to be amplifying relatively large differences in school readiness across social groups.

Analysis of skill trajectories of Canada's 15 year olds using longitudinal data from Canada's Youth in Transition Survey (Cartwright, 2012) suggest that this process continues through adolescence. Individuals with low skills continue to accumulate relative disadvantage, not only

in skill but in other outcomes. Research shows that youth with lower skills are less likely to graduate from high school, are less likely to pursue post-secondary education, are less likely to access university level education, gain access to less desirable fields of study and programs and are less likely to graduate with a degree diploma of certificate.

Analysis of longitudinal data on post-secondary graduates demonstrates that these skill differences translate into large differences in early labour market success, including the time taken to find employment after graduation and the initial wage rate.

Analysis of data from IALSS reveals that literacy skill underlies enormous differences in the levels of adults' participation in formal, informal and non-formal adult learning (Belanger and Tuijnman, 1997). Given that much adult learning is focused on workplace health and safety it is reasonable to assume that those with low literacy and numeracy, and by extension, low health literacy, have much less exposure to health information than their more skilled peers.

Collectively, these data suggest that literacy and numeracy play a key role in defining relative success in several of the dimensions identified by Cutler and Lleras-Muney as potential mediators of the relationship between education and health. It is important, however, to keep two things in mind. First, that the observed relationships are probabilistic rather than deterministic. Second that the relationships appear to be recursive to some extent. Students with low literacy levels are less likely to do well in school but are also less likely to enjoy school, something that serves to reduce the amount they learn and their persistence to graduation. Nevertheless, skill levels appear to be the single most important determinants of initial education, income, adult education, job quality and labour market success.

Richard Desjardins has undertaken the most refined analysis of the determinants of the literacy and numeracy skills of adults in several countries, including Canada (Desjardins, 2004). Using cross-sectional data from the 2003 IALSS study Desjardins establishes that education remains the most important predictor of literacy proficiency in all countries. However, the total effect of education is significantly mediated through the application of skills and further learning occurring at work, at home and in the community. Therefore, the job and other literacy-related factors complement education in predicting literacy proficiency. This result points to a virtuous cycle of lifelong learning, particularly to how educational attainment influences other learning behaviours throughout life. In addition, results show that home background as measured by parents' education is also a strong predictor of literacy proficiency, but in many countries, including Canada, this occurs only if a favourable home background is complemented with some post-secondary education.

Unfortunately, a second body of research complicates the cross-sectional model of skill acquisition even further. Using data from the British Birth Cohorts, Bynner shows the presence of significant numeracy and literacy skill loss in youth immediately following leaving post-secondary education (Reder, Bynner and Strawn, 2010). Remarkably the apparent half life of numeracy skill was 3.5 years. Analysis of skill gain and loss using a synthetic cohort analysis of the 1994 IALS and 2003 IALSS data (Willms and Murray, 2007) shows that a significant proportion of Canadian adults lost a significant amount of the literacy skill they once had between 1994 and 2003. Ironically, much of the skill loss is concentrated in relatively skilled adults. Economic theory suggests that the most likely cause of the observed skill loss is inadequate levels of social and economic demand for skill acquisition and maintenance. These findings carry enormous implications for the current analysis. Specifically, they suggest that one cannot assume that supply measures alone will generate the expected economic and health benefits. Policy must also ensure that demand is sufficient to absorb any new skill supply. The fact that much publicly-funded health care is designed to compensate for health literacy deficiencies suggests that the health system itself attenuates skill demand.

3.6   The determinants of health literacy

In work undertaken for one of the authors (Murray) Desjardins estimated the determinants of health literacy using similar methods.

Figure 3.4 summarizes a set of hypotheses into a single linear structural model, which specifies a causal structure that may underlay health literacy proficiency. The purpose of the model is to disentangle the influences of various factors and to estimate the extent to which each may contribute to the development of health literacy, while at the same time accounting for the interaction among some of the factors included in the model. In so doing, causal directions among the factors are hypothesized. These are merely hypotheses advanced on the basis of theory and previous research. The findings do not in themselves prove or disprove the hypotheses, but provide reasonable support for or against the specification. A good fit of the model suggests a reasonable specification amongst alternative specifications.

Initially the model introduces factors that are not easily influenced such as gender, age, language status and home background, but can significantly affect learning experiences, attitudes, behaviours, opportunities and choices. These factors are treated as strictly independent in the structure. Implicit in the structure of the model is time, which can be read from left to right, such that factors positioned to the right of other factors occur at a later time. This is a necessary condition to establish causation. Because the ALL is a cross sectional survey as well as other practical limitations, some of the inherent reciprocal and dynamic relationships among the factors alluded to earlier cannot be taken into account. For example, the cumulative effect of continued learning in adulthood on literacy proficiency cannot be accounted for, perhaps leading to an underestimation of the relative effect of the job and other literacy related factors occurring in adulthood.

Figure 3.4

Structural model of health literacy determinants from lifelong-lifewide learning perspective
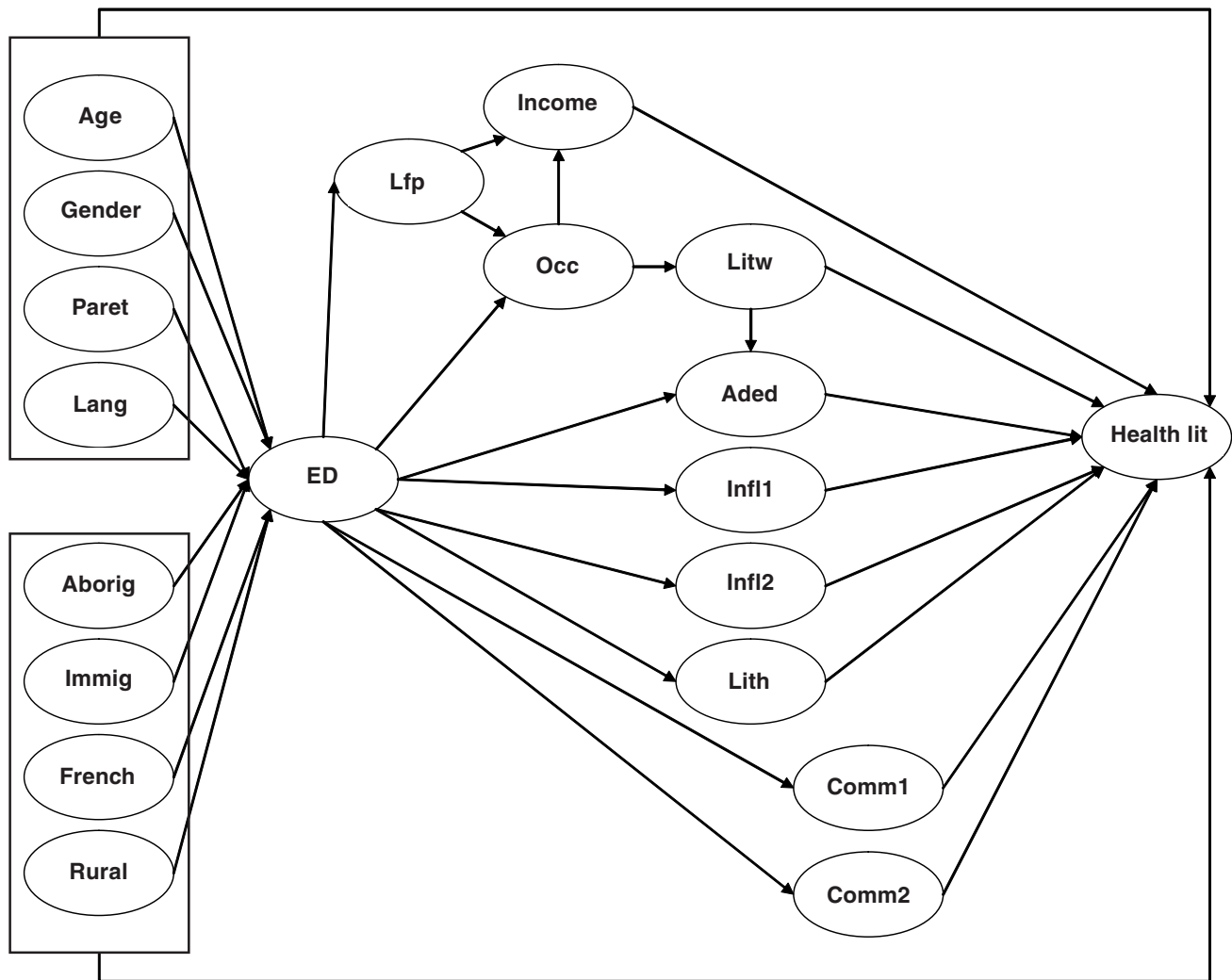
Notes:

x₂   Parents' education (PARED),
x₂   Age (AGE),
x₃   Gender (GENDER),
x₄   Mother tongue not same as test language (LANG),
x₅   Community size (URBAN),
x₆   Aboriginal (ABORIG),
x₇   French (FRENCH),
x₈   Born in country (IMMIG),
h   Formal education (ED),
h₂   Labour force participation (LFP),

h₃   Occupation (OCC),
h₄   Household income (INCOME),
h₅   Literacy practices at work (LITW),
h₆   Participation in adult education (ADED),
h₇   Learning by exposure to educative contexts (INFL1),
h₈   Self learning (INFL2),
h   Literacy practices at home (LITH),
h   Health literacy (HEALTHLIT)The following two charts, drawn from the authors analysis for the CCL's report summarize the results of this analysis for adults aged 16 to 65 and 66 and over respectively.

Figure 3.5

Factors predicting health literacy, ages 16 to 65

Legend:
- Very strong effect (orange)
- Moderate effect (teal)
- Weak effect (light blue)
- Weak negative effect (light grey)
- Strong negative effect (dark grey)
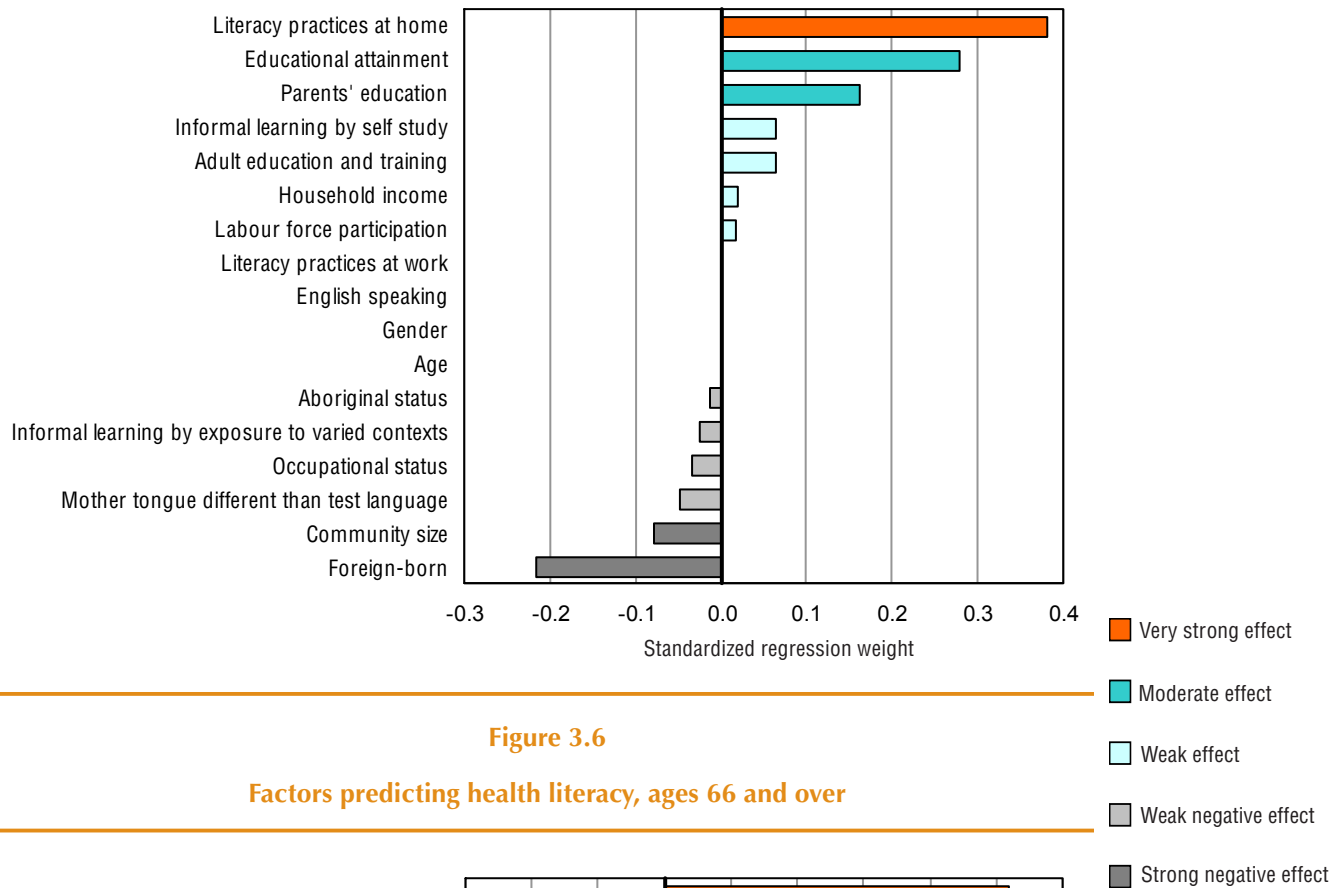
Figure 3.6

Factors predicting health literacy, ages 66 and over
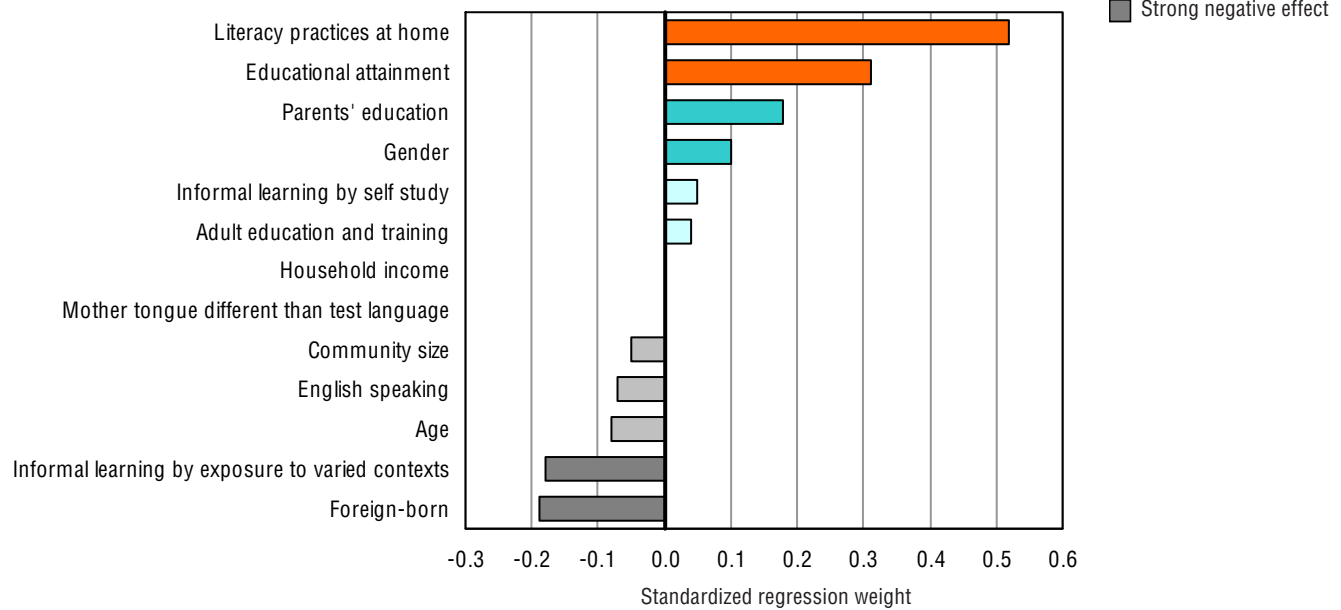
The Desjardin analysis was replicated with a simpler regression analysis as documented in the following table.

