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The physical and psychosocial health profile of transit employees by occupational category in Calgary Alberta

By

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ABSTRACT

The research purpose was to investigate differences in the health profile of employees within Calgary Transit, using data collected through a contracted consulting firm. Specifically, we examined the physical and psychosocial health outcomes and Workers Compensation Board (WCB) rates between employees in three transit departments (maintenance, office, and operators/drivers) and between employees classified as blue versus white collar. Secondary analysis of a cross-sectional dataset was conducted using analysis of variance and t-tests. Overall, 18 differences were detected between department categories. Maintenance workers had the greatest health risk, while office workers had the lowest health risk. This trend was also observed when the departments were collapsed into blue and white collar categories. Despite limitations within the survey design, the overall results resemble the well-known social gradient whereby low socioeconomic status is associated with poorer health status. This research serves as a strong starting point for other Canadian studies to build on.

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CHAPTER 1: INTRODUCTION

The workplace is an important yet often overlooked determinant of health (Smith, Frank, & Mustard, 2008). Many determinants of health, including employment, working conditions, income, social status, education, physical and social environments, personal health practices and social support networks (Public Health Agency of Canada, 2001) are related to occupation, and/or operate within a workplace setting. In Canada, approximately 25.8 million people are employed in full or part-time work and the average full-time worker spends approximately one third of his/her adult life at work (Statistics Canada, 2005). It is important, therefore to study the role of the workplace and how job type and occupational classification influence employee health. Jackson (2004) concludes his *Unhealthy Canadian Workplace* chapter by noting an important need for more and better information on workplace related health determinants, because of the lack of systematic evidence in the Canadian context.

The purpose of this research was to investigate the health profile of employees within the public transit sector. Specifically, we examined the physical and psychosocial health outcomes and Workers Compensation Board (WCB) rates between Calgary transit workers by job department (i.e. office, operators/drivers and maintenance) and by hierarchical dichotomy of job category: blue collar vs. white collar. For the purpose of this research a health profile is defined as a summary of health risk related behaviours, measured physical outcomes; such as blood pressure, body composition and blood lipids; as well as psychosocial factors that are known to influence physical health outcomes, health behaviours and workplace injuries. We utilized worksite wellness program data previously collected through a private consulting firm.

The topic of workplace as a determinant of health will be summarized first, including an overview of theories that have been developed for study on this topic. This is followed by a discussion on the issue of occupational hierarchy and status, and an overview of the existing literature on workplace hierarchy and health. This will lead into a focused discussion on health outcomes that are of specific relevance to this thesis, namely, physical and psychosocial health.

CHAPTER 2: BACKGROUND

1. Workplace as a Determinant of Health

In recent years, health research has recognized that many workplace factors can influence employee physical and mental health. Seven dimensions of employment have been identified as having the potential to impact employee health and wellbeing (Jackson, 2004). These are: job and employment security, physical conditions of work, work pace and stress, working time, opportunities for self-expression and individual development at work, participation at work, and work-life balance (Jackson, 2004). These dimensions can directly and indirectly affect physical health through health enabling or disabling behaviours or via psychosocial interactions between the employee and their work environment. For example, physical environment of the workplace, shift time and duration, work pace, and stress levels may impact an employee's ability to practice healthy behaviours such as planning regular physical activity and choosing healthy foods for meals and snacks consumed in the workplace.

The concept of health promotion in the workplace has primarily emerged over the last few decades due to economic motivation. Workplace wellness has traditionally been seen as a means to increase employee productivity and reduce absenteeism (Conrad, Riedel, & Gibbs, 1990; Steinhardt, Greenhow, & Stewart, 1991). Having employees with health risks has been directly linked to increased health care related costs for the employer, while a healthy workforce has been found to be more cost-effective for employers (Ozminkowski, Ling, Goetzel, Bruno, Rutter, Isaac et al., 2002; Stave, Muchmore, & Gardner, 2006). As a result, more employers are implementing health promotion and health surveillance programs in the workplace to improve their bottom line. In one example, an employer that

implemented a health and wellness program yielded an average cost savings of $613 per employee (Stave et al., 2006).

2. The Workplace Physical and Social Environment

Different jobs have different exposures to physical and social influences on health and personal health practices. The physical workplace environment includes: the air, water, surrounding community and roads, all of which can contribute to good health (Public Health Agency of Canada, 2001). The social environment includes: the strength of social support networks, social stability, recognition of diversity, safety, and relationships between employees, supervisors and subordinates (Public Health Agency of Canada, 2001). The different values and norms within a workplace or occupation can also influence employee health and personal health practices (Public Health Agency of Canada, 2003). This influence on behaviour can be understood as the product of three inter-related dimensions: individuals; the social environment; and the interaction between individuals and the social environment (Public Health Agency of Canada, 2003). As a result it is important to study health from both the individual and workplace perspective.

From a physical environment perspective, health can be influenced by toxic exposures as well as by the built environment in which people live, work and play (Public Health Agency of Canada, 2003). The built environment can impact both physical and psychosocial well-being. As an example, the workplace physical environment may impact employee physical activity levels through the location and proximity to resources to complete job tasks as well as the surrounding services and facilities to support intentional and unintentional physical activity during breaks and lunch hours. Further, the physical workplace structure may influence the social interaction between and within colleagues,

supervisors, subordinates and clients/customers. Floor plans and workplace design may inadvertently support specific types and styles of communication and may contribute to stress and other negative outcomes (Heerwagen, Heubach, Montgomery, & Weimer, 1995). For example, the physical working environment may contribute to stress through distraction from co-workers, lack of privacy, noise or whether people send emails or make phone calls to speak with colleagues rather than walk over to speak with them in person.

Personal health practices and coping skills are also important determinants of health. Personal health practices, i.e. behaviours, refers to a person's physical activity level, how well they eat and whether or to what extent they drink alcohol or use tobacco products (Public Health Agency of Canada, 2001). Coping skills refer to how well a person relates to those around them and how well they manage life stresses and challenges (Public Health Agency of Canada, 2001). Personal health practices and coping skills are influenced by social, economic and environmental factors that influence how people make decisions about their health. These determinants include income and social status, social support networks, culture, education, employment and working conditions, as well as physical and social environments (Public Health Agency of Canada, 2001). Consequently, it is important to study personal health practices at the individual level simultaneously with social and physical environmental factors to fully understand the determinants of health and health related behaviours at the workplace level. For example, an employee who works in an industrial area may be less likely to take a walk at lunch because of the surrounding environment and may have fewer healthy food choices available to purchase for snacks and lunches within walking distance of the workplace.

3. Theories of Work and Health

Several theoretical models have been developed to understand the influence of workplace on health. Four models will be discussed: the Job Strain model, the Effort-Reward Imbalance (ERI) model, the Work-Life Conflict model and the Work Hours model (Duxbury & Higgins, 2001; Frone, 2000; Karasek & Theorell, 1990; Siegrist, 1996; Spurgeon, Harrington, & Cooper, 1997).

First, the job strain model has three components as shown in Figure 1: demands, control, and social support (Karasek & Theorell, 1990). Demands refer to the quantity of physical and/or psychosocial work required within a set timeline (Karasek & Theorell, 1990). Control is defined as the worker's discretion or decision latitude over use of skills on the job (Karasek & Theorell, 1990). Social support refers to overall levels of helpful social interaction available on the job from both supervisors and co-workers. High demand, low control and insufficient social support is viewed as the worst combination of these three elements, and can have a negative impact on employee health and productivity outcomes (Bosma, Marmot, Hemingway, Nicholson, Brunner, & Stansfeld, 1997b; Duxbury & Higgins, 2001; Karasek & Theorell, 1990). This combination of factors creates increased pressure and moves the locus of control away from the employee. For example, nurses aids, bus drivers, gas station attendants, food services, telephone operator/dispatchers, labours and janitors are all employees that work in time sensitive environments with low levels of control over their work loads (Karasek & Theorell, 1990). These jobs may also have lower levels of support from their co-workers, supervisors and/or family therefore these occupations have higher job-related strain. Examples of occupations that have lower job strain include: teachers, supervisors, managers, engineers and lawyers

(Karasek & Theorell, 1990). These types of jobs have more control over workload/demand coupled with greater support in place at work and home.

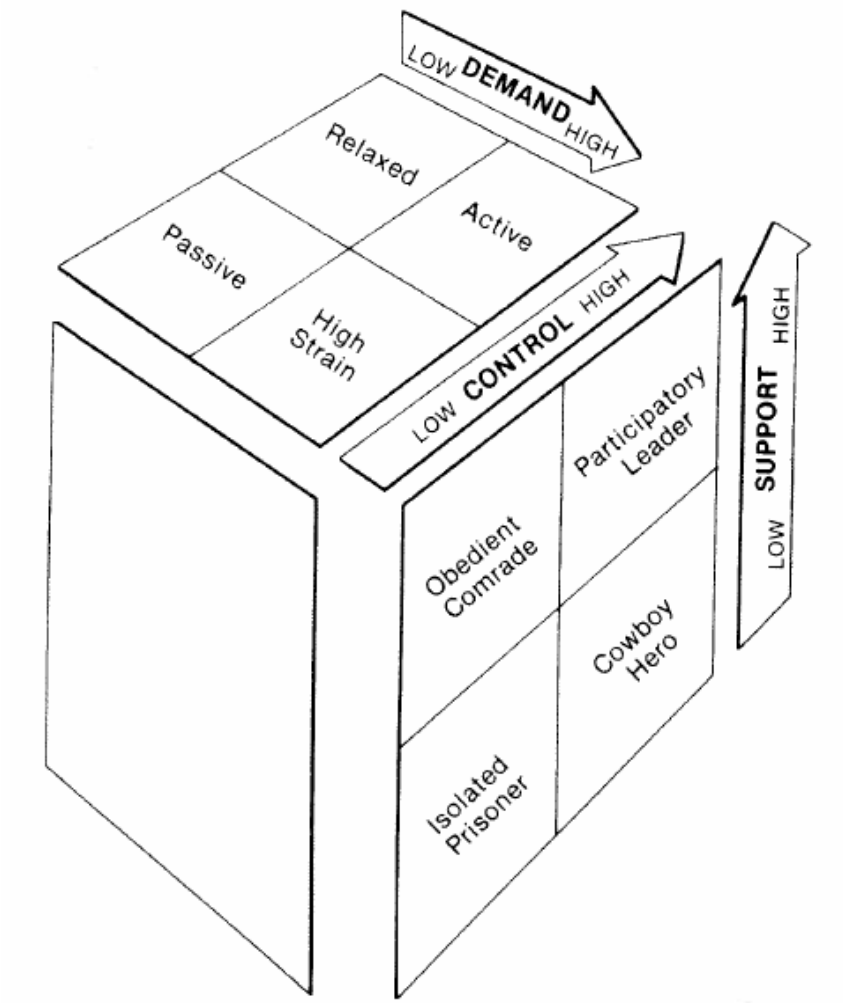

Figure 1. A three dimensional model of the psychosocial work environment.[1]

The second model is the Effort-Reward Imbalance model, (see Figure 2) which has two components: effort and reward; both of which can have intrinsic and extrinsic components. Effort can reflect the actual demands of the job (extrinsic) or the internal perceptions of the worker in the demanding situation (intrinsic) (Siegrist, 1996). Reward refers to occupational gratification resulting from: extrinsic rewards such as money,

[1] Adapted from: *Healthy work: Stress, productivity and the reconstruction of working life.*, by R. Karasek & T. Theorell, 1990, Copyright 1990 by Basic Books, New York.

approval and/or status; or intrinsic rewards such as control, esteem or personal fulfillment (Siegrist, 1996). The combination of effort and reward outlines the health significance of fairly matching employee reward, recognition and compensation to employee effort and employer demand (Siegrist, 1996). An example as outlined by Siegrist (1996) that supports this model is blue collar workers. These workers may experience high effort and low reward (few opportunities for advancement and increased compensation) but the cost of disengagement (such as decreased pay or being laid off) creates an imbalance between reward, effort and demand thereby increases employees' risk of cardiovascular disease (CVD) risk factors and depression (Chandola, Siegrist, & Marmot, 2005; Siegrist, 1996).

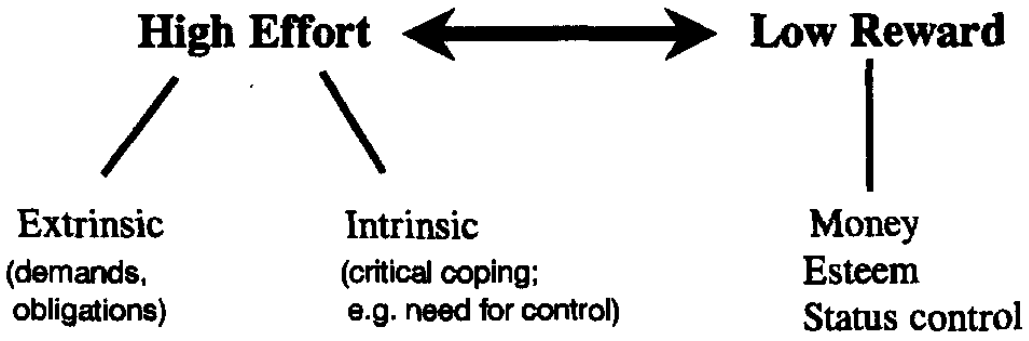

Figure 2. The effort-reward imbalance model at work.[2]

Third, the Work-Life Conflict model discusses how different roles the employee plays outside of work compete for time with work (Duxbury & Higgins, 2001; Karasek & Theorell, 1990). These roles may include: spouse, parent, caregiver, friend, sibling or volunteer. The collective demands from all of the employee's roles can result in either overload (too much to do, too little time) and/or interference (conflicting demands between different roles), thus impacting employee physical and mental health (Duxbury & Higgins, 2001). For example: a working mother may experience conflict between her role as a

[2] Adapted from: (1996). Adverse Health Effects of High-Effort/Low-Reward Conditions, by J. Siegrist, 1996, *Journal of Occupational Health Psychology, 1*, pp. 27-41. Copyright 1996 by the American Psychological Association.

mother and a worker when her child stays home from school sick or when the child's soccer schedule conflicts with work hours.

Lastly, the Work Hours model is based on the observation that duration of work hours can impact employee work-life conflict as well as physical and mental health outcomes (Spurgeon et al., 1997). Further, the time of day or type of shift that an employee works has also been found to impact employee work-life conflict based on how social or anti-social the hours are relative to the employee's social networks (Frone, 2000). For example, a father that has to continuously go to work early and stay late misses out on most of his young child's waking hours and subsequently spends less time with his family than a typically 9 to 5 worker.

In summary, a strong theoretical base in the literature supports workplace as a determinant of health. There is also substantial evidence to support the psychosocial impact of work on the physical and mental health of employees.

4. Health Outcomes

There are many ways to define and think about health. According to the traditional western model of medicine, health is the state of being free from disease, illness or malfunction. This definition is rooted in the belief that understanding the disease process and the body's response to the disease process, will allow medicine to intervene therapeutically (McKeown, 1965). This biomedical approach taken by modern medicine has largely removed contextual factors (e.g., the social environment; characteristics of the workplace) from the study of health and illness. The view of health adopted for this research originates in the holistic definition of health developed in 1948 by the World Health Organization (WHO), namely, "the state of complete physical, mental and social

well-being and not merely the absence of disease or infirmity" (World Health Organization, 1948). Certainly the evolution of this definition over time to incorporate other elements has occurred. For example within the context of health promotion, health is seen as a means to an end which can be expressed in functional terms as a resource which permits people to lead an individually, socially, and economically productive life (World Health Organization, 1998). Further, health is a resource for everyday life, not the object of living. It is a positive concept emphasizing social and personal resources as well as physical capabilities (McLean, 1979; World Health Organization, 1998). This broader perspective on health allows us to examine risk factors related to lifestyle, social class and the workplace. It also follows along with the ecological and population health approaches, which propose that individual determinants of health do not act in isolation, rather, interdependently in a complex interaction that has a far greater effect on health (McLaren & Hawe, 2005).

According to these above perspectives, health is a broad/holistic concept that includes physical, psychological, and social dimensions; and these are interrelated. For the purpose of this research, working definitions for 'physical' and 'psychosocial' health will be provided because these correspond to the outcome measures outlined in the Methods chapter.

Physical health is related to the physical functioning of the body (Thompson Rivers University, 2008). Physical health is measured many ways but some common ways are through assessment of outcomes such as blood pressure, blood lipids, and heart rate; as well as associated behaviours, such as physical activity, diet, smoking, and sleep (Canadian Society of Exercise Physiology, 2003; Canadian Society of Exercise Physiology, 2003; Kesaniemi, Danforth, & Jensen, 2001; Leino-Arjas, Solovieva, Riihimaki, Kirjonen, &

Telama, 2003; US Department of Health and Human Services: Centers for Disease Control and Prevention, 1996; Canadian Society of Exercise Physiology, 2003; Kesaniemi et al., 2001; Leino-Arjas et al., 2003; US Department of Health and Human Services: Centers for Disease Control and Prevention, 1996). Physical health can also be measured through presence or absence of disease or conditions such as cardiovascular disease or obesity. Conversely it can be measured subjectively through self reported health.

Psychosocial health refers to the influence of social factors on an individual's mind or behaviour, and to the interrelation of behavioural and social factors as they relate to health (Oxford English Dictionary, 2008; Thompson Rivers University, 2008). In general, this may refer to self esteem, sense of control, well-being, and social support (Thompson Rivers University, 2008), among others. Psychosocial stress is an important component of health in the workplace. Stress, also known as strain, has been found to arise in the workplace from a number of sources, as discussed above (Jackson, 2004; Karasek & Theorell, 1990). These may include: work-life conflict, work hours, effort reward imbalance, job demand, support and control imbalances and job insecurities (Duxbury & Higgins, 2001; Frone, 2000; Karasek & Theorell, 1990; Siegrist, 1996; Spurgeon et al., 1997). Workplace stress has been linked to increased injuries at work, cardiovascular disease, mental health conditions and other lifestyle related risk factors, such as physical inactivity, smoking, poor diet and excessive alcohol consumption (McLean, 1979).

