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The psychosocial work environment and incident diabetes in Ontario, Canada

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Background Relatively few longitudinal studies have explored the relationship between psychosocial work conditions and diabetes incidence. Given the increasing global burden of diabetes this is an important area for public health research.

Aims To examine the relationships between dimensions of the psychosocial work environment on the subsequent incidence of diabetes among men and women in Ontario, Canada over a 9 year period.

Methods We used data from Ontario respondents (35 to 60 years of age) to the 2000–01 Canadian Community Health Survey linked to the Ontario Health Insurance Plan database for physician services and the Canadian Institute for Health Information Discharge Abstract Database for hospital admissions. Our sample of actively employed labour market participants with no previous diagnoses for diabetes was followed for a 9 year period to ascertain incident diabetes.

Results There were 7443 participants. Low levels of job control were associated with an increased risk of diabetes among women, but not among men. Counter to our hypotheses high levels of social support were also associated with increased diabetes risk among women, but not among men. No relationship was found between any psychosocial work measure and risk of diabetes among men.

Conclusions Given the increasing prevalence of diabetes worldwide, job control could potentially be an important modifiable risk factor to reduce the incidence of diabetes among female, but not among male, workers. More research is needed to understand the pathways through which low social support may protect against the development of diabetes.

Key words Diabetes; occupational health; psychosocial factors; social epidemiology.

Introduction

Diabetes is a growing public health concern. In Ontario, Canada, the prevalence of diabetes in 2005 had already surpassed the predicted global rate for the year 2030, almost doubling between 1995 and 2005 [1]. Given the large increases in the prevalence of this condition, identifying modifiable factors that are associated with an increased risk of diabetes, or a protective effect on diabetes incidence, is an important area for public health research. The psychosocial work environment may potentially be one such factor [2,3]. The two primary pathways linking high psychosocial work stress to diabetes risk are (1) via disruptions to neuroendocrine and immune system functioning and increased or prolonged cortisol and sympathetic hormone release in reaction to stress and (2) through changes in health behaviour patterns, particularly those related to diet and energy expenditure, possibly as coping mechanisms [4].

While there has been a large amount of work examining the relationship between the psychosocial work environment and hypertension and heart disease, to date there have been relatively few studies examining the relationship between psychosocial work conditions and diabetes [5]. A recent systematic review in this area only identified six prospective studies, from four population cohorts, which have examined this relationship, with only two samples containing both men and women [5]. These two samples were the Whitehall II cohort, where the relationship between working conditions and diabetes has been examined by three papers [3,6,7] and a community sample from

Sweden [8]. The earliest Whitehall II study reported no relationship between job control, job demands or social support and incident diabetes over a 9 to 14 year follow-up, among either men or women [7]. However, later studies (albeit with key differences in the sample definition and inception point) have reported a relationship between iso-strain (the combination of low job control and high job demands (high job strain), and low social support [9]) and incident diabetes among women, but not among men, over a 13 year period [3]. More recently, another study using the same cohort has reported a stronger relationship between exposure to job-strain and incident diabetes among women, but not among men, over an 18 year follow-up [6]. The Swedish study also reported a stronger relationship between job control and social support (albeit outside work) and an increased incidence of diabetes over a 10 year follow-up period among women, but not among men [8]. Taken together these studies suggest that iso-strain may be an important psychosocial determinant of diabetes risk, in particular among women, although findings to date have been mixed [5]. Further, only one of the studies above was based on a representative population cohort [8], with the remaining studies being either occupation or sector specific.

The objectives of this study were to examine the relationship between dimensions of the psychosocial work environment and the subsequent incidence of diabetes over a 9 year follow-up in a representative population cohort of men and women in Ontario, Canada. Given the limited research examining the relationship between the psychosocial work environment and diabetes among representative population cohorts, this objective addressed a research area where currently very little is known. We hypothesized that exposure to high psychological demands and low job control (job strain), as well as iso-strain (the combination of job strain and low social support) would be associated with an increased risk of diabetes, in particular among women.