Table 3.7

Regression of health literacy on to determinants of health literacy using the IALSS

Source	Dependent Variable: Health literacy				
	DF	Type III SS	Mean Square	F Value	Pr > F
Mother Tongue English	1	815629.0857	815629.0857	893.24	<.0001
Mother Tongue French	1	324709.3458	324709.3458	355.61	<.0001
Gender	1	63.1899	63.1899	0.07	0.7925
Age Grp	1	178938.1724	178938.1724	195.96	<.0001
Aborig YN	121590.4325	21590.4325	23.64	<.0001	

Parameter	Estimate	Standard Error	t Value	Pr > |t|	
Intercept	233.2215689	1.78261896	130.83	<.0001	
Visiting Library	3.7832060	0.29591394	12.78	<.0001	
Newspaper Reading	-0.5306699	0.16989650	-3.12	0.0018	
Freq Variety Reading	7360102	0.36597125	15.67	<.0001	
Learning by Doing	3.3664108	0.31829721	10.58	<.0001	
Read_Work	1.2825454	0.38439039	3.34	0.0009	
Writing_Work	0.7936316	0.42050489	1.89	0.0591	
Education_Level 5	6.5105088	0.22686923	28.70	<.0001	
Adult_Education	7.0309767	0.63473758	11.08	<.0001	
Income	0.0000675	0.00000800	8.43	<.0001	
LF_Act	-3.8987731	0.96240087	-4.05	<.0001	
Mother_Tongue_Eng	23.5994400	0.78961969	29.89	<.0001	
Mother_Tongue_Fre	17.6913527	0.93815861	18.86	<.0001	
Gender	0.1594915	0.60628439	0.26	0.7925	
Age_Group	-3.5348436	0.25251160	-14.00	<.0001	
Aboriginal_YN	-8.9885402	1.84850708	-4.86	<.0001	

The regression analysis reveals that all of the variables save gender have a significant impact on the observed health literacy score. The impact of being an Aboriginal adult has the largest negative individual impact. Participation in adult education has the largest positive individual impact.

3.7 Correlations among prose literacy, document literacy, numeracy and health literacy

In order to better understand the nature of the health literacy measure three separate analyses were undertaken – one to explore the correlations among prose literacy, document literacy, numeracy and health literacy, a second to see how oral fluency is correlated to these measures and a third that estimates the relative impact of each of the constitute proficiency scores at each point along the health literacy scale. The following tables plot the correlations among prose literacy, document literacy, numeracy and health literacy scores.

Table 3.8

Correlations among prose literacy, document literacy, numeracy and health literacy[2]

	Prose_Avg	Doc_Avg	Num_Avg
Doc_Avg	0.96202 <.0001		
Num_Avg	0.90001 <.0001	0.92459 <.0001	
HLTHPV_Avg	0.81520 <.0001	0.79553 <.0001	0.77694 <.0001

Table 3.8 (concluded)

Correlations among prose literacy, document literacy, numeracy and health literacy[2]

	HlthLev1=1			
	Prose_Avg	Doc_Avg	Num_Avg	HLTHPV_ Avg
Prose_Avg				
Doc_Avg	0.95804 <.0001			
Num_Avg	0.89774 <.0001	0.92201 <.0001		
HLTHPV_Avg	0.71013 <.0001	0.66486 <.0001	0.66832 <.0001	

	HlthLev1=2			
	Prose_Avg	Doc_Avg	Num_Avg	HLTHPV_ Avg
Prose_Avg				
Doc_Avg	0.92542 <.0001			
Num_Avg	0.80136 <.0001	0.85024 <.0001		
HLTHPV_Avg	0.62184 <.0001	0.59375 <.0001	0.55919 <.0001	

	HlthLev1=3			
	Prose_Avg	Doc_Avg	Num_Avg	HLTHPV_ Avg
Prose_Avg				
Doc_Avg	0.91499 <.0001			
Num_Avg	0.79050 <.0001	0.84656 <.0001		
HLTHPV_Avg	0.60052 <.0001	0.59464 <.0001	0.55548 <.0001	

	HlthLev1=4			
	Prose_Avg	Doc_Avg	Num_Avg	HLTHPV_ Avg
Prose_Avg				
Doc_Avg	0.91401 <.0001			
Num_Avg	0.75840 <.0001	0.82342 <.0001		
HLTHPV_Avg	0.54440 <.0001	0.50882 <.0001	0.47011 <.0001	

	HlthLev1=5			
	Prose_Avg	Doc_Avg	Num_Avg	Avg
Prose_Avg				
Doc_Avg	0.96687 <.0001			
Num_Avg	0.88954 <.0001	0.88794 <.0001		
HLTHPV_Avg	0.55455 <.0001	0.53560 <.000	0.53061 <.0001	

The results of the first analysis shows that:

- Prose literacy, document literacy, and to a lesser extent numeracys, are all very highly correlated (90% + for the former, 80%+ for the latter)
- Prose literacy, document literacy and numeracy are correlated with health literacy but the correlations are weaker, ranging from 50% to 70% depending on the level of health literacy
- The strength of the correlation between health literacy and the constituent skills falls as health literacy level rises.

The analysis employed the following variables:

"Doc-Avg" = average document literacy score
"Num-Avg" = average numeracy score
"Prose-Avg" = average prose literacy score
"HLTHPV-Avg" = average health literacy score
"HLTH Lev1 = 1" = health literacy score < 226
"HLTH Lev1 = 2" = health literacy score 226-275
"HLTH Lev1 = 3" = health literacy score 276-325
"HLTH Lev1 = 4" = health literacy score 326-375
"HLTH Lev1 = 5" = health literacy score 376-500

Readers should note that 6 levels were defined on the HALS scale respondents with scores from 0-175 were placed in a level labelled <1 and those with scores from 175-225 were labelled level 2. For the purposes of this analysis these groups were collapsed in to a single group.

Correlations among prose literacy, document literacy, numeracy, oral fluency and health literacy

The following table extends the first correlation analysis to include oral fluency.

Table 3.9

Correlations among prose literacy, document literacy, numeracy, oral fluency and health literacy

	Health_ Literacy	Prose	Doc	Numeracy	Oral_ Fluency
Health_Literacy					
Prose	0.10253 0.0003				
Doc	0.14708 <.0001	0.76913 <.0001			
Numeracy	0.20020 <.0001	0.70165 <.0001	0.86173 <.0001		
Oral_Fluency	0.02310 0.4374	0.50397 <.0001	0.42476 <.0001	0.39121 <.0001	

The table reveals that:

- Oral fluency is correlated with prose literacy (50%), document literacy (42%) and to a lesser extent numeracy (39%).
- Surprisingly oral fluency is even less correlated with health literacy (2%).

3.8 What these findings imply about the link between health literacy and health

Collectively these findings provide a context for us to set out our own framework for thinking about health literacy and how it influences health.

Literacy is generated in large measure by formal educational processes but acquisition begins much earlier in life, even before birth in response to maternal health, nutrition and health behaviours. Large differences in language and literacy emerge within the first 24 months of life in response to differences in the level of stimulation and nutrition. Jurisdictions that devote more resources to the provision of health services to new mothers, such as Quebec, manage to reduce the size of social inequalities in school readiness, including literacy levels.

Gaps in skill outcomes across social groups continue to grow throughout primary and secondary education. Jurisdictions appear to have some control over the size of these gaps. Those systems that maintain a positive disciplinary climate, that maintain high learning expectations for all students and that limit the amount of social segregation seem to achieve overall higher and more socially equitable distributions of scores. The physical and mental health of students does have an impact on learning outcomes but the number of students with severe enough impairments is relatively small so has little impact on the overall distribution.

Canadian post-secondary systems select highly on literacy and numeracy skill but large numbers of secondary school leavers with low literacy skill levels are able to access post-secondary education.

Higher skill levels are associated with a number of advantages in Canada's labour markets. Higher skilled individuals are more likely to work, work more weeks, are less likely to experience a spell of unemployment, experience fewer and shorter periods of unemployment, work fewer hours over the course of a year, are more likely to work in knowledge and skill intense job, earn higher wages, are more likely to participate in adult education and training and are more likely to receive employer support for doing so. Collectively, these advantages translate into higher incomes. As a result higher skilled adults are less likely to depend on income support programs and, interestingly for the current analysis, are less likely to experience a workplace illness or accident. Adults with Level 1 and 2 literacy skills bear a disproportionate share of disadvantage.

Thus, adults with low levels of skill have less income to devote to purchasing a healthy diet or health promoting leisure activities. They also tend to work in jobs that grant them less autonomy and hence jobs that induce more distress. The also tend to work more hours in jobs that exposure them to higher levels of workplace illness and accident – that ironically they do not have the skills to attenuate.

Chapter 4

The Impact of Health Literacy on Health

This chapter explores the relationship between health literacy and health outcomes. We begin with an analysis based on the IALSS data where the two measures are observed for the same individuals. The chapter then explores the relationships between health literacy and health with the linked CCHS and IALSS data file.

Drawing together these data leads us to postulate three distinct pathways that mediate the relationship between health literacy and health and, by implication, on the utilization of health goods and services and health costs.

First, health literacy has a direct effect on health. Adults with low health literacy do not have the skills to understand and apply health information and thus choose to rely more frequently on less reliable sources for advice such as family members, workmates or friends. Together these two effects are associated with:

- More workplace illness and accident, lost productivity, income replacement and treatment costs
- Less healthy life style choices
- More reliance on expensive information alternatives, particularly doctors

Second, health literacy has an indirect effect on health. Adults with low health literacy get systematically selected into occupations that:

- Expose them to more risk of workplace illness and accident,
- Offer less stable employment
- Pay them less and thereby reduce their ability to purchase health care and health-promoting goods and services.

Third, we believe that health literacy has a cumulative effect. The impact of low health literacy on life chances leads to chronic stress that impairs immune system function and precipitates higher morbidity and mortality. This pathway is associated with:

- A loss of productivity
- Lower lifetime earnings
- Increased reliance on income support
- Higher treatment costs
- Reduced quality of life

The IALSS data also provide indirect evidence that health literacy also has a marked impact on age at death. Average scores in the oldest cohorts rise a finding the suggests that the least skilled adults aer dying earlier.

Under the assumption that the foregoing causal web describes the mechanisms that underlie the observed relationship between health literacy and health, one would expect that investments that serve to raise adult health literacy might precipitate reductions in prevalence rates of several diseases and associated treatment costs.

The balance of this chapter explores the relationship between health literacy and health using data from a variety of sources including the 2003 IALSS skill assessment.

The first chart plots the relationship between self-perceived health, as reported by respondents in the 2003 IALSS assessment, and health literacy score.

Figure 4.1

Average health literacy score by self-perceived general health status, population aged 16 and over (including seniors), Canada, 2003
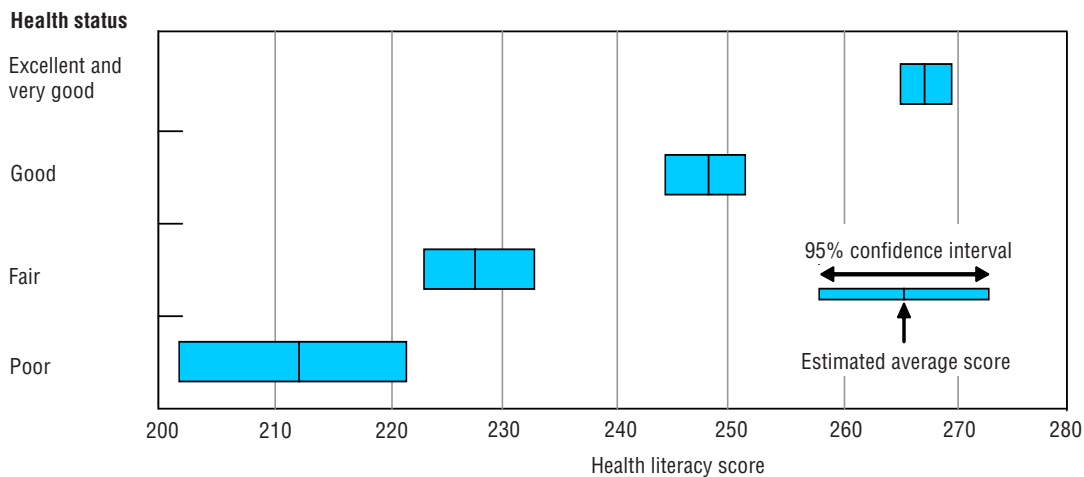
The figure reveals an almost 60 point difference in average health-literacy scores between adults reporting excellent and poor general health status, roughly equal to the increase in health literacy associated with two and a half years of additional schooling. It is this link between health literacy and health status that is of interest to policy-makers. Provided that health literacy generates health, policies aimed at increasing levels of health literacy might turn out to be low-cost alternatives to existing practice.

The fact that there are more people with low levels of health literacy (60%) than there are with low levels of literacy (48%) suggests a difference between the two. In order to master health literacy tasks, adults are usually required to use their prose literacy, document literacy and numeracy skills simultaneously. In other words, health literacy involves more than the ability to read or understand numbers. Context matters, as does the ability to find, understand, evaluate and communicate health-related information.

As noted above this incidence of low health literacy is cause for concern. Canadians with the lowest health literacy skills were found to be more than two-and-a half times as likely to be in fair or poor health as those with the highest skill levels, much less likely to have participated in a community group or to have volunteered, and more than two-and-a-half times as likely to be receiving income support.

The next four charts plot the relationship between more objective summary measures of physical and mental health and health literacy.

Figure 4.2 plots the relationship between health literacy level and physical health as measured by the SF-12.

Figure 4.2

Average physical health score by health literacy, adults aged 16 and over, Canada, 2003
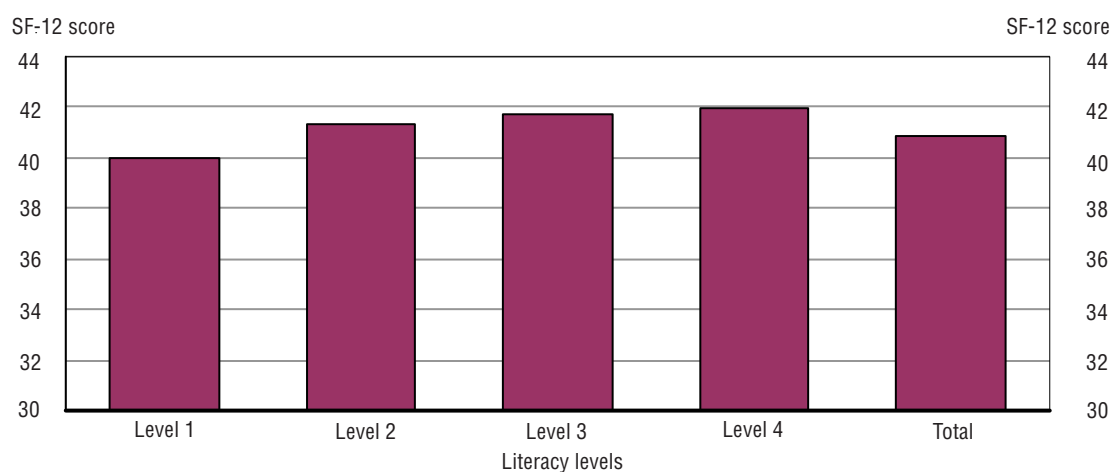
The figure reveals that average physical health scores rise slightly with rising health literacy.

Figure 4.3 displays the distribution of health literacy scores by physical health status.

Figure 4.3

Thedistribution of physical health score by health literacy, adults aged 16 and over, Canada,2003
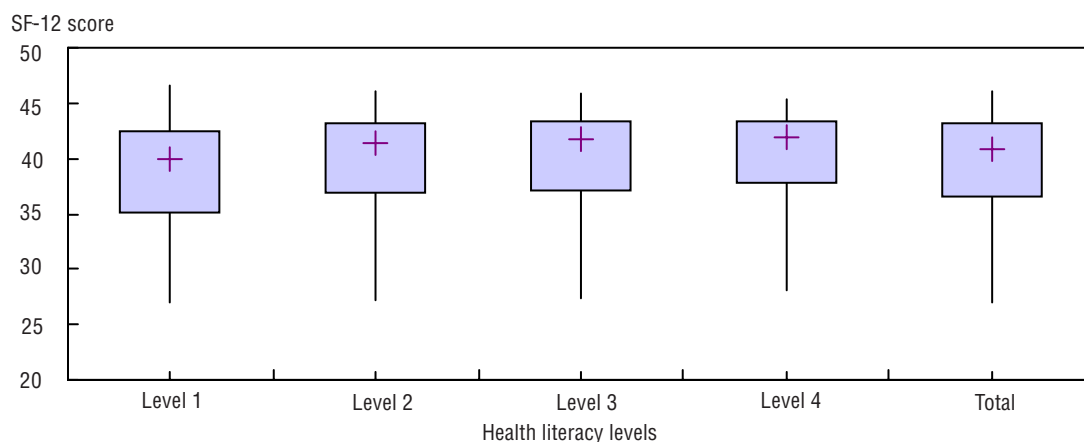
The figure shows that average health literacy scores obscure interesting variation in the distribution of physical health scores. More specifically, the distributions of physical health scores display more dispersion in the lower health literacy levels and become increasingly negatively skewed. These distributions imply that adults with low levels of health literacy are much more likely to have low physical health scores.

Figure 4.4 plots the relationship between health literacy level and mental health as measured by the SF-12.