Physical activity as a lifestyle related risk factor will be examined in the present study and therefore a brief discussion follows. Since 1990 trends of increased body fat composition and decreased fitness levels within the workplace setting, perhaps related to decreased leisure time physical activity, have been identified (Harbin, Shenoy, & Olson, 2006). Historically, this may be related to technological changes such as the integration of

computers in the workplace that assist both manual and non-manual employees. Physical inactivity has been linked to numerous preventable chronic conditions such as hypertension, type 2 diabetes, back pain, cardiovascular disease, obesity, osteoporosis and anxiety (Kesaniemi et al., 2001; US Department of Health and Human Services: Centers for Disease Control and Prevention, 1996). Regular physical activity has many health benefits, as demonstrated in dose-response relationship with triglycerides, blood pressure, body composition and high density lipoprotein (HDL-C) (Canadian Society of Exercise Physiology, 2003), whereby the more physical activity accumulated in a week, the greater improvement observed in the above factors. Based on such evidence, the American College of Sports Medicine, the largest sports medicine and exercise science organization in the world, recommends 30 minutes of physical activity on most days of the week for health benefits (Pate, Pratt, Blair, Haskell, Macera, Bouchard et al., 1995).

A final comment regarding health in the workplace concerns worker's compensation for illness or injury at work. Numerous workplace studies have found that employees that demonstrate one or more of the following risk factors: physical inactivity, obesity, poor sleep, job dissatisfaction, low supervisor support, low social support as well as time spent driving, have increased injury claims, muscular skeletal disorders and/or industrial or motor vehicle accidents (Chau, Mur, Touron, Benamghar & Dehaene, 2004; Gauchard et al., 2006; Harkness, Macfarlane, Nahit, Silman & McBeth, 2004; Krause, Ragland, Fisher & Syme,1998; Krause, Ragland, Greiner, Syme & Fisher, 1997; Krause, Rugulies, Ragland & Syme, 2004; Morken, Mageroy & Moen, 2007; Ostbye, Dement & Krause, 2007; Philip & Akerstet, 2006). Worker's compensation claims thus become relevant to this study. In Alberta alone, there were over 217,000 claims in 2007 and over 223,000 claims in 2006 (Thompson Rivers University, 2008; WCB-Alberta, 2008). Claims

made to WCB range from repetitive strain injuries and falls to fatalities. Since the inception of the Alberta Workers Compensation Board in 1918 over 1.74 million workers have received coverage (Thompson Rivers University, 2008; WCB-Alberta, 2008), thus demonstrating the importance WCB plays in employee health.

5. Socioeconomic Hierarchy within the Workplace

The current available literature on workplace and health cites numerous different ways to classify employees. The classifications used include: white collar / blue collar, skilled / unskilled, manual / non-manual, as well as divisions based on job title or work sector or a derived scales such as the Duncan Socioeconomic Index, British Registrar General's Social Classification, Cambridge Scale of Classification, Goldthorpe class scheme and Canadian National Occupational Classification Scale (Duncan, 1961; Galobardes, Shaw, Lawlor, Smith, & Lynch, 2009; Goldthorpe & Hope, 1974; Goyder & Frank, 2007; Prandy, 1990). Nonetheless, our systematic review of literature, described in more detail below, found varied use of these classifications. Some articles used one dichotomy, for example: white collar/blue collar. Many articles used a combination of two or more of the following: skill level, education level, manager/worker, blue/white collar or professional/non-professional. Other articles used the Duncan index, the Erikson Goldthorpe Portocarero (EGP) social class scheme, and Wright's social class indicators (Borrell, 2004; Schrijvers, 1998).

One conventional dichotomy is blue collar and white collar employees[3]. Blue collar workers typically perform manual labour, may be skilled or unskilled, are compensated hourly, wear a uniform and/or work cloths and work in a trade, construction or service

[3.] The terms White and Blue Collar were kept in this paper as they are commonly used in Workplace Health Promotion and Sociology literature. By no means has this term been used to discriminate again employees.

related industry (Collins Dictionary of Sociology, 2006a; Korda, Strazdins, Broom, & Lim, 2002; Merriam-Webster, 2008a; Morris, Conrad, Marcantonio, Marks, & Ribisl, 1999). Well known examples of blue collar jobs include: cleaners, maintenance workers, trade workers, welders, machine operators, painters, labourers and drivers (Vahtera, 1999; Morris et al., 1999; Turrell et al. 2007). Conversely, white collar workers are known to perform less manual labour, use more mental capacity and they likely have completed a minimum of 1-2 years of post-secondary education, work in an office environment, have salaried compensation and perform clerical, administrative, professional or managerial work (Collins Dictionary of Sociology, 2008; Merriam-Webster, 2008d; Morris et al., 1999; Wu & Porell, 2000). Examples include: physicians, school teachers, nurses, managers, engineers, social workers, accountants, and salespersons (Morris et al., 1999; Vahtera, Virtaen, Kivimäki, & Pentti, 1999; Won, Ahn, Song, Koh, & Roh, 2007). Blue-collar workers are typically considered to hold a lower social status or rank than white-collar workers; (Mills, 1956). Differences between employee classes have been found to be related to remuneration, job prospects and work autonomy (Chandola & Jenkinson, 2000). Lower social classes are also concentrated around least advantaged positions and industries more affected by economic fluctuation and consequently higher levels of unemployment (Eriksen, 2009).

Other literature classifies employees as manual or non-manual based on occupational physical or mental exertion levels involved in their job (Collins Dictionary of Sociology, 2006b). A manual worker is described as someone who performs physical labour with their hands and/or body (Collins Dictionary of Sociology, 2006b). For example an office worker would be classified as non-manual and a construction worker classified as

manual. Such manual and non-manual jobs may or may not require a trained skill at the time of hire, for example a janitor would be considered an unskilled manual worker (trained on the job) and a plumber a skilled manual worker (trained through a formal vocational apprentice program) (Merriam-Webster, 2008c; Merriam-Webster, 2008b; The Hutchinson Unabridged Encyclopedia with Atlas and Weather guide, 2008a; The Hutchinson Unabridged Encyclopedia with Atlas and Weather guide, 2008b). Typically, skilled workers (whether manual or non manual) are more desirable within the job market; they are paid more and have higher education and/or training than unskilled workers (Merriam-Webster, 2008c; Merriam-Webster, 2008b; The Hutchinson Unabridged Encyclopedia with Atlas and Weather guide, 2008a; The Hutchinson Unabridged Encyclopedia with Atlas and Weather guide, 2008b). It is becoming increasingly difficult for unskilled workers to survive on the lower income associated with this level of work (Raphael, 2004). Both manual labour and blue collar work are often associated with lower social prestige since physical tasks and industries most affected by economic fluctuation were historically completed by slaves and people of a lower caste or class in early times (Karlsen & Nazroo, 2006). This is evident in Western Europe and in the United States with the African slave trade during the 15th to 19th centuries as well as the discrimination against the Irish and Jewish people in Western Europe and the discrimination of eastern European and Jewish immigrants in the United States in the 20th century (Karlsen & Nazroo, 2006). This is still observed with illegal Hispanic immigrant workers in the United States.

6. Research on Socioeconomic Hierarchy in the Workplace

An unpublished systematic review of literature was conducted to identify research on socioeconomic hierarchy in the workplace in relation to health and a total of 43 pertinent

studies were identified. Two different key word searches were completed. First, a search based on terms “Blue Collar Workers AND White Collar Workers” resulted in 22 articles. The second search focused on articles that examined social class and health in a workplace setting; this search yielded 21 studies. The search terms for this search were grouped into four concepts (concept A, B, C, D). Concept A was workplace, concept B was social class, concept C was health surveys OR health behaviour OR health status OR attitude to health, and concept D was physical activity (key word) or motor activity. Two combined searches were then conducted. The first was concept A+B+C and the second was concept A+B+D. The inclusion criteria for both the first and second search are outlined in Table 1. The exclusion criteria included: animals, children and seniors, studies earlier than 1988, studies published in languages other than English and studies that only examined one socioeconomic group only, such as only white collar or only blue collar workers.

Table 1. Literature review inclusion criteria.

Population	Intervention	Date	Language	Methodological Design	Reviewed
Human	White vs. Blue Collar comparison	1988-Present	English	Pre-post studies	Peer Review
Employees 18-65				Case Control	Government sponsor/issue
Workplace				Qualitative	
White Collar				Quantitative	
Blue Collar				Prospective Studies	
Grey Collar				Cross-Section Design	
Socio-economic status in workplace					
Multi-cultural workplace					

Employees were classified three different ways within these studies: manual and non-manual, blue and white-collar, skilled and unskilled. None of the studies, however defined these terms, instead examples were listed to describe these terms. Table 2 in Appendix A identifies the author, year of publication, title, purpose and findings of each study examined. The studies reviewed took place at the population or community level as well as in a more local setting including industry specific settings such as in a municipal or health care employer environment.

In general, a social gradient was observed in these studies, whereby lower socioeconomic position was associated with poorer health outcomes, across a range of outcomes including health behaviours, self reported health, coping strategies with stress, as well as injury and sick time away from work. A social gradient refers where “wherever

you stand on the social ladder, your chances of an earlier death are higher than it is for your betters" (Epstein, 1998). This means that life expectancy is shorter and most diseases are more common further down the social ladder in each society (Wilkinson & Marmot, 2003). Marmot (2000) shows that the social gradient in mortality is observed for most of the major causes of death.

With regard to cardiovascular disease risk, those with a lower socioeconomic status had more risk factors for CVD (Armstrong, Strogatz, Barnett, & Wang, 2003; Bennett, 1996; Ihlebaek & Eriksen, 2003; Niknian, Linnan, Lasater, & Carleton, 1991; Nourjah, Wagener, Eberhardt, & Horowitz, 1994; Rose, Kumlin, Dimberg, Bengtsson, Orth-Gomer, & Cai, 2006; Tsutsumi, Kayba, Tsutsumi, & Igarashi, 2001; Wilbur, Naftzger-Kang, Michaels Miller, Chandler, & Montgomery, 1999). However, studies that examined physical activity found mixed results based upon whether occupational physical activity, leisure-time physical activity or both were measured (Burton & Turrell, 2000; Kwak, Kremers, van Baak, & Brug, 2007; Leino-Arjas et al., 2003; Moradi, Nyren, Zack, Magnusson, Persson, & Adami, 2000; Salmon, Owen, Bauman, Schmitz, & Booth, 2000; Schneider & Becker, 2005; Schofield, Badlands, & Oliver, 2005; Steele & Mummery, 2003; Wandell & Roos, 2006; Wilbur et al., 1999; Wu & Porell, 2000). Steele & Mummery (2003), examined occupational physical activity and found that blue collar workers were more active, however when leisure time physical activity was studied, white collar or non-manual employees tended to be more active (Burton & Turrell, 2000; Gillen, Yen, Trupin, Swig, Rugulies, Mullen et al., 2007; Leino-Arjas et al., 2003; Moradi et al., 2000; Schneider & Becker, 2005; Wu & Porell, 2000). Three studies examined both leisure-time and occupational physical activity levels. Two studies of the three found that

when occupational and leisure-time physical activity were combined, there was little difference between occupational categories (Salmon et al., 2000; Schofield et al., 2005; Wilbur et al., 1999). The third did not combine occupational physical activity with leisure-time physical activity, instead they found that these two variables differed by occupational categories (Wilbur et al., 1999). Generally, the studies on physical activity supported health benefits regardless if the energy expenditure was occupational or leisure-time physical activity.

The socioeconomic gradient also existed when it came to occupational injury, sick-time and time away from work with lower socioeconomic groups accumulating more time away from work (Christensen, Labriola, Lund, & Kivimaki, 2008; Strong & Zimmerman, 2005; Vahtera et al., 1999; Won et al., 2007). Gillen et al., (2007) found that the psychosocial workplace factors played a more important role than socioeconomic status with regard to injury risk. With relation to self-reported health, a socioeconomic gradient existed with lower social classes reporting lower self-reported health (Borg & Christensen, 2000; Borrell, Muntaner, Benach, & Artazcoz, 2004b; Ihlebaek & Eriksen, 2003; Korda et al., 2002). However, when working conditions and job control and demand were accounted for, the gradient decreased (Rahkonen, Laaksonen, Martikainen, Roos, & Lahelma, 2006; Schrijvers, vande Mheen, Stronks, & Mackenback, 1998). Psychosocial and job related factors were also found to be more important than SES in relation to injury when musculoskeletal injuries were examined as the outcome measure (Gillen et al., 2007).

Sixteen of these studies were from the United States of America, 18 from Europe, seven from Australia and New Zealand, one from Japan and one from Korea. There were no Canadian studies and to date, no study to the best of the researchers' knowledge has

compared health related factors, risks and/or behaviours between employee socioeconomic stratification categories.

7. The Present Study

The purpose of this study was to examine the health profile of different classifications of employees working in the Public Transit sector in Calgary, Alberta. The health profile included indicators of physical and psychosocial health, based on Health Risk Assessment (HRA) variables and WCB injury claims. Two different ways to classify employees were examined. First, employees were classified by their workplace departments: transit drivers/operators, maintenance workers and office workers. Second, employees were classified as Blue Collar and White Collar workers. This study involved City of Calgary transit employees who had participated in a HRA between the years of 2000 and 2006.

The contributions of this study are three fold. First, it provides information about the health profiles of a unique and understudied group of employees: those employed in the Canadian public transit sector in Calgary, Alberta. Second, it provides important insight into whether different ways of classifying employees based on socioeconomic status or hierarchy used in other international studies make sense in a Canadian transit setting. Third, it will be helpful for health promotion programming, in order to best target employee needs and match intervention strategies to employment categories.

7.1 Specific Objectives

1. To examine differences between office workers, drivers/operators, and maintenance workers employed in the transit sector on:

   a. physical health outcomes
   b. psychosocial health outcomes
   c. Workers' Compensation Board rates.

2. To explore differences in physical health outcomes and psychosocial health outcomes between blue collar and white collar workers.

CHAPTER 3: METHODS

1. Research Design

A secondary analysis was completed using cross-sectional data collected through a contracted private consulting firm (Cicciarella, 1997) to achieve the objectives (examine differences between Calgary Transit office workers, drivers/operators, and maintenance workers on physical health outcomes, psychosocial health outcomes, and WCB claims; examine differences between health outcomes between blue and white collar categories). Ethics approval for this research was received by the Conjoint Health Research Ethics Board on February 27, 2008 and amended on March 12, 2009. Letters of support from Foothills Health Consultants and Calgary Transit are found in Appendix B.

2. Study Population

The population of interest was employees of the City of Calgary Transit Department. This employee group was characterised by a range of specific occupations, hours of work, wages, and ethnicity. The hours of work for transit employees can occur anytime between 4:00 a.m. and 3:00 a.m., seven days a week (City of Calgary Human Resources, 2007). Table 3 outlines the wage ranges by department in 2000 and 2005 (D. Tod, personal communication, October 30, 2008). It is important to note that only some operators were guaranteed 30 hours of work per week. The rate of pay during training was approximately 50% of their starting wage as an independent operator. Appendix C contains further descriptive statistics including number of employees, gender, age and years of service. The Calgary Transit department is an ethnically diverse workplace (E. DeGroot, personal communication, July 17, 2007). Although the City of Calgary does not collect

information on race or ethnicity, approximately 30-40% of Calgary Transit employees are estimated to be non-white or of a visible minority (D. Tod, personal communication, July 18, 2007).

Table 3. Hourly wage range for Calgary Transit Employees in 2000 and 2005.

Year	Office	Operator/Driver	Maintenance
2000	$10.01-27.87	$13.83 – 23.85	$14.61-25.18
2005	$11.86-33.24	$14.85-23.85	$17.31-29.83

All employees within Calgary Transit are classified into one of three job categories: Operator/Driver, Maintenance or Office employee. Specific jobs within each category are shown in Table 4 (E. DeGroot, personal communication, September 13, 2007).

Table 4. Calgary Transit job departments.

Drivers/Operators	Maintenance	Office
Bus Drivers	Bodymen	Dispatch
Light Rail Train Operators	Facilities (includes landscaping, platform / station cleaning)	Human Resources
Shuttle Bus Drivers	Heavy Duty Mechanics	Management
Field Supervisors	Painters	Planning & Scheduling
Protective Services Officers	Rail Repair (Track & Way)	Reception
	Service Lane (train & bus cleaners)	Secretaries
	Shop/Area Supervisors	
	Snow removal	
	Welders	

In this study, job departments were also classified as blue collar (transit drivers and mechanics) or white collar (office workers) as shown in Table 5. Calgary transit drivers/operators were classified as blue collar in this study because they are compensated hourly, are hired unskilled, wear a uniform and work in a service related industry. Maintenance workers were classified as blue-collar because most of them work in a trade related role, are compensated hourly and perform manual labour. Office workers were considered white collar employees since they worked in an office work environment, received a salary, performed non-manual labour and have at least 1-2 years of post-secondary education. To classify these departments as such, an intuitive process along with the definitions of blue and white collar workers in section 5 of Chapter 2 was used. The face validity of this classification was confirmed by a Calgary Transit Human Resources Professional and Workplace Safety Coordinator (D. Todd and E. De Groot, personal communication, January 29, 2009) along with members of the supervisory committee.

Table 5. Transit classification groups.

Classification 1 (Calgary Transit employee category)	Classification 2 (blue collar vs. white collar)
Drivers / operators	Blue collar
Maintenance	Blue collar
Office worker	White collar

It was not possible to assign more refined job classifications, since specific job titles at the individual level were not available in the HRA database.

3. Sampling

A sample of convenience was used in this study since employees at Calgary Transit access the HRA on a voluntary basis. Participants were encouraged to complete an initial health risk assessment, and then to repeat it approximately six months later and then annually after that. For the purpose of this study only initial/first HRA data were examined in order to avoid the potential confounding effect of behaviour change based on knowledge of the results of the first HRA. All costs related to participation were paid for by Calgary Transit. Participation in the HRA was dependent on participants' desire to know their health risk profiles and thus self selection bias is very likely. Both male and female employees are represented in the sample; however, there is no data within the HRA on ethnicity.