Methods

This study used secondary data from Ontario respondents to the 2000–01 Canadian Community Health Survey (CCHS) linked to the Ontario Health Insurance Plan database (OHIP) covering physician services as well as the Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD) for hospital admissions at the individual level. Follow-up information from the OHIP and CIHI-DAD databases were available up to 31 March 2010. For the purpose of this analysis we focused on labour market participants aged 35 to 60 at cohort inception, who had not been previously diagnosed with diabetes, were not self-employed and had worked more than 10 h per week for more than 20 weeks in the last 12 months (n = 7443). Approval for the secondary data analyses was obtained through the University of Toronto, Health Sciences Ethics committee.

Our main outcome was incident diabetes, which was classified as respondents with one hospital admission with a diabetes diagnosis, or two physician service claims with a diabetes diagnosis within a 2 year period. The sensitivity and specificity for this algorithm with chart-recorded medical diabetes diagnosis has been reported as 86 and 97%, respectively [10]. Although the administrative data available in the OHIP database cannot distinguish between type 1 and type 2 diabetes, given the high prevalence of type 2 diabetes, in particular among older cohorts, this restriction is unlikely to impact on our results [11].

Our primary independent variables were measures of the psychosocial work environment that included job control, psychological demands and social support; each assessed by an abbreviated measure of the Job Content Questionnaire [12]. This instrument consists of five questions assessing job control, two questions assessing psychological demands at work and three assessing social support (a list of these questions is provided in Appendix One, available as Supplementary data at *Occupational Medicine* Online). The internal consistency of these questions has previously been reported as 0.34 for psychological demands, 0.61 for job control and 0.22 for social support [13]. While these alpha estimates are low, they are to be expected given the small number of questions capturing a broad concept [14]. These constructs were examined separately as well as in combination to form measures of job strain and iso-strain. Job strain was defined as the combination of high psychological demands and low job control based on median splits of each dimension. Iso-strain was defined as high job strain combined with low social support [9].

Models were additionally adjusted for shift schedule (regular, evening or night, rotating, and other) and self-reported occupational physical activity (usually sits; stands or walks about quite a lot, but does not carry or lift things; usually lifts or carries light loads, or has to climb stairs or hills often; does heavy work or carries very heavy loads) given that each of these measures may be potentially linked to an increased risk of diabetes [15,16]. Models also included whether the respondent had worked less than 40 weeks in the last 12 months (yes/no) and whether the respondent was working in multiple jobs (yes/no).

Socio-demographic variables included in our models included immigration status (length of time in Canada); ethnicity (White, South Asian, East Asian and other minorities); age (grouped); gender; marital status; activity limitations at work; having a

major depressive episode in the 12 months prior to the baseline survey (assessed using the Composite International Diagnostic Interview-Short Form for Major Depression [17,18]; living location (urban or rural); highest level of education completed; and the self-reported presence of heart disease or hypertension at cohort inception (yes/no).

We examined potential mediation between psychosocial work stress measures and diabetes through two pathways: body mass index (BMI) and health behaviours.

BMI was calculated using self-reported weight and height. BMI scores were grouped into the following four groups: underweight (BMI <20.0); normal weight (BMI = 20.0–24.9); overweight (BMI = 25.0–29.9) and obese (BMI >30.0).

Four health behaviour measures are contained in the CCHS: leisure time physical activity in the previous 3 months (inactive, moderately active, active); smoking status (never, former, occasional, 1 to 10 cigarettes per day, more than 10 cigarettes per day); alcohol consumption (non-drinker; non-binge drinker; binge drinker less than once per month; binge drinker once a month or more); and daily fruit and vegetable consumption (five or more portions a day; less than five or more portions a day).

A series of logistic models including age, gender, length of time in Canada, ethnicity and education examined the probability of missing responses for work information or other covariates. Older respondents, those who were female, South Asian, and recent immigrants were more likely to be missing responses on work variables. Females were also more likely to be missing information on other covariates.