Figure 4.4

Average mental health score by health literacy, adults aged 16 and over, Canada, 2003

SF-12 mental health score   SF-12 mental health score
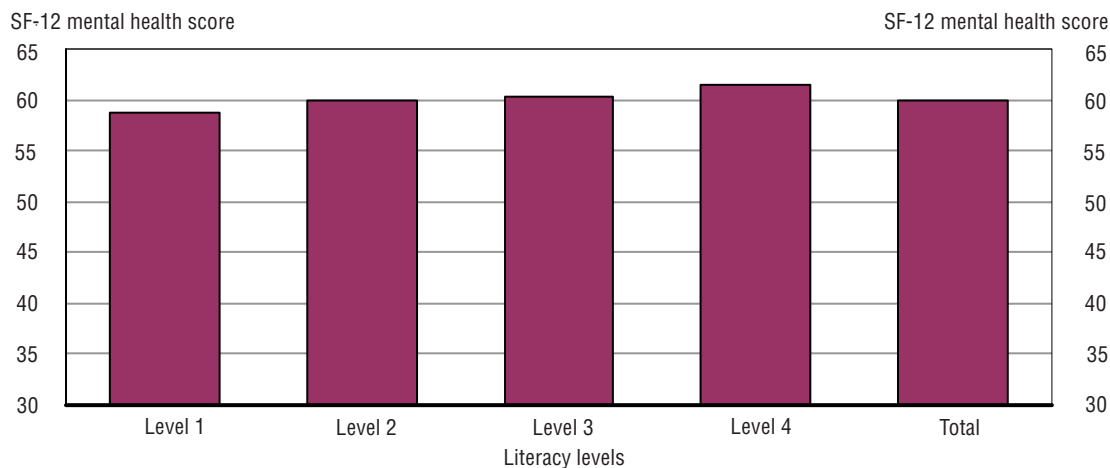
The figure reveals that there appears to be no relationship between average health literacy scores and mental health as measured by the SF-12.

The next chart plots the distribution of mental health scores by health literacy level.

Figure 4.5

Distribution of average mental health scores by health literacy level, adults aged 16 and over, Canada, 2003

SF-12 mental health score
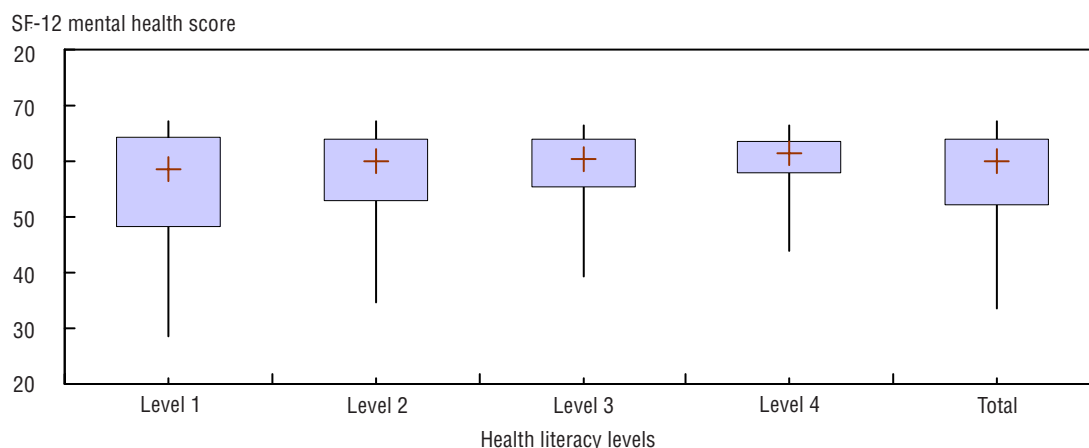
The chart displays results that mirror those observed for physical health i.e. the distributions of mental health scores display more dispersion in the lower the health literacy levels and become increasingly negatively skewed. These distributions imply that adults with low levels of health literacy are much more likely to have low mental health scores.

The key hypothesis underpinning this analysis is that differences in health literacy have an impact on individuals health status, and, by extension, their use of the health care system and their cost of treatment. Figure 4.6 shows that Canadians with the lowest health literacy skills are still two and a half times as likely to be in fair or poor health as those with skills at levels 4 or 5 even after removing the impact of age, gender, education, mother tongue, immigrant and Aboriginal status. In Quebec adults at Levels 1 and 2 are judged to be at the highest risk, as they are roughly 2.5 times more likely to report being in fair or poor health.

Figure 4.6

**Likelihood of being in fair or poor health by health literacy level,
population aged 16 and over, Canada, 2003**

Adjusted odds | Adjusted odds

Legend: Level 1, Level 2, Level 3, Level 4/5

X-axis: Canada, B.C., Alta., Sask., Man., Ont., Que., N.B., N.S., P.E.I., N.L., Yn, N.W.T., Nvt.
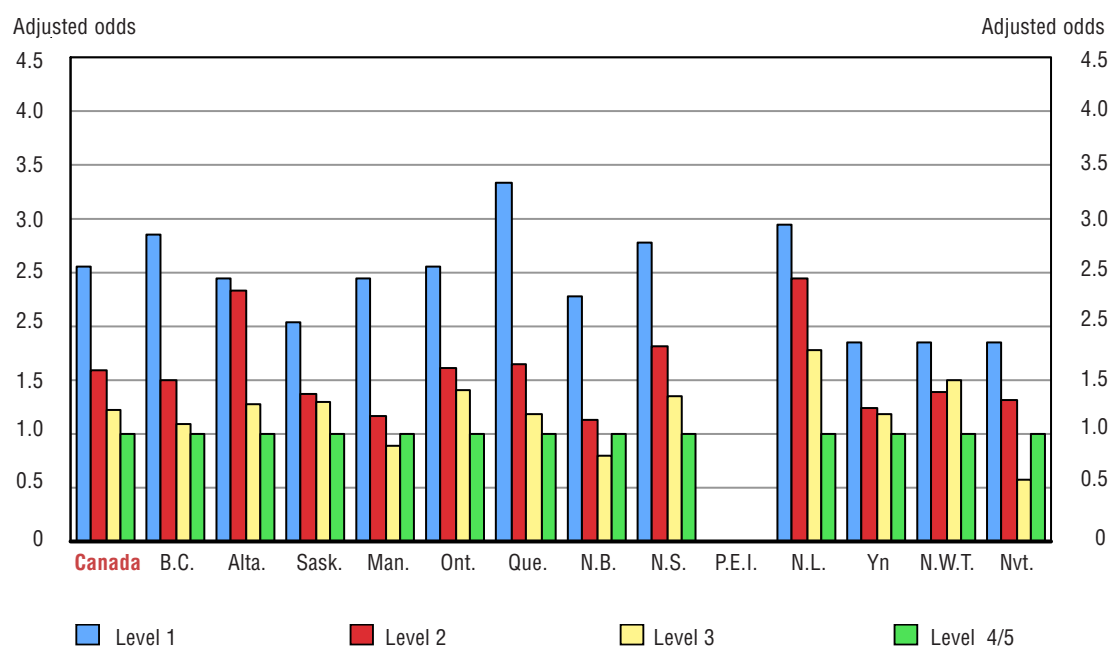
These effects are large enough to suggest that policies aimed at reducing the proportion of adults with low health literacy skills might simultaneously precipitate significant increases in overall population health and decreases in prevailing levels of social inequality in health outcomes. The size of the effect that low health literacy has on health status also suggests that current policies and programs that have been designed to compensate for low health literacy levels have been ineffective.

Figure 4.7 shows that individuals at health literacy Level 1 are two and a half times more likely to be receiving income support, that is Employment Insurance or social assistance, than those at level 4 or 5 even after removing the impact of age, gender, education, mother tongue, immigrant and Aboriginal status. In Newfoundland and Labrador those at the lowest level are nearly four times as likely to be receiving some form of income support. As noted earlier this effect is largely a function of literacy and numeracy skill impairing the ability to earn rather than the effect of health on same.

Figure 4.7

**Likelihood of receiving income support by health literacy level,
population aged 16 and over, Canada, 2003**
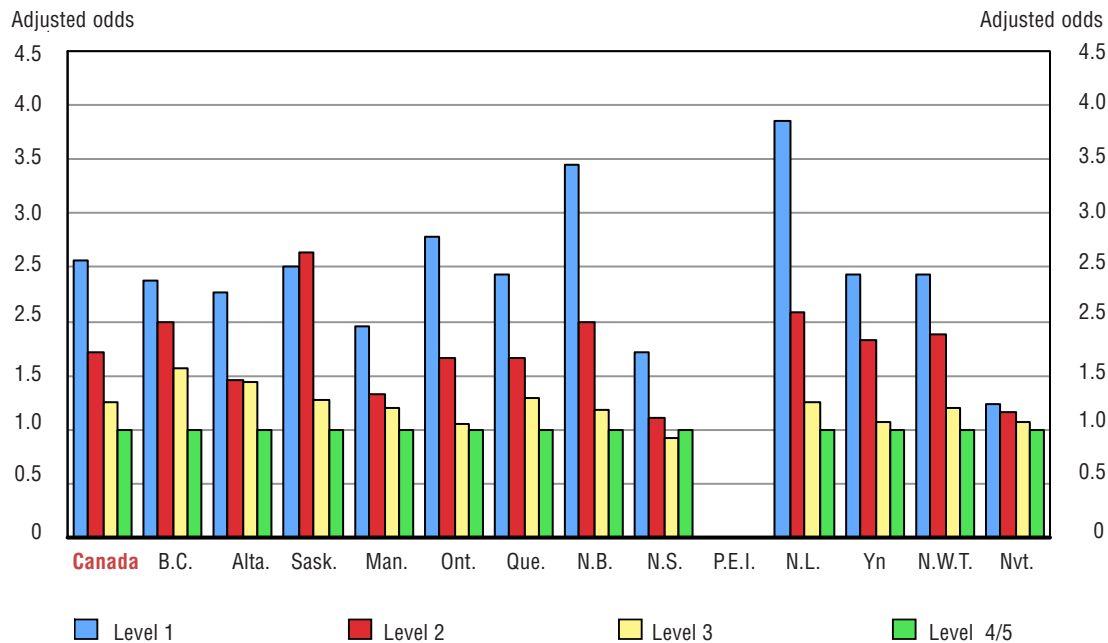
These effects suggest that low health literacy limits individual's ability to generate income and stable employment and thus impair the performance of the overall economy. Newfoundland adults in Level 1 are approximately 4 times more likely than their more skilled peers to be in receipt of some form of income support.

Thus, policies aimed at reducing the proportion of adults with low literacy skills might simultaneously precipitate significant increases in overall economic growth and decreases in prevailing levels of social inequality in weeks worked, hours worked, wages and incomes and health outcomes.

While the available evidence would seem to support the hypothesized pathways current data do not allow for empirical confirmation. The present analysis will allow us to look more closely at the relationship between health literacy, the utilization of health goods and services, health costs and health behaviours.

The last figure in this series plots the adjusted likelihood of not engaging in community activities by health literacy level.

Figure 4.8

Likelihood of not engaging in community activities by health literacy level, population aged 16 and over, Canada, 2003
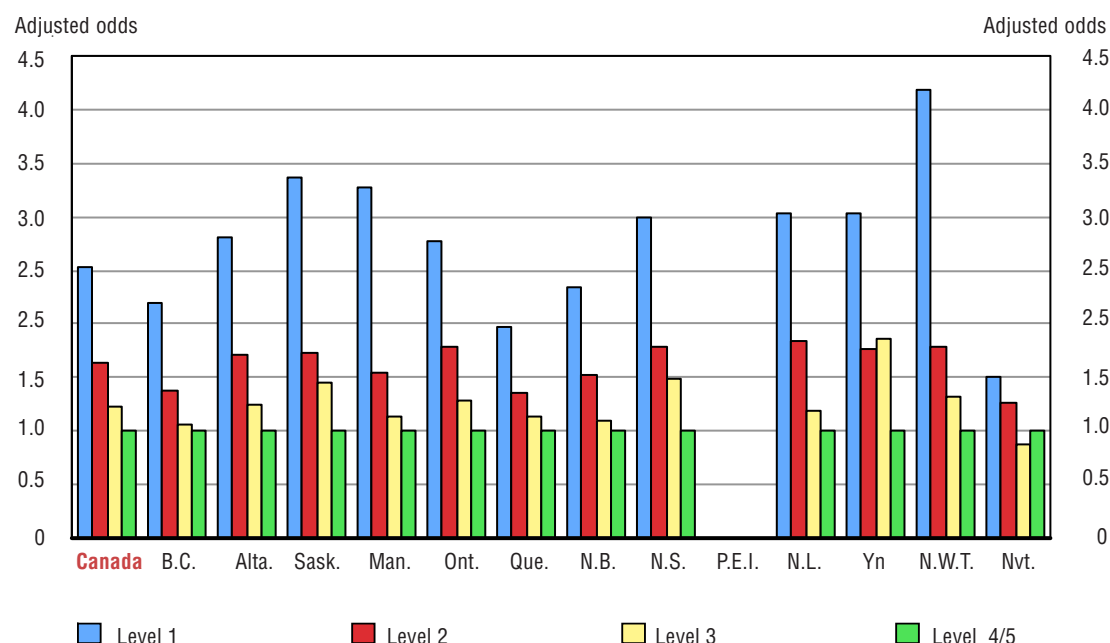
As with the previous two charts, the plot shows that adults in the lowest health literacy level are much more likely to be socially disengaged even after controlling for a broad range of differences in background characteristics. Interestingly, the size of the adjusted disadvantage appears to vary significantly by jurisdiction. Adults with Level 1 health literacy living in Nunavut are 1.5 times more likely to not engage in community activities compared to their peers in the Northwest Territories who are over 4 times less likely to participate in community activities. Disengagement implies a weaker social network upon which to depend and higher stress levels.

Health literacy and the prevalence of disease

Having established that there is a relationship between health literacy and health the next section of the report deepens the analysis by exploring the relationship between the prevalence of a number of diseases observed and health literacy observed at the level of health district. The presence of a relationship between health literacy and prevalence rates would provide additional support for our hypothesis that improved health literacy might improve population health and reduce health care costs. It is important to keep in mind, however, that a correlation between prevalence rates and health literacy in these charts might simply reflect underlying differences in the demographics and socio-economic characteristics among health regions. Nevertheless, the diseases profiled are important in that they impose a heavy burden of suffering on adults who are afflicted and are responsible for a significant fraction of public expenditures on health and any simple relationships are important.

The first chart plots the relationship between arthritis prevalence and health literacy by health district.

Arthritis is an important disease. By 2026 it is estimated that more than 6 million adult Canadians will have arthritis (Arthritis Society, 2010). According to the Public Health Agency of Canada, in 2000 the total cost of musculoskeletal diseases (including arthritis) was $22.3 billion.

Figure 4.9

Prevalence rates of arthritis by average health literacy score by health district, adults aged 16 and over, Canada, 2003
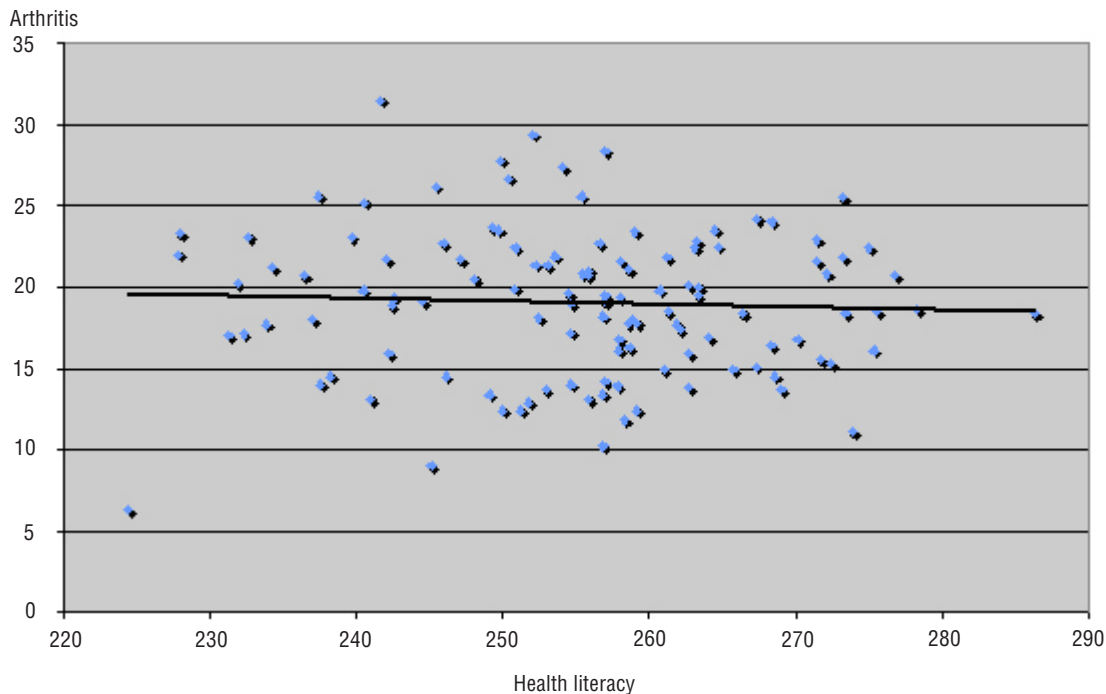
The chart reveals the presence of a relationship, specifically that health districts with lower average health literacy scores have higher incidence of arthritis. Provided the underlying relationships are causal, investments that lead to higher average health literacy scores would precipitate reductions in arthritis prevalence rates in subsequent periods.