4. Data Sources

The data for this analysis came from Calgary Transit HRAs, which are offered to transit employees on a semi-annual basis. The program has been in place since 2000 and Foothills Health Consultant (FHC), which is a company external to the City of Calgary, was contracted to collect the data. The HRA program includes standardized testing of physical measures, such as blood pressure, height, weight, body mass index, waist circumference, total cholesterol (TC), high density lipoproteins (HDL-C), low density lipoprotein (LDL-C), triglycerides (TG) and fasting blood glucose. Lifestyle and psychological health related variables were collected through a self-report HRA questionnaire. All data were collected and stored in FHC's online, secure database (K. Blackshaw, personal communication, March 16, 2007). As mentioned, participation in this program was voluntary and free of charge to employees. Participants were notified prior to

participating in this program that individual information held by FHC is confidential and only aggregate information may be used for research.

4.1 Physical Measures

The City of Calgary Transit department communicates information to employees about the times and locations of all physical HRAs and blood draws offered on-site at the City Bus Barns. All physical measures are taken by appointment or on a first come-first serve basis by a Canadian Society of Exercise Physiology (CSEP) certified kinesiologist. All blood draws were pre-booked by the kinesiologist for the lab-tech or nurse and participants are reminded and/or educated on the need for 12 hour fasting in order to obtain proper blood lipid analysis. It was the employees' responsibility to sign up and attend their scheduled appointments to have their measures taken (W. Pugh, personal communication, March 16, 2007). The physical measures taken are: blood pressure, height, weight, waist circumference, and 12 hour fasted cholesterol and blood glucose. All norms are outlined in Appendix D. See Table 6 for blood pressure, BMI and waist circumference in addition to Table 7 for fasted lipid and glucose values.

4.2 HRA Questionnaire

After the kinesiologist had measured blood pressure, BMI and waist circumference, the employees received an ID and instructions on how to complete the HRA questionnaire. The employee was instructed to use the results of their assessment with the kinesiologist and lab tech to complete the HRA questionnaire. The questionnaire could be accessed on-line, via the telephone or by completing a paper copy and returning it to FHC. Employees therefore had the option to complete this information at the worksite, at home or anywhere

else they feel comfortable doing so. These three options were developed to increase the likelihood of response by removing barriers that may inhibit participation (W. Pugh, personal communication, March 16, 2007). All HRAs completed using the telephone and/or paper copy of the survey are entered by the database manager into a complete file for the employee (W. Pugh, personal communication, March 16, 2007). All the data completed on-line were entered directly into the database, with no work required by the database manager (W. Pugh, personal communication, March 16, 2007).

The HRA was organized into three sections: Health, Wellness, and Worksite Factors. All questions and variables listed under each of these sections are outlined in a separate confidential document. The Health section of the questionnaire included physical measures of blood pressure, body composition, cholesterol, and glucose (as measured by the Kinesiologist), as well as self-reported assessment of physical activity, alcohol, driving factors, smoking, family medical history, health screening practices, environmental factors and safety. The Wellness section of the questionnaire included assessment of sleep, energy, nutrition, personal relationships, social networks, emotional health, concentration, memory, work/life balance, personal control, and stress in personal/family life. The Worksite section of the HRA questionnaire included assessment of the physical environment of the job location, job definition, career opportunities, work hours, work load, participation in decision making, job control, rewards, stress level at work, job security, company support, relationship with coworkers, relationship with supervisors, relationship with staff reporting to you (if applicable), demands of responsibility with reporting staff, valued at work, receiving adequate feedback, task completeness, shift work, change management, overall work satisfaction, commitment to organization and intent to turnover (W. Pugh, personal communication, March 16, 2007).

These three-section HRA survey was developed in 1995 by Foothills Health Consultants. The Health and Wellness sections (first and second sections) of the survey followed the measurement and testing standards from the Canadian Medical Association and the Canadian Society of Exercise Physiology. The Worksite section (third section) was largely based on a variety of existing instruments related to worksite, organizational measures and satisfaction shown to be related to health based on predictive modeling (W. Pugh, personal communication, March 16, 2007). Some of the psychosocial models that the HRA was based on include: the Job Strain model, the Effort Reward Imbalance model, the Work-Life Conflict model and the Work-Hours model (Duxbury & Higgins, 2001; Karasek & Theorell, 1990; Siegrist, 1996; Spurgeon et al., 1997).

From the full set of variables listed above, a subset was chosen for analysis in the present study, based on the review of literature showing association with a physical or psychosocial health outcome or WCB injury that was pertinent to this population of employees. This subset of variables are outlined and defined in Tables 8 and 9. These tables also delineate the method of measurement, the Likert scale anchors if applicable, and the model or concept it is related to in the literature. Table 8 outlines all physical and behavioural health risk assessment variables that are linked to the physical functioning of the body or injury. Table 9 outlines all the psychosocial factors that related to health behaviours and/or outcomes. From a separate database, WCB claims were examined by departments; this is described in more detail below.

Table 8. Physical and behavioural factors examined in the present study.

Variables	HRA variable definition	Method of Measure & Scale anchors if applicable	Related model or concept
Blood Pressure	Systolic over Diastolic	Measured	Physical health outcome
Body Composition	Height & Weight Waist Circumference	Measured	Physical health outcome
Cholesterol	Total cholesterol, HDL-C, LDL-C, triglycerides	Measured	Physical health outcome
Glucose	12 hour fasted Glucose	Measured	Physical health outcome
Self Reported Health	Compared to others in your age group how would you rate your health	Self-report: Excellent, very good, good, fair, needs improvement	Health outcome
Physical Activity	All leisure and non-leisure body movements produced by skeletal muscles resulting in a substantial increase in energy expenditure	3 Self-report questions: - Frequency, intensity & time of PA. - Each answer is scored 1-3 points to be scored out of 9 -see Table 10 for more detail	Health behaviour
Driving	The average distance driven per year	Self-report: 9 distance categories scored 1-9. Points taken away for drinking & driving, cell phone use while driving, not wearing a seat belt &/or driving while sleepy	Increase risk of injury & increases time spent sedentary
Smoking	Current and/or former smoking status	Self-report; 9 options: Never smoked, quit > 1 year ago, quit <1 year ago, 1-2 cigarettes/day or occasional smoker, 3-5 cigarettes/day, 6-12 cigarettes/day, 13-25 cigarettes/day, 1-2 packs/day, >2 packs /day	Health Behaviour

Table 8 Con't. Physical and behavioural factors examined in the present study.

Variables	HRA variable definition	Method of Measure & Scale anchors if applicable	Related model or concept
Sleep	Duration and quality of sleep	Self-report 0-9 Likert Scale - Likert anchors: - Short, broken, never rested - Well-rested, good unbroken night sleep	Health Behaviour
Energy	Level of vigour for daily activities at home and work	Self-report 0-9 Likert Scale - Likert anchors: - No energy for daily activities. - Always vigorous at work and home	Health Outcome
Nutrition	Defined by eating breakfast and eating Canada's Food Guide recommended daily servings for 4 food groups	5 Self-report questions: 1 yes/no & 4 yes/no/don't know Do you eat: breakfast 5+ days per week, 5-12 grains/day, 5-10 fruit & vegetables, 2-4 milk products, 2-3 meat & alternatives	Health Behaviour

Table 9. Psychosocial factors examined in the present study.

Variables	HRA variable definition	Method of Measure & Scale anchors if applicable	Related model or concept
Leisure Time	Time to spend doing enjoyable things for self as well as holiday time from work	Self-report 0-9 Likert Scale - No time for leisure activities or self. - At least 1 hour/day of leisure time for self and annual holiday time.	Work-Life Conflict model & psychosocial factor
Social Networks	Contact with friends and family, and/or belonging to social groups	Self-report 0-9 Likert Scale - Little contact with friends or family, don't belong to social groups. -Pleasurable contact with friends and family, strong sense of belonging to a group who share interests and social activities.	Job Strain model & psychosocial factor
Concentration	Ability to pay attention and focus when needed.	Self-report 0-9 Likert Scale -Easily distracted, unable to pay attention when needed. - Able to focus & pay attention when needed.	Workplace injuries & psychosocial factor
Work-Life Balance	Degree of conflict between family and work roles	Self-report 0-9 Likert Scale - Always feel conflict between work and family, unable to combine responsibilities. - Little conflict between roles, easy to combine family and work.	Work-Life Conflict model & psychosocial factor
Personal Control	Degree to which one feels in charge of their life and their reactions	Self-report 0-9 Likert Scale - Little control over my life, other people or events control my life. - I can control what happens to me or how I react	Job Strain model & psychosocial factor
Job Definition	Extent to which daily or changing tasks and/or roles are outlined for the employee	Self-report 0-9 Likert Scale - High confusion, no clear definition of role/tasks, changing expectations are not defined. - Clear job & task definition, required changes are well defined.	Job Strain model & psychosocial factor

Table 9 Con't. Psychosocial Health risk assessment factors examined in the present study.

Variables	HRA variable definition	Method of Measure & Scale anchors if applicable	Related model or concept
Career Opportunity	Prospects for promotion or and/or continued learning	Self-report 0-9 Likert Scale - No opportunities for promotion or continued learning. - Good opportunity for career advancement & new learning.	Effort- Reward Imbalance model & psychosocial factor
Job Control	Level on autonomy over how job and/or tasks are performed	Self-report 0-9 Likert Scale - Unable to control how job is done, told how every detail is to be performed. - Ability to control how I get my job done, have flexibility in doing tasks.	Job Strain Model & psychosocial factor
Work Hours	Hours worked, time off, flexibility of schedule satisfaction with the above	Self-report 0-9 Likert Scale - Too many hours, unsatisfied with overtime and time off, no flextime. - Hours manageable via flextime, good flexibility and support.	Work Hours Model & psychosocial factor
Work Load	The amount of work to be done and the support to manage the work load	Self-report 0-9 Likert Scale - Feel overwhelmed, no work support, no opportunity to delegate, unrealistic demands. - Cope well with load, good support to manage realistic demands.	Job Strain Model & Work-Life Conflict & psychosocial factor
Rewards	Recognition, personal satisfaction or monetary to make the job worthwhile	Self-report 0-9 Likert Scale - Insufficient rewards, both monetary and personal satisfaction, given demands of the job. - Regardless of the demands, rewards (praise, recognition, monetary) make the job worth while.	Effort, Reward, Imbalance model & psychosocial factor
Stress Level at Work	Amount of problems at work that create a sense of stress.	Self-report 0-9 Likert Scale - Highly stressed, anxious, pre-occupied with problems at work. - Little/no sense of stress, problems managed at work.	Job Strain model & psychosocial factor

Table 9 Con't. Psychosocial Health risk assessment factors examined in the present study.

Variables	Definition	Method of Measure	Related model or concept
Relationships with Co-workers (peers)	Quality of communication and level of conflict with peers.	Self-report 0-9 Likert Scale - High conflict, distant, poor communication. - Positive mutually supportive, good communication.	Job Strain model & psychosocial factor
Relationships with Supervisors	Quality of communication, support and level of conflict with supervisor	Self-report 0-9 Likert Scale - Very difficult, poor communication, conflict high, unreasonable demands. - Positive, supportive, differences can be resolved.	Job Strain model & psychosocial factor
Relationship with Staff reporting to you	Quality of communication, level of conflict with subordinates.	Self-report 0-9 Likert Scale - Very difficult, poor communication conflict high, poor productivity. - Positive, open, differences can be resolved.	Job Strain model
Shift Work	Length of shifts and ability to feel well rested, energised and manage personal life while on shift.	Self-report 0-9 Likert Scale -Shift length excessive, fatigued sue to shift, unable to have a personal life. - Shift length reasonable, can maintain healthy levels of sleep and energy, able to manage personal life.	Work Hours

4.2.1 Quality of the HRA questionnaire

Reliability and validity of the HRA questionnaire has been assessed and reported using the Transit HRA data (P. Ferris, personal communication, March 27, 2007). Ferris found FHC's HRA tool to be reliable, valid and useful for assessment of health risk. Ferris (personal communication, 2004) found Cronbach's alpha (Cronbach, 1951) rated as good (.86) and excellent (.92) for the personal wellness and work factors sections of the HRA respectively, yet health factors rated poor (.39). A poor result implies that the health factors

measured are not testing the same underlying construct. This is acceptable and exactly what was intended in this case (P. Ferris, personal communication, March 27, 2007). The purpose of the health factors assessment is to assess for various health related risk attributable to different negative health outcomes. As a result, a combined score could be utilized for the wellness and worksite sections; however, a single score in the health section would not be advised.

Although Foothills Health Consultants developed the HRA tool based on a number of theoretical models and methods of best practice, most of the scales and questions were modified from the original models in order to trademark or copyright their HRA tool. As a result these questions are related to their original models but are not identical to the original models, thus limiting comparisons between this survey tool and others found in the literature. For the most part, the questions in the Wellness and Worksite sections follow a Likert scale from zero to nine, with zero anchoring high risk or least desirable response and nine anchoring the low risk or the most desirable response. Unfortunately because an even numbered Likert scale was used there was not a true mid-point to the scale, nor; was it defined.

Three of the variables examined were reported in the database on a Likert scale from 0 to 9, however; the responses were not generated by giving the participant a scale to self-rate the behaviour. Instead the participant answered a series of questions and was scored accordingly. The three variables were physical activity, nutrition and driving. For physical activity, a three by three point matrix was constructed from the frequency, intensity and duration and is summarized in Table 10. For nutrition, participants that responded no to all questions were considered high risk and given 2 points. Those who responded a yes to some questions and no to others were assigned 4 points and considered

moderate risk. To be considered low risk, participants had to respond yes to all questions and were assigned 7 points. For the driving variable, respondents were scored from 0-9 based on their response to the annual distance driven question. Points were taken away or not taken away based on the remaining four questions related to drinking and driving, seat belt use, fatigue while driving and cell phone use. Based on the answers from these four questions (with three response options per question), a full point, half a point or no points were subtracted from their distance score.

Table 10. Physical activity point matrix.

Points for response	1	2	3
Frequency	0-2 days/week	3-4 days/week	>4 days per week
Intensity	Gentle	Moderate	Vigorous
Duration	0-19 minutes	20-39 minutes	>40 minutes

4.2.2 ***Communication of HRA results.***

Personalized HRA results were emailed in letter form to web-users or sent by mail to employees who responded using the telephone or paper copy of the questionnaire. Participants were also given the option to allow FHC to send their family physician the results of their HRA. Further, participating employees were contacted by FHC if their scores presented in a borderline or high risk category (W. Pugh, personal communication, March 16, 2007). There is no duty of care on the part of the student researcher to notify anyone in the event that a high risk participant profile is identified.

4.2.3 Protection of personal information.

Since FHC is a company external to the City of Calgary and contracted to provide this service as stated previously, all information is held in a secure on-line data-base,

accessible only by the staff of FHC. FHC collects, stores and shares information by following both the Health Information Act (HIA) and Freedom of Information and Privacy Protection Act (FOIP) (W. Pugh, personal communication, March 16, 2007). Data are made available for access via the privacy disclaimer on page 1 of the HRA as well as the letters stating permission to access the data in Appendix C.

4.3 Workers Compensation Board Data

All annual and quarterly WCB reports were provided by the Safety Officer for Calgary Transit (T. Sharples, personal communication, March 26, 2007). These reports detailed the frequency and the types of WCB claims reported on the job for Calgary Transit Employees and they were obtained through personal communication with Mr. E. DeGroot on July 17th, 2007. The types of WCB claims are outlined in Table 11. (E. DeGroot, personal communication, July 17, 2007). The City of Calgary Transit department also disclosed all of its WCB claim annual reports detailing annual and quarterly claims according to FOIP (T. Sharples, personal communication, March 26, 2007). Due to FOIP, WCB data is not able to be linked to HRA data. Therefore disclosure of personal identifiers is not an option for this proposed study (E. DeGroot, personal communication, Aug 22, 2007). Subsequently the WCB data are not available at the individual level, or at the level of specific job description. The WCB claims portion of this study will be examined at the aggregate level, by Calgary Transit departments (drivers/operators, maintenance, office workers) as well as blue and white collar categories.

Table 11. Types of reported Workers Compensation Board claims by department.

Drivers/Operators	Maintenance	Office
Slips, trips & falls*	Over exertion/improper body positioning*	Over exertion/ improper body positioning*
Contacting ruts/potholes/curbs	Slipping on a slippery surface*	Slips, trips, & falls*
Traffic accidents	Falls from a different level*	Finger or hand injuries
Assaults	Foreign body in the eye(s)	Repetitive strains injuries*
Seat bottoming out	Finger or hand injuries	
Repetitive strain*	Repetitive strains injuries*	

* examined in present study

The types of WCB claims that were examined in this study are over exertion, improper body positioning, slips, trips, & falls, and various repetitive strains injuries. The reason that these specific variables were chosen is because they are known or suspected to have an association with health outcomes examined in this study (Bosma, Marmot, Hemingway, Nicholson, Brunner, & Stansfeld, 1997a; Kesaniemi et al., 2001; Kivimäki, Leino-Arjas, Luukkonen, Riihimäki, Vahtera, & Kirjonen, 2002; US Department of Health and Human Services: Centers for Disease Control and Prevention, 1996).

5. Data Analysis

We took a descriptive approach to data analysis. All data management and analysis were undertaken using Stata 9.0. First, the data were checked for accuracy and completeness and a uni-variate analysis of the data was completed to examine the distributions and to check for outliers (Norman & Streiner, 2000a). In the case of missing data, the data were checked for the amount and pattern of missing data. The amount and type of missing data are outlined in Table 12 found in Appendix E. There were three types of missing data in this database: not applicable, truly missing, or error. “Not applicable”

was a valid response provided by the respondent, which was treated as missing for these analyses because only a few variables in the HRA qustionaire had “not applicable” as a potential response option. “Truly missing” refers to instances where the respondent should have responded but did not. “Error” refers to instances in which an implausible value was recorded (e.g., in the result from a blood test), and also to situations in which the respondent selected more than one response. For this analysis all three types of missing data were deleted.

