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Original Article

Heart Disease and Occupational Risk Factors in the Canadian Population: An Exploratory Study Using the Canadian Community Health Survey

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ABSTRACT

Background: The objective of this study is to find temporal trends in the associations between cardiovascular disease and occupational risk factors in the context of the Canadian population.

Methods: Population data were analyzed from the Canadian Community Health Survey (CCHS) collected between 2001 and 2014 for trends over time between heart disease and various occupational risk factors: hours worked, physical exertion at work, and occupation type (management/arts/education, business/finance, sales/services, trades/transportations, and primary industry/processing).

Results: We found no significant difference in the average number of hours worked/wk between individuals who report having heart disease in all years of data except in 2011 ($F_{1,96} = 7.02, p = 0.009$) and 2012 ($F_{1,96} = 8.86, p = 0.004$). We also found a significant difference in the degree of physical exertion at work in 2001 ($F_{1,79} = 7.45, p = 0.008$). There were statistically significant results of occupation type on self-reported heart disease from 2003 to 2014.

Conclusion: Canadian data from the CCHS do not exhibit a trend toward an association between heart disease and the number of hours worked/wk. There is an association between heart disease and physical exertion at work, but the trend is inconsistent. The data indicate a trend toward an association between heart disease and occupation type, but further analysis is required to determine which occupation type may be associated with heart disease.

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1. Introduction

Globally, cardiovascular disease is one of the leading causes of death, accounting for the largest proportion (46%) of deaths worldwide caused by noncommunicable diseases in 2012 [1]. Overall, ischemic heart disease was the number one cause of death in the world. In Canada, heart disease was the second leading cause of death in 2012 [2]. There is increasing evidence that occupational health variables may contribute to higher risks of cardiovascular disease.

The majority of Canadians work full-time. In 2014, 66% of Canadians aged 17 years to 64 years were employed full-time, defined as working at least 30 hours/wk [3]. As much as 74% of males and 57% of females were employed full-time. A Canadian study found

that 60% of employees worked more than 45 hours/wk. The typical employee, particularly knowledge workers, spends 50.2 hours in work-related activities/wk [4]. Long working hours have been associated with an elevated risk of cardiovascular disease. In two systematic reviews and meta-analyses, long working hours were found to be associated with an increased risk of incident coronary heart disease [5,6]. There was approximately a 1.4- to 1.8-fold increased probability of coronary heart disease associated with long working hours [6]. In addition, U.S. employees who worked an average of 46 hours or more/wk for at least ten years had an increased risk of cardiovascular disease [7]. The risk of cardiovascular disease increased by 16% for employees who worked 55 hours/wk compared with 45 hours/wk for at least ten years. The risk further increased to 35% if an employee worked an additional

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15 hours longer. For every additional hour worked/wk for at least ten years, there was a 1% increase in the risk of cardiovascular disease.

A Canadian study found that approximately 60% of participants were employed in managerial or professional occupations [4]. Approximately half of the participants worked in the public sector, a third worked in the not-for-profit sector, and 10% worked in the private sector. This is important because occupation type has been found to be associated with a higher risk of cardiovascular disease, such as shift work. Vyas et al [8] conducted a systematic meta-analysis and found that all shift work schedule types, except evening shifts, are associated with a 24% increased risk of myocardial infarction, coronary mortality, or hospital admission due to coronary artery disease. Vetter et al [9] found that female registered nurses who worked rotating night shifts for many years had a small, but significantly increased risk of incident coronary heart disease. Other studies on shift work as a risk factor found that it is associated with a 30–50% increase in the risk of cardiovascular disease [10].

A study conducted by the Centers for Disease Control and Prevention found that employees working in the community and social services, transportation and material moving, and architecture and engineering sectors had the highest prevalence of meeting two or fewer of the seven ideal cardiovascular health behaviors [11]. These were behaviors and modifiable factors identified by the American Heart Association that would improve cardiovascular disease outcomes. It is interesting to determine whether disparities in cardiovascular health and occupational groups are observed in Canada as well.