Diabetes is an important disease in Canada. An estimated 2.5 million Canadians lived with diabetes in 2010, a number that is expected to grow to 3.7 million by 2020 (Doucet, G. and Beatty, M., 2010). The same analysis estimates that the Canadian economy will lose $11 billion annually as a result of net mortality of diabetes patients, and long term care costs for diabetes patients are projected to rise to $2.7 billion annually by 2020. Clearly, the human and economic costs imposed by diabetes on Canadians are huge. The second chart plots the prevalence rates of diabetes by average health literacy score by health district.

Figure 4.10

Prevalence rates of diabetes by average health literacy score by health district, adults aged 16 and over, Canada, 2003
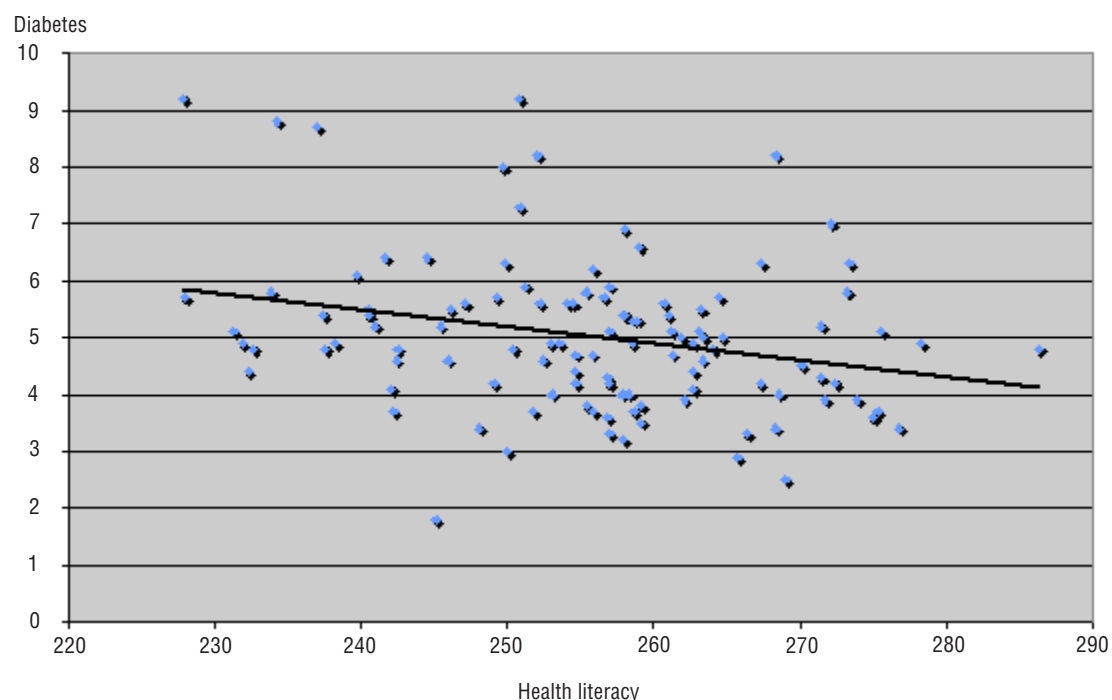
The figure reveals a strong inverse correlation between average health literacy scores and the prevalence of diabetes at the level of health district. Analysis reveals that virtually all of this relationship is explained by underlying differences in the demographic, education and income characteristics among health districts. This finding does not, however, preclude the possibility that investments designed to raise health literacy levels might precipitate large declines in prevalence rates for diabetes and the associated cost of treatment.

Figure 4.11 plots the relationship between drinking alcohol and average health literacy scores.

Figure 4.11

Prevalence rates of drinking by average health literacy score by health district, adults aged 16 and over, Canada, 2003

Drinking
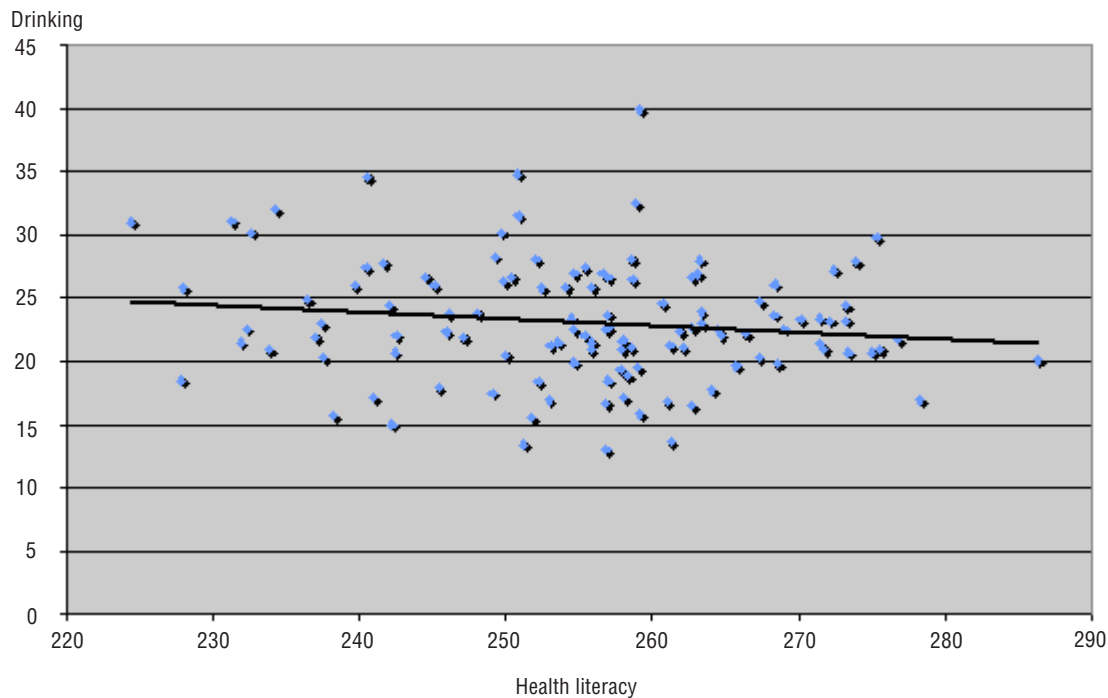
Health literacy

The figure reveals the presence of a relationship in which health districts with higher average health literacy have lower proportions of adults that drink alcohol.

This finding is somewhat surprising given the high cost of alcohol in Canada and the strong positive link between health literacy and income.

Excessive alcohol consumption costs Canadians dearly in terms of lost productivity, health care expenses for problems caused by excessive drinking, law enforcement and criminal justice expenses related to excessive alcohol consumption and motor vehicle crash costs from impaired driving. US analysis suggests that these costs might be as high as $224 billion annually in Canada[3].

Figure 4.12 plots the relationship between high blood pressure and average health literacy scores at the health district level.

Figure 4.12

Prevalence rates of high blood pressure by average health literacy score by health district, adults aged 16 and over, Canada, 2003

High blood pressure
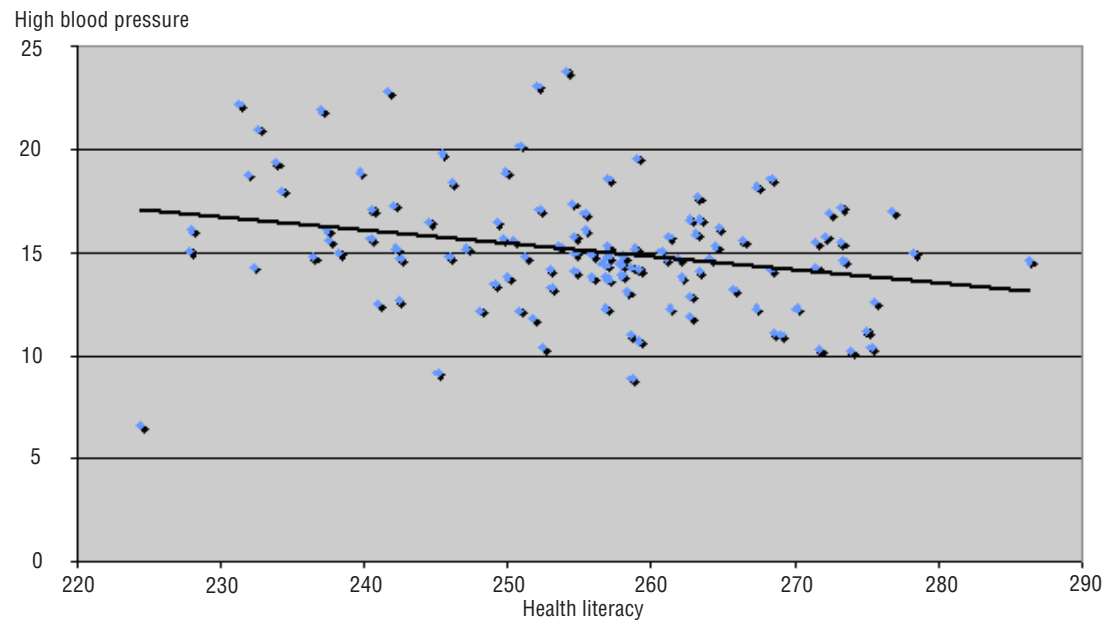
The figure reveals a strong negative correlation between average health literacy scores for health districts and the prevalence of high blood pressure.

Figure 4.13 plots the relationship between the rate of injuries in the adult population by average health literacy score by health district.

Figure 4.13

Prevalence rates of injuries by average health literacy score by health district, adults aged 16 and over, Canada, 2003
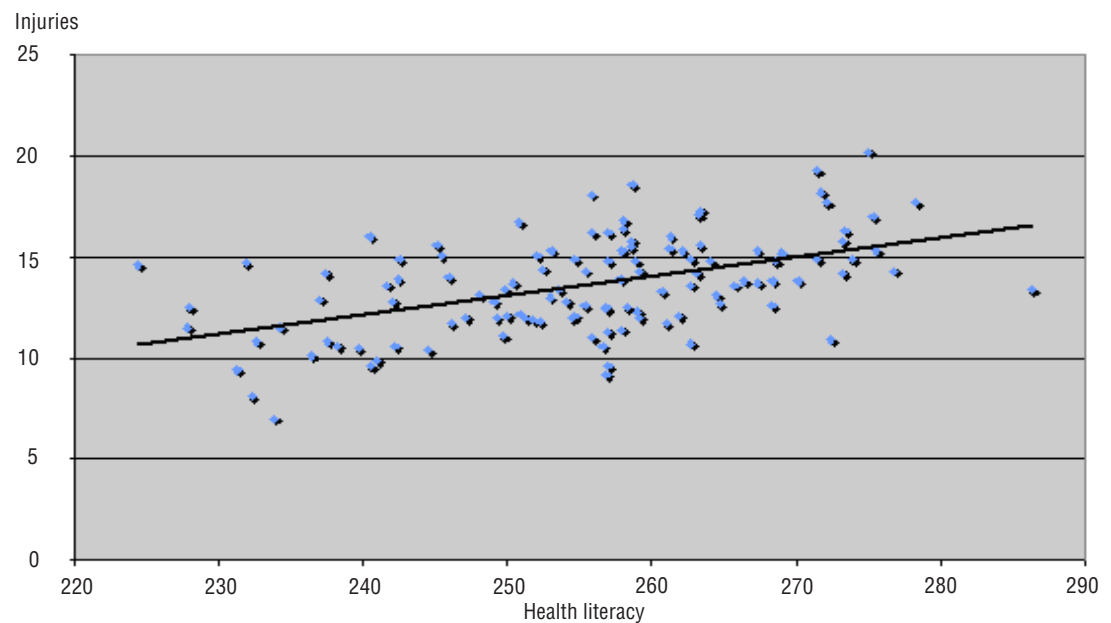
Injuries

The figure reveals a strikingly different relationship than observed for arthritis, drinking and high blood pressure. The prevalence rate of injuries rises significantly with the average health literacy score of a health district. Analysis suggests that this relationship is a function of income i.e. higher income adults have higher levels of education and health literacy skill and tend to participate in leisure activities that carry with them relatively high risks of injury e.g. skiing, tennis, golf, squash.

Figure 4.14 plots the relationship between life stress and average health literacy scores by health district.

Figure 4.14

Prevalence rates of life stress by average health literacy score by health district, adults aged 16 and over, Canada, 2003
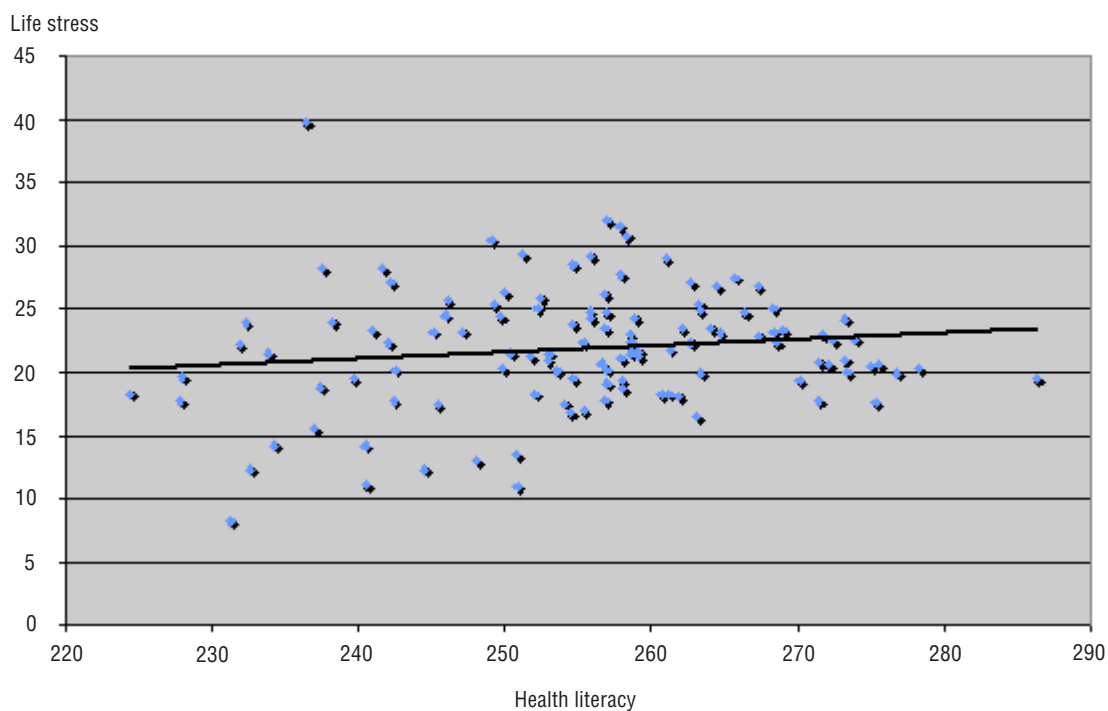
The figure reveals a slight positive correlation between average health literacy scores and life stress. Speculatively, this finding is likely a function of adults with higher levels of education, income and skills being more likely to be living in more densely populated and stressful urban areas.

Alternately some jobs may be in her only more stressful. To produce the observed effect jobs demanding higher education and skill levels would have to be, on average, more stressful.