Next, the age variable was generated. This was completed by determining the median date for the time period between the start and end date for each HRA session. To estimate age at time of assessment the date of birth was subtracted from the median assessment date. Session ranged from a few weeks to approximately one year in duration. The accuracy of the estimated ages, therefore, at time of first assessment ranged from within a couple weeks to within six months.

Outliers were identified and scrutinised as to whether they were possible or impossible values. One case was identified where the variable was impossible, since the participant’s age was calculated to be greater than 100 years of age at time of assessment. The case was considered an error in data input and date of birth was deleted for this individual.

All variables were assessed for normality based on a visual assessment of the distribution, i.e. histograms. Descriptive statistics and sample sizes were calculated on worksite demographic variables of age, sex and department. All self-reported data using a 0-9 Likert scale was treated as continuous. Analysis of variance (ANOVA) followed by post hoc tests were used to determine if there were any statistically significant differences between the health and WCB profiles of the three occupational departments of transit

workers listed in Table 4. Two sample two tail t-tests were conducted to determine if there were any statistically significant differences between the health and WCB profiles between blue and white collar workers. Statistical significance was set at the conventional level of 5% (α=0.05), which refers to the probability of finding a difference between samples when in fact there is no difference (i.e. the type I error rate) (Norman & Streiner, 2000a). The Bonferroni correction and Sheffee's correction were considered as strategies to account for the number of statistical tests conducted since, the likelihood of finding a significant result increases with each test completed. The Bonferroni correction was selected because it is known to be the more conservative correction of the two corrections. The Bonferroni correction involves dividing the alpha value (.05 in this case) by the number of tests conducted or by multiplying the p-value by the number of tests conducted (Norman & Streiner, 2000b).

The Bonferroni correction was applied to account for the multiple pair-wise comparisons made between the variables; in this case, three pair-wise comparisons were conducted for the first objective (office vs. mechanics, office vs. drivers/operators, mechanics vs. drivers/operators). Since the Bonferroni correction was applied to the p-value by Stata, the p-value was adjusted by multiplying it by 3 (the number of pair-wise comparisons made) (Norman & Streiner, 2000a). When the job categories were collapsed into Blue and White Collar categories (second objective), the resulting alpha value applied was 0.00156 (α=0.05/32).

CHAPTER 4: RESULTS

Between 2000 and 2006, 1,059 Calgary transit employees participated in HRA conducted by FHC. Table 13 outlines the number of people who completed a health risk assessment by department in Calgary Transit during all six years of data collection. As shown in Table 13, operators and driver make up the greatest proportion of the sample, followed by maintenance, and office workers. Approximately 2% of the sample did not declare a department.

Table 13. Sample size stratified by department and sex.

Department	Female Participants	Male Participants	Number of Participants (n)
No department	4	20	24 (2.3%)
Maintenance	14	232	246 (23.2%)
Office	68	105	173 (16.3%)
Operator/Driver	112	504	616 (58.2%)
Total	198	861	1059

1. Descriptive Statistics

The total observations by department and mean age at time of assessment are summarized in Table 14. Also summarized in Table 14 is mean age at time of assessment stratified by department and sex. It is important to note that total and stratified by department sample sizes differ between Tables 12 and 13 because a total of 30 participants did not give their date of birth and one date of birth was excluded because it was determined to be impossible for this sample of people, as stated previously. As a result, age at time of assessment was not able to be calculated for these individuals and they were excluded from the sample.

Table 14. Mean age stratified by department and sex.

Department	Sex	Observations	Mean Age	Standard Deviation	Min	Max
Maintenance		238	46.58	8.37	21.55	67.44
	F	13	43.05	8.58	33.67	56.91
	M	225	46.78	8.33	21.55	67.44
Operator		600	43.19	9.53	19.93	76.64
	F	106	40.11	8.54	19.93	61.39
	M	494	43.85	9.61	20.76	76.64
Office		169	45.13	7.5	26.86	63.99
	F	66	43.82	7.15	27.76	58.76
	M	103	45.97	7.64	26.86	63.99
No department		21	44.27	9.15	28.04	59.43
	F	4	44.25	9.68	34.51	56.59
	M	17	44.27	9.34	28.04	59.43
Total		1028	44.31	9.06	19.92	76.64
	F	189	41.7	8.24	19.93	61.39
	M	839	44.9	9.13	20.76	76.64

Each study variable examined is summarized in Table 15 by sample size, mean, standard deviation and range. Table 15 illustrates the extent to which the number of observations by variable varies. Variable observations range from a low of 120 responses to a high of 1028 responses for age at time of assessment. The pattern of missing data appears to follow the steps along the HRA process such that, kinesiologist measured variables have the highest number of observations, followed by the self-report HRA questions and the lab tech measured blood lipids. Amongst the self-report HRA questions,

observations dropped again below 200 for self reported health, work life balance, personal control, job control, and shift work which perhaps reflects a perceived sensitivity about these questions. From this point forward in the analysis, stratification by sex was not continued because the number of female maintenance participants was too low and none had a complete set of data.

Table 15. Sample size, mean value and standard deviation (SD) by variable.

Variable	Observations	Mean	SD	Min	Max
Age (years)	1028	44.31	9.06	19.93	76.64
Self Reported Health	153	3.16	1.09	1	5
Systolic (mmHg)	961	129.26	14.62	74	229
Diastolic (mmHg)	961	81.44	9.98	51	139
TC (mmol/L)	648	5.35	1.02	1.05	10.4
HDL-C (mmol/L)	648	1.19	0.355	0.36	4.3
LDL-C (mmol/L)	630	3.36	0.9	0.21	7.61
TG (mmol/L)	640	1.86	1.09	0.33	9
Glucose (mmol/L)	670	5.38	1.084	3.4	14.1
Body Mass Index (kg/m^2)	994	28.77	5.63	0.003	62.77
Waist Circumference (cm)	994	95.64	12.68	62	152
Physical Activity	789	3.8	2.63	0	9
Driving	806	3.27	2.24	0	9
Smoking	820	7.6	2.26	1	9
Sleep	818	5.15	2.21	0	9
Energy	814	5.42	1.95	0	9
Nutrition	819	5.01	2.12	0	9
Leisure Time	818	5.55	2.29	0	9
Social Networks	813	6.49	2.04	0	9
Concentration	811	6.2	2.002	0	9
Work Life Balance	173	6.37	2.05	0	9
Personal Control	172	6.74	1.87	0	9
Job Definition	809	6.27	1.99	0	9
Career Opportunities	809	5.5	2.41	0	9
Work Hours	813	5.74	2.33	0	9
Work Load	807	6.06	2.07	0	9
Job Control	169	6.31	1.99	0	9
Rewards	805	5.12	2.47	0	9

Table 15 Con't. Sample size, mean value and standard deviation (SD) by variable.

Variable	Observations	Mean	SD	Min	Max
Stress Level @ Work	804	6.18	1.88	0	9
Relationship with Co-Workers	806	6.62	1.8	0	9
Relationship with Supervisors	805	6.47	2.12	0	9
Relationship with Report Staff	567	6.32	2.0	0	9
Shift Work	120	5.19	2.63	0	9

2. Normality/Data Distribution

The distributions for all health risk assessment variables were assessed for normality by visually assessing the shape of the histograms and box plots of each variable, see Appendix F. When using large sample sizes, a statistically significant skewness does not often deviate enough from normality to make an important difference in the analysis (Tabachnick & Fidell, 2001). Thus, skewness values are not as important as sample size and the visual distribution of the data distributions (Tabachnick & Fidell, 2001). After examining the distribution figures in Appendix F, transformations were attempted on those variables that showed a notable skew either to the right or to the left. Interestingly, self-reported variables only showed left skewness and the one measured variable showed right skew. Transformations did not improve the distributions of self-reported variables, therefore; the data was analysed in its original form. Because triglycerides showed a notable right skew, we performed a log transformation to improve the distribution of the variable. ANOVA and post hoc tests were run on both the transformed and non transformed versions of the variable but the results did not differ between the two versions. Therefore we presented the results from the untransformed variable, for ease of interpretation. All data were thus assumed to be sufficiently normal for the purpose of conducting parametric tests, namely ANOVA, t-tests and post hoc tests. The smoking

variable was not analysed because after examining the distributions and mean values nearly 90% of those who responded to this variable smoked. Therefore smoking was assumed to be a characteristic of the sample and too skewed to conduct analysis on.

3. Results of Analyses to Examine Differences in Health Profile by Department (Objective 1) and by Blue/White Collar Designation (Objective 2)

3.1 Objective 1: Differences between Office Workers, Drivers/Operators, and Maintenance Workers

Analysis of variance was conducted to determine whether differences existed in the physical and psychosocial health factors between office workers, drivers/operators and maintenance workers. Table 16 summarizes the results of all 32 ANOVAs completed. A total of 13 variables were found to have a significant difference between groups, however; after applying the Bonfferoni correction, only twelve variables identified a significant difference between departments. In this case three comparisons were made. Symbols are used in Table 16 to identify significant differences. We observed five significant differences between maintenance and office; eight significant differences between maintenance and operators/drivers; and five significant differences between office and operators/drivers.

Table 16. Analysis of variance results comparing physical and psychosocial health factors by department.

Dependent variable (n)	Mean	Standard Deviation	F-ratio	p-value
SRH (153)				
Maintenance (37)	3.19	1.10	0.18	0.83610
Office (34)	3.24	0.96		
Operator (82)	3.11	1.14		
Systolic (961)				
Maintenance (216)	132.85	17.41	8.93	**0.0001*§†**
Office (158)	127.47	13.69		
Operator (565)	128.32	13.53		
Diastolic (961)				
Maintenance (216)	82.12	10.72	0.74	0.47620
Office (158)	81.01	9.85		
Operator (565)	81.24	9.74		
TC (648)				
Maintenance (154)	5.39	1.04	0.21	0.80970
Office (125)	5.37	1.03		
Operator (349)	5.32	1.01		
HDL-C (648)				
Maintenance (153)	1.18	0.32	11.25	**<0.00001*§‡**
Office (126)	1.32	0.37		
Operator (349)	1.15	0.36		
LDL-C (630)				
Maintenance (147)	3.40	0.83	0.69	0.50090
Office (122)	3.28	1.01		
Operator (341)	3.37	0.89		
TG (640)				
Maintenance (151)	1.89	1.15	1.17	0.31040
Office (122)	1.74	1.04		
Operator (347)	1.91	1.09		
Glucose (670)				
Maintenance (164)	5.54	1.12	2.87	0.05740
Office (126)	5.24	1.05		
Operator (359)	5.37	1.08		
BMI (994)				
Maintenance (231)	28.78	5.25	0.11	0.89560
Office (163)	28.88	5.68		
Operator (577)	28.66	5.72		

Table 16 Con't. Analysis of variance results comparing physical and psychosocial health factors by department.

Dependent variable (n)	Mean	Standard Deviation	F-ratio	p-value
Waist Circumference-male (812)				
Maintenance (217)	97.47	11.45	1.07	0.34280
Office (100)	95.48	9.62		
Operator (476)	96.79	1.54		
Waist Circumference-female (182)				
Maintenance (14)	84.34	16.60	1.36	0.25900
Office (63)	89.16	15.03		
Operator (101)	91.50	16.89		
Physical Activity (789)				
Maintenance (197)	3.87	2.44	3.59	**0.02790*‡**
Office (142)	4.27	2.65		
Operator (430)	3.60	2.70		
Driving (806)				
Maintenance (202)	3.44	2.25	9.97	**0.0001*‡**
Office (149)	3.91	2.15		
Operator (434)	3.00	2.20		
Sleep (818)				
Maintenance (208)	4.87	2.10	3.99	**0.01890*†**
Office (151)	5.02	2.13		
Operator (439)	5.36	2.27		
Energy (814)				
Maintenance (205)	5.36	1.70	0.16	0.85040
Office (151)	5.42	1.81		
Operator (438)	5.45	2.09		
Nutrition (819)				
Maintenance (208)	4.94	1.79	0.15	0.85900
Office (150)	5.06	2.10		
Operator (441)	5.02	2.24		
Leisure Time (818)				
Maintenance (207)	5.70	2.17	0.56	0.56960
Office (151)	5.54	2.29		
Operator (439)	5.49	2.33		
Social Networks (813)				
Maintenance (206)	6.95	1.75	0.63	0.5333
Office (149)	6.86	1.72		
Operator (438)	6.59	1.99		

Table 16 Con't. Analysis of variance results comparing physical and psychosocial health factors by department.

Dependent variable (n)	Mean	Standard Deviation	F-ratio	p-value
Concentration (811)				
Maintenance (205)	6.10	1.85	0.44	0.64190
Office (148)	6.28	1.77		
Operator (438)	6.23	2.15		
Work Life Balance (173)				
Maintenance (42)	6.71	1.85	1.28	0.27990
Office (42)	6.00	2.30		
Operator (89)	6.38	2.01		
Personal Control (172)				
Maintenance (42)	6.95	1.75	0.63	0.53330
Office (42)	6.86	1.72		
Operator (88)	6.59	1.99		
Job Definition (809)				
Maintenance (205)	5.65	2.10	17.16	**<0.00001*†‡**
Office (151)	6.12	1.86		
Operator (432)	6.60	1.90		
Career Opportunity (809)				
Maintenance (206)	4.44	2.44	28.64	**<0.00001*§†**
Office (151)	5.84	2.34		
Operator (432)	5.88	2.29		
Work Hours (813)				
Maintenance (207)	5.70	2.25	5.30	**0.00520*§‡**
Office (151)	6.30	2.06		
Operator (434)	5.60	2.40		
Job Control (169)				
Maintenance (42)	6.12	2.11	0.25	0.77950
Office (41)	6.37	1.85		
Operator (86)	6.37	2.01		
Work Load (807)				
Maintenance (206)	5.84	2.03	3.48	**0.03120***
Office (150)	5.83	2.06		
Operator (431)	6.23	2.06		
Rewards (805)				
Maintenance (204)	4.42	2.50	11.74	**<0.00001*§†**
Office (149)	5.42	2.28		
Operator (432)	5.37	2.46		

Table 16 Con't. Analysis of variance results comparing physical and psychosocial health factors by department.

Dependent variable (n)	Mean	Standard Deviation	F-ratio	p-value
Stress Level at Work (804)				
Maintenance (204)	5.92	1.89	3.38	**0.03470*†**
Office (149)	6.08	1.65		
Operator (431)	6.32	1.94		
Relationship with Co-Workers (806)				
Maintenance (205)	6.26	1.87	5.22	**0.00560*†**
Office (150)	6.70	1.51		
Operator (432)	6.74	1.86		
Relationship with Supervisors (805)				
Maintenance (205)	6.14	2.17	3.07	**0.04690*†**
Office (150)	6.51	1.90		
Operator (431)	6.58	2.16		
Relationship with Report Staff (567)				
Maintenance (165)	6.15	1.97	1.96	0.14230
Office (112)	6.62	1.69		
Operator (275)	6.25	2.15		
Shift Work (120)				
Maintenance (28)	5.57	2.71	0.63	0.53420
Office (16)	5.50	2.61		
Operator (76)	4.99	2.61		

* signifies a significant p-value less than the 0.05 alpha level.
§ signifies a significant difference between maintenance and office
† signifies a significant difference between maintenance and operator
‡ signifies a significant difference between office and operator

3.2 Objective 2: Differences Between Blue and White Collar Workers

For the second research question two-sample t-tests were completed between white collar (office) and blue collar (maintenance & driver/operator) workers for each variable. Table 17 summarizes the results of all of 32 t-tests (Bonferroni-corrected) completed comparing the physical and psychosocial health related factors between worker categories. Three variables were found to be significantly different after adjusting for type one error: HDL-C, driving and work-hours.

Table 17. Two sample two-tail t-test results comparing physical and psychosocial health factors between blue and white collar worker classifications.

Dependent variable (n)	Mean	Standard Deviation	T-statistic	Confidence Interval	p-value
SRH (153)					
Blue Collar (119)	3.13	1.13	-0.48	-0.52, 0.32	0.63550
White Collar (34)	3.24	0.96			
Systolic (961)					
Blue Collar (781)	129.57	14.83	1.64	-0.41, 4.61	0.10060
White Collar (158)	127.47	13.69			
Diastolic (961)					
Blue Collar (781)	81.48	10.02	-0.54	-1.24, 2.18	0.58890
White Collar (158)	81.01	9.85			
TC (648)					
Blue Collar (503)	5.34	1.02	-0.21	-0.22, 0.18	0.83090
White Collar (125)	5.37	1.03			
HDL-C (648)					
Blue Collar (502)	1.16	0.35	-4.61	**-0.23, -0.09**	**<0.00001***
White Collar (126)	1.32	0.37			
LDL-C (630)					
Blue Collar (488)	3.38	0.87	1.12	-0.077, 0.28	0.26520
White Collar (122)	3.28	1.01			
TG (640)					
Blue Collar (498)	1.90	1.10	1.52	-0.049, 0.38	0.12960
White Collar (122)	1.74	1.04			
Glucose (670)					
Blue Collar (523)	5.42	1.10	1.75	-0.024, 0.4	0.08130
White Collar (126)	5.24	1.05			
BMI (994)					
Blue Collar (808)	28.69	5.58	-0.38	-1.13, 0.76	0.70140
White Collar (163)	28.88	5.68			
Waist Circumference (male) (812)					
Blue Collar (693)	97.00	11.51	1.26	-0.85, 3.89	0.20700
White Collar (100)	95.48	9.62			
Waist Circumference (female) (182)					
Blue Collar (115)	90.62	16.95	0.57	-3.58, 6.5	0.56770
White Collar (63)	89.16	15.03			

Table 17 Con't. Two sample two-tail t-test results comparing physical and psychosocial health factors between blue and white collar worker classifications.