Job strain is associated with a small increased risk of coronary heart disease [12]. In one meta-analysis, Kivimäki and Kawachi [5] found that workers who experienced stress factors at work, including long hours at work, job insecurity, and job strain, have a 10–40% increase in the risk of cardiovascular disease compared with those who did not experience these work stressors. A recent case–control study involving 12,461 participants from 52 countries found that physical exertion increased an individual's odds of experiencing an acute myocardial infarction by 2.31 times [13]. The study suggests that heavy physical exertion may be a trigger of acute myocardial infarction, rather than any physical activity. Despite the results of this study, it is currently unknown whether an association exists between physical exertion at work and heart disease. Collectively, these findings suggest that there may be a relationship between heart disease and occupational factors.

The purpose of this study was to examine the relationship between heart disease and occupational factors in a Canadian population. We analyzed data from the Canadian Community Health Survey (CCHS) collected between 2001 and 2014 for trends over time between occupational risk factors and heart disease. A temporal trend would indicate a persistent relationship, and therefore further support an association between heart disease and employment. Associations observed in heart disease and occupational health factors will be substantial for employers and other stakeholders to engage in health promotion and cardiovascular disease prevention strategies in the workplace.

2. Materials and methods

Health and occupational data from the Canadian population were collected for the CCHS and were used in this study. The Canadian Institute for Health Information, Statistics Canada, and Health Canada jointly created the CCHS to collect health-related information about the Canadian population to be used for policy-making, program development, and population health research. The CCHS is a cross-sectional survey that comprises questions

related to health status, use of health-care services, and health-related behaviors. The survey is distributed annually to private residences in 117 health regions located across all 10 provinces and three territories. The collection methods for the CCHS are telephone and personal interviews. The survey is targeted toward individuals who are at least 12 years of age except for some groups. Approximately 98% of the Canadian population over 12 years of age is represented in this survey. Estimates of key health indicators are validated by comparison with data from previous years. We used data collected in 2001, 2003, 2005, 2007–2008, 2009–2010, 2012, and 2013–2014.

2.1. Data analysis

Data analysis was completed in Stata/MP 14 (StataCorp LLC, College Station, TX, USA), with “svyset” commands to apply sampling weights and to adjust for clustering of observations within the health region stratification. We examined the relationships between self-reported heart disease and three occupational factors: physical exertion, the number of hours worked/wk, and type of occupation. A linear regression was performed with self-reported heart disease as the predictor variable and physical exertion at work as the outcome variable. Data on physical exertion at work were available for 2001, 2003, 2005, and 2007–2008. The degree of physical exertion is rated on a scale from 0 to 4, with higher scores indicating greater work stress and physical efforts. A second linear regression was performed with self-reported heart disease as the predictor variable and number of hours worked/wk as the outcome variable. The CCHS collected data on the total number of hours worked for respondents with one or more jobs. Data on self-reported heart disease and the number of hours worked/wk were available for all survey years. Logistic regression was performed with occupation type as the predictor variable and self-reported heart disease as the outcome variable. Data on occupation type were available for 2001, 2007–2008, 2009–2010, 2012, and 2013–2014. Occupation types or areas included management/education, business/finance; sales/customer service; trades/transportation; and primary sector. The management, education, business, and finance occupation category was chosen as the reference group as it had the highest number of cases in CCHS compared with the other occupation groups. Logistic regression was performed, and self-reported heart disease (Yes or No) was the dependent variable. Six variables were included as independent variables in the demographics and related-factors model (Table 1).

3. Results

Across all the years of data collection, the majority of respondents were working full-time and female. As a general trend, the number of participants who endorsed working part-time has been declining since 2001. The mean self-reported heart disease was 6.8 with a standard deviation of 0.42.

3.1. Heart disease and hours worked/wk

In 2011, there was a statistically significant result of self-reported heart disease on the number of hours worked/wk ($F_{1,96} = 7.02, p = 0.009$). Again, in 2012, there was a statistically significant result of self-reported heart disease on the number of hours worked/wk ($F_{1,96} = 8.86, p = 0.004$). Respondents with self-reported heart disease had significantly lower mean weekly hours than those who did not self-report having heart disease. Mean hours worked by individuals with self-reported heart disease is provided in Table 2.