Figure 4.15

Prevalence rates of asthma by average health literacy score by health district, adults aged 16 and over, Canada, 2003
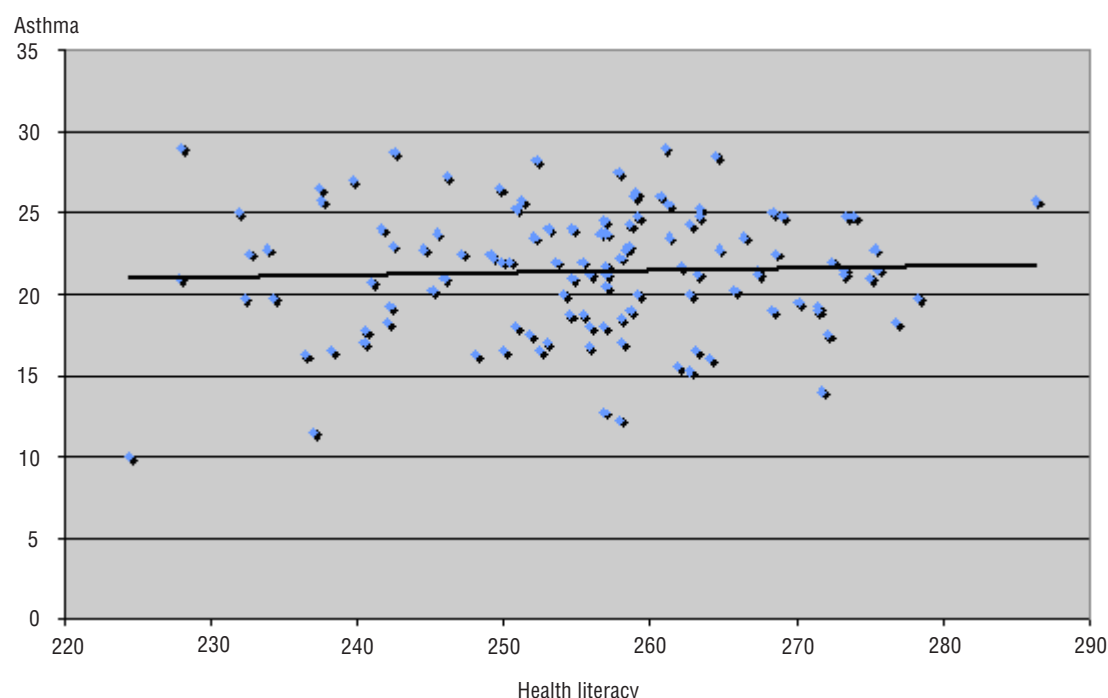
The figure reveals a very slight positive correlation between prevalence rates of asthma and health literacy. As for life stress this may reflect the fact that adults with higher health literacy also tend to dive in more polluted urban environments.

The foregoing series of charts suggest that differences in average health literacy scores might be associated with prevalence rates for a range of diseases that themselves inflict a large burden of suffering on those afflicted and that cost Canadian tax payers significant amounts to treat.

The analysis reveals interesting variation in relationships. Most diseases display the expected negative correlation in which prevalence rates decline with rising average health literacy scores. Three diseases – injuries, asthma and life stress - display a positive correlation in which prevalence rates rise with rising average health literacy scores. Collectively, these findings provide some support for the hypothesis that investments that improved health literacy scores might precipitate large decreases in the prevalence rates of important diseases and in the associated costs of treatment.

Chapter 5

The Relationship Between Health Practices, Health Outcomes and Health Utilization

Having built a case in support of our hypothesis that a causal relationship exists between health literacy and health outcomes, the current chapter uses a linked CCHS and IALSS file to extend and deepen this analysis to include a broader range of health outcomes, health practices and health literacy.

The following table defines the CCHS questions that are associated with the labels used in the following data tables.

Data label	CCHS question
Alcohol: +2 drinks/day	Have more than 2 drinks per day.
Alcohol: Drinks over 7 days	Number of alcoholic drinks over last 7 days
Dental visit in last 12 months.	With a dental visit in the last 12 months.
Fruits Vegetables 7 days	Five or more daily servings of fruits and vegetables
Medical Visit in last 12 months.	With a medical visit in the last 12 months.
No pap smear in last 3 years	Has had no pap smear in the last 3 years.
Smoking	Is a daily smoker.
Walking	Walking for exercise in the last 3 months.
Diabetes	With diabetes.
With a Disability	With 14 disability days in the last 2 weeks.
General Health Perception: Good	General Health Perception: Good
General Health Perception: Scale	General Health Perception: Scale 0-4
Mental Health Perception: Good	Mental Health Perception: Good
Mental Health Perception	Mental Health Perception: Scale 0-4
Heart Disease	With heart disease.
Obese	Obese (Classes I, II or III)
STD History Yes / No	History of STD
Chronic	Has a chronic condition.
Chiropractor Visits 12 months.	Chiropractor Visits 12 months.
Dental Visits in the last 12 months.	Dental Visits in the last 12 months.
Eye Visits 12 months.	Visits to eye doctor in the last 12 months.
Hospital Days in the last 12 months.*	Hospital Days in the last 12 months.*
Hospital Stay in the last 12 months.	Hospital Stay in the last 12 months.
Medical Visits in the last 12 months.	Medical Disits in the last 12 months.
Medical Other Visits 12 months.	Medical Other visits 12 months.
Nurse Visits 12 months.	Nurse visits 12 months.
Dental Cost	Estimated dental cost.
Eye Care Cost	Estimated eye care cost.
Hospital Cost	Estimated hospital cost.
Physician Cost	Estimated physician cost.

The first table documents the results of a regression analysis that explored the relationships among health outcomes, health practices and health literacy.

The relationship of health literacy to health practices

Adults' health practices influence both the prevalence of disease and the cost of treatment. The health practices can be mapped in to the Rudd health literacy framework. For example "walking" and "Eating Fruits and vegetables in the last 7 days" would be classified as a health promotion practices in the Rudd classification "having a Pap smear" would be classified as disease prevention "Smoking" and "medical and dental visits" would be classified as health protection, disease prevention or health care depending on the reason for the visit. In the Rudd framework "Smoking" would be classified under health promotion even though the act of smoking carries negative consequences for health. "Alcohol consumption" could be seen as health promotion at low consumption levels.

The first set of regression results attempt to isolate the impact of health literacy on a range of health practices. Impacts are classified by strength – one asterix indicates that the impact is statistically significant at the 5% level, two asterix indicate that the effect is statistically significant at the 1% level and three asterix indicate that the effect is statistically significant at the 0.01% level.

Table 5.1

Impact of health literacy level on health practices, adults aged 16 and over, Canada, 2003

| | Regression of health practices bry demographics and health literacy level | | | | | | | |
	Walking	Smoking	Alcohol consumed in last 7 days	Alchohol abuse	Medical visit in last 12 months	Dental visit in last 12 months	Fruits and vegetables	Pap smear in last 3 years
Household income	***	***	***	***	***	***	***	***
Family single		***	***	***	***	***	**	***
Drug benefits		***	***		***	***	*	
Dental benefits						***	**	*
Optical benefits							**	
Hospital benefits	**	**	*			***		**
Province	***	***	***	***	***	***	***	***
Gender	***	***	***	***	***	***	***	***
Age group	***	***	***	***	***	***	***	***
Education	***	***	*	**	**	***	***	***
Labour force status	***	**	***	***	***		***	**
Mother tongue	***	***	***	***	**	***	**	***
Occupation	***	***	***	***	***	***	***	***
Aboriginal		***				***		
Urban/Rural	***	***		*	***	**	***	
Immigrant	***	***	**		*		**	**
Ethnicity	**	***	***	***		**		***
Health literacy level					**			

* significant at 5%
** significant at 1%
*** significant at .01%

The analysis suggests that health literacy has, with the exception of "having had a medical visit in the past 12 months" no statistically significant impact on health practices.

Table 5.2 replicates the same analysis but excludes income, education and labour force status, three variables that have been shown earlier in the report to be highly influenced by health literacy level.

Table 5.2

Impact of health literacy level on health practices (excluding income and education) and labour force status, adults aged 16 and over, Canada, 2003

	Regression of health practices bry demographics and health literacy level (Excluding household income, labour force status and education)							
	Walking	Smoking	Alcohol consumed in last 7 days	Alchohol abuse	Medical visit in last 12 months	Dental visit in last 12 months	Fruits and vegetables	Pap smear in last 3 years
Family single	***	***	***	***	***	***	**	***
Drug benefits	*	***	***	*	***	**		*
Dental benefits						***	*	***
Optical benefits	*					**	**	
Hospital benefits	**	***	***	***	**	***	***	***
Province	***	***	***	***	***	***	***	***
Gender	***	***	***	***	***	***	***	***
Age group	***	***	***	***	***	***	***	***
Mother tongue	***	***	***	***	**	***	**	***
Occupation	***	***	***	***	***	***	***	***
Aboriginal		***			**	***	**	
Urban/Rural	***		**	**	***	***	*	
Immigrant	***	***	**	*	*		***	*
Ethnicity	**	***	***	***		*	*	***
Health literacy level						***	***	***

*   significant at 5%
**   significant at 1%
*** significant at .01%

When income education and labour force status are excluded health literacy is very significant in relation to walking, smoking, fruits and vegetables and pap smears. It is also significant for dental visits.

The relationship of health literacy to health outcomes

The second set of regression results explore the impact that health literacy has on a range of health outcomes.

Table 5.3

Regression of health utilization by health practices, demographics and health literacy level, adults aged 16 and over, Canada, 2003

	Regression of health practices by demographics and health literacy level									
	General health perception	General health perception: good	Mental health perception	Mental health perception: good	STD experience	Hear disease	Chronic	With a disability	Obese	Diabetes
Household income	**		***	***	**		***	***	***	***
Family single	*	***			**		**		*	***
Drug benefits	**	***	**	***			*			
Dental benefits			*	***						**
Optical benefits	***		**		**	***			*	
Hosp benefits	***		***	*		***				*
Walking		**					**		**	**
Smoking	***		***	***	***	*			*	***
Alcohol 7days	***	**	**	**		**	*	*		
Alcohol Abuse (> 2 drinks per day)	**			**						
Medical visit in last 12 months	***	***	***	***	***	***	***	***	***	***
Dental visit in last 12 months	***	***	*	***	***					
Fruits vegetables in last 7 days	**		***		***	**	**	**	**	
Pap smear in last 3 years	***		***			***		**		**
Province		*	***	***	**	***		***	**	**
Gender	***		***	***	***	***		**		*
Age group	***	***	***	***	***	***		***	***	***
Education	***		***		***	**		***		**
Labour force status	***	***	***			***	***		***	**
Immigrant			**	**	**	**		***		
Ethnicity	**			**				***		
Health literacy level	*	**		*				**	**	**

*   significant at 5%
**   significant at 1%
***   significant at .01%

The table reveals that health literacy has quite a modest independent impact on health status and on other indicators of health.

Table 5.4 replicates the same analysis but excludes income, education and labour force status, three variables that have been shown earlier in report to be highly influenced by health literacy level and which themselves have a powerful influence on health outcomes.

Table 5.4

Regression of health utilization by health practices, demographics and health literacy level (excluding income, labour force status and education), adults aged 16 and over, Canada, 2003

	Regression of health practices bry demographics and health literacy level (Excluding household income, labour force status and education)									
	General health perception	General health perception: good	Mental health perception	Mental health perception: good	STD experience	Hear disease	Chronic	With a disability	Obese	Diabetes
Family single			***	***	***	*	*	***		
Drug benefits	***	***	***	**	*	***	***		**	***
Dental benefits		**						***	**	**
Optical benefits	*	**								
Hospital benefits	***	***	***	***	**	**	**	***	**	***
Walking	***	***	***	***			**	***	*	
Smoking	***	***	***	***	***		***	**	***	*
Alcohol 7days	***	***	**	**	***	**	***	***	***	***
Alcohol Abuse (> 2 drinks per day)	***	***		*			***		**	**
Medical visit in last 12 months	***	***	***	***	***	***	***	***	***	***
Dental visit in last 12 months	***	***	***	***		***	**	**	***	***
Fruits vegetables in last 7 days	***	***	***	***			*		***	
Pap smear in last 3 years	***	***	***	***	***	***			***	*
Province	***	***	***	***	***	***	***	***	***	*
Gender	***	**	***	***	***	***		**		*
Age group	***	***	***	***	***	***		***	***	***
Education	***	***	***		***	**		***		**
Mother tongue	***	***	***	***	**	***	**	***		
Occupation	***	***	***	***	***	***	***	***		
Aboriginal						***				
Urban/Rural				*	***	**	***			
Immigrant			**		*		**	**		
Ethnicity	***		***	***		**		***		
Health literacy level	***	***			**					

*   significant at 5%
**   significant at 1%
*** significant at .01%

       As expected when income, education and labour force status are excluded, health literacy is very significant in relation to general indicators of physical and mental health, obesity, diabetes and disability.

The relationship of health literacy to the utilization of health goods and services

The third set of regressions explore the impact that health literacy has on the utilization of health goods and services.

Table 5.5

Regression of health utilization by health practices, demographics and health literacy level

| | Regression of health practices bry demographics and health literacy level | | | | | | | | |
	Hospital stay in last 12 months	Hospital days in last 12 months	Medical visits in last 12 months	Dental visits in last 12 months	Eye visits in last 12 months	Other medical visits in last 12 months	Nurse visits in last 12 months	Chiro-practor visits in last 12 months	Physio-therapist visits in last 12 months	Social worker/counsellor visits in last 12 months
Household income	**		***	***	**		***	***	***	***
Family single	*	***			**		**		*	***
Drug benefits	**	***	**	***			*			
Dental benefits			*	***						**
Mother tongue: Muit	***		**		**	***			*	
Hosp benefits	***		***	*		***				*
Mother tongue: Muit		**					**	***		
Mother tongue: Muit	***	***	***	***	**	***	**	***		
Alcohol 7days	***	**	**	**		**	*	*		
Alcohol Abuse (> 2 drinks per day)	**			**						
Medical visit in last 12 months	***	***	***	***	***	***	***	***	***	***
Dental visit in last 12 months	***	***	*	***	***					
Fruits vegetables in last 7 days	**		***		***	**	**	**	**	
Mother tongue: Muit	***		***			***		**		**
Mother tongue: Muit		*	***	***	**	***		***	**	**
Gender	***		***	***	***	***		**		*
Age group	***	***	***	***	***	***		***	***	***
Education	***		***			***	**		***	**
Labour force status	***	***	***			***	***		***	**
Immigrant			**	**	**	**		***		
Ethnicity	**			**				***		
Health literacy level	*	**		*				**	*	
Mother tongue: Muit		**	**		**					**
Immigrant			**	**	**	**		***		
Ethnicity	**			**				***		
Health literacy level	*	**		*				**	**	**

*	significant at 5%
**	significant at 1%
***	significant at .01%

Health literacy is not significant in relation to most measures of health utilization. Health literacy does, however, show a significant relationship to hospital days, chiropractor visits, physio visits and social work visit in the past 12 months and a slight relationship to the incidence of a hospital stay in the past 12 months and to dental visits.

Table 5.6 replicates the same analysis but excludes income, education and labour force status, three variables that have been shown earlier in report to be highly influenced by health literacy level and which themselves have a powerful influence on health utilization.

Table 5.6

Regression of health outcomes by health practices, demographics and health literacy level
(Excluding household income, labour force status and education)

	Regression of health practices bry demographics and health literacy level (Excluding household income, labour force status and education)									
	Hospital stay in last 12 months	Hospital days in last 12 months	Medical visits in last 12 months	Dental visits in last 12 months	Eye visits in last 12 months	Other medical visits in last 12 months	Nurse visits in last 12 months	Chiro-practor visits in last 12 months	Physio-therapist visits in last 12 months	Social worker/ counsellor visits in last 12 months
Family single		***	**		*	**	***			***
Drug benefits	**	***	***	**	**			*		*
Dental benefits				***						*
Optical benefits	***		**		**	***				
Hospital benefits	***		***	*		***				***
Walking		**						**	***	
Smoking	***	**	***	***	***	*		*	*	***
Alcohol 7days	***	**	**	*		*				
Alcohol abuse (> 2 drinks per day)	**			**		*				**
Medical visit in last 12 months	***	***	***	***	***	***	***	**	***	***
Dental visit in last 12 months	***	***	***	***	***			*	**	
Fruits vegetables in last 7 days	**		**		***	***	***	**	***	
Pap smear in last 3 years	***		***			***		*	*	**
Province	***	***	***	***	***	***	***	*	***	***
Gender	***		***	***	***	***		**		***
Age group	***	***	***	***	***	***	**	***	***	***
Mother tongue	*	**	.	.	.	***	***	*	***	***
Occupation	***	***	***	***	***	***	***	***	***	***
Aboriginal	*		**							***
Urban/Rural			**	**		***				**
Immigrant			**	***	**			***		
Ethnicity	***	*	*	*	**			*	***	
Health literacy level	**	**		*	*			**		

* significant at 5%
** significant at 1%
*** significant at .01%

When income, education and labour force status are excluded health literacy is significant in relation to hospital stays, eye visits and social worker visits, all services with high costs of provision

Collectively these three sets of analyses suggest that investments in health literacy would yield modest improvements in health practices and overall population health as well as reductions in the demand for health goods and services. The next chapter uses these relationships to estimate the savings in health expenditures that could be realized through an investment in health literacy that was large enough to bring all adults to Level 3 on the health literacy scale.

Chapter 6

The Economics of Health Literacy

The relationships revealed in Chapter 5 provide support for the hypothesis that significant improvements in population health could be realized were health literacy levels raised through instruction. These improvements in health literacy would, in turn, precipitate significant reductions in the demand for health goods and services and, by extension, significant reductions in public expenditures on health. This chapter summarizes the results of a cost/benefit analysis that explores the potential returns on investment that could be realized. More specifically the chapter provides:

- Estimates of the likely costs of raising the health literacy levels of all adult Canadians to Level 3 on the health literacy scale
- Estimates of the magnitude of the potential reductions in public health expenditures that would be realized as a result of this investment
- Estimates of the rates of return that are implied by these costs and benefits

6.1   Estimates of instructional costs

The section provides estimates of the size of the investment that would be required to move every adult aged 16 and over to Level 3 on Rudd, Kirsch and Yamamoto's health literacy scale.