Dependent variable (n)	Mean	Standard Deviation	T-statistic	Confidence Interval	p-value
Physical Activity (789)					
Blue Collar (627)	3.69	2.63	-2.41	**-1.07, -0.11**	0.01620
White Collar (142)	4.27	2.65			
Driving (806)					
Blue Collar (636)	3.14	2.23	-3.8	**-1.16, -0.37**	**0.0002***
White Collar (149)	3.91	2.15			
Sleep (818)					
Blue Collar (647)	5.20	2.22	0.91	-0.21, 0.57	0.36400
White Collar (151)	5.02	2.13			
Energy (814)					
Blue Collar (643)	5.42	1.97	0.04	-0.34, 0.35	0.96660
White Collar (151)	5.42	1.81			
Nutrition (819)					
Blue Collar (649)	4.99	2.10	-0.35	-0.44, 0.31	0.72850
White Collar (150)	5.06	2.10			
Leisure Time (818)					
Blue Collar (646)	5.56	2.28	0.07	-.39, 0.42	0.94500
White Collar (151)	5.54	2.29			
Social Networks (813)					
Blue Collar (644)	6.71	1.92	-0.57	-0.47, 0.26	0.6535
White Collar (149)	6.86	1.72			
Concentration (811)					
Blue Collar (643)	6.19	2.06	-0.52	-0.45, 0.26	0.60130
White Collar (148)	6.28	1.77			
Work Life Balance (173)					
Blue Collar (131)	6.49	1.96	1.35	-0.23, 1.2	0.17960
White Collar (42)	6.00	2.30			
Personal Control (172)					
Blue Collar (130)	6.71	1.92	-0.45	-0.81, 0.51	0.65350
White Collar (42)	6.86	1.72			
Job Definition (809)					
Blue Collar (638)	6.30	2.02	0.98	-0.18, 0.53	0.32580
White Collar (151)	6.12	1.86			
Career Opportunity (809)					
Blue Collar (638)	5.42	2.44	-1.94	-0.85,	0.05300
White Collar (151)	5.84	2.34		0.0055	

Table 17 Con't. Two sample two-tail t-test results comparing physical and psychosocial health factors between blue and white collar worker classifications.

Dependent variable (n)	Mean	Standard Deviation	T-statistic	Confidence Interval	p-value
Work Hours (813)					
Blue Collar (641)	5.63	2.35	-3.22	**-1.08, -0.26**	**0.0013***
White Collar (151)	6.30	2.06			
Job Control (169)					
Blue Collar (128)	6.29	2.04	-0.21	-0.78, 0.63	0.83030
White Collar (41)	6.37	1.85			
Work Load (807)					
Blue Collar (641)	6.10	2.06	1.47	-0.09, 0.64	0.14080
White Collar (150)	5.83	2.06			
Rewards (805)					
Blue Collar (636)	5.06	2.51	-1.6	-0.8, 0.08	0.10910
White Collar (149)	5.42	2.28			
Stress Level at Work (804)					
Blue Collar (635)	6.19	1.93	0.63	-0.23, 0.44	0.52650
White Collar (149)	6.08	1.65			
Relationship with Co-Workers (806)					
Blue Collar (637)	6.59	1.88	-0.7	-0.44, 0.21	0.48690
White Collar (150)	6.70	1.51			
Relationship with Supervisors (805)					
Blue Collar (636)	6.44	2.17	-0.34	-0.44, 0.31	0.73050
White Collar (150)	6.51	1.90			
Relationship with Report Staff (567)					
Blue Collar (440)	6.21	2.08	-1.9	-0.83, 0.011	0.05640
White Collar (112)	6.62	1.69			
Shift Work (120)					
Blue Collar (104)	5.14	2.64	-0.5	-1.76, 1.05	0.61600
White Collar (16)	5.50	2.61			

* signifies a significant p-value less than the adjusted Bonferonni alpha level.

4. WCB results

Episodes of time lost due to accidents in Calgary Transit are summarized in Table 18 by department. One episode of lost time simply means that more than one day of work

was missed as a result of an injury sustained while at work. Lost time takes effect when the worker misses the next regular shift. For example, if a worker's shift is 7:00 to 4:00 and they are hurt at 11:15 a.m., then goes to doctor and then home and back to work the next day for their regular shift at 7:00 AM, then, no lost time has occurred. However, if the same series of events occur but the worker does not return to work the next day at 7:00 as scheduled, this becomes lost time at 7:00 a.m. that day. Unfortunately office workers were not included in these aggregate reports until 2008, therefore; we are not able to present WCB data for office or white collar workers. The year 2002 had the fewest overall lost time episodes due to accidents, followed by 2001. The highest number of time lost accidents occurred in 2003. The highest number of time lost accidents in Maintenance workers occurred in 2003 as well, but the highest number of time lost accidents for operators occurred in 2006.

Table 18. Total episodes of time lost due to accidents, by year (2000-2006) and by department (maintenance, operators/drivers).

	2000	2001	2002	2003	2004	2005	2006
Maintenance	30	26	27	44	24	27	35
Operators/Drivers	85	67	64	131	101	97	132
Total	115	93	91	175	125	124	167

The pattern observed in Table 19 changes when time lost due to accident is expressed more meaningfully as a percentage, using to the following formula:

$$\text{Percentage of time lost accident} = \frac{\text{\# of episodes of lost time due to accident} \times 100}{\text{employees}}$$

$$\text{\# of employees}$$

These figures are shown in Table 19. The fewest total time lost episodes occurred in 2002 and the highest occurred in 2003. The fewest time lost episodes in Operators/Drivers also

occurred in 2002, and the fewest time lost episodes for maintenance workers occurred in 2004. From 2000-2003 the maintenance department had more lost time episodes than operators/drivers, however; from 2004-2006 transit operators/drivers had more lost time episodes than maintenance. This trend between departments was maintained when lost time accidents were reported as a percent in table 19, however; the differences no longer appeared to be as great.

Table 19. Percent lost time accidents by department.

	2000	2001	2002	2003	2004	2005	2006
Maintenance	6.07	5.26	5.43	8.8	4.76	5.09	6.77
Operators/Drivers	5.83	4.2	3.99	8.29	6.18	5.7	7.86
Total	5.89	4.45	4.33	8.41	5.85	5.56	7.6

WCB claims are summarized by type and department in Tables 20 (Operators/Drivers) and 21 (Maintenance). Unfortunately since the claims are relatively different and occurred in different environments, comparisons of specific claims are difficult. Nevertheless some are similar as in table 20 and 21, it can be seen that operators and drivers had a greater total of slips, trips and falls each year as compared to maintenance, even when slips from a different level and slipping on a slippery surface were combined. This trend also continued for repetitive strain injuries, whereby the total number of claims was greater in drivers/operators when compared to maintenance over the seven year period.

Table 20. WCB claims for operators/drivers by type and year.

Operators/Drivers								
	2000	2001	2002	2003	2004	2005	2006	Mean from 2000-06
Slips, Trips and Falls								
Lost Time Incidents	15	21	11	42	15	20	18	20.29
Medical Aid Incidents	6	3	7	3	8	4	4	5.00
First Aid	1	2	1	1	2	0	0	1.00
Untreated	22	24	28	23	10	11	25	20.43
Total	44	50	47	69	35	35	47	46.71
Traffic Accidents								
Lost Time Incidents	11	5	18	25	16	15	35	17.86
Medical Aid Incidents	6	4	8	4	7	5	3	5.29
First Aid	0	0	2	0	4	0	0	0.86
Untreated	7	4	15	12	12	9	8	9.57
Total	24	13	43	41	39	29	46	33.57
Contacting Ruts Potholes or Curbs								
Lost Time Incidents	2	2	2	2	2	2	1	1.86
Medical Aid Incidents	1	2	0	0	1	0	0	0.57
First Aid	-	-	-	-	-	-	-	-
Untreated	0	2	1	0	0	1	0	0.57
Total	3	6	3	2	3	3	1	3.00
Steering Wheel Manipulation								
Lost Time Incidents	11	7	6	8	6	6	4	6.86
Medical Aid Incidents	5	3	1	2	3	0	3	2.43
First Aid	0	1	1	1	0	0	0	0.43
Untreated	10	4	3	1	0	3	3	3.43
Total	26	15	11	12	9	9	10	13.14

Table 20 Con't. WCB claims for operators/drivers by type and year.

Operators/Drivers								
	2000	2001	2002	2003	2004	2005	2006	Mean from 2000-06
Seats Bottom Out								
Lost Time Incidents	5	7	4	7	4	4	2	4.71
Medical Aid Incidents	2	2	2	0	0	1	0	1.00
First Aid	-	-	-	-	-	-	-	-
Untreated	6	1	2	4	4	0	0	2.43
Total	13	10	10	11	8	5	2	8.43
Repetitive Strain Injury								
Lost Time Incidents	17	8	10	9	13	17	15	12.71
Medical Aid Incidents	19	10	5	2	6	4	7	7.57
First Aid	0	0	1	0	0	0	0	0.14
Untreated	7	6	1	2	3	4	4	3.86
Total	43	24	17	17	22	25	26	24.86
Assaults								
Lost Time Incidents	0	1	2	13	10	17	19	8.86
Medical Aid Incidents	0	2	6	5	6	4	6	4.14
First Aid	-	-	-	1	1	0	0	0.50
Untreated	5	9	7	6	3	4	18	7.43
Total	5	12	15	15	20	25	43	19.29
Miscellaneous								
Lost Time Incidents	25	16	15	5	35	23	38	22.43
Medical Aid Incidents	18	11	18	7	11	13	17	13.57
First Aid	5	11	6	3	10	1	-	6.00
Untreated	29	22	32	4	26	27	25	23.57
Total	77	60	71	19	82	62	80	64.43

Table 21. WCB claims for maintenance workers by type and year.

Maintenance								
	2000	2001	2002	2003	2004	2005	2006	Mean from 2000-06
Overexertion/Improper Body Positioning								
Lost Time Incidents	16	9	14	17	10	7	17	12.86
Medical Aid Incidents	11	7	7	12	3	5	3	6.86
First Aid	-	-	-	0	1	0	0	0.25
Untreated	5	2	14	11	7	2	9	7.14
Total	35	18	35	40	21	14	29	27.43
Slipping on Slippery Surfaces								
Lost Time Incidents	3	13	4	8	6	9	8	7.29
Medical Aid Incidents	4	3	1	4	2	1	4	2.71
First Aid	-	-	-	2	0	1	0	0.75
Untreated	8	4	10	16	4	2	10	7.71
Total	15	20	15	30	12	13	22	18.14
Falls from Different Levels								
Lost Time Incidents	1	0	0	-	-	-	-	0.33
Medical Aid Incidents	1	0	1	-	-	-	-	0.67
First Aid	-	-	-	-	-	-	-	-
Untreated	1	1	0	-	-	-	-	0.67
Total	3	1	1	-	-	-	-	1.67
Foreign Body in the Eye								
Lost Time Incidents	2	0	0	1	0	1	2	0.86
Medical Aid Incidents	7	2	6	5	3	1	5	4.14
First Aid	-	-	-	0	1	0	0	0.25
Untreated	0	0	1	3	0	0	2	0.86
Total	10	4	7	9	4	2	9	6.43

Table 21 Con't. WCB claims for maintenance workers by type and year.

Maintenance								
	2000	2001	2002	2003	2004	2005	2006	Mean from 2000-06
Finger/Hand								
Lost Time Incidents	4	1	1	10	4	2	4	3.71
Medical Aid Incidents	11	3	7	11	4	3	3	6.00
First Aid	3	1	1	2	1	2	1	1.57
Untreated	1	4	2	7	4	1	3	3.14
Total	19	9	11	30	13	8	11	14.43
Repetitive Strain Injury								
Lost Time Incidents	2	1	2	3	0	2	1	1.57
Medical Aid Incidents	6	2	7	2	4	1	4	3.71
First Aid	-	-	-	-	-	-	-	-
Untreated	4	0	2	2	0	0	1	1.29
Total	11	3	11	7	4	3	6	6.43
Miscellaneous								
Lost Time Incidents	2	3	6	6	2	5	3	3.86
Medical Aid Incidents	7	4	5	5	4	1	10	5.14
First Aid	2	1	-	-	3	-	-	2.00
Untreated	1	3	12	12	4	5	4	5.86
Total	12	11	23	23	13	11	17	15.50

CHAPTER 5: DISCUSSION

1. Summary of Results

The purpose of this study was to evaluate the differences in the physical and psychosocial health risk profiles between three Calgary transit departments (drivers/operators, maintenance and office) as well as between blue collar and white collar classifications. Tables 4 and 5 outline the types of jobs that fit within these designations. Overall 18 significant differences were found between departments and these differences were within 12 variables. When these three categories were collapsed into blue and white collar categories, only three variables were found to have a statistical difference. Unfortunately, lack of office related WCB summary reports limited the comparisons between all three departments using WCB data, thus; only descriptive data could be presented for this outcome. In general, when a difference occurred between categories, maintenance workers had the greater health risk, followed by drivers/operators. In every case where a difference occurred between an office worker and another department, the office worker had lower health risk. This trend also continued when the departments were collapsed to blue and white collar categories. For the three significant differences detected in the blue/white collar comparison, white collar workers had lower risk.

1.1 Physical Health Measures by Department

Examining these differences in more detail, systolic blood pressure was statistically higher in the maintenance department than in office workers and drivers/operators, whose mean systolic pressures were relatively similar. Operators and maintenance workers had lower mean HDL-C levels than office workers. There was no significant difference in HDL-C levels between operators and maintenance workers. The differences between departments in systolic blood pressure and HDL-C may be related to the physical activity

levels these three departments report, as physical activity can impact systolic blood pressure and HDL-C levels.

Interestingly, physical activity was only found to be significantly different between office workers and operators/drivers, with office workers showing a higher mean physical activity level than operators/drivers. This was somewhat surprising because the questionnaire defined PA as all leisure-time and non-leisure time activity; thus, one might have expected that maintenance workers would have reported higher physical activity levels than office workers as their occupational activity levels are far higher than both office workers and operators/drivers (E. DeGroot, personal communication, January 29, 2009). This finding may reflect different perceptions between the departments as to what constitutes physical activity and why self-reported PA often differs from measured PA (Prince, Adamo, Hamel, Hardt, Gorber, & Tremblay, 2008). For example, maintenance employees may be conditioned to their job, and may not perceive their work to be producing a substantial increase in energy expenditure, and thus not report it as physical activity. This may have been due to the wordiness of the physical activity definition or the much greater amount of text, as compared to other questions, involved in the PA portion of the HRA. Therefore, people may have skimmed the question and definition then answered what they felt to be correct. Nevertheless, our finding is consistent with the literature examining leisure time physical activity levels between occupational categories (Burton & Turrell, 2000; Salmon et al., 2000; Schneider & Becker, 2005), in that blue collar and/or less skilled workers accumulated less leisure time physical activity. One study suggests that blue collar workers are more active when occupational physical activity levels are included with leisure time physical activity and total physical activity levels are assessed (Schofield et al., 2005).

1.2 Psychosocial Health Measures by Department

Operators and drivers scored the lowest on the driving related risk factors, which reflects their occupation (3.0 out of 9 on the Likert scale). However, driving was only statistically different between office workers and operators/drivers and not maintenance workers. Nonetheless, driving scores for all three groups are below the mid-point of the Likert scale, suggesting an increase in health risk related behaviours for all employees in the sample. In psychosocial categories, the maintenance and operator/driver departments demonstrate the most significant differences at seven. Further, in all seven variables, the maintenance department reported lower scores than operators/drivers, indicating greater risk. Specifically, maintenance workers reported they had less and/or worse sleep, less job definition, fewer career opportunities, less work related rewards, more stress at work and poorer relationships with their coworkers and supervisors.

A similar trend also follows when we examine statistically significant differences between maintenance workers and office workers. Once again maintenance workers report lower or more at risk results. This illustrates that maintenance workers report fewer career opportunities, worse work hours and fewer rewards associated with their department. This also follows the same trend when comparing physical health, such that maintenance had higher systolic blood pressure, and lower HDL-C levels. In every significant difference detected between maintenance and another department, the other department outperformed maintenance and reported more favourable results.

Finally, when differences between office workers and operators were examined, two out of the three psychosocial differences showed that operators were worse off than office workers. Operators/drivers reported more time on the road (which is to be expected), in addition to worse work hours. In one category, job definition, operators/drivers reported

better definition than office workers. Even so, when physical health variables were examined, operators reported lower levels of PA and had lower HDL-C levels.

Upon examining these different department based comparisons, a pattern emerges that resembles the social gradient in health, whereby low socioeconomic status is associated with poorer health status. Namely, the pattern we observed was that maintenance staff had the greatest number of physical and psychosocial health risks than both other departments. Further, these trends also appear to rank office workers as the most content and at least risk followed by transit drivers.

1.3 Blue and White Collar Comparisons

After two-tail t-tests were conducted on the physical and psychosocial health variables, three significant differences were found between white collar and blue collar classifications. These were: work hours, driving and HDL-C. White collar workers scored their hours better/high on the Likert scale than their blue collar counterparts. Work hours include: hours worked, over-time, flexibility to manage schedule and the support provided in which to do so. Mean driving hours were higher for blue collar workers, thus indicating greater risk in this group relative to white collar workers. HDL-C was lower in blue collar workers and higher in white collar workers, once again supporting greater health risk associated with blue collar status.

Fewer significant differences were detected in the blue versus white collar comparison, than in the comparison between the three departments. This probably reflects, in part, collapsing the two blue collar departments and thereby dampening some characteristics/nuances that existed between the two blue collar departments. Another possible reason for fewer differences between the blue and white collar categories could be due to the blue collar nature of the entire Calgary Transit Business Unit, relative to other

industries such as banking. For example, a visual impression of the office environment at the bus barns would suggest it appears to be more blue collar in nature than an office environment at a bank or energy company in Calgary's downtown.

