

November, 2009

Cognitive Function, Aging and Paid Work**Policy Brief No. 1****Summary**

In the context of an aging population and aging workforce, we consider the relationship between cognitive function and paid work. Cognitive function is maintained for most adults as they age, and there is evidence of a positive relationship between stimulating and engaging work environments and both levels of cognitive function and their maintenance over time. At the same time, irregular and long work hours are associated with poorer cognitive outcomes. However, the relationship between paid work and cognitive function is complex; education and training as well as health status are also related to cognitive function and work. We discuss implications for policy makers and areas where further research is required.

Key Findings

- While not an inevitable part of aging, when cognitive decline does occur, regulatory or mechanical abilities (fluid intelligence), rather than the experience-based or accumulated knowledge aspects of intelligence (crystallized), are most often affected.
- Engaging and stimulating work environments are associated with higher levels of cognitive function, while atypical work schedules or long hours, are negatively related with cognitive function.
- Physical and mental health problems are both related to cognitive function in later life. In particular, coronary heart disease, problems with blood pressure regulation, anxiety, and depressive symptoms all exert a negative influence on cognitive function.
- There is some evidence regarding the effectiveness of cognitive training programs and interventions designed to improve specific aspects of cognitive function. However, the issue of how these programs are related to on-the-job training, skills development and continuing education for older workers is less clear.

Context: Canada's Aging Population

Canada's population, like that of many industrialized nations, is aging due a number of factors: low fertility rates, increased life expectancy at birth, and the aging of the baby boom generation. In 2001, one in eight Canadians was 65 years or older, and this proportion is expected to increase to one in five by 2026.[1] These demographic changes have prompted concern about public expenditures for older adults associated with the Canadian and Quebec Pension Plans (CPP/QPP), the Old Age Security (OAS) program, and health and long-term care. While the old-age dependency ratio in Canada (the ratio of adults 65 and over to the working-age population) is expected to increase over the next 30 years, [2] it is consistent with, and in some cases, lower than that of many other OECD countries.[3]

Population Change and Lifecourse Strategic Knowledge Cluster

Population Studies Centre, Social Science Centre, The University of Western Ontario, London, ON N6A 5C2

Website: <http://sociology.uwo.ca/cluster/>Email: pclc-cppv@uwo.ca



Cognitive Function, Aging and Paid Work

Population Aging & Canada's Changing Labour Market & Labour Force

Contemporaneous shifts in the nature of the labour market in Canada have also occurred. Over the past 50 years, Canada's economy has shifted from one that was largely resource-based to one where knowledge and innovation are vital sources of capital. The closure of many resource-based industries has resulted in concentrated and regionally specific unemployment, with older workers being particularly affected by these changes.[4] While continuing to increase, the labour force is expected to grow at a slower rate in the coming years, and there will be a continued increase in the proportion of older workers relative to the total working population. These projections, based on increased age-specific labour force participation rates, nonetheless indicate a lower overall labour force participation rate and more retirements.[5] Yet, many workers over the age of 55 are more likely to be in non-standard employment characterized by lower job security and fewer hours of work, and, compared to younger workers, older adults typically experience longer periods of unemployment following job loss.[4] From an economic perspective, encouraging greater labour market participation among older adults and later retirement represent two strategies to curb the declining growth of Canada's labour force.

Many factors are important for understanding labour market participation among older adults, including economic considerations, health, and personal preferences.[6] Cognitive function may also be important for both the health and well-being of older workers, and their continued ability to engage in employment.

Cognitive Function & Aging

Cognitive ability is typically understood as a combination of crystallized (cognitive representation) and fluid intelligence (cognitive control). Crystallized intelligence is believed to accumulate over time through educational, occupational and cultural experiences and is reflected in tests of vocabulary, information accumulation, and specific knowledge-based activities. Fluid

intelligence encompasses information processing, reasoning, short-term memory, abstract thinking, reaction time, and regulatory processes.[7,8] Although scholars first believed that cognitive decline was a natural consequence of aging, more recent evidence suggests that many older adults are able to maintain cognitive function as they age. Data from the Canberra Longitudinal Study indicated no significant declines over time in crystallized abilities across all age groups, including the group who was 85+ at baseline. When declines were observed, they were noted in markers of fluid intelligence (memory and cognitive speed).[8] Evidence from research that has tracked intra-individual change in cognitive function over time suggests a stable pattern for most healthy middle age and older adults. For example, research that followed individuals 64-83 years at baseline over a period of 15.5 years found that approximately 60% did not demonstrate any clinically significant declines in the first 12 years, and over 80% reported no such declines within the first 5 years[9].