Cox-proportional hazard regression models examined the relationship between our variables describing dimensions of work and the probability of diabetes over the 9 year follow-up period. Initial models examined associations between dimensions of work and diabetes after adjustment for all potential covariates. A second model included an adjustment for BMI and a third model additionally adjusted for health behaviours (as well as BMI) as potential mediators in the relationship between the psychosocial work environment and diabetes. All models were conducted separately for men and women given the previous differences noted in diabetes incidence across the psychosocial work environment [3,8]. We did not examine if the effects of our main independent variables on diabetes risk differed across other study variables. To account for the complex sample design of the CCHS, in line with guidelines from Statistics Canada, the confidence intervals around each point estimate were adjusted using a bootstrap technique [19]. All analyses were weighted to account for the probability of selection into the original sample and non-response.

Results

Our original sample of 35- to 60-year-old non-self-employed labour market participants totalled 8663. Of this sample, 356 respondents (4.1%) were defined as having diabetes at baseline using either self-reported information from the CCHS, or medical information from the OHIP, and were removed from the sample. An additional two respondents were missing information on self-reported diabetes at baseline, so could not be included, leaving a sample of 8305 respondents free of diabetes. Of this sample, 425 (5.1%) were missing information on measures describing the nature or availability of work, and an additional 437 (5.3%) were missing information on one or more of our covariates of interest (including health behaviours), leaving a final sample of 7443 respondents (89.6% of the original sample) without diabetes.

Table 1 describes diabetes incidence across our main independent variables (results for all study variables are presented in Appendix Two, available as Supplementary data at *Occupational Medicine* Online). Over our study period we had 65 692 person-years of follow-up (median follow-up 8.94 years), with 8.7% of our study population developing diabetes (10.3% of men and 6.9% of women). Larger differences in diabetes incidence were observed across levels of job control and social support among women than among men; larger differences in diabetes incidence were observed across psychological demands among men than women. However, in only one instance were these differences in our hypothesized direction. As predicted, low job control (among women) was associated with higher incidence of diabetes. However, contrary to our predicted hypotheses, low psychological demands (among men) and high social support (among women) were also associated with higher incidence of diabetes. No differences were observed among high job strain for either men or women, or for iso-strain.

Table 2 presents the hazard ratios associated with dimensions of work and diabetes in a series of nested models adjusted for different potential confounders and mediators stratified by gender. Given that no relationships for job strain and iso-strain were observed in Table 1, Table 2 only presents separate dimensions of the psychosocial work environment (results for high strain work and iso-strain are available on request). Among men no relationship was observed between any measure of the psychosocial work environment and risk of incident diabetes. Among women we observed an increased risk of diabetes among those with low job control. Estimates for low social support in our female sample indicated a protective effect for low support on diabetes risk. We also estimated the population attributable fraction of diabetes in our final fully adjusted model using the general formula: $PAF = pd \times [(HR_{adj} - 1)/HR_{adj}]$; where PAF = population attributable fraction; pd = prevalence of each variable in the population with diabetes; and

Table 1. Diabetes incidence across main study variables, stratified by gender

	Males	Females
	Diabetes incidence *n* (%)	Diabetes incidence *n* (%)
Total sample	3691 (10.3)	3752 (6.9)
	Main independent variables	
Job control		
1st quartile (high)	1247 (9.3)	912 (4.6)
2nd quartile	1019 (10.3)	1023 (7.2)
3rd quartile	701 (12.5)	826 (5.6)
4th quartile (low)	724 (10.0)	991 (9.7)
Psychosocial demands		
1st quartile (high)	545 (7.9)	771 (6.2)
2nd quartile	1274 (9.5)	1283 (7.5)
3rd quartile	1017 (10.6)	1006 (5.6)
4th quartile (low)	855 (12.8)	692 (8.3)
Social support		
1st quartile (high)	542 (8.9)	553 (10.6)
2nd quartile	1210 (10.8)	1312 (6.8)
3rd quartile	1288 (10.3)	1200 (5.7)
4th quartile (low)	651 (10.8)	686 (6.0)
High job strain (high psych demands/low job control)		
No	3043 (10.3)	2884 (6.8)
Yes	648 (10.7)	868 (7.0)
Iso-strain (high job strain/low social support)		
No	2813 (10.0)	2695 (6.7)
Yes	878 (11.3)	1057 (7.3)