Table 1
Summary of demographic characteristics. Percentages of the total sample size are provided

Variable	2001	2003	2005	2007–2008	2009–2010	2012	2013–2014
Sample size	130,880	42,592	132,221	131,061	124,188	61,707	127,462
Males	46.2%	45.1%	45.8%	45.5%	45.5%	44.7%	44.9%
Females	53.8%	54.9%	54.2%	54.5%	54.5%	55.3%	55.1%
Age (y)							
12–19	13.4%	13.6%	12.3%	11.1%	11.7%	10.8%	10.3%
20–29	12.5%	10.9%	12.8%	11.4%	12.1%	11.3%	10.8%
30–39	17.4%	15.0%	15.4%	14.5%	13.2%	11.9%	11.5%
40–49	18.5%	15.5%	15.4%	14.8%	13.1%	11.9%	10.7%
50–59	14.2%	17.4%	15.8%	17.2%	16.8%	17.0%	17.0%
60–69	10.7%	13.5%	12.9%	14.5%	15.9%	18.3%	19.3%
70–79	8.9%	9.8%	9.9%	10.5%	10.8%	11.7%	12.8%
>80	4.4%	4.4%	5.4%	6.0%	6.4%	6.9%	7.5%
Employment status*	59.7%	57.8%	61.3%	60.8%	59.4%	41.5%	56.3%
Full-time	51.1%	45.7%	44.5%	43.7%	41.2%	40.0%	38.5%
Part-time	11.6%	10.0%	9.2%	9.2%	9.8%	9.7%	9.6%
Employed in the last week	52.3%	43.9%	49.7%	49.1%	47.2%	46.0%	44.5%
Self-reported heart disease	6.1%	7.1%	6.5%	6.7%	6.9%	7.2%	7.3%

* Employment status 12 months previous to survey completion.

Table 2
Number of work hours/wk and self-reported heart disease

Year	Sample size	Mean ± standard error	<i>p</i>
2001	1,756	39.93 ± 0.55	0.888
2003	629	38.946 ± 0.74	0.662
2005	1,648	40.91 ± 0.87	0.462
2007	1,681	40.37 ± 0.49	0.390
2008	893	39.62 ± 0.96	0.869
2009	1,678	39.22 ± 0.63	0.706
2010	829	39.33 ± 0.95	0.819
2011	1,720	38.39 ± 0.48	0.009
2012	835	37.28 ± 0.78	0.004
2013–2014	1,782	40.03 ± 0.83	0.579

3.2. Heart disease and physical exertion

In 2001, there was a statistically significant result of self-reported heart disease on physical exertion at work ($F_{1,79} = 7.45$, $p = 0.008$). In 2003, there was no statistically significant result of self-reported heart disease on physical exertion at work ($F_{1,3} = 0.05$, $p = 0.843$). In 2005 also there was no statistically significant result of self-reported heart disease on physical exertion at work ($F_{1,21,401} = 1.69$, $p = 0.193$). In 2007–2008, again, there was no statistically significant result of self-reported heart disease on physical exertion at work ($F_{1,8011} = 1.00$, $p = 0.317$; Table 3).

3.3. Heart disease and occupation type

In 2001, there was an overall statistically significant result of occupation type on self-reported heart disease ($p > F = 0.0075$; see Table 4). The following occupations were significantly different ($p < 0.05$) compared with management occupations in 2001: technologist [odds ratio (OR): 0.63, 95% confidence interval (CI): 0.41–0.97] and sales/services (OR: 0.79, 95% CI: 0.65–0.97). In 2007–2008, there was no statistically significant result of

Table 3
Rate of physical exertion and self-reported heart disease

Year	Sample size	Mean ± standard error	<i>p</i>
2001	1,256	2.00 ± 0.03	0.008
2003	51	2.38 ± 0.51	0.843
2005	506	1.77 ± 0.06	0.193
2007–2008	185	1.96 ± 0.04	0.317

occupation type on self-reported heart disease ($p > F = 0.1534$). In 2009–2010 also there was no statistically significant result of occupation type on self-reported heart disease ($p > F = 0.0511$). However, trades/transportation/equipment occupations were significantly different (OR: 1.44, 95% CI: 1.07–1.93, $p = 0.016$) compared with management occupations. In 2012, there was no statistically significant result of occupation type on self-reported heart disease ($p > F = 0.0786$). In 2013–2014, there was a statistically significant result of occupation type on self-reported heart disease ($p > F = 0.0376$). Trades/transportation/equipment occupations were significantly different (OR: 1.52, 95% CI: 1.18–1.97, $p = 0.002$) compared with management occupations. In two of the five CCHS cohorts, occupations in trades/transportations/equipment had significantly higher odds ($p < 0.05$) of heart disease compared with management occupations within the same cohort.