How instructional costs were estimated

The cost estimates are based upon the "best practice" interventions identified for each literacy market segment in the analyses published in *Reading the Future: Planning for Canada's Future Literacy Needs* (CCL, 2008) and a set of unit costs published in *Addressing Canada's Literacy Challenge: A Market Segmentation Analysis* (DataAngel, 2009). The cost estimates were developed by experts that are actively involved in delivering various sorts of efficient and effective remedial literacy and numeracy programs to Canada's adult populations. Separate costings were done for those who are currently employed, those who have worked at some point in the 5 years preceding the 2006 Census and those out of the labour force. Adults identified as having health literacy skill below Rudd's level 3 are divided into one of eight literacy market segments based on their demographic characteristics, patterns of strength and weakness in the mechanics of reading. This classification yields groups of learners who have similar learning needs, a prerequisite to efficient and effective instruction.

The cost of eliminating literacy skill shortages through "best practice" instruction were derived in two stages as outlined below.

Direct instructional costs

First, the direct costs of instruction were estimated by multiplying the estimated average number of hours needed to raise learners to the next level by the estimate of the number of learners in the respective group. The initial model assumed a standard rate of pay for instructors of $35 per hour, the prevailing rate for the Foundations Program delivered by Douglas College. The current analysis utilizes a much more detailed table of hourly wage rates that reflects the differences in wage structures in urban and rural areas of each jurisdiction.

Readers should not take this as an endorsement of a college-based solution to Canada's health literacy problems. The fact that this rate is considerably higher than many instructors are currently paid means that the cost estimates presented in the report are on the high side, with the result that the estimated rates of return to literacy investments are conservative. At a minimum the rates used are high enough to attract and retain instructors of the requisite quality.

Indirect instructional costs

Second, the indirect costs of supporting instruction are estimated. Separate estimates are derived for:

- Recruitment costs
- Diagnostic costs
- Retention costs
- Certification costs
- Facilities costs
- Participant supplies
- Other infrastructure costs

Recruitment costs are those costs associated with securing participation in programs. Recruitment costs also include marketing, outreach and basic program intake operations.

Diagnostic costs are those costs incurred in undertaking formative assessment to establish learning goals, learner needs and to establish baseline skill levels.

Retention costs represent those costs that are incurred to provide sufficient learner support to ensure retention to completion. These include funding to support personal contact throughout the program and for incidental expenses such as daycare, transportation, etc.

Certification costs are costs incurred at program exit to establish, through comparison to initial skill level, learning gain.

Facilities costs include things such as classroom rentals.

Participant supplies include instructional resources such as paper, pens, workbooks, etc.

Other infrastructure costs include institutional overheads.

As for the direct costs of instruction indirect costs are estimated as averages that are judged to be sufficient overall. Clearly, the average costs mask considerable variation in what it would cost to offer programs in specific communities.

Direct and indirect costs are then converted to a per point basis. Aggregate cost estimates were then derived for each segment by multiplying the average number of points to the desired proficiency level by the per point unit costs for each segment.

Caveats related to the cost analysis

As outlined below the cost estimates presented in this report exclude several elements of cost that one would ideally want to include but were beyond the remit of the current project to estimate.

In the initial analyses upon which the current work builds no effort was made to estimate the cost of training the instructors that would be needed to deliver the programs. It was assumed that these costs could be absorbed in the current post-secondary education budgets. The current analysis also excludes these costs – an exclusion that limits the utility of the estimates and causes rates of return to be systematically over-estimated.

Similarly, no estimates have been provided for the cost of developing and administering a system of instructor certification, nor for providing the general system supports such as the development of more efficient and effective curricula and delivery systems. Implicitly this assumes that current federal and provincial budgets are judged to be sufficient for these purposes–again an exclusion that limits the utility of the estimates and causes rates of return to be systematically over-estimated. It is worth noting, however, that the current approach of developing and delivering disease-specific health literacy instruction is far more expensive than the proposed creation of transferable health literacy skills.

It should also be noted that these costs also exclude the cost of any related language training. The ISRS study allows one to classify respondents into one of six groups based upon their assessed oral language proficiency. Average oral language proficiency scores for English segments C and D, and for French segments C, D and B1, fell in the highest two levels. Average language scores for the other segments were considerably lower, suggesting a need for language training. The IALSS data confirm that large proportions of immigrants and Aboriginal adults have a mother tongue other than one of Canada's official languages. The failure to include language training costs limits the utility of the estimates and causes rates of return to be systematically over-estimated.

It would be important in future analyses to include these costs.

Table 6.1

Instructional costs by province, adults aged 16 and over, Canada, 2003

	Cost of skill upgrading	Total point spread to level 3
	Millons of dollars	000's
Newfoundland and Labrador	464	8,842,917
Prince Edward Island	97	2,020,175
Nova Scotia	987	18,045,270
New Brunswick	1,032	17,552,376
Quebec	8,053	143,365,064
Ontario	12,704	233,820,565
Manitoba	665	13,617,987
Saskatchewan	804	15,375,774
Alberta	1,638	34,575,942
British Columbia	2,897	57,850,484
Canada	**29,340**	**545,066,554**

The table reveals a need for an investment on the order of $29 billion – a very large amount by any standard.

6.2   Estimates of benefits to the health system

This section of the report provides estimates of the value of reductions in health expenditures associated with moving adult Canadians to Level 3 on the Rudd health literacy scale. The estimates of potential savings were derived by applying the relationships between health literacy and the utilization revealed in Chapter 4. The analysis is restricted to potential savings for four common health services:

- Dental costs
- Physician costs
- Eye care cost
- Hospital costs

Tables 6.1 and 6.2 below provide standard costs for each of these services were obtained from estimates published by the Canadian Institute for Health Information (CIHI, 2011), are multiplied by the reduction in the predicted reduction in utilization associated with raising adult health literacy scores Level 3.

Table 6.1

Total health expenditure by use of funds, Canada, 1975 to 2011 — Current Dollars

	Hospitals	Other institutions	Physicians	Other professionals			
				Dental services	Vision care services	Other	Sub-Total
	A	B	C	D	E	F	G
Year	$' 000,000						
2003	36,003.0	12,938.2	15,838.9	8,472.9	2,681.6	2,050.2	13,204.7
2004	38,844.0	14,056.8	16,718.9	8,971.9	3,062.4	2,149.2	14,183.5
2005	40,989.4	14,458.4	17,887.6	9,822.5	3,182.5	2,176.4	15,181.3
2006	43,620.1	15,441.9	19,342.9	10,364.5	3,443.8	2,503.0	16,311.3
2007	46,095.9	16,122.6	20,805.2	11,107.3	3,769.7	2,513.1	17,390.2
2008	49,504.2	16,887.4	22,977.8	11,833.5	3,925.8	2,840.6	18,599.9
2009	52,949.5	18,092.2	24,822.7	12,136.9	4,221.4	2,814.9	19,173.2
2010 f	56,297.2	19,378.0	26,604.9	12,863.6	4,411.0	2,975.5	20,250.1
2011 f	58,417.4	20,233.0	28,095.0	13,770.0	4,674.5	3,166.2	21,610.7

Table 6.2

Total health expenditure by use of funds, Canada, 1975 to 2011 — Current Dollars

	Drugs							Other health spending		
	Prescribed drugs	Non-prescribed drugs	Sub-total	Capital	Public health	Adminis-tration	Health research	Other	Sub-total	Grand total
	A	B	C	D	E	F	G	H	J	A+B+C+D+ E+F+G+H+J
Year					$' 000,000					
2004	16,413.7	3,762.2	20,176.0	5,601.6	7,636.8	4,704.8	2,304.2	5,270.1	7,574.3	123,678.4
2005	17,855.8	3,930.2	21,786.0	5,510.0	7,769.5	4,975.6	2,486.6	5,456.2	7,942.8	131,787.1
2006	19,109.9	4,084.0	23,193.8	6,596.7	8,646.4	5,165.4	2,540.4	5,993.9	8,534.3	140,653.4
2007	20,830.9	4,263.2	25,094.1	7,240.7	9,301.4	5,225.3	2,871.3	6,474.6	9,345.9	150,923.6
2008	21,999.6	4,439.9	26,439.6	7,255.4	10,526.1	5,653.9	3,090.3	7,068.1	10,158.5	160,447.3
2009	23,406.8	4,515.7	27,922.4	8,167.7	11,085.5	5,860.5	3,591.8	7,626.2	11,218.0	172,223.5
2010 f	24,807.3	4,756.5	29,563.7	8,761.9	11,409.4	5,831.8	3,538.6	7,969.6	11,508.2	182,112.7
2011 f	25,961.7	4,839.1	30,800.8	9,966.9	11,623.5	5,985.3	3,565.7	8,381.5	11,947.2	192,853.9
Total Health Expenditure by Use of Funds, Canada, 1975 to 2011— Current Dollars	27,181.6	4,862.4	32,043.9	9,069.0	12,498.9	6,114.7	3,738.1	8,678.3	12,416.4	200,499.1

Table 6.3

Selected health care savings for Canada and the provinces, adults aged 16 and over, Canada, 2003

	Impact on Health Spending[1]			
	Hospital cost	Physician cost	Dental cost	Eye care
Jurisdiction		Dollars (000)		
Change in cost per literacy point	-1.629057	-0.07705281	-0.07684	0.0435778
		Dollars		
Newfoundland and Labrador	14	1	1	-
Prince Edward Island	3	-	-	-
Nova Scotia	29	1	1	1
New Brunswick	29	1	1	1
Quebec	234	11	11	6
Ontario	381	18	18	10
Manitoba	22	1	1	1
Saskatchewan	25	1	1	1
Alberta	56	3	3	2
British Columbia	94	4	4	3
Canada	**888**	**42**	**42**	**24**

1. These dollar values are for the year 2003

The table reveals several interesting facts, including that:

- Annual savings of $888 million could be realized on hospital visits at the national level
- Annual savings of $42 million could be realized on physician costs at the national level
- Annual savings of $42 million could be realized on dental costs at the national level
- Annual costs on eye care would rise by an estimated $24 million at the national level
- The pattern of savings observed at the provincial level generally mirror those observed at the national level

It is important to note that these estimated savings that would flow from reductions in the demand for health goods and services. They exclude the significant reductions in the cost of treatment that would be precipitated by the same investment in skill. Current data do not provide a means to estimate the magnitude of these savings.

6.3   Estimates of other benefits

Raising the health literacy skills of Canadian adults would also generate a number of additional economic benefits. First, and most importantly, a significant body of research suggests that such an investment would be expected to lead rapid increases in labour productivity and, by extension, Gross Domestic Product (Coulombe and Tremblay, 2009). Second, such an investment would also be expected to yield significant savings in government expenditures on Employment Insurance, Social Assistance and Workers Compensation (CLLN, 2012).

Table 6.4 uses the relationship between prose literacy skill earnings and program expenditures on Employment Insurance, Social Assistance and Workers' Compensation revealed in the linked IALSS-SLID files to estimate the expected earnings increase and program expenditure reductions per additional point of prose literacy gained through instruction.

The following table provides estimates of the value of these savings for Canada and the provinces.

Table 6.4

Impact of prose literacy on earnings and social spending per additional point of learning, adults aged 16 and over, Canada, 2003

	Impact on Earnings/Point	Impact on social spending		
		Savings in dollars per point		
		Employment Insurance	Social Assistance	Workers' Compensation
Dollars	155	0.61	3.85	0.90

Table 6.5

Estimated increase in earnings and decreases in expenditures on employment insurance, social assistance and workers' compensation programs, adults aged 16 and over, Canada, 2003

Jurisdiction	Expected annual increase in earnings	Employment insurance regular benefit payments	Social assistance benefit payments	Workers compensation benefit payments
	Millions of dollars			
Newfoundland and Labrador	1,371	5	34	8
Prince Edward Island	313	1	8	2
Nova Scotia	2,797	11	69	16
New Brunswick	2,721	11	68	16
Quebec	22,222	87	552	129
Ontario	36,242	143	900	210
Manitoba	2,111	8	52	12
Saskatchewan	2,383	9	59	14
Alberta	5,359	21	133	31
British Columbia	8,967	35	223	52
Canada	**84,485**	**332**	**2,099**	**91**

The table reveals several important facts, including:

- Annual earnings of Canadian workers would be expected to rise $84.5 billion
- Regular Employment Insurance benefit payments would be expected to fall by $332 million annually
- Social Assistance benefit payments would be expected to fall $2.1 billion annually
- Worker's Compensation benefit payments would be expected to fall $491 million annually.

6.4   Estimated rates of return

This section of the Chapter presents estimates of the simple rates of return on investment implied by the costs and benefits presented above.

The estimated rates of return are based on several simplifying assumptions, including:

- No allowance has been made for the cost of capital needed to finance the skill investment. This exclusion suggests that the rates of return have been slightly over-estimated
- The computation assumes that the skill investment would be made in a single year. Given the number of learners and the current capacity of the adult education sector a more reasonable assumption would see the skill investment spread out over a 5 year period. This would reduce capital costs but would cause benefits to accrue at a slower rate.
- The computation assumes that benefits accumulate over a 5 year period. Conventional practice would see benefits estimated over a 10 year period. In fact, adults are likely to benefit over the balance of their life course. This restriction implies that estimated rates of return have been significantly under-estimated.
- No allowance has been made for other reductions in the cost of treatment that serve to reduce the duration of illness including better self-care, fewer cases of mis-medication, etc.
- No allowance has been made for the value that is associated with an overall lower burden of disease and concomitant improvements in the quality of life. These benefits undoubtedly have enormous economic value but are difficult to quantify. Inclusion of these benefits would drive up the estimated rates of return significantly.

- No allowance has been made for savings that would flow from the reorganization of health care infrastructure that would be enabled by the investment. The health system currently spends significant amounts on the provision of services that are designed to compensate for weakness in health literacy skill. Inclusion of these reductions would drive up the estimated rates of return significantly.

- No allowance has been made for the fact that reductions in Employment Insurance and Workers Compensation payments would allow for concomitant reductions in the premiums that finance these systems. Economic theory suggests that these systems are economically inefficient because the reduce employment levels and reduce employer incentives to reduce workplace illness and accident rates.

Overall we believe that the estimated rates of return represent the minimum values that a skill investment would return.

Table 6.6

Estimated rates of return on investment for Canada and the provinces, adults aged 16 and over, Canada, 2005 to 2009

	Return on investment over 5 years using 100% of earnings	Fiscal return on investment over 5 years using 33% of earnings
	Percent	
Newfoundland and Labrador	1,446	456
Prince Edward Island	1,578	502
Nova Scotia	1,381	431
New Brunswick	1,279	396
Quebec	1,343	419
Ontario	1,392	436
Manitoba	1,559	495
Saskatchewan	1,450	457
Alberta	1,611	515
British Columbia	1,518	481
Canada	**1,406**	**441**

The table reveals that the proposed investment would yield impressive rates of return.

The overall return on investment at the Canada level is estimated to be 1406% over 5 years.

The fiscal rate of return that reduces the earnings gain to the expected increase in tax revenues is 441% at the national level.

Rates of return vary slightly by province.

Chapter 7

Summary and Conclusions

Rapidly rising demand for publically-funded health goods and services is placing enormous pressure on federal and provincial budgets. Politicians and policy makers have a keen interest in exploring policy options that may serve to attenuate the demand for health goods and services and, by extension, the rate of growth in health costs without reducing the current level of population health.

This report explores the possibility that an investment that served to increase the health literacy skills of the adult population might have a dramatic impact on both the demand for health goods and services and government expenditures on same. The analysis combines individual level data on health literacy skill from the Adult Literacy and Life Skills Survey (ALL), individual data on the learning needs of different groups of low skilled adults from the International Survey of Reading Skills (ISRS), individual level income and benefit receipt data from the Survey of Labour and Income Dynamics (SLID), health utilization data from the Canadian Community Health Survey (CCHS) and standard unit cost data for procedures from the Canadian Institute for Health Information (CIHI) to estimate the costs, benefits and rates of return that would be precipitated by an investment that raised all adults to Level 3 on Rudd's health literacy skill. While not the highest health literacy level identified on the Rudd scale, Level 3 is judged to be sufficient to cope independently with the vast majority of health literacy demands that they confront in daily life.

The evidence presented in Chapter 3 suggests that health literacy skill is largely a function of an individual's, prose literacy, document literacy and numeracy skills. Health literate behaviour simply involves the application of these skills to acquire and apply health information. Interestingly oral fluency ways as little influence on the Rudd measure of health literacy.