Ontario respondents to the CCHS, 2000–01, aged 35 to 60 years of age, who were working more than 10 h per week, more than 20 weeks in the last 12 months.

HR_{adj} is the hazard ratio from the fully adjusted model [20]. The PAF associated with low job control among women was 19%, which was above all PAFs for health behaviours (smoking, drinking, physical activity and fruit and vegetable consumption) in our final model but below those for being obese (PAF = 42%) (results not presented but available on request).

Discussion

In this 9 year longitudinal cohort study, we found that low job control was associated with an increased risk of diabetes among women, but not among men. We also found, counter to our expectations, that low levels of social support were associated with a protective effect on diabetes incidence among women. Adjustment for baseline measures of BMI and health behaviours had a minimal impact on these relationships. Based on the hazard ratios across decreasing job control quartiles it appears that in our sample job control and diabetes incidence did not follow a direct gradient, but rather a threshold effect, with the excess risk only present in the lowest job control quartile. Conversely the hazard ratios associated with decreasing quartiles of social support followed a direct gradient with diabetes risk. We did not observe any relationship between any dimension of the psychosocial work environment and risk of diabetes among men.

The results of this study, however, should be interpreted with the following limitations in mind. Our study relied upon administrative health care medical records to determine incident cases of diabetes, leaving the possibility that a proportion of our sample had diabetes, but had not been diagnosed [21]. While undiagnosed diabetes is a concern, we note that there was an increased awareness of, and screening for, diabetes in Ontario. Recent studies estimate that over a 5-year period more than 70% of Ontarians aged over 40 receive a serum blood glucose test [22,23]. We examined the last contact with the health care system across respondents in our sample and found that 99% had contact with the health care system during our follow-up period, with 85% having their last contact in our last 3 years of follow-up. In addition, Ontario has a publicly funded health care system, with limited socioeconomic differences in access to general practitioner care [24,25]. All our covariates were measured at baseline, which limits causal inferences aside from those relating to the temporality between psychosocial work conditions and incident diabetes. Our measures of the psychosocial work environment were abbreviated measures. Although recent work suggests that two-item scales can still assess the same underlying concepts as the full scales [26], this may have introduced unwanted misclassification in our work stress dimensions. We did not have access to

Table 2. Hazard ratios and 95% CIs for risk of incident diabetes over a 9 year follow-up across psychosocial work measures, stratified by gender