4. Discussion

The purpose of this study was to examine the associations between cardiovascular disease and occupational risk factors, specifically the number of hours worked/wk, physical exertion at work, and occupation type, in the Canadian population. A significant statistical relationship was found between heart disease and the number of hours worked/wk in all survey years except for the 2011 and 2012 cohorts. There was also a statistically significant relationship between heart disease and the degree of physical exertion at work in 2001. Occupation type was found to have a statistically significant result in 2001, 2009–2010, and 2013–2014.

Heart disease was associated with the number of hours worked/wk in the 2011 and 2012 datasets. The result in most years supports findings from other studies that show that longer hours worked are associated with an increased risk of heart disease [3,6,7]. The lack of a statistically significant relationship in other years may be attributed to how heart disease was defined in the different studies compared with the self-reported nature of the data collected in the CCHS. For example, some studies specifically looked at coronary heart disease [5]. The CCHS only asks whether or not the participant has heart disease and does not ask participants to report the specific type. Furthermore, some studies only looked at the incident cardiovascular disease, thus excluding patients who have a chronic disease [5]. Nontraditional work hours may have had an effect on the results of this study; however, due to the nature of the CCHS, this information was not collected. A study on the health disparities in police officers found that nearly half of the police officers worked a nonday shift compared with less than 10% of the US working

Table 4
Odds ratio estimates and 95% confidence intervals of self-reported heart disease as a function of occupation type

Year	Occupation	Sample size	Odds ratio	95% Confidence interval	p
2001	Management	8,283	1.00		
	Professional	12,183	0.86	0.67–1.13	0.293
	Technologist	5,910	0.74	0.41–0.97	0.037*
	Administration/finance/clerical	9,354	0.76	0.75–1.14	0.455
	Sales/services	19,885	0.78	0.65–0.97	0.022*
	Trades/transportation	12,320	1.00	0.77–1.32	0.961
	Farm/forestry/fisheries	5,016	1.30	0.96–1.63	0.090
	Processing/manufacturing	3,850	0.86	0.45–1.21	0.230
	Other	5,753	0.82	0.47–1.06	0.096
2007–2008	Management/arts, education	23,891	1.00		
	Business/finance	12,339	0.95	0.71–1.29	0.768
	Sales/services	16,321	1.03	0.79–1.20	0.780
	Trades/transportation	10,592	1.51	0.95–1.69	0.110
	Primary industry/processing	6,231	1.47	0.93–1.93	0.114
2009–2010	Management/arts, education	21,859	1.00		
	Business/finance	11,638	0.98	0.91–1.42	0.249
	Sales/services	15,245	0.90	0.80–1.18	0.769
	Trades/transportation	9,270	1.41	1.07–1.93	0.016*
	Primary industry/processing	5,521	1.36	0.88–1.80	0.195
2012	Management/arts, education	10,922	1.00		
	Business/finance	5,276	0.79	0.45–1.69	0.684
	Sales/services	7,417	0.93	0.53–1.08	0.125
	Trades/transportation	4,650	1.52	0.67–1.85	0.686
	Primary industry/processing	2,683	1.59	0.94–1.69	0.122
2013–2014	Management/arts, education	21,772	1.00		
	Business/finance	10,407	1.10	0.89–1.50	0.266
	Sales/services	14,988	1.09	0.89–1.34	0.377
	Trades/transportation	8,982	1.61	1.18–1.97	0.002**
	Primary industry/processing	5,659	1.44	0.88–1.58	0.263

* $p < 0.05$.

** $p < 0.01$.

population. It suggested that night-shift work resulted in higher levels of cardiovascular disease, resulting in police officers having one of the poorest cardiovascular disease health profiles of any occupation [14]. Lastly, in this study, we examined the difference in the number of hours worked between participants who had heart disease and those who did not. In this study, the relationship among participants with self-reported heart disease and lower mean weekly work hours warrants future investigation. Another study compared self-reported cardiovascular disease between participants who worked the standard 35–40 hours/wk and those who worked more than 55 hours/wk [5]. The differences in how the variables were defined in the CCHS and other studies may contribute to the understanding of this paper's results.