Results presented in Chapter 4 reveals that health literacy influences health status observed at individual level and disease prevalence observed at the level of health district.

The analysis presented in Chapter 5 confirms that individual levels of health literacy have a significant impact on adults' health practices and on their use of health goods and services but only after the confounding influence of education, income and labour force participation have been removed.

The theory and evidence reviewed in Chapter 2 suggest that these relationships are causal. Health literacy has a profound impact on health, one that dwarfs the reciprocal impact of health on health literacy. Health literacy also has a profound impact on a broad range of other factors that themselves have large impact on health. These factors include educational attainment, labour market success, income and social engagement. The available evidence suggests that these relationships are recursive in the sense that they tend to amplify levels of

inequality in health and other outcomes over time. Individuals with relatively high initial levels of health literacy accumulate advantage over time whereas individuals with relatively low initial levels of health literacy accumulate disadvantage. In statistical terms skill advantaged individuals move further above the mean at any given age and skill disadvantaged individuals move further below the mean at the same age. These mechanisms explain most of the rising variance in social and economic outcomes observed over the life course and levels of social inequality in a broad range of valued outcomes and support the hypothesis that investments in health literacy might yield significant returns.

The estimates presented in Chapter 6 suggest that raising health literacy levels to the desired level would require an investment of $29billion.

This investment would yield significant annual savings to the health system $948 million precipitated by reductions in utilization of key services on eye care, hospital visits, physician visits and dental visits alone. These cost savings imply that the investment could be recovered over an 11 year period.

It is likely that this same investment would yield significant savings on treatment costs . Current data do not provide a means to estimate these saving.

The same skill investment would precipitate significant other benefits.

Related research suggests that higher health literacy skills would drive an annual increase in labour earnings of $84.5 billion and concomitant annual reductions in the costs of Canada's income support programs: $332 million in Employment Insurance payments, $2.1 billion in Social Assistance benefits and $491 million in Workers Compensation benefit payments.

Adding these benefits converts what was a useful investment into a wonderful investment. The improved health literacy skills generated by a $29 billion investment would yield $88.4 billion in annual benefits – a level that implies a 300% annual rate of return. As noted earlier, actual rates of return are likely to be much higher as the investment would reduce the demand for a much broader range of health expenditures and would reduce the cost of treatment in the remaining demand.

Next steps

The analyses presented in this report provide a convincing argument for government to invest in raising the health literacy skill of Canada's adult population. Indirectly, the analyses also argue for government investment that would serve to raise the health literacy skills of youth leaving Canada's secondary education system. Currently an estimated 60% of youth are leaving the secondary system with health literacy skill below Level 3, a fact that suggests that the proportion of adults with inadequate levels of health literacy skill is likely to remain stable over the coming decades.

Although the methods used to underpin this analysis can only provide indicative results the implied economic returns are so attractive that it is well worth undertaking additional research that would provide governments with an unequivocal rationale for investing in health literacy. This chapter concludes with suggestions about what such research might include.

A first recommendation would be to fund a randomized controlled trial of sufficient scale to determine the impact that improved health literacy skills have on health, health behaviours, health utilization and the cost of treatment. This would allow for a more refined benefit analysis to be undertaken. Much of the needed data on benefits could be drawn from a variety of administrative sources so most of the cost would be associated with assessing individual health literacy levels before and after instruction.

A second recommendation would be to profile current levels of health literacy skill demand facing healthy and unhealthy Canadians and how individuals and the health system compensate for adults with low levels of health literacy. This profiling would involve cataloguing health literacy tasks and coding their difficulty. The resulting profile would confirm that Level 3 is adequate for people.

A third recommendation would involve the development of a more refined estimation of the costs of raising health literacy levels. These refined cost estimates would include the costs of creating the required instructional capacity, adapting curriculum and developing suitable assessment products to inform instruction.

A final recommendation would be to create a mechanism that enables adult educators, health and economic policy makers and health practitioners to discuss how they might use the findings presented in this report to make recommendations to politicians. The creation of such a mechanism is crucial breaking down institutional barriers that stand in the way of collaboration across Ministries and levels of government and to creating the political will to act.

Annex A

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Annex B

Statistical Tables

Table 2.2

Labour market participation rate by literacy skill proficiency level, adults aged 16 to 65, Canada, 2003

	Prose literacy level					
	Level 1	Level 2	Level 3	Level 4	Level 5	Total
	Percent					
Participation rate	69	79	82	85	87	80

Table 2.3

Average weeks worked per year by prose literacy level, adults aged 16 and over who were employed at some in the year, Canada, 2003

Prose literacy level	Weeks worked per year	Weeks worked per year for those who worked at some time in the year	Hours worked per year	Hours worked per year for those who worked at some time in the year	Hourly earnings
	Hours				Dollars
Level 1	18	45	923	1,832	14
Level 2	31	46	1,405	1,800	16
Level 3	36	47	1,625	1,828	19
Level 4	41	47	1,702	1,800	21
Level 5	42	48	1,763	1,811	23

Table 2.4

Average hours worked per year, adults aged 16 and over who were employed at some time in the year, Canada, 2003

	Hours worked per year
Level 1	1,832
Level 2	1,800
Level 3	1,828
Level 4	1,800
Level 5	1,811

Table 2.5

Average half-life of unemployment, by skill level, Canada, 2003

Weeks	Levels 1and 2	Levels 3 and 4/5
	Probability	
0	0.124	0.161
2	0.253	0.363
4	0.281	0.392
7	0.345	0.511
9	0.350	0.530
11	0.395	0.578
13	0.397	0.583
15	0.420	0.621
17	0.423	0.626
20	0.448	0.643
22	0.453	0.647
24	0.468	0.660
26	0.469	0.663
28	0.474	0.673
30	0.475	0.675
33	0.484	0.683
35	0.485	0.683
37	0.494	0.687
39	0.495	0.687
41	0.500	0.694
43	0.500	0.696
46	0.502	0.700
48	0.502	0.701
50	0.502	0.701
52	0.502	0.701

Source: Adult Literacy and Life Skills Survey, 2003.

Table 2.6

Average hourly earnings by prose literacy level, adults aged 16 and over who were employed at some in the year, Canada, 2003

	Hourly earnings
Level 1	14
Level 2	16
Level 3	19
Level 4	21
Level 5	23

Table 2.7

Percent increase in weekly earnings per increase of 10-percentiles on the document literacy scale, and per increase of additional year of schooling, adjusted three stage least squares model, labour force populations aged 16 to 65, 2003

	Document literacy	Education
Italy	56.253	0
Bermuda	41.8482	-10.9444
Norway	12.7956	2.43317
Canada	9.4745	5.10239
United States	6.1068	7.85797
Switzerland	0	7.78049

Table 2.8

The impact of skill on individual labour market outcomes, earnings and literacy proficiency, controlling for education and labour force experience

	Education attainment	Literacy proficiency	Experience
		Percent	
Canada	28	32	20
Finland	31	29	34
United Kingdom	38	29	17
Norway	17	28	22
New Zealand	29	26	16
Australia	28	25	12
United States	38	24	11
Ireland	31	21	11
Portugal	23	20	35
Hungary	40	19	8
Denmark	33	19	27
Slovenia	46	18	5
Netherlands	30	16	21
Belgium (Flanders)	44	15	16
Switzerland	40	12	29
Sweden	23	10	37
Chile	40	10	13
Czech Republic	38	8	23
Germany	36	8	20
Poland	35	0	16

Table 4.9

Adjusted, unadjusted and standardized effect sizes of health literacy proficiency on various indices of health conditions, ALL 2003

	A. Diabetes value			B. Drinking value			C. High blood pressure value			D. Injuries value			E. Life stress value		
	U.E	A.E	A.S.E	U.E	A.E	A.S.E	U.E	A.E	A.S.E	U.E	A.E	A.S.E	U.E	A.E	A.S.E
I. Dependent variables are aggregated by health district and independents variables are individual level data															
Health literacy	-0.001***	-0.001***	-0.05***	0.002	0.000	0.00	-0.002***	-0.002***	-0.07***	0.004***	0.004***	0.12***	0.001***	-0.001	-0.01***
Age		0.001***			0.002			0.002 ***		0.006***		-0.007		***	
Male		0.020			0.062			0.009			0.054*			-0.018	
Years of schooling		-0.013***		-0.071	***		-0.025***	-0.012		***		0.040***			
Foreign-born		-0.225***		-2.087	***		-0.334***	-0.342		***		0.274***			
Aboriginal		0.086**			1.033***			-0.186 **		0.717	***	-1.948***			
Foreign-language		-0.043**			-0.391***			-0.398 ***		0.026		0.056			
II. Dependent and independent variables are aggregated by health district															
Health literacy	-0.023***	-0.017	-0.18	-0.049*	-0.083034359	**-0.260	**-0.048	***-0.028223019	-0.138	0.064	***0.07240728***	0.442036897***	0.060**	0.000	0.001
Age		0.030			-0.175728907	**		0.097172359 *			0.039519083			-0.081	
Male		1.950			2.707623045			3.675735199			2.922979508			-0.985	1.266
Years of schooling		-0.025996451			0.874073668	***		-0.243370858			-0.127834492			0.234	
Foreign-born		-2.165803555			-16.80305228			-4.870776358	*		1.712873024				
Aboriginal		-0.067058044			23.74830403***			-9.845522146**			7.438174237	**		-16.762	***
Foreign-language		-0.314038931			-0.151627295			-1.667116679			-0.298213699				0.118

A.E.   Adjusted Effect Size
A.S.E.   Adjusted Standardized Effect Size
U.E.   Unadjusted Effect Size

*   significant at 5%
**   significant at 1%
*** significant at .01%

Source: Adult Literacy and Lifeskills Survey (2003); and source for indices of health condiitons by health district??.

Annex C

Methods Employed to Inpute a Health Literacy Score on to the CCHS

The imputation procedure employed to put health literacy scores individual on to CCHS recovers was intended to generate the following:

- an imputed Health Literacy Level which is one of 1 to 5.
- a Health Literacy Score between 100 and 500 which is consistent with the level.
- an estimate of the confidence level associated with these imputed values.

   Two forms of regression were used to generate the imputed values:

- Logistic regression where the dependent variable is the Health Literacy Level (1 to 5).
- Ordinary Least Squares regression where the dependent variable is the Health Literacy Score.

To assist in the imputation, the IALSS data were used to compare the percentiles of actual scores to percentiles of predicted Literacy Values.

- Using the IALSS survey the actual Health Literacy Scores are compared to predicted values (based on the OLS Regression).
- This is done within each Health Literacy Level so one can compare the percentiles of the actual scores associated with the percentiles of the predicted values.

The imputation procedures for each individual on the CCHS microdatafile were as follows:

- A Health Literacy Level (1-5) is imputed based on the Logistic Regression Coefficients. The imputed value is random using not only the coefficients but also the variance/covariance matrix.
- A preliminary Health Literacy Score is imputed based on the OLS Regression. This score may not be in the appropriate range for the imputed Literacy Level.
- This preliminary Health Literacy Score is converted into a final score as follows:
- The preliminary Health Literacy Score is converted into a percentile of predicted scores (based on the IALSS analysis) within the imputed Literacy Level.
- This percentile level is used to pick an actual score from the IALSS at this percentile level, within the Health Literacy Level.
- This actual score is the imputed Health Literacy Score.
- This imputation is repeated 10 times so that a variance in the various Health Literacy Scores and levels can be estimated.

Imputation was based on Regressions with the following Covariates:

Gender

Educ_Level : 5 Categories

Age Group :

Mother_Tongue : English French Multiple and Other

Province

Labour Force Status: Employed, Unemployed, Not in Labour Force
Occupation ; 10 Categories

Aboriginal : Yes/No

Immigrant : Yes/No

The following table compares the distribution of Health Literacy Levels on the IALSS and on the CCHS. They are virtually identical, indicating that the distribution of the demographic characteristics in the two surveys is very close. The table also presents the distribution of the populations on the two surveys by the demographic characteristics used in the regression and by the Health Literacy Level over the various values observed for the demographic variables.

Table C1

Estimated confidence intervals for proportions of imputed health literacy levels by selected demographic characteristics

	Confidence Interval: +/- 1.96 standard deviations						
	Population	Level 1	Level 1/2	Level 3	Level 4	Level 4/5	Level 5
	Numbsr			Percent			
Aborig_YN							
Total	**23,628,000**	**24% +/- 0.3%**	**59% +/- 0.4%**	**32% +/- 0.4%**	**8% +/- 0.3%**	**9% +/- 0.3%**	**0.9% +/- 0.1%**
Non-Aboriginal	23,281,000	24% +/- 0.3%	58% +/- 0.4%	33% +/- 0.4%	8% +/- 0.3%	9% +/- 0.3%	0.9% +/- 0.1%
Aboriginal	347,000	25% +/- 2.6%	71% +/- 2.8%	21% +/- 2.6%	7% +/- 1.6%	9% +/- 1.8%	1.9% +/- 1.0%
Age_Grp							
Total	**23,628,000**	**24% +/- 0.3%**	**59% +/- 0.4%**	**32% +/- 0.4%**	**8% +/- 0.3%**	**9% +/- 0.3%**	**0.9% +/- 0.1%**
16-24	4,050,000	14% +/- 0.8%	50% +/- 1.2%	37% +/- 1.2%	11% +/- 0.8%	13% +/- 0.8%	1.7% +/- 0.3%
25-34	4,034,000	14% +/- 0.8%	47% +/- 1.0%	41% +/- 1.1%	11% +/- 0.7%	12% +/- 0.7%	0.9% +/- 0.2%
35-44	5,036,000	18% +/- 0.8%	50% +/- 1.1%	39% +/- 1.1%	10% +/- 0.6%	11% +/- 0.7%	1.1% +/- 0.2%
45-54	4,273,000	20% +/- 0.8%	58% +/- 1.0%	32% +/- 1.0%	9% +/- 0.6%	10% +/- 0.7%	0.9% +/- 0.2%
55-64	2,947,000	32% +/- 1.%	68% +/- 1.0%	27% +/- 1.0%	5% +/- 0.5%	5% +/- 0.5%	0.3% +/- 0.1%
65 +	3,288,000	59% +/- 0.8%	87% +/- 0.6%	11% +/- 0.6%	2% +/- 0.3%	2% +/- 0.3%	0.1% +/- 0.0%
Educ_Level5							
Total	**23,628,000**	**24% +/- 0.3%**	**59% +/- 0.4%**	**32% +/- 0.4%**	**8% +/- 0.3%**	**9% +/- 0.3%**	**0.9% +/- 0.1%**
Less than H.S.	5,059,000	54% +/- 0.8%	85% +/- 0.6%	12% +/- 0.6%	3% +/- 0.3%	3% +/- 0.3%	0.2% +/- 0.1%
Secondary Grad.	4,586,000	25% +/- 0.9%	63% +/- 1.0%	31% +/- 1.0%	6% +/- 0.5%	6% +/- 0.5%	0.7% +/- 0.2%
PS dipl.	4,903,000	13% +/- 0.7%	48% +/- 1.0%	41% +/- 1.0%	10% +/- 0.6%	11% +/- 0.6%	1.2% +/- 0.2%
Some PSE/Trade	4,589,000	19% +/- 0.8%	56% +/- 1.0%	35% +/- 1.0%	7% +/- 0.6%	9% +/- 0.6%	1.2% +/- 0.2%
PSE Grad.	4,491,000	9% +/- 0.6%	37% +/- 1.1%	45% +/- 1.1%	17% +/- 0.8%	18% +/- 0.9%	1.3% +/- 0.3%
Ethnicity							
Total	**23,293,000**	**24% +/- 0.3%**	**58% +/- 0.4%**	**32% +/- 0.4%**	**8% +/- 0.3%**	**9% +/- .3%**	**0.9% +/- 0.1%**
Aboriginal	700,000	22% +/- 1.7%	62% +/- 2.1%	29% +/- 2.1%	8% +/- 1.3%	9% +/- 1.4%	1.3% +/- 0.5%
Chinese	825,000	35% +/- 2.6%	68% +/- 2.7%	26% +/- 2.6%	6% +/- 1.5%	7% +/- 1.6%	0.7% +/- 0.6%
European	13,758,000	23% +/- 0.4%	56% +/- 0.5%	34% +/- 0.5%	9% +/- 0.3%	10% +/- 0.3%	1.0% +/- 0.1%
Other	2,648,000	31% +/- 1.4%	66% +/- 1.5%	27% +/- 1.5%	7% +/- 0.8%	7% +/- 0.9%	0.6% +/- 0.2%
Other Canadian	4,776,000	23% +/- 0.7%	59% +/- 0.9%	32% +/- 0.9%	8% +/- 0.6%	9% +/- 0.6%	0.8% +/- 0.2%
South Asian	586,000	34% +/- 3.2%	67% +/- 3.3%	26% +/- 3.2%	7% +/- 2.0%	7% +/- 2.0%	0.6% +/- 0.6%
Family_Single							
Total	**23,628,000**	**24% +/- 0.3%**	**59% +/- 0.4%**	**32% +/- 0.4%**	**8% +/- 0.3%**	**9% +/- 0.3%**	**0.9% +/- 0.1%**
Single	2,936,000	32% +/- 0.6%	65% +/- 0.7%	28% +/- 0.7%	7% +/- 0.4%	8% +/- 0.4%	0.7% +/- 0.1%
Family	20,692,000	23% +/- 0.4%	58% +/- 0.5%	33% +/- 0.5%	9% +/- 0.3%	9% +/- 0.3%	0.9% +/- 0.1%
Gender							
Total	**23,628,000**	**24% +/- 0.3%**	**59% +/- 0.4%**	**32% +/- 0.4%**	**8% +/- 0.3%**	**9% +/- 0.3%**	**0.9% +/- 0.1%**
Female	12,092,000	25% +/- 0.5%	59% +/- 0.6%	32% +/- 0.6%	8% +/- 0.3%	9% +/- 0.4%	0.9% +/- 0.1%
Male	11,537,000	24% +/- 0.5%	58% +/- 0.6%	33% +/- 0.6%	8% +/- 0.4%	9% +/- 0.4%	0.9% +/- 0.1%
HHLD_Income							
Total	**17,726,000**	**24% +/- 0.4%**	**59% +/- 0.5%**	**32% +/- 0.5%**	**8% +/- 0.3%**	**9% +/- 0.3%**	**0.9% +/- 0.1%**
NO OR <$20,000	2,228,000	52% +/- 1.4%	81% +/- 1.1%	16% +/- 1.1%	3% +/- 0.5%	3% +/- 0.5%	0.3% +/- 0.2%
$20,000-$29,999	1,972,000	20% +/- 1.2%	64% +/- 1.5%	29% +/- 1.5%	7% +/- 0.8%	7% +/- 0.9%	0.7% +/- 0.3%
$30,000-$39,999	1,946,000	12% +/- 1.0%	42% +/- 1.6%	47% +/- 1.7%	10% +/- 1.0%	11% +/- 1.0%	1.1% +/- 0.3%
$460,000-$49,999	2,034,000	10% +/- 0.9%	36% +/- 1.4%	39% +/- 1.5%	24% +/- 1.4%	25% +/- 1.4%	1.3% +/- 0.3%
$50,000-$74,999	3,767,000	7% +/- 0.5%	33% +/- 1.1%	42% +/- 1.2%	13% +/- 0.8%	25% +/- 1.1%	12.3% +/- 0.8%
$75,000-$99,999	3,166,000	23% +/- 0.9%	57% +/- 1.2%	33% +/- 1.2%	9% +/- 0.7%	10% +/- 0.7%	0.9% +/- 0.2%
$100,000-$149,999	1,739,000	41% +/- 1.2%	73% +/- 1.2%	22% +/- 1.2%	5% +/- 0.6%	5% +/- 0.6%	0.5% +/- 0.2%
$150,000-$199,999	573,000	36% +/- 2.1%	70% +/- 2.2%	24% +/- 2.2%	5% +/- 1.2%	6% +/- 1.3%	0.5% +/- 0.4%
$200,000 OR MORE	301,000	28% +/- 3.2%	63% +/- 3.5%	29% +/- 3.5%	7% +/- 2.0%	7% +/- 2.1%	0.7% +/- 0.6%
IMM_YN							
Total	**23,628,000**	**23% +/- 0.4%**	**59% +/- 0.4%**	**33% +/- 0.4%**	**7% +/- 0.2%**	**8% +/- 0.2%**	**0.9% +/- 0.1%**
Immigrant	5,019,000	19% +/- 0.8%	54% +/- 1.0%	36% +/- 1.0%	9% +/- 0.6%	10% +/- 0.6%	1.% +/- 0.2%
Non-Immigrant	18,609,000	15% +/- 0.4%	49% +/- 0.5%	40% +/- 0.5%	11% +/- 0.3%	12% +/- 0.4%	1.1% +/- 0.1%