	Model One[a]		Model Two[b]		Model Three[c]	
	HR	95% CI	HR	95% CI	HR	95% CI
Men						
Job control						
1st quartile (high)	*ref*		*ref*		*ref*	
2nd quartile	0.96	(0.61–1.51)	0.99	(0.64–1.53)	1.02	(0.67–1.56)
3rd quartile	1.17	(0.74–1.84)	1.25	(0.80–1.95)	1.27	(0.81–1.96)
4th quartile (low)	0.84	(0.48–1.45)	0.94	(0.57–1.55)	0.92	(0.56–1.51)
Psychosocial demands						
1st quartile (high)	*ref*		*ref*		*ref*	
2nd quartile	0.59	(0.33–1.05)	0.65	(0.37–1.15)	0.68	(0.39–1.19)
3rd quartile	0.74	(0.47–1.16)	0.76	(0.49–1.19)	0.76	(0.48–1.19)
4th quartile (low)	0.72	(0.45–1.14)	0.74	(0.46–1.18)	0.77	(0.48–1.23)
Social support						
1st quartile (high)	*ref*		*ref*		*ref*	
2nd quartile	1.02	(0.61–1.70)	0.90	(0.54–1.50)	0.93	(0.56–1.52)
3rd quartile	0.99	(0.56–1.75)	0.88	(0.51–1.54)	0.88	(0.51–1.53)
4th quartile (low)	1.19	(0.68–2.10)	1.06	(0.61–1.83)	1.05	(0.61–1.81)
Women						
Job control						
1st quartile (high)	*ref*		*ref*		*ref*	
2nd quartile	1.51	(0.87–2.61)	1.44	(0.84–2.48)	1.49	(0.86–2.58)
3rd quartile	1.21	(0.64–2.26)	1.14	(0.61–2.15)	1.15	(0.61–2.16)
4th quartile (low)	**2.17**	**(1.23–3.83)**	**2.03**	**(1.15–3.57)**	**2.04**	**(1.15–3.61)**
Psychosocial demands						
1st quartile (high)	*ref*		*ref*		*ref*	
2nd quartile	1.08	(0.56–2.12)	1.03	(0.53–2.00)	1.04	(0.54–1.99)
3rd quartile	1.21	(0.71–2.08)	1.18	(0.69–2.03)	1.19	(0.69–2.06)
4th quartile (low)	0.75	(0.43–1.33)	0.73	(0.42–1.29)	0.76	(0.43–1.33)
Social support						
1st quartile (high)	*ref*		*ref*		*ref*	
2nd quartile	0.57	(0.33–1.01)	0.61	(0.36–1.04)	0.60	(0.35–1.03)
3rd quartile	**0.48**	**(0.27–0.84)**	**0.51**	**(0.29–0.89)**	**0.49**	**(0.28–0.85)**
4th quartile (low)	**0.43**	**(0.23–0.82)**	**0.45**	**(0.24–0.85)**	**0.45**	**(0.24–0.85)**

Ontario respondents to the CCHS 2000–01. *ref* is the reference group for analysis. Estimates significant at $P < 0.05$ are in bold.
[a]Adjusted for age, immigration status, ethnicity, marital status, urban or rural living location, education, heart disease at baseline, hypertension at baseline, depression at baseline, activity limitations at work due to health problems, and other work variables (shift schedule, weeks worked, multiple jobs, physical activity at work).
[b]Additional adjustment for BMI.
[c]Additional adjustment for health behaviours (smoking, alcohol, leisure time physical activity and fruit and vegetable consumption).

information on some potentially important confounders such as family history of diabetes. Our inability to distinguish between type 1 and type 2 diabetes may have attenuated some of the associations reported in this paper as the relationship between the work environment and each type of diabetes may differ.

Our study also has a number of strengths, including a large representative data source with many important variables. We were able to accurately estimate the time between our baseline interview and diabetes diagnosis by linking to health care records, rather than relying on the time between survey cycles. These strengths allowed for one of the first prospective examinations of the relationships between working conditions and diabetes in Canada.

Our findings are somewhat consistent with the only other population-based study in this research area—that of Norberg and colleagues among a Northern Swedish population [8]. In this study, an elevated risk of diabetes was also associated with low job control among women, but not among men, while no statistically significant relationship was observed between psychological demands and diabetes risk for either men or women. However, in this study an interaction was also observed between level of job control and social support, with the impact of job control much greater for female respondents with low non-work-specific emotional support. In our study, we found that female respondents with low workplace support had a reduced risk of diabetes, with no interaction between job strain and social support. These differences may be due to the different concepts of social support measured in our study and the study from Norberg, or due to underlying differences in the populations from

which each sample was drawn (Northern Sweden versus Ontario). The lack of relationships between Karasek and Theorell's demand-control components among men is consistent with other studies in this area [3,6,7], with Kumari and colleagues reporting stronger relationships between effort-reward imbalance [27] and diabetes among men in their analyses [7]. A direct comparison of our results with the previous two studies by Heraclides [3,6] is hampered by the Heraclides' papers focusing only on white (Caucasian) British civil servants. The reason for removing non-Caucasian respondents in these two studies was to address the potential confounding effect of non-white ethnicity (in particular South Asian ancestry) on the relationship between work stress and diabetes [28,29]. Following a similar approach in our study would have created a hypothetical population sample, no longer representative of the Ontario labour market [30].