There is an association between physical exertion at work and heart disease in one (2001) of four years of available data. This relationship is in contrast to previous studies that suggest that physical exertion at work is potentially associated with heart disease. A study of taxi drivers found that while they have low rates of physical exertion on the job (3.72 ± 2.11 on a scale of 10), it was not considered to be a predictor of a cardiovascular high-risk profile based on multiple logistic regression analysis [15]. However, brief episodes of physical exertion increase the risk of cardiovascular events, such as ventricular arrhythmia [16]. Further studies are needed to better understand this association and to examine underlying mechanisms that may affect the risk of developing chronic cardiovascular disease compared with an acute cardiovascular event.

Occupation type is associated with heart disease in three of five years of available data, suggesting that a potential relationship exists in the Canadian data. While the results of our study do not provide insight into the underlying mechanisms, stress levels within the workplace may play a role as there is a wealth of research that suggests a link between occupational stress and heart diseases [17]. In a 2010 study, 62% of workers who reported being highly stressed attributed it primarily to work [6]. Furthermore, 53% of these workers held a white-collar position, which includes management and professional occupations,

suggesting that individuals with these types of occupations experience more work-related stress. Our results from the 2001 CCHS found that management occupations had higher levels of self-reported heart disease compared with other types of occupations. Further studies are needed to elucidate why this relationship exists, whether or not stress is the underlying mechanism, and if so, the main sources of stress.

Because the data used in this study were collected from a large sample size during a 13-year span, our findings can expand on the evidence reviewed by Kivimäki and Kawachi [5] on the association between work stressors and cardiovascular disease. Our findings suggest that a relationship may exist between occupation type and heart disease. A weak association between cardiovascular disease and hours worked/wk and physical exertion at work was also found in this study. The results of this study provide evidence for potential associations between certain occupational factors and heart disease in the context of the Canadian population.

4.1. Limitations

There are limitations to using administrative data for statistical purposes. Quality control over the data may be lacking, the data may be incomplete due to missing items or records, the results may be biased due to concepts being interpreted differently (i.e., a concept has not been defined), and a diagnosis of heart disease may not be accurate because it was self-reported without clinical validation. Recall bias of participants regarding past attitudes and behaviors is an important limitation that may have affected the findings from this study. Given the cross-sectional design of the study that utilized prevalent data and the nonrarity of outcomes, multivariable OR estimates may be overestimated. Another limitation is that occupational hazards such as shift work have an effect on cardiovascular disease [18] (e.g., myocardial infarction) but not on heart disease. This study examined heart disease as an outcome variable, but not cardiovascular disease. Therefore, the influence of occupational hazards may be underestimated. Finally, occupational

chemical and physical factors having cardiotoxicities were not evaluated in this study.

The main strength of this study is the robust sample size available across multiple years. It allows researchers to measure various occupational outcomes over time to assess the health of the population.

In the context of the Canadian population, the CCHS data did not demonstrate a trend toward an association between heart disease and the number of hours worked/wk. This conflicts with the findings from other studies. However, these differences may be attributed to the various types of heart disease that were studied or specified. We found an association between heart disease and physical exertion at work, but the trend toward this association was inconsistent and requires further examination. The data indicate that an association may exist between cardiovascular disease and occupation type, but further analysis is required to determine which occupation type may be associated with heart disease. Future studies should be performed to elucidate the relationship between occupation type and work stress levels as risk factors for heart disease. Another area of study should be focused on how nontraditional work hours may affect an individual's risk for heart disease. Policy makers should use these preliminary results to support additional funding that examines cardiovascular disease-prevention interventions at the workplace that specifically address heart disease. Practitioners may also consider expanding their history taking to include questions related to occupational heart disease. The results of this study are important for employers, organizations, and public health agencies to address the overarching issue of increased cardiovascular risk in the workplace by engaging in health promotion and disease-prevention initiatives.

Conflicts of interest

None declared.

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None.

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