1.4 WCB comparisons

Differences in WCB claims unfortunately could not be examined using the three departments or blue and white collar categories since we were only able access aggregate data for two departments: drivers/operators and maintenance. This also prevented testing for differences between blue and white collar categories since drivers/operators collapsed into only the blue collar category. Further, no office workers were included in the annual reports until 2008, two years after the end of our reporting period. Interestingly enough though, the maintenance department had a higher percentage of lost time accidents from 2000-2003 and from 2004-2006 drivers/operators had a higher percentage of lost time accidents. One reason for this is that in 2003 mandatory lifting training was implemented for all existing and new maintenance employees (T. Sharples personal communication, March 26, 2007).

2. Interpretation of Findings

2.1 Difference Between Departments vs. Workplace Risk

2.1.1 Measured variables.

There were a few cases in which there were not significant differences between groups, but a health risk exists nevertheless. As a result, it is important to examine these variables in order to get a better understanding of the health of the workplace by department. The mean systolic blood pressure in the maintenance department was borderline high at 132.85, exceeding the 130 mmHg cut point (Blood Pressure Canada, Heart and Stroke Foundation of Canada, Canadian Hypertension Education Program,

Canadian Hypertension Society, & Société Québécoise d'hypertension artérielle, 2008). All three departments have borderline high total cholesterol numbers as each department mean exceeds the cut point of 5.2 for those 30-65 given by Calgary Laboratory Services (CLS) (Table 7) (Calgary Laboratory Services, 2009). This is supported as the mean LDL-C value, for both the maintenance and operator/drivers, is at the high end of the acceptable range given by CLS. Using sex specific WC measures, the female means in the office and operations indicate an at risk population, as their sex specific department means exceed the cut point of 88cm. For male transit employees, no department mean exceed the male cut point of 102cm (Heart and Stroke Foundation of Canada, 2009). Mean BMI in all three departments exceeded the healthy range for 18.5-25 kg/m2 (Health Canada, 2003). In fact the mean department range was 28.66-28.88 kg/m2. Lastly, the mean BMI for every department is >25 kg/m^2, but less than 30 kg/m^2, thus indicating that the mean BMI is overweight but not obese. However, when examining the distribution of this variable we find that only 20% of those with a calculated BMI are within a health range according to Health Canada guidelines (BMI 18.5-25 kg/m^2) as a result 80% are overweight or obese. Thirty-four percent are classified as obese with a BMI over 30 kg/m^2 and 10% have a BMI over 35 kg/m^2.

2.1.2 Self-reported variables.

Two of the self-reported HRA variables in Calgary Transit also appear to indicate higher health risk amongst this group of employees. Namely, mean response values for physical activity and driving are below the HRA Likert scale mid-point. It is possible that physical inactivity could be related to some of the above measured physical health variables such as systolic blood pressure, BMI, waist circumference, and total cholesterol; however, such associations were not examined in this study.

2.2 Job Characteristics

Some of the differences detected between departments could reflect the nature of the job itself. For example, the maintenance department could be reporting lower levels of contentment and high levels of risk based on the effort-reward imbalance (Siegrist, 1996) and/or high demand coupled with low control and/or support (Karasek & Theorell, 1990). This is very plausible due to the repair nature of the department. For example, there may be an influx of time-sensitive jobs come in at the end of morning or evening rush hour that must be completed to meet the demands of the next scheduled shift. For example, if a bus or train was to break down or have a mechanical problem, a team of different maintenance workers may work on it, including welders, cleaners, and heavy duty mechanics. One job may have to wait for another to be complete, thus reducing the amount of control each individual has to meet the demand of having the bus or train ready for the next shift of drivers/operators. These time pressures can fluctuate and can make workloads unpredictable. The nature of this department, as it relates to varying workload and time pressures could then help to explain some of the differences found in the results, such as job definition, rewards, stress at work along with relationships with coworkers and supervisors. Since the very nature of the maintenance department is to keep things running and fix things when they are broken, it is likely that there are irregular cycles of work when equipment breaks down unexpectedly, which in turn adds to the psychosocial pressures within the work environment.

To contrast the situation in the maintenance department, office workers reported working better work hours, having greater career opportunities and more rewards. This makes sense due to the fact that office workers work daytime hours, have more flexibility as to how to manage their workload, meetings and breaks. They are also likely provided

with more career opportunities due to the education required for the various positions. Office workers also likely report more rewards due to the fact that they have a closer physical proximity to their supervisors to witness reward worthy behaviour.

C-train operators and bus drivers report significantly greater job definition than both maintenance and office workers. This is likely because they drive specific routes and follow specific run times. For drivers and operators, their entire day, including: when they leave the bus barns; when they eat; and at what stations they can take bathroom breaks, is scheduled. Drivers/operators also reported significantly more career opportunities than maintenance workers; this may reflect the greater occupational opportunities associated with driving. For example, many new employees start as shuttle drivers and later transfer to driving full sized buses. As they acquire more seniority they can also earn more money and/or a guaranteed schedule. They may then also apply for the opportunity to be trained to drive light rail transit (LRT) trains and/or be promoted to field supervisor; however, all promotions are also based on performance and/or skills and qualifications for the position. Although there is room for growth for maintenance workers within their department, this generally means coming out of the union and into a management position, with specific qualification criteria to be met, including overall knowledge, attendance, and personal performance (E. DeGroot, personal communication, February 26, 2009). These career opportunities may also be related to the observation that drivers/operators and office workers perceived more reward opportunities than maintenance workers. Lastly, operators and drivers were found to report significantly better relationships with their supervisors and co-workers than maintenance staff. This may be due to the fact that drivers drive alone, thus conflict between co-workers and supervisors may be minimized. Further, many drivers spend time and socialize in the bus barns before and after their scheduled shifts or

while waiting to receive a shift for the day, thus creating camaraderie between them. This is unlike the maintenance environment where employees all work together in the same bus barns performing different trades and jobs, and as a result more interaction in this environment may lend itself to greater conflict due to demands and time pressures. This is also supported by our findings with the stress at work variable, whereby maintenance workers reported significantly greater stress levels at work, on average, than drivers/operators.

2.3 Blue and White Collar Characteristics

When Calgary Transit departments were collapsed into Blue and White collar categories, a statistically significant social gradient was still found in three variables. Specifically, we found that blue collar workers reported significantly lower HDL-C, high risk driving related factors and worse work hours. Although collapsing drivers/operators and maintenance into the blue collar category resulted in fewer statistically significant differences than the inter-department comparison, it still supports the concept of a social gradient related to physical and psychosocial health risk related factors in the workplace setting. This finding also supports is the importance of job titles as a means of indicating status or prestige when examining the social gradient in the workplace.

3. Strengths and Weaknesses

3.1 Bias

3.1.1 Confounding.

In this descriptive study of the Calgary Transit Department, the primary potential source of bias is unmeasured confounders (Rothman, 2002). An example of this is job self-selection. The results from this study indicate that the maintenance department is at greatest health risk, followed by drivers/operators; but, there is no way to determine if these

conditions were pre-existing to employment at Calgary Transit. In fact there is no way of knowing if employees with certain health profiles are attracted to certain departments. As a result, causality can not be assessed; rather it is important to emphasize that only associations can be drawn from the results of this thesis.

Another unmeasured confounder is the hierarchy that exists within departments. This could have been controlled for by further stratification by job title; however, this information was not collected. One type of hierarchy within the departments could include: differences in skill and/or education levels. For example, in the office, dispatchers and secretaries are classified with professional engineers and accountants. In the maintenance department journeymen trades are classified in the same category as unskilled cleaners and snow removal personnel. This potential for bias is supported by one study using health surveys in the workplace, it found that women and those with a higher occupational social class were more likely to respond (Martikainen, Laaksonen, Piha, & Lallukka, 2007). This would potentially influence the results of the HRA, however; all three departments have some sort of educational or skill related hierarchy, as a result this would not bias the result to show no difference between departments.

Sex may have also biased the results. Although it was collected in the HRA, stratification was not possible by sex due to a small number of female observations in the maintenance department and incomplete HRA questionnaires for females in the maintenance department. Nonetheless, had sample size been sufficient, regression modeling would have been more appropriate in order to assess for confounding and effect modification by sex and department.

This study design also presents a few weaknesses in relation to data collection since the data was previously collected for a different purpose than this study. In fact, the data

were collected by a private consulting firm for use by a worksite wellness program, with no explicit link to academic research. This could be a weakness since the study design and research question followed the data collection, thus; increasing the chance for unmeasured confounders, such as skill and/or education level that could have been accounted for with job titles or participant WCB claim information that would allow us to link HRA data with WCB data at the individual level. Further, this would have ensured information was collected for office workers, therefore enabling a complete WCB analysis. Also, the non-academic basis for the data meant that the theoretical basis for the questionnaire components, and the content and structure of individual items, both suffered from limitations. Nonetheless, this data makes this an affordable project, with a large sample size and allows for 7 years of HRA and WCB data to be analysed retrospectively, something that would not normally be possible for a master's level project. It also allowed us to discern some lessons learned through a worksite wellness – academic research partnership, elaborated below.

3.1.2 Selection bias.

Another potential source of bias in this study is selection bias (Rothman, 2002). Since the sample of convenience is not random but self selected, systematic error is possible. Nevertheless when the Workforce Analysis report in Appendix D is examined and compared with Table 13 and Table 14, the descriptive statistics do not differ greatly. Based on the numbers from the 2007 report, 2518 employees worked for Calgary Transit that year. Of these employees 486 were female and 2032 were male. The average age in 2007 was 47 years old. Based on these values approximately 42% of employees participated in the HRA. However, when the proportion of employees by sex is compared to the sample in this study, they were nearly the same. For example, 19.4% of transit

employees were female and 80.6% were male, and in our sample, 18.4% were female and 81.6% were male. The average age of our sample at first assessment between 2000 and 2006 was 44.3 years old. Compared to the mean age of Calgary Transit in 2007 these values are essentially the same, especially since the mean age during the assessment period could be assumed to be lower. Given that the descriptive statistics of our sample match those of Calgary Transit so closely, evidence for selection bias on age and sex due to self-selection appears to be minor.

Perceived health risk may have motivated individuals to seek assistance or assessment, thus overestimating risk in transit workers. In the event that the HRA program at Calgary Transit attracted healthier participants, known as a healthy volunteer effect (Froom, Melamed, Kristal-Boneh, Benbassat, & Ribak, 1999), the risk in transit workers would have been underestimated. Conversely, the purpose of this research was to assess differences between departments and categories, therefore this would not affect the difference found between departments and/or categories (unless there was differential healthy volunteer effect by department), only the magnitude of the descriptive statistics.

Over the seven year period HRAs were offered, approximately one half of maintenance workers completed an HRA, one third of operators/drivers completed and HRA and an unknown proportion of office workers completed an HRA as well. As a result it is difficult to generalize the results of this study past those who participated because the sample was not randomly selected and participants will systematically differ from those who did not participate in a HRA. However, despite a self-selected sample of convenience, the pattern of results found in this study was consistent with those found in the systematic review of literature. In other words, those with lower status showed the highest physical and psychosocial health risk.

3.1.3 Measurement bias.

Another type of systematic error that may have affected the internal validity of this study is measurement bias. The HRA used in this study uses both measured and reported data and the validity and reliability have been assessed for the purposes of its use and deemed sufficient as previously outlined in the methods chapter, section 4.2. One aspect of the questionnaire that may contribute to measurement error is the self-report sections of the HRA. Self-report data includes potential bias (Streiner & Norman, 1995), as opinions, perceptions and social desirability vary. For example, the perception of what constitutes physical activity may affect the reliability and validity of the variable. Further, physical activity is considered a healthy behaviour and self-report of this activity may be subject to social desirability bias whereby people tend to over report their involvement in physical activity. This source of bias would be particularly problematic if it differed between comparison groups; for example, if office workers were more likely to over report physical activity than maintenance workers. Unfortunately, the extent of this potential bias is not known; however, the questionnaire did state that all leisure and non-leisure body movements produced by skeletal muscle were to be included.

Interestingly, the HRA asks for frequency, intensity and duration of physical activity and also explains that it included both occupational and leisure-time physical activity, but the responses tend to indicate office workers are the most active in Calgary Transit. This may indicate that the inclusion of occupational physical activity was missed by respondents in the maintenance department. There are two reasons this may be true. First, the questionnaire does not state occupational physical activity, rather it states non-leisure body movements produced by skeletal muscle, and this may have been confused by the reader. Second, these findings are different than then in Schofield et al., (2005) who

found blue collar workers accumulate more total physical activity and occupational activity than other job categories (Schofield et al., 2005). Nevertheless, the differences detected based on measured data in the study were of a similar pattern to those detected in the self reported data, providing some support for the validity of the self report data. Measurement error in the measured variables due to human error may also be a potential limitation; however, all measured data collection followed specific Canadian Medical Association or Canadian Society of Exercise Physiology measurement protocols, so this source of error is likely to be low.

3.2 Causality and Study Design

The study design used in this research is known to have potential limitations threatening the internal validity of the results. In particular, the assessment of causality in this type of research is limited due to the study design used (Rothman, 2002). Traditionally, randomized control-trials (RCT) are often regarded as the gold-standard in health research, as they are seen as one of the best ways in which to assess causality by virtually eliminating bias and confounding from a study (Rothman, 2002). Although a cross-sectional design is not traditionally seen as a highly credible study design due to threats to internal validity; it is the best fit for this secondary data analysis study. This design is also, arguably very appropriate given the current absence of knowledge about the health profile of this group of employees and represents an appropriate starting point for further study. The results of this study may provide a great starting point for further study using a stronger study designs such as a cohort and case-control studies (Rothman, 2002).

3.3 Missing Data

There was a large amount missing data in this analysis, most of which appeared to follow a pattern. For example, the amount of truly missing data is relatively low for all of the kinesiology measured variables, then increases for the lab tech measured blood lipids, which may indicate some people did not attend their blood draws or enter their results into the HRA tool. Following this, there is another increase in truly missing data for certain self-report variables. This may indicate that there was another subset of people who failed to complete the self-report section of the HRA. Overall, there were five self-reported variables had more than 75% truly missing responses. They included: self-reported health, work life balance, personal control, job control and shift work. Low response rate for self-reported health may be due to the fact that this is the first question in the HRA but it is not numbered as the first question. The following question on blood pressure is the numbered as the first HRA question. Next, work life balance, personal control and job control have a high amount of truly missing data which may be due to a perceived sensitivity regarding these questions. Finally, the high amount of missing data for the shift work variable may be due to the fact that participants may have opted to choose non-response over selecting not applicable. However, this still does not explain the fact that the majority of positions in Calgary Transit are shift based with the exception of office workers.

Another reason for a drop in questionnaire response rates may be the high estimated proportion of visible minorities in the study population. In survey research, language barriers are a rather important threat to internal validity. Approximately 40% of employees were of a visible minority (D. Todd, personal communication, July 18, 2007), further, the health risk assessment was written to a grade eight reading comprehension level, therefore those employees with English as a second language may have had difficulty reading and/or

comprehending the questionnaire. As a result this may offer a potential explanation why the number of missing responses increased dramatically from the measured data to the questionnaire data. It is also plausible to speculate that reading comprehension across the sample more generally could have contributed to low response levels on the questionnaire section of the HRAs. Another reason for low response in the questionnaire section of the health risk assessment could be distrust in the security of the employee's personal health information. Employees may not trust that their individual health information, and responses about their superiors, will be kept confidential.

3.4 Study Strengths

There are many strong attributes to this study. First, this survey includes a broad range of variables that contributes to individual employee health in the workplace health as opposed to focusing on fewer variables linked to a specific outcome. The inclusion of both physical and psychosocial variables in this study enables a more holistic concept of health to be examined and for various dimensions of the workplace to be explored, through the inclusion of both physical, psychosocial and WCB variables. Second, this research also provided a unique opportunity to study a real workplace in its natural form, influenced by a true social and political environment and to create a starting point to base further research on. Third, this study has yielded important knowledge regarding the health profile of Calgary transit workers; such information is currently not available. Fourth, we examined the health of this population in a more nuanced way, by exploring several ways of classifying employees by the nature of their employment at Calgary Transit. This makes a novel and interesting contribution to the literature. Fifth, permission to use both HRA and WCB data from both FHC and the City of Calgary Transit department removed all costs

related to the development of the HRA survey and technology, in addition to the cost to collect 7 years of measured data. Finally, the retrospective nature of this study allows for an analysis of seven years of initial HRA data collection to be attainable for this thesis project.

4. Recommendations

4.1 Research Recommendations

This study serves as a strong starting point for other Canadian studies to build on. The findings from this study suggest that different types of occupations within the same large employer can have different physical and psychosocial health risk profiles, which may reflect the nature of their work and the workplace culture and environment in which they work. It would be very interesting to expand on this thesis by collecting more detailed occupational information such as job titles rather than just department worked in. This information at the individual level would allow the researcher to examine the same study question using various occupational categories or ranking systems. Some interesting comparisons could be made based on the skill/education level at time of hire, the occupational physical activity level or the prestige associated with various jobs. Unfortunately this was not possible to accomplish with this specific study as we were not able to obtain job title information that could link to the HRA database due to confidentiality. In some departments, such as maintenance, workers' skill/education levels ranged from post-secondary trained trades, such as welders and heavy duty mechanics, to unskilled jobs, like transit cleaners and snow removal. In the office environment, education levels range from high school or GED equivalents to diplomas, undergraduate degrees and professional designations such as Professional Engineers.

Another aspect that job titles would help to address is the internal department hierarchies present within the Calgary transit departments. For example, in earlier sections of this thesis, the different rankings of drivers within transit (i.e., shuttle bus, city bus, LRT) were discussed. Field supervisors are also included in the department and are associated with greater levels of prestige relative to the other positions in these departments. Maintenance also has shop area supervisors included in their department category. As for the office, the occupational prestige associated with management, human resources and planning are very different than that of a receptionist, dispatcher and/or secretary. If job titles were taken into account future studies would be able to account for these different levels of hierarchies within departments. Classification systems such as the British Occupational-Based Social Class, or the Cambridge Scale of Occupations, or the updated Canadian National Occupational Classification Scale (Galobardes et al., 2009; Goyder & Frank, 2007; Prandy, 1990) would be able to take into account the prestige or classification rank associated with various occupations as well as the rank within, were supervisors or managers of occupations are moved up in rank. Further, modeling this thesis using another occupational classification system would help to increase the generalizability of the results to other studies and groupings within Canada or internationally depending on the scale used.