Table C1 (continued)

Estimated confidence intervals for proportions of imputed health literacy levels by selected demographic characteristics

	Confidence Interval: +/- 1.96 standard deviations						
	Population	Level 1	Level 1/2	Level 3	Level 4	Level 4/5	Level 5
	Numbsr	Percent					
LF_Status							
Total	**23,628,000**	**11% +/- 0.3%**	**43% +/- 0.5%**	**43% +/- 0.5%**	**13% +/- 0.3%**	**15% +/- 0.3%**	**1.4% +/- 0.1%**
Employed	14,410,000	11% +/- 0.5%	42% +/- 0.7%	43% +/- 0.7%	13% +/- 0.5%	15% +/- 0.5%	1.6% +/- 0.2%
NILF	8,230,000	10% +/- 0.5%	40% +/- 0.9%	44% +/- 1.0%	15% +/- 0.7%	16% +/- 0.8%	1.2% +/- 0.2%
Unemployed	988,000	24% +/- 1.7%	59% +/- 2.1%	32% +/- 2.1%	8% +/- 1.3%	9% +/- 1.3%	0.9% +/- 0.4%
Mother_tongue							
Total	23,628,000	41% +/- 0.5%	74% +/- 0.5%	22% +/- 0.5%	4% +/- 0.2%	4% +/- 0.2%	0.3% +/- 0.1%
English	13,520,000	20% +/- 0.4%	54% +/- 0.5%	35% +/- 0.6%	10% +/- 0.4%	11% +/- 0.4%	1.0% +/- 0.1%
French	5,356,000	24% +/- 0.7%	59% +/- 0.9%	32% +/- 0.9%	8% +/- 0.5%	9% +/- 0.6%	0.9% +/- 0.2%
Other	4,611,000	16% +/- 0.8%	50% +/- 1.0%	38% +/- 1.0%	11% +/- 0.7%	12% +/- 0.7%	1.2% +/- 0.2%
Multiple	141,000	40% +/- 4.4%	72% +/- 4.5%	23% +/- 4.4%	5% +/- 2.4%	5% +/- 2.5%	0.3% +/- 0.6%
Occupation							
Total	**23,628,000**	**26% +/- 0.4%**	**64% +/- 0.4%**	**29% +/- 0.4%**	**6% +/- 0.2%**	**7% +/- 0.3%**	**0.7% +/- 0.1%**
Not Employed	6,537,000	24% +/- 0.7%	59% +/- 0.8%	32% +/- 0.8%	8% +/- 0.5%	9% +/- 0.5%	0.9% +/- 0.2%
A	1,369,000	18% +/- 1.1%	51% +/- 1.6%	38% +/- 1.7%	11% +/- 1.1%	12% +/- 1.2%	1.3% +/- 0.4%
B	3,171,000	27% +/- 1.0%	66% +/- 1.2%	28% +/- 1.2%	6% +/- 0.6%	6% +/- 0.6%	0.5% +/- 0.2%
C	1,160,000	41% +/- 2.2%	73% +/- 2.2%	22% +/- 2.1%	5% +/- 1.2%	6% +/- 1.2%	0.4% +/- 0.3%
D	933,000	22% +/- 1.7%	57% +/- 2.2%	38% +/- 2.2%	5% +/- 1.1%	5% +/- 1.1%	0.4% +/- 0.2%
E	1,197,000	24% +/- 1.5%	59% +/- 1.9%	32% +/- 1.9%	8% +/- 1.1%	9% +/- 1.2%	0.9% +/- 0.4%
F	664,000	48% +/- 2.2%	80% +/- 1.9%	17% +/- 1.8%	3% +/- 0.9%	3% +/- 0.9%	0.2% +/- 0.2%
G	4,403,000	11% +/- 0.7%	43% +/- 1.1%	44% +/- 1.1%	12% +/- 0.7%	13% +/- 0.7%	1.7% +/- 0.3%
H	2,367,000	11% +/- 1.0%	46% +/- 1.5%	43% +/- 1.6%	10% +/- 0.9%	11% +/- 1.0%	1.2% +/- 0.3%
I	695,000	4% +/- 1.2%	32% +/- 2.8%	48% +/- 3.0%	18% +/- 2.1%	20% +/- 2.2%	1.8% +/- 0.8%
J	1,131,000	12% +/- 1.4%	47% +/- 2.0%	39% +/- 2.1%	14% +/- 1.4%	14% +/- 1.4%	0.3% +/- 0.2%
Urban_Rural							
Total	**23,628,000**	**5% +/- 0.2%**	**29% +/- 0.4%**	**49% +/- 0.5%**	**20% +/- 0.4%**	**22% +/- 0.4%**	**1.3% +/- 0.1%**
Urban	19,202,000	10% +/- 0.3%	36% +/- 0.5%	49% +/- 0.5%	13% +/- 0.4%	15% +/- 0.4%	1.6% +/- 0.1%
Rural	4,426,000	19% +/- 0.8%	57% +/- 1.1%	33% +/- 1.1%	9% +/- 0.6%	10% +/- 0.7%	1.1% +/- 0.2%

Table C2

Comparing the IALSS and inputed CCHS health literacy distributions

			Health literacy level				
		Total	Level 1	Level 2	Level 3	Level 4	Level 5
				Percent			
Province							
Total	**CCHS File**	**100**	**24**	**34**	**32**	**8**	**1**
	IALSS File	100	25	34	31	8	1
Nfld	CCHS File	100	32	31	29	7	0
	IALSS File	100	32	34	26	7	0
PEI	CCHS File	100	31	33	27	8	0
	IALSS File	100	31	33	27	9	0
NS	CCHS File	100	24	30	35	9	1
	IALSS File	100	27	30	33	9	0
NB	CCHS File	100	29	36	28	7	0
	IALSS File	100	28	36	28	7	0
Que	CCHS File	100	28	38	28	6	0
	IALSS File	100	27	39	28	6	0
Ont	CCHS File	100	24	34	33	8	1
	IALSS File	100	26	33	31	8	0
Man	CCHS File	100	27	32	34	7	1
	IALSS File	100	27	32	33	7	0
Sask	CCHS File	100	23	32	34	9	2
	IALSS File	100	23	30	36	9	0
Alta	CCHS File	100	20	33	35	10	1
	IALSS File	100	21	33	36	10	0
BC	CCHS File	100	20	32	35	11	1
	IALSS File	100	22	32	34	11	0
Territories	CCHS File	100	17	30	35	13	0
Age_Grp							
Total	**CCHS File**	**100**	**24**	**34**	**32**	**8**	**1**
	IALSS File	100	25	34	31	8	1
16-24	CCHS File	100	14	37	36	11	2
	IALSS File	100	14	38	36	11	1
25-34	CCHS File	100	14	33	41	11	1
	IALSS File	100	14	34	40	11	1
35-44	CCHS File	100	18	33	39	10	1
	IALSS File	100	20	33	37	9	1
45-54	CCHS File	100	20	38	32	9	1
	IALSS File	100	22	38	31	9	1
55-64	CCHS File	100	32	37	26	5	0
	IALSS File	100	32	35	27	5	0
65 +	CCHS File	100	58	29	11	2	0
	IALSS File	100	61	27	10	2	0
Educ_Level5							
Total	**CCHS File**	**100**	**24**	**34**	**32**	**8**	**1**
	IALSS File	100	25	34	31	8	1
Less than High School	CCHS File	100	54	32	12	3	0
	IALSS File	100	52	33	12	3	0
Secondary Graduate	CCHS File	100	25	39	30	6	1
	IALSS File	100	24	39	31	6	0
PS dipl.	CCHS File	100	13	35	41	9	1
	IALSS File	100	13	35	41	10	0
Some Post Secondary	CCHS File	100	18	38	34	8	1
Education/Trade	IALSS File	100	19	38	35	7	1
Post Secondary Education	CCHS File	100	9	28	45	17	1
Graduate	IALSS File	100	8	28	46	18	1

Table C2 (continued)

Comparing the IALSS and inputed CCHS health literacy distributions

		Health literacy level					
		Total	Level 1	Level 2	Level 3	Level 4	Level 5
					Percent		
Gender							
Total	**CCHS File**	**100**	**24**	**34**	**32**	**8**	**1**
	IALSS File	100	25	34	31	8	1
Female	CCHS File	100	24	35	32	8	1
	IALSS File	100	26	34	31	8	1
Male	CCHS File	100	24	34	32	8	1
	IALSS File	100	25	34	31	8	1
IMM_YN							
Total	**CCHS File**	**100**	**24**	**34**	**32**	**8**	**1**
	IALSS File	100	25	34	31	8	1
Immigrant	CCHS File	100	41	33	23	4	0
	IALSS File	100	43	32	22	4	0
Non-Immigrant	CCHS File	100	20	35	35	10	1
	IALSS File	100	20	35	34	9	1
Aboriginal_YN							
Total	**CCHS File**	**100**	**24**	**34**	**32**	**8**	**1**
	IALSS File	100	25	34	31	8	1
0	CCHS File	100	24	34	32	8	1
	IALSS File	100	25	34	32	8	1
1	CCHS File	100	24	46	22	6	1
	IALSS File	100	27	46	19	6	0
LF_							
Total	**CCHS File**	**100**	**24**	**34**	**32**	**8**	**1**
	IALSS File	100	25	34	31	8	1
0	CCHS File	100	38	33	24	5	0
	IALSS File	100	41	32	22	5	0
1	CCHS File	100	15	35	38	11	1
	IALSS File	100	17	36	37	10	1
LF_Not labour force							
Total	**CCHS File**	**100**	**24**	**34**	**32**	**8**	**1**
	IALSS File	100	25	34	31	8	1
0	CCHS File	100	16	36	37	10	1
	IALSS File	100	18	36	36	10	1
1	CCHS File	100	40	32	23	5	0
	IALSS File	100	43	31	21	4	0
LF_Unemployed							
Total	**CCHS File**	**100**	**24**	**34**	**32**	**8**	**1**
	IALSS File	100	25	34	31	8	1
0	CCHS File	100	24	34	32	8	1
	IALSS File	100	25	34	32	8	1
1	CCHS File	100	26	39	29	5	0
	IALSS File	100	32	37	25	6	0
Mother_Tongue_English							
Total	**CCHS File**	**100**	**24**	**34**	**32**	**8**	**1**
	IALSS File	100	25	34	31	8	1
0	CCHS File	100	33	36	25	5	0
	IALSS File	100	34	36	25	5	0
1	CCHS File	100	18	33	37	10	1
	IALSS File	100	19	33	37	10	1

Table C2 (concluded)

Comparing the IALSS and inputed CCHS health literacy distributions

		Health literacy level					
		Total	Level 1	Level 2	Level 3	Level 4	Level 5
		Percent					
Mother_Tongue_French							
Total	**CCHS File**	**100**	**24**	**34**	**32**	**8**	**1**
	IALSS File	100	25	34	31	8	1
0	CCHS File	100	24	33	33	9	1
	IALSS File	100	25	33	32	9	1
1	CCHS File	100	26	40	28	5	0
	IALSS File	100	27	40	28	5	0
Mother_Tongue_Multiple Languages							
Total	**CCHS File**	**100**	**24**	**34**	**32**	**8**	**1**
	IALSS File	100	25	34	31	8	1
0	CCHS File	100	24	34	32	8	1
	IALSS File	100	26	34	31	8	1
1	CCHS File	100	23	33	39	0	0
	IALSS File	100	0	0	28	0	0
Mother_Tongue_Non English or French							
Total	CCHS File	100	24	34	32	8	1
	IALSS File	100	25	34	31	8	1
0	CCHS File	100	20	35	35	9	1
	IALSS File	100	21	35	34	9	1
1	CCHS File	100	41	31	22	5	0
	IALSS File	100	43	31	21	5	0
Occupation							
Total	**CCHS File**	**100**	**24**	**34**	**32**	**8**	**1**
	IALSS File	100	25	34	31	8	1
0	CCHS File	100	48	33	16	3	0
	IALSS File	100	56	30	12	2	0
1	CCHS File	100	10	32	45	12	2
	IALSS File	100	12	32	43	12	0
2	CCHS File	100	11	35	42	10	1
	IALSS File	100	12	37	41	10	0
3	CCHS File	100	3	28	48	19	2
	IALSS File	100	5	32	46	16	0
4	CCHS File	100	11	38	38	13	0
	IALSS File	100	14	38	36	12	0
5	CCHS File	100	5	25	49	20	1
	IALSS File	100	5	25	49	20	0
6	CCHS File	100	11	26	49	12	1
	IALSS File	100	10	27	49	13	0
7	CCHS File	100	18	38	34	9	1
	IALSS File	100	20	40	31	8	0
8	CCHS File	100	24	36	32	7	2
	IALSS File	100	29	36	29	6	0
9	CCHS File	100	21	36	37	5	0
	IALSS File	100	29	32	34	4	0
10	CCHS File	100	29	43	24	4	0
	IALSS File	100	33	41	23	3	0