The most surprising finding in our paper was the protective effect of low social support (initially hypothesized as a risk factor) on diabetes risk among women. To explore this finding, we ran a post-hoc regression model with each of our three social support items included as separate variables. In this model, a protective effect on diabetes incidence was only observed for lack of supervisor support (results not presented but available on request), with no relationship observed for exposure to hostility or conflict or co-worker support. We are not aware of any previous studies that have documented a similar pattern between social support at work and diabetes risk. We believe it is unlikely there is a plausible direct biological pathway linking lack of supervisor support with a decreased risk of diabetes. Potential indirect pathways linking low levels of supervisor support to decreased diabetes incidence may be through subsequent positive changes in health behaviour patterns (e.g. increased physical activity) as an active coping mechanism, weight loss in response to stress, or through an increased likelihood of subsequent employment changes. Future work, using repeated measures of working conditions and health behaviours, should examine the relationship between weight gain, weight loss, health behaviour patterns and high work stress produced as a result of low social support from supervisors at work among women to determine if this result is an anomaly of our sample.

In conclusion, this prospective study demonstrated that low job control is associated with an increased risk of diabetes among women in Ontario. Given the rising prevalence of diabetes in Ontario, researchers and population health decision makers should further examine the importance of job control in the aetiology of diabetes among female labour market participants. We also observed a protective relationship between low social support at work, in particular from supervisors, and diabetes risk. More research is required to better understand the potential importance of this pathway.

Key points

- The relationship between work stress and diabetes has not been well examined to date.
- In our representative sample of the Ontario population, low job control was associated with an increased risk of diabetes among female, but not among male, labour market participants. Contrary to our expectations, low social support at work was associated with a protective effect on diabetes risk among women.
- Job control could potentially be an important modifiable risk factor to reduce the incident of diabetes among female, but not among male, labour market participants. More research is required to understand the potential importance of our observed relationship between low social support and decreased risk of incident diabetes.

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Conflicts of interest

None declared.

References

1. Lipscombe LL, Hux JE. Trends in diabetes prevalence, incidence, and mortality in Ontario, Canada 1995–2005: a population-based study. *Lancet* 2007;**369:**750–756.
2. Chandola T, Brunner E, Marmot MG. Chronic stress at work and metabolic syndrome: prospective study. *Br Med J* 2006;**332:**521–525.
3. Heraclides A, Chandola T, Witte DR, Brunner EJ. Psychosocial stress at work doubles the risk of type 2 diabetes in middle-aged women: Evidence from the Whitehall II study. *Diabetes Care* 2009;**32:**2230–2235.
4. McEwen B. Protective and damaging effects of stress mediators *N Eng J Med* 1998;**338:**171–179.
5. Cosgrove MP, Sargeant LA, Caleyachetty R, Griffin SJ. Work-related stress and Type 2 diabetes: systematic review and meta-analysis. *Occup Med (Lond)* 2012;**62:**167–173.
6. Heraclides A, Chandola T, Witte DR, Brunner EJ. Work stress, obesity and the risk of Type 2 diabetes:

gender-specific bidirectional effect in the Whitehall II study. *Obesity* 2012;**20:**428–433.
7. Kumari M, Head J, Marmot MG. Prospective study of social and other risk factors for incidence of type 2 diabetes in the Whitehall study. *Arch Intern Med* 2004;**164:**1873–1880.
8. Norberg M, Stenlund H, Lindah B, Andersson C, Eriksson JW, Weinehall L. Work stress and low emotional support is associated with increased risk of future type 2 diabetes in women. *Diabetes Res and Clin Pract* 2007;**76:**368–377.
9. Johnson JV, Hall EM. Job strain, work place social support, and cardiovascular disease: A cross-sectional study of a random sample of the Swedish working population. *Am J Public Health* 1988;**78:**1336–1342.
10. Hux JE, Ivis F, Flintoft V, Bica A. Diabetes in Ontario: Determination of prevalence and incidence using a validated administrative data algorithm. *Diabetes Care* 2002;**25:**512–516.
11. American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabetes Care* 2005;**28:**S37–S42.
12. Karasek R, Theorell T. *Healthy Work: Stress Productivity and the Reconstruction of Working Life*. New York: Basic Books Inc., 1990.
13. Wilkins K, Beaudet MP. Work stress and health. *Health Rep* 1998;**10:**47–62.
14. Streiner DL. Being inconsistent about consistency: When coefficient alpha does and doesn't matter. *J Pers Assess* 2003;**80:**217–222.
15. Wang XS, Armstrong MEG, Cairns BJ, Key TJ, Travis RC. Shift work and chronic disease: the epidemiological evidence. *Occup Med (Lond)* 2011;**61:**78–89.
16. van Uffelen JGZ, Wong J, Chau JY, *et al.* Occupational sitting and health risks. A systematic review. *Am J of Prev Med* 2010;**39:**379–388.
17. Kessler RC, Ustun TB. The World Mental Health (WMH) Survey Initiative version of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI). *Int J Methods Psychiatr Res* 2004;**13:**93–121.
18. Wade T, Cairney J. Age and depression in a nationally representative sample of Canadians: A preliminary look at the National Population Health Survey. *Can J Public Health* 1997;**88:**297–302.
19. Yeo D, Mantel H, Liu TP. *Bootstrap Variance Estimation for the National Population Health Survey*. Baltimore; 778–783.
20. Hennekens CH, Buring JE. Measures of disease frequency and association. In: Mayrent SL, ed. *Epidemiology in Medicine*. Toronto: Little, Brown and Company, 1987; 54–98.
21. Young TK, Mustard CA. Undiagnosed diabetes: does it matter? *CMAJ* 2001;**164:**24–31.
22. Wilson SE, Lipscombe LL, Rosella LC, Manuel DG. Trends in laboratory testing for diabetes in Ontario, Canada 1995-2005: A population-based study. *BMC Health Serv Res* 2009;**9:**4.
23. Wilson SE, Rosella LC, Lipscombe LL, Manuel DG. The effectiveness and efficiency of diabetes screening in Ontario, Canada: a population-based cohort study. *BMC Public Health* 2010;**10**.
24. Curtis LJ, MacMinn WJ. Health care utilization in Canada: Twenty-five years of evidence. *Canadian Public Policy* 2008;**34:**65–87.
25. Glazier RH, Agha MM, Moineddin R, Sibley LM. Universal health insurance and equity in primary care and specialist office visits: A population-based study. *Ann Fam Med* 2009;**7:**396–405.
26. Fransson EI, Nyberg T, Heikklia K, *et al.* Comparison of alternative versions of the job demand-control scales in 17 European cohort studies: the IPD-Work consortium. *BMC Public Health* 2012;**12:**62.
27. Siegrist J. Adverse health effects of high-effort/low-reward conditions. *J Occup Health Psychol* 1996;**1:**27–41.
28. Gerstein HC, Anand S, Yi QL, *et al.* The relationship between dysglycemia and atherosclerosis in South Asian, Chinese, and European individuals in Canada—A randomly sampled cross-sectional study. *Diabetes Care* 2003;**26:**144–149.
29. McKeigue PM, Shah B, Marmot MG. Relation of central obesity and insulin resistance with high diabetes prevalence and cardiovascular risk in South Asians. *Lancet* 1991;**337:**382–386.
30. Savitz DA. *Interpreting Epidemiological Evidence: Strategies for Study Design and Analysis*. New York: Oxford University Press, 2003; 137–161.