This study outlined a number of methodological issues related to the HRA questionnaire that are a function of working with the workplace wellness sector. Although each section of the survey was designed by a subject matter expert, the Wellness and Worksite sections would have benefited by having a stronger theoretical basis linking specific questions to specific theories of work and health and/or health outcomes. Nevertheless, this not always feasible in the business model of a private workplace

wellness consulting firm whereby the copyright protected tool is bought and sold for profit. Conversely, the quality of the HRA survey tool could have been improved for research related purposes from the involvement of a researcher with skills in survey design, data collection and data analysis. This researcher would have been able to advise on issues related to the theoretical basis of the questionnaire and item structure to ensure that the data generated satisfied the consultants needs, yet created publishable data for the research community. A number of lessons were learned about the HRA tool and how it impacted data collection and data analysis. These issues could have been addressed if a researcher with knowledge in survey design was involved at the development stage of the tool. Although some of the issues encountered were less than ideal, this study illustrates a very important exercise in health research, workplace partnership and the need for quality health research in the workplace setting. As already identified in the literature, more rigorous workplace literature is needed, thus demonstrating the important need to for real world partnerships between health research and the workplace.

4.2 Program Recommendations

Based on the results found in this study, we would recommend addressing some of the psychosocial factors that are different between Calgary Transit departments. Primarily, these program recommendations would be most closely related to Human Resources and Health Workplace Policies. Suggestions include more rewards and recognition available for employees for a job well done and/or when they perform above and beyond regular expectations. Recognition and rewards don't always have to cost money; in many cases verbal recognition is more appropriate, especially in the case of maintenance workers, who are some of the highest earners in Calgary Transit (E. DeGroot, personal communication, February 26, 2009). It is recommended that supervisors are trained to be able to provide

employees with effective and constructive feedback, including verbal recognition and praise when warranted. It may also be worthwhile to implement a peer nomination program in which workers working together on and between shifts can recognize each other for a job well done. For example, when one shift has a light workload, they could be rewarded for helping the next shift with some of their tasks which may help with some of the ebb and flow in work related stress levels. Another approach to take in the maintenance department is team building events in which all nine different job titles can learn to relate to one another on and off the job. Further, a workplace physical activity incentive program or contest could be helpful to encourage leisure-time physical activity. Lastly, all of the above factors could be even more useful and effective if a comprehensive workplace wellness program is implemented to focus on both the physical health and psychosocial health needs and enabling behaviours and environments in order to have the greatest impact on the HRA profiles measured in this study. These suggestions support a less medicalized approach to health and more towards an upstream psychosocial determinant based approach.

5. Conclusions

This comparison of physical and psychosocial health risks and WCB claims between departments in Calgary Transit is the first known Canadian study to examine differences in health outcomes between socially ranked occupational groups within a workplace setting. Overall, there were 18 significant differences detected between office workers, drivers/operators and maintenance workers and three significant differences between blue and white collar workers. In the case where differences were detected between maintenance and another department, maintenance workers outcome variables were associated with greater health risk each time. This is potentially related to the occupational nature of this department, such as the physical and social environments and

requirements of the job. However the social gradient trend remained when the maintenance and driver/operators departments were collapsed to compare blue and white collar worker categories, thereby lending credence to the evidence found in this study. The social gradient found in this study is also supported by the systematic review of the literature and social determinants of health literature, whereby those with lower social status have greater health risks and inferior health. This finding was maintained despite methodological problems such as a self-selected sample of convenience and cross-sectional study design.

Several lessons were learned from this descriptive study which provides guidance for future research and intervention. First, it would be important in future studies to have job title information at the individual level, to avoid collapsing into categories that do not recognise the key job characteristics that influence health. Second, more differences existed between departments and blue and white collar classification related to the psychosocial HRA factors than to physical factors. This supports the need to adopt a holistic conceptualisation of health for this type of research as both psychosocial factors and physical health behaviours have an impact on physical health outcomes. Third, further collaboration needs to occur between the workplace wellness sector and health research in order to improve upon the lessons learned in this study, the quality of the research produced in this field as well as program best practice. In conclusion, the results of this study provide a strong starting point for other Canadian researchers to further examine health in relation to other classifications, occupational industries and/or the broader Canadian population.

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APPENDICES

APPENDIX A: Literature Review Summary

Table 2. Literature review summary.

Author & Year	Title	Country	Objective /RQ	Outcome	Comment 1	Comment 2	Comment 3
(Armstrong et al., 2003)	Joint Effects of Social Class and Community Occupational structure on Coronary mortality among black and white men, upstate NY 1988-92	USA	Examine the joint effect of social class, race, and county occupational structure on coronary mortality for men 35-64 in upstate NY from 1988-92.	An inverse association between, CHD mortality and occupational structure was observed among black and white men.	Lowest CHD observed in white collar white men.	Two times higher mortality was found in blue collar than white collar men.	Highest mortality was observed in blue collar black men.
(Bennett, 1996)	Socioeconomic Inequalities in Coronary Heart Disease and Stroke Mortality Among Australian Men, 1979-1993	Australia	Examines subsequent trends in socioeconomic inequalities, with reference to socioeconomic patterns in major cardiovascular risk factors.	Men in manual positions were at least 35% more likely to die from CHD than men in professional occupations and 60% more likely to die from stroke.	During 1979-85 professionals had a decrease in death rate by 6.4% and manual workers 1.7%.	Smoking showed negative association with SES and prevalence declined in all occupation groups overtime.	Mean Systolic BP and prevalence of hypertension were lower among professional occupations and all occupations. All occupational groups experienced a decrease 80-89
(Borg & Christensen, 2000)	Social class and Self-rated Health: Can the gradient be explained by differences in lifestyle or work environment	Denmark	Describe differences in work environment and lifestyle factors between social classes in Denmark and to investigate to what extent these factors can explain social class differences with regard to changes in self-rated health over a 5 year period.	SES gradient: low SES have low SRH	high psychosocial demands higher in higher classes	more obese people and smokers in lower classes	

(Borrell, Muntaner, Benach, & Artazcoz, 2004a)	Social class and self reported health status among men and women: what is the role of work organization, household material standards and household labour	Spain	to analyze the association between self-reported health status and social class and to examine the role of work organization, household material standards and household labour as potential mediating factors in explaining the association.	Part of the association between social class positions and poor health accounted for by physical and psychosocial working conditions and job security (in men). For women, it was partly accounted for by working conditions, material wellbeing at home and household labour	SES gradient	Wrights social class indicators were used	
(Burton & Turrell, 2000)	Occupation, Hours Worked and Leisure Time Physical Activity	Australia	The association between occupation, time spent in paid employment, and participation in LTPA.	BC workers were ~50% more likely to be classified as insufficiently active using LTPA.	Rates of insufficient PA tended to increase with age and were highest among BC, mothers with dependant children, current smokers, the obese, those with non-reported height and weight and those with poor self - rated health.		
(Christensen et al., 2008)	Explaining the social gradient in long-term sicknesses absence: prospective study of Danish Employees	Denmark, UK & Finland	To identify differences in risk of sickness absences between socioeconomic groups and to examine to what extent these differences can be explained by health behaviour and work environment factors.	SES gradient evident in both genders in long-term sickness rates	Physical work environment explained more of this than health behaviours	Psychosocial environment has small effect in women but not men	
(Cunradi, Lipton, & Banerjee, 2007)	Occupational correlates of smoking among urban transit operators: A prospective study	USA	investigate the contribution of occupational factors to smoking over a 10 yr period among a multiethnic group of transit operators while accounting for alcohol	35% of workers increased, initiated or maintained smoking	This was associated with job problem frequency		

(Eller, Nettersto m, & Hansen, 2006)	Psychosocial factors at home and at work and levels of salivary cortisol	Denmark	To examine the whether cortisol levels are affected by psychosocial factors	NO SES impact on psychosocial factors	Psychosocial factors impacted salivary cortisol levels		
(Gillen et al., 2007)	The association of socioeconomic status and psychosocial and physical workplace factors with musculoskeletal injury in hospital workers.	USA	The combined effect of socioeconomic, organizational, psychosocial, and physical factors on work-related muscular-skeletal injuries were studied in a heterogeneous, socioeconomic diverse sample of hospital workers	Psychosocial and physical job related factors more important than SES in relation to injury			
(Hope, Kelleher, & O'Connor, 1999)	Lifestyle and Cancer: The Relative Effects of a Workplace Health Promotion Program Across Gender and Social Class	Ireland	examined whether a needs assessment/client led assessment, would have an impact on lifestyle and health, in blue-collar or manual occupational women	SES gradient favouring WC coping strategies	White-collar workers reported more stress related to job demands and work relationships	White-collar workers had better coping strategies than blue collar	
(Hunt, Stoddard, Barbeau, Goldman, Wallace, Gutheil et al., 2003)	Cancer prevention for working class, multi-ethnic populations through small businesses: the healthy directions Study	USA	We report demographic and social contextual characteristics of multi-ethnic, blue collar workers from the baseline survey of a study conducted in 24 small businesses	RCT design was used, but only descriptive statistics were reported			
(Ihlebaek & Eriksen, 2003)	Occupational and Social variation in subjective health complaints	Norway	To examine the relationships between occupation, lifestyle, and subjective health complaints.	Few differences in Subjective Health Complaints (SHC) and sickness were found when education, age and gender were controlled for.	Physical workload and sleep quality showed significant relationships with SHC for bother genders. Education was a significant factor for women only	Female health worker showed more pseudoneurological complaints than WC workers. Male BC had a higher frequency of sickness absence than WC workers.	

(Korda et al., 2002)	The health of the Australian workforce:1998-2001	Australia	To describe the heath of the Australian workforce in relation to occupational status.	Occupational inequalities in self-rated health were evident for both men and women, with professionals reporting the best health.	BC workers reporting health problems were less likely to take time off work	BC workers also had higher rates of short-term conditions and reduced activity days due to health compared to professionals	
(Kwak et al., 2007)	A poster-based intervention to promote stair use in blue and white collar worksites	Netherlands	This study test whether an intervention using prompts is effective in stimulating stair use in two types of worksites: one consisting mainly of WC workers and one mainly of BC workers	There was a significant difference between stair use at baseline and during the poster intervention in both types of worksites.	After removal of the posters stair well use decreased significantly to a level that was not significantly different from baseline.		
(Laaksonen, Sarlio-Lahteenkorva, Leino-Arjas, Martikainen, & Lahelma, 2005)	Body Weight and Health Status: Importance of Socioeconomic Position and Working Conditions	Finland	Examine the association between relative body weight and health status and the potential modifying effects of socioeconomic position and working conditions on this association.	SES did not modify association with BMI . BMI. was inversely related with physical health	Body weight was inversely associated with physical health but in mental health, differences between BMI were small and inconsistent	SES did not modify the relationship between BMI and health	As BMI increased, women's health decreased. In men this occurred in the obese only.
(Leino-Arjas et al., 2003)	LTPA and strenuousness of work as predictors of physical functioning: a 28year follow-up of a cohort of industrial employees	Finland	To examine the associations of LTPA and physical strenuousness of work with physical functioning 28-years later.	Vigorous exercise and housework were inversely associated with poor physical functioning 28 years later in both BC and WC workers.	High physical strenuousness of work, overweight and smoking were predictive of later poor physical functioning.	Among BC workers a beneficial association was observed with all LTPA including low intensity.	
(Louhevaara, Pennttinen, & Tuomi K., 1999)	Work Ability and Job demands of aging white and blue collar workers in 1981 and 1996	Finland	A comparison of perceived work ability and job demands in 1981 and 1996.	Perceived work ability ad psychological resources changed very little from 1981 to 1996, but there seemed to be a more positive view toward a more positive view of future work ability	General and mental job demands, in particular seemed to be increasing among WC workers.	The observed differences in work ability and job demands were systematically more positive among BC workers than among WC workers.	

(Lusk, Kerr, & Ronis, 1995)	Health-Promoting Lifestyles of Blue-Collar; Skilled Trade and White Collar Workers	USA	To determine differences in health promoting lifestyles behaviours by worker category, ethnicity, age, gender, education and marital status.	WC workers were significantly higher than the other two groups on self-actualization, exercise and interpersonal support subscales.	BC workers were significantly lower than the other groups on nutrition and health promoting lifestyle	Those with an education of high school or less had lower scores than the other groups on self actualization, interpersonal support and health promoting lifestyle. Those with college degrees had higher scores on health responsibility, exercise, nutrition and stress management.	The effects of education eliminated the majority of the effects of job categories.
(Macleod, Smith, Metcalfe, & Hart C., 2005)	Is Subjective Social status a more important determinant of health than objective social status? Evidence from a prospective observational study of Scottish men.	UK	examined the relationship between social position, health behaviour and perceived stress	bad factors in early child hood more important determinant of health than self perception of health as adult	lower social position was associated with adverse profile of disease risk		
(Moradi et al., 2000)	Breast cancer risk and lifetime leisure-time and occupational PA	Netherlands	To clarify whether type and timing of PA affect postmenopausal breast cancer risk	women with sedentary jobs during reproductive years have 50% higher risk for postmenopausal breast cancer	Effect of OPA and LTPA on BC risk appear to have different latency times and/or effect modified by age or reproductive status		
(Niknian et al., 1991)	Use of Population-Based Data to Assess Risk Factor Profiles of Blue and White Collar Workers	USA	Compares CVD risk Factors in BC and WC respondents from a population-based random sample survey conducted in two SE New England Communities	Regardless of gender, a significantly higher proportion of WC reported exercising at least 1x per week, increasing exercise in the last year, attempting to loose wt, having blood cholesterol measured in the last year and limiting fat and salt intake compared to BC workers.	More BC workers reported exercising everyday than their WC counterparts. BC workers also had significantly higher currently smokers, heavier smokers, higher diastolic & systolic BP, lower HDL-C and higher BMI when compared to WC.	All comparisons become similar when gender was considered	With regard to health attitudes, BC workers were more likely than WC workers to have never encouraged another person to quit smoking, lose weight, limit salt/fat or exercise.

(Nourjah et al., 1994)	Knowledge of Risk Factors and Risk Behaviours Related to Coronary Heart Disease among Blue and White Collar Males	USA	Examines the association of knowledge of CHD risk factors and selected behaviours among currently employ BC and WC workers.	WC were more knowledgeable about the risk factors of CHD than BC. Fewer WC reported smoking than BC	WC reported trying to loose weight more than BC regardless of weight.	For both WC and BC, the odds of being overweight were similar for knowledgeable and non-knowledgeable individuals.	Confounding was tested for by age, income, education, race and ethnicity and Ors did not change significantly.
(O'Campo, Eaton, & Muntaner, 2004)	Labour market experience, work organization, gender inequalities and health status: results from a prospective analysis of US employed women	USA	Examine gender specific employment patterns and exposures, on overall general health	Other important workplace factors were found that should be measured including: promotion/demotion history, firm characteristics, occupational gender inequalities	Women had greater inequalities in terms of pay.		
(Quinn, Sembajwe, Stoddard, Kriebel, Krieger, Sorensen et al., 2007)	Social disparities in the burden of occupational exposures: results of a cross sectional study	USA	assess the burden of exposures reported in 1 year by a socially diverse population working a wide range of industries and evaluate whether Social demographic characteristics affected the patterns of exposure	Exposure reporting varied by SES groups	Sociodemographic characteristics should be considered when conducting exposure assessment using questionnaires		
(Rose et al., 2006)	Work-related life events, psychological well-being and cardiovascular risk factors in male Swedish automotive workers (Volvo)	Sweden	To analyse the relationship between life events, social support, psychological well-being and cardiovascular risk factors in BC and WC Swedish automotive workers.	BC workers appeared to have an increased risk of CVD compared to WC due to higher proportion of smokers, higher WHR and higher TG.	BC workers reported having worse general health and less emotional self-control but were less anxious than the WC workers.		