Employment Dynamics, Conditions of Work and Cognitive Function

To date, there is limited evidence that cognitive function alone is a strong predictor of labour market outcomes, such as the probability of unemployment, earnings, and labour market entry or exit.[10,11] In Germany, higher speed test scores (a test of fluid mechanics) were associated with a lower likelihood of being unemployed but this effect was no longer significant after also evaluating the joint effects of cognitive ability (speed test) and education. However, the joint effect of speed test scores and education was positively associated with earnings; higher speed tests scores were related to higher earnings for all full-time workers and even more beneficial for those with higher levels of education.[10] In these data, the effects of cognitive ability and education on labour market outcomes were closely related, reflecting the close association between level of education and cognitive function.[12] In other work, where education and cognitive function were only moderately correlated, Haardt [11] found that changes in cognitive function over a 2-year period (approximately 45% reported a decline in the cognitive



Cognitive Function, Aging and Paid Work

function index) did not predict labour market entry or exits among adults who were 50-70 years at baseline.

Conditions of work (work hours, irregular shifts, and prevailing work activity) are also related to cognitive function. For example, in a large sample of wage earners in France, atypical work schedules (work before 6:00 or after 22:00), as well as work that is physical (as opposed to social or mental) were negatively associated with cognitive performance, independent of sleep, age, sex, and education level.[13] Conversely, cognitive stimulation on the job, including training received, cognitively rich work, and opportunities to increase and develop skills were associated with higher cognitive performance. However, the directionality of the relationships observed in cross-sectional data is unclear. It is possible that high functioning individuals are simply more likely to work in cognitively demanding jobs.[14] For this reason, longitudinal research that investigates how conditions of work influence cognitive function over time is crucial.

Where these relationships have been studied longitudinally, there is evidence that conditions of work do influence cognitive function over time. For example, over a period of 30 years, complexity of work positively influenced levels of intellectual functioning; a finding that applied to men and women.[15] Among British civil servants, long work hours (>55 hrs/week) were associated with lower follow-up scores of inductive reasoning (a measure of fluid intelligence) for all respondents, and for men, long work hours were also related to lower vocabulary test scores (a marker of crystallized intelligence) at both baseline and follow-up.[16] In the same sample, 'high strain' employment was associated with lower cognitive performance, although this association was largely explained by employment grade.[17]

Cognitive Function & Health Status among Older Adults

Health status is also related to cognitive function, and in some cases, predictive of changes in cognitive function over time (see [12] for a review). In particular,

coronary heart disease (CHD) [18] and blood pressure [19] are associated with declines in cognitive function.

With respect to mental health, scholars hypothesize that depression and anxiety are associated with attention resource deficits and task irrelevant thoughts that may affect cognitive performance, as well as neurobiological processes that are associated with deficits in cognition.[20,21] For example, anxiety symptoms have been linked with poorer processing and inhibition, and comorbid anxiety and depressive symptoms with lower performance on tests of semantic memory, episodic memory and speed processing.[20] Understanding the complex interrelationship between cognitive function and health is important, particularly in light of the fact that health problems also influence other life domains, including decisions about employment and retirement.

Research & Knowledge Gaps

Improving our understanding of the relationship between cognitive function, aging and paid work necessitates clarifying the complex relationships that exist between cognitive function, health status, and employment conditions / labour market participation over time at the national level. To date, such efforts have been limited by the lack of national data containing measures of cognitive function, employment, health, and socio-demographic information.

Evaluations of cognitive training interventions aimed at improving specific aspects of cognitive function, such as memory, or a broader set of cognitive skills suggest that improvements in cognitive function can be made and sustained over time (see [23] for a review). However, we know much less about how training in the context of the workplace, or programs designed to re-train older workers for ongoing labour market participation influence cognitive function or vice-versa. For example, federal initiatives such as the *Targeted Initiative for Older Workers* (TIOW), aim to provide skill upgrading and work experience for displaced older workers, but whether or how such programs also address cognitive issues is unclear.

Funded by the Social Sciences & Humanities Research Council (SSHRC)



Cognitive Function, Aging and Paid Work

Relevance for Public Policy Makers

The health of Canada's older workers is important as Canada's population ages. Opportunities for older adults to participate in meaningful employment are important for their own social and economic well-being, and their participation is important for mitigating the economic effects of population aging and the declining growth of the labour force. Initiatives that support continuing education, opportunities for skill development in the workplace, and efforts to foster work environments that are intellectually engaging are all likely important to maintaining higher levels of cog-

nitive function over time. At the same time, reducing exposure to conditions of work that are negatively associated with cognitive function, such as long or atypical work hours, is important. Policy makers must also recognize the challenges faced by displaced older workers seeking re-employment, and the interrelationships between conditions of work, physical and mental health, and cognitive function in this regard. In particular, the labour market challenges faced by individuals with low cognitive function need to be considered, as this group is often the target of initiatives and programs to facilitate re-employment and skills development

References

1. Health Canada. Canada's Aging Population. A report prepared by Health Canada in collaboration with the Interdepartmental Committee on Aging and Seniors Issues. 2002; Division of Aging and Seniors, Health Canada, Ottawa, ON.
2. Mercenier J, Merette M. Will population aging increase inequality across regions in Canada? R-02-1E – Applied Research Branch Strategic Policy Human Resources Development Canada. 2000; HRDC Publications Centre.
3. Gonand F. Assessing the robustness of demographic projections in OECD countries. Economics Department Working Papers No. 464. 2005; Organisation for Economic Co-operation and Development.
4. Cohen E Rt. Hon, Bertrand F, MacKinnon WA, Riddell WC [Expert Panel on Older Workers]. Supporting and engaging older workers in the new economy. 2008.
5. Martel L, Caron-Malenfant E, Vézina S, Bélanger A. Labour Force Projections for Canada 2006-2031. Canadian Economic Observer. 2007;20(6):3.1-3.13.
6. Chappell N, Gee E, McDonald L, Stones M. Work and Retirement. In: Aging in Contemporary Canada. Toronto, ON: Prentice Hall; 2003. p. 309-342.
7. Craik FIM, Bialystok E. Cognition through the lifespan: mechanisms of change. Trends in Cognitive Sciences. 2006;10(3):131-137.
8. Christensen H. What cognitive changes can be expected with normal ageing? Australian and New Zealand Journal of Psychiatry. 2001;35:768-775.
9. Rubin EH, Storandt M, Miller JP, Kinscherf DA, Grant EA, Morris JC, Berg L. A prospective study of cognitive function and onset of dementia in cognitively healthy elders. Archives of Neurology. 1998;55:395-401.
10. Anger S, Heineck G. Cognitive abilities and labour market outcomes – First evidence for Germany. DIW Berlin Discussion Paper 665, Berlin: German Institute for Economic Research.
11. Haardt D. Cognitive functioning and labour force participation among older men and women in England. SEDAP Research Paper No. 222.
12. Anstey K, Christensen H. Education, activity, health, blood pressure and apolipoprotein E as predictors of cognitive change in older age: A review. Gerontology. 2000;46:163-177.
13. Ansiau D, Wild P, Niezborala M, Rouch I, Marquié JC. Effects of working conditions and sleep of the previous day on cognitive performance. Applied Ergonomics. 2008;39:99-106.
14. Ansiau D, Marquié JC, Soubelet A, Ramos S. Relationships between cognitive characteristics of the job, age, and cognitive efficiency. International Congress Series. 2005;1280:43-48.
15. Schooler C, Mulatu MS, Oates G. The continuing effects of substantively complex work on the intellectual functioning of older workers. Psychology and Aging. 1999;14(3):483-506.
16. Virtanen M, Singh-Manoux A, Ferrie JE, Gimeno D, Marmot MG, Elovainio M et al. Long working hours and cognitive function. The Whitehall II study. American Journal of Epidemiology. 2009;169(5):596-605.
17. Elovainio M, Ferrie JE, Singh-Manoux A, Gimeno D, De Vogli R, Shipley MJ et al. Cumulative exposure to high-strain and active jobs as predictors of cognitive function: the Whitehall study. 2009;66:32-37.
18. Singh-Manoux A, Sabia S, Lajnef M, Ferrie JE, Nabi H, Britton AR et al. History of coronary heart disease and cognitive performance in midlife: the Whitehall II study. European Heart Journal. 2008;29:2100-2107.
19. Qiu C, Winblad B, Fratiglioni L. The age-dependent relation of blood pressure to cognitive function and dementia. The Lancet Neurology. 2005;4:487-499.
20. Belanoff JK, Gross K, Yager A, Schatzberg AF. Corticosteroids and cognition. Journal of Psychiatric Research. 2001;35:127-145.
21. Eysenck MW, Derkshan N, Santos R, Calvo MG. Anxiety and cognitive performance: Attentional Control Theory. Emotion. 2007;7(2):336-353.
22. Beaudreau SA, O'Hara R. The association of anxiety and depressive symptoms with cognitive performance in community-dwelling older adults. Psychology and Aging. 2009;24(2):507-512.
23. Thompson G, Foth D. Cognitive-training programs for older adults: What are they and can they enhance mental fitness? Educational Gerontology. 2005;31:603-626.

This policy brief was based on a review of the literature on the relationships between cognitive function and age, paid work, health, education, and training programs. The brief was prepared by Laurie M. Corna, PhD Cand., University of Toronto, with David Haardt, PhD, Dalhousie University.

Population Change and Lifecourse Strategic Knowledge Cluster

Population Studies Centre, Social Science Centre, The University of Western Ontario, London, ON N6A 5C2

Website: <http://sociology.uwo.ca/cluster/>

Email: pcl-cppv@uwo.ca