(Salmon et al., 2000)	LT, Occupational and household PA among Professional, skilled and less-skilled workers and homemakers	Australia	To examine the association between occupational status and combinations of LTPA, home based PA and OPA.	After adjusting for: age, BMI, Education, country of birth, marital status and smoking less skilled workers were less likely to report LTPA.	Occupational category was not a strong predictor of combined vigorous OPA and home PA.	With the inclusion of time spent in combined vigorous occupational and home PA, there was no longer an association of activity with occupational status for men, however the association remained for women.	
(Schneider & Becker, 2005)	Prevalence of Physical Activity among the working population and correlation with work-related factors: Results from the first German national Health Survey	Germany	investigates the levels of engagement in PA among the total German working population and for specific subgroups.	SES gradient in LTPA - manual workers with below average educational qualifications from lower SES groups were less likely to engage in LTPA	Those with physically strenuous jobs and frequent overtime work were less likely to engage in leisure time physical activity		
(Schofield et al., 2005)	Objectively-measured PA in New Zealand workers	New Zealand	1) Measure daily PA OPA, and LTPA for 6 job categories 2)ascertain the relationship between various activities collected via self-report and step counts in the same sample of working adults	A significant difference with Retail and BC achieving higher PA levels in comparison to the other occupational categories in OPA and total PA.	Proportionally BC workers accumulated more steps in the workplace than any other occupation followed by nurse/aids.	No relationship existed between tertiles of hours worked and PA classification for work and non-work pedometer values.	Please note n= 9 in the BC category
(Schrijvers et al., 1998)	Socioeconomic inequalities in health in the working-population: the contribution of working conditions	Netherlands	The aim was to study the impact of different categories of working conditions on the association between occupational class and self-reported health in the working population.	Lower social class had lower SRH for both men and women	odds of less than good SRH was greater in those working in hazardous working conditions, lower job control, lower social support	Social gradient explained by job conditions and low job control across social class	

(Sorensen, Barbeau, Stoddard, Hunt, Kaphingst, & Wallace, 2005)	Promoting Behaviour Change Among Working-Class, Multiethnic workers: Results of the Health Directions-Small Business Study	USA	Examined the efficacy of a cancer prevention intervention designed to improve health behaviours among working class, multiethnic populations employed in small manufacturing businesses.	Intervention reported greater improvements than control group	Workers had greater health improvements than managers		
(Sorensen, Emmons, Stoddard, Linnan, & Avrunin, 2002)	Do Social Influences Contribute to Occupational Differences in Quitting Smoking and Attributes toward quitting	USA	to examine the occupational differences in social influences supporting quitting smoking and their relationships to intentions and self-efficacy to quit smoking and to quitting	Social environments may impact smoking by occupational category	Compared with other groups blue collar workers reported less pressure to quit and less social support to quit.		
(Sorensen, Stoddard, Dubowitz, Barbeau, Bigby, Emmons et al., 2007)	The influence of Social Context on Changes in Fruit and Vegetable Consumption: Results of the Health Directions Studies	USA	the relationship between social context factors in our conceptual model and changes in Fruit and Veg consumption from baseline to completion in Health Centre and small business studies.	SES gradient on Fruit and Veg Consumption	Those with strongest social networks, supportive social norms, less household crowding and food insufficiency were associated with greater change in fruit and veg consumption		
(Steele & Mummery, 2003)	Occupational physical activity across occupational categories	Australia	To investigate the amount of PA that occurs during normal working hrs, highlighting the occupational differences in PA by occupational category.	Professionals did significantly fewer steps than their BC counterparts and that WC workers also did significantly less than the BC workers	Professionals reported more hours at work than WC and BC	When OPA was analysed using METS, professionals reported more light OPA than WC or BC. BC reported more moderate and heavy OPA than WC and professionals.	

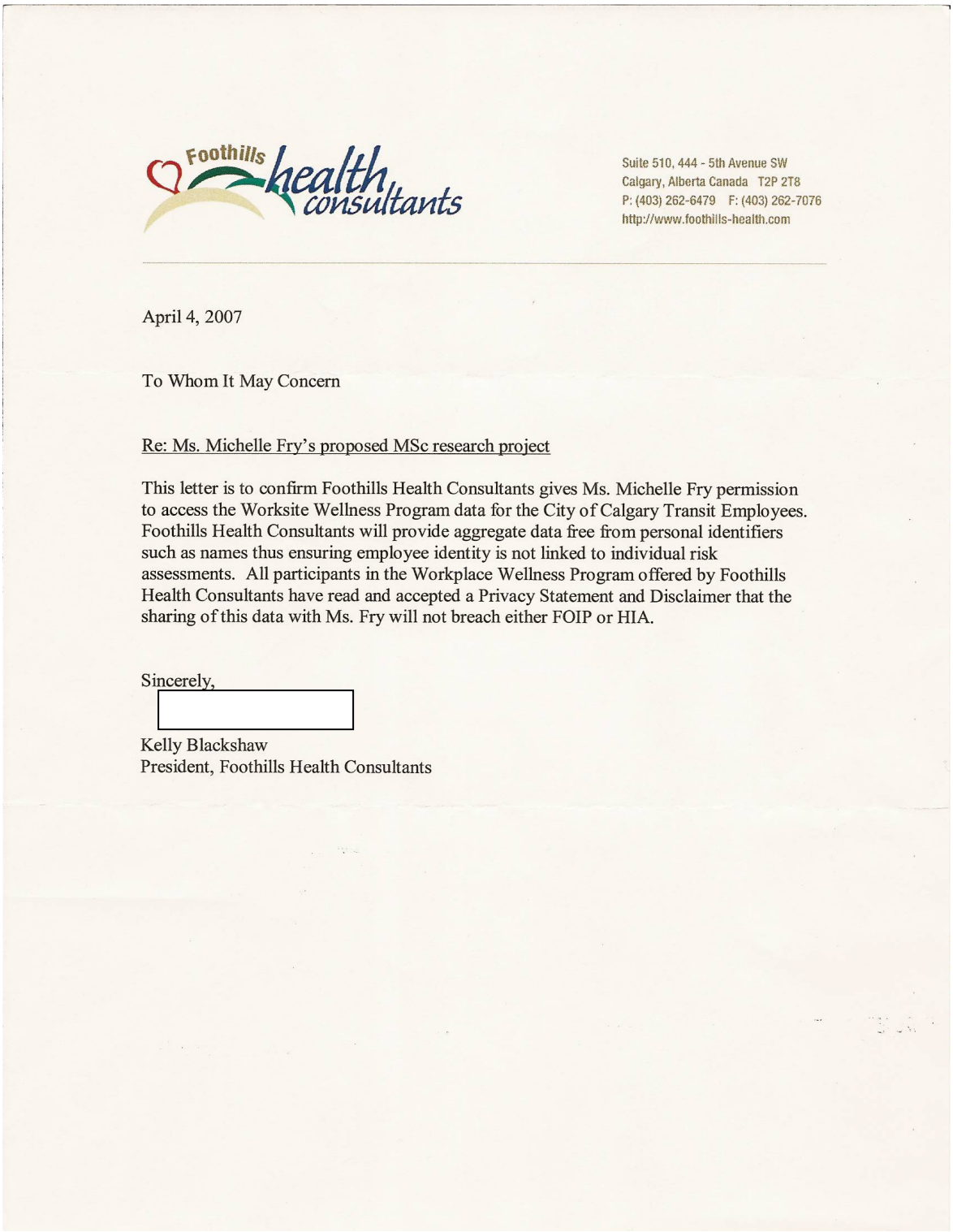
(Strong & Zimmerman, 2005)	Occupational Injury and absences from work among AA, Hispanic and NH white workers in the National Longitudinal survey of Youth	USA	How race and ethnicity influence injury and illness risk and number of days of work missed as a result of injury or illness.	The following were associated with having an increased odds of occupational injury or illness: having a blue collar occupation, working fill-time, having longer tenure, working 1 vs. 2 jobs, and working the late shift.	\		
(Tsutsumi et al., 2001)	Association between job strain and prevalence of hypertension: a cross sectional analysis in a Japanese working population with a wide range of occupations: the Jichi Medical School cohort study	Japan	To explore the association between the prevalence of hypertension in Japanese working population and job strain and to estimate this association in different socio-demographic status.	The stratified analyses showed significant excess risk in the subordinate groups compared with managers, BC workers, less educated workers and the older age groups. This association was not significant in women	In men the level of job strain correlated with the prevalence of hypertension.		
(Turrell, Kavanagh, Draper, & Subramanian, 2007)	Do places affect the probability of death in Australia? A multilevel study of area-level disadvantage, individual-level socioeconomic position and all-cause mortality, 1998-2000.	Australia	To examine the association between area-level disadvantage and all-cause mortality before and after adjustment for within-area variation in individual SEP using unlinked census and mortality register data in a multi-level context.	Death rates were highest among BC than WC employees.	Living in a disadvantage area, after adjustment for occupational differences, was associated with higher all cause mortality	Consistent with international and AUS studies, a strong association between existed between occupation and mortality: compared with professionals BC workers had significantly higher mortality and WC employees significantly lower rates.	
(Vaananen, Pahkin, Kalimo, & Buuk, 2004)	Maintenance of subjective health during a merger: the role of experienced change and pre-merger support at work in white and blue collar workers.	Finland and Netherlands	1) subjective health effects of a merger among employees who has experienced a change in their job position and 2)effects of pre-merger support at work on the experiences change in job position and on	weak org support increase self reported health impairment	strong co-worker support increased the risk of poor subjective health among blue-collar workers when their job position decreased	A negative change in job positions and lack of upper level social support at work create a potential risk for health impairment.	

			subjective health.				
(Vahtera et al., 1999)	Workplace as an origin of health inequalities	Finland	To investigate the effect of the workplace on the socioeconomic gradient of sickness absence.	Sick leave was 4.9 and 2.8 times higher in blue collar male and female workers than their same sex white collar counterparts.	These risks varied by the town they were assessed in. Men in relation to long sick leaves regardless of cause, and women in relation to long leaves from infection.	In men, and to a lesser extent women, workplace is significantly associated with health inequalities as reflected by sick leave and the corresponding socioeconomic gradients of health.	
(Wandell & Roos, 2006)	Age perceptions and PA among middle aged men in three occupational groups	Norway	QUALITATIVE: Explore how middle aged men in different socio-economic groups and with different work experiences, talk about ageing and how they see age as a reason for pursuing or not pursuing PA	carpenters worried about declines in strength due to an angina body, engineers worried about staying in shape to handle stress and drivers focused on leaving he body as it is/taking age as it comes	Men in all three categories were thinking about their health more as they aged		
(Wilbur et al., 1999)	Women's Occupations, Energy Expenditure and CV risk Factors	USA	to examine the CVD risk factors and energy expenditure of women from occupations that differ by PA level and socioeconomic level	CVD benefits, particularly for lipid profiles may be derived from small increased in OPA	Women with active jobs had higher HDL and lower TC than women with lower occupational energy scores		

(Wilbur et al., 1999)	Occupational injuries in Korea: A Comparison of Blue and White Collar works' rates and underreporting	USA	Q2 How do perceptions of worksite health climate compare between blue and white collar workers? Q2 Does this differ in redefined Subgroups (BC: incentives. Hourly wage) (WC: support staff vs. engineering)	Blue and white collar workers view the workplace health climate differently. Differences were independent of Education level. Compared to BC, WC view workplace more positively.	Q1: Biggest difference between BC and WC was noted in: Supervisor social support, Anti-smoking attitudes and smoking norms. In each comparison except smoking norms, white collars reported higher scores than blue. Three subscales were not significantly different: Exercise norms, job tension norms, support for healthy behaviour.	Engineers more uniform in perceptions than support staff in regards to organizational support. Blue collar groups were not significantly different from each other. But the Engineers were different from support staff and BC in the following areas: Higher nutrition, lower smoking, employer health orientation and pro-exercise attitudes.	
(Won et al., 2007)	Occupational injuries in Korea: A Comparison of Blue and White Collar works' rates and underreporting	Korea	To determine the occupational injuries, illnesses between white and blue collar workers, and to estimate the magnitude of under-reporting in Korea.	Blue-collar workers had 3.47 more cases per 100 person-years when white-collar workers for Musculo-Skeletal disease or injury and poisoning.	Injury rate was 2.74 to 3.29 injured workers and the incidence rate was 3.62 to 5.44 injuries and illnesses per hundred workers	Hospital visits higher in blue than white collar workers except for the 60+ age group when stratified.	
(Wu & Porell, 2000)	Job Characteristics and Leisure PA	USA	To estimate an empirical model of leisure exercise activity using a sample population of older workers	WC workers are more likely to do light PA. BC workers tend to engage in more vigorous exercise.	WC with stressful jobs exercise regular light exercise. BC with high stress jobs engage in regular vigorous exercise	BC and WC who were smokers were less likely to engage in both light and vigorous PA. BC and WC workers who reported regular PA also reported good self-perception of health.	

APPENDIX B: Letters of Support

Foothills Health Consultants



Foothills health consultants

Suite 510, 444 - 5th Avenue SW
Calgary, Alberta Canada T2P 2T8
P: (403) 262-6479 F: (403) 262-7076
http://www.foothills-health.com

April 4, 2007

To Whom It May Concern

Re: Ms. Michelle Fry's proposed MSc research project

This letter is to confirm Foothills Health Consultants gives Ms. Michelle Fry permission to access the Worksite Wellness Program data for the City of Calgary Transit Employees. Foothills Health Consultants will provide aggregate data free from personal identifiers such as names thus ensuring employee identity is not linked to individual risk assessments. All participants in the Workplace Wellness Program offered by Foothills Health Consultants have read and accepted a Privacy Statement and Disclaimer that the sharing of this data with Ms. Fry will not breach either FOIP or HIA.

Sincerely,

Kelly Blackshaw
President, Foothills Health Consultants

Transit from Calgary Transit

THE CITY OF
CALGARY

CALGARY TRANSIT, SAFETY AND SECURITY DIVISION 166 SG

2007 July 25 File No.: HS-07

To Whom It May Concern:

Subject: Michelle Fry's Proposed MSc Research Project

This letter is to confirm The City of Calgary, Transportation Department, gives Michelle Fry permission to access the Worker's Compensation Board's annual and quarterly reports.

The information in these reports summarizes injury incidence in Maintenance and Operations employees and will be used for her thesis. The City of Calgary will provide these annual reports free from personal identifiers ensuring no identity is linked to WCB claim information. The City of Calgary, Transportation Department agrees to support this request.

Yours truly,

Ed DeGroot
Coordinator, System Safety
Safety Section
Safety and Security Division'
Calgary Transit

ED/lgd

www.calgary.ca call 3-1-1 P.O. Box 2100, Stn. M, Calgary, AB, Canada T2P 2M5

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APPENDIX C: Transit Workforce Descriptive Statistics

Report ID: CCHR006 **WorkForce Analysis** Basic Descriptive Data

Explanation and use of the Graphic Pages: Any age or years of service category with fewer than 10 people is suppressed for privacy reasons. The graphic pages of this report are intended for those DEPTID owners with large numbers of staff where distributions of staff by category will remain higher than 10 people.

Business Unit: CALGARY TRANSIT

	Entire WorkForce	Core WorkForce *
Business Unit Staffing as of 06-JUL-2007 =	2518	2369
Average Age of Employees =	47.0	47.0
Standard Deviation =	7.3	9.4
Average Years of Service =	12.8	13.2
Standard Deviation =	10.4	10.4

Employee Classification	Entire WorkForce	Core WorkForce *
Student	2	
On Call	91	
Permanent	1955	1955
Pre 95 LTD	7	
Probation	326	326
Seasonal		
Supp Of Comp		
Temporary	49	
Trial	88	88
Volunteer		
Total	**2518**	**2369**

Full/Part Time	Entire WorkForce	Core WorkForce *
Full Time	2217	2159
Part Time	301	210
Total	**2518**	**2369**

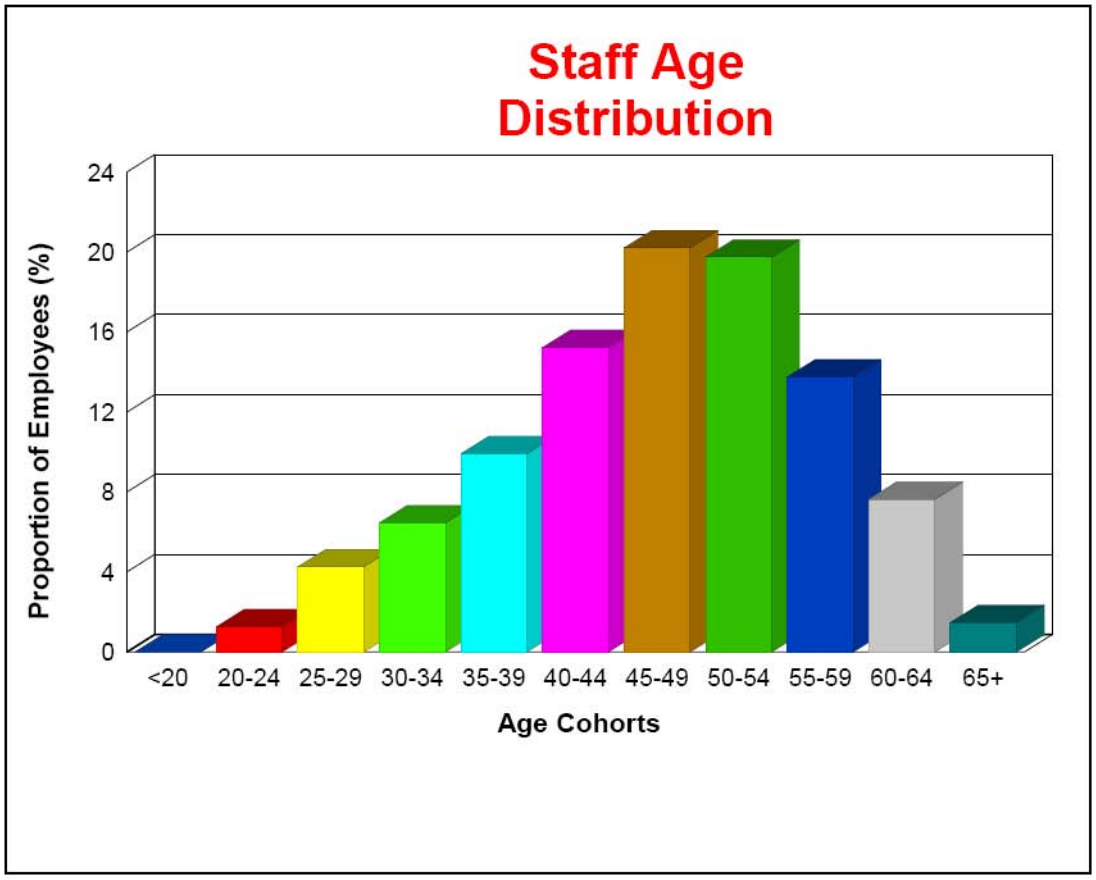
Gender	Entire WorkForce	Core WorkForce *
Female	486	432
Male	2032	1937
Total	**2518**	**2369**

Union/Association	Entire WorkForce	Core WorkForce *
ATU Local 583	2248	2125
Emergency Medical Services		
CUPE Local 37 Outside Workers		
CUPE Local 38 Inside Workers	79	58
CUPE Local 709 Foremen		
Calgary Police Association		
Executives and General Managers	1	1
Exempt	167	164
IBEW L254 Communication Officers		
IBEW Local 254	10	10
Firefighters (non floor members)		
Firefighters Local 255		
Local 1779, 2103 Carpenters	2	2
Other **		
Police Sr Officers Association		
Professional Engineers	10	9
Recreation Temp		
Special Category Temp Class	1	
TESA		
Total	**2518**	**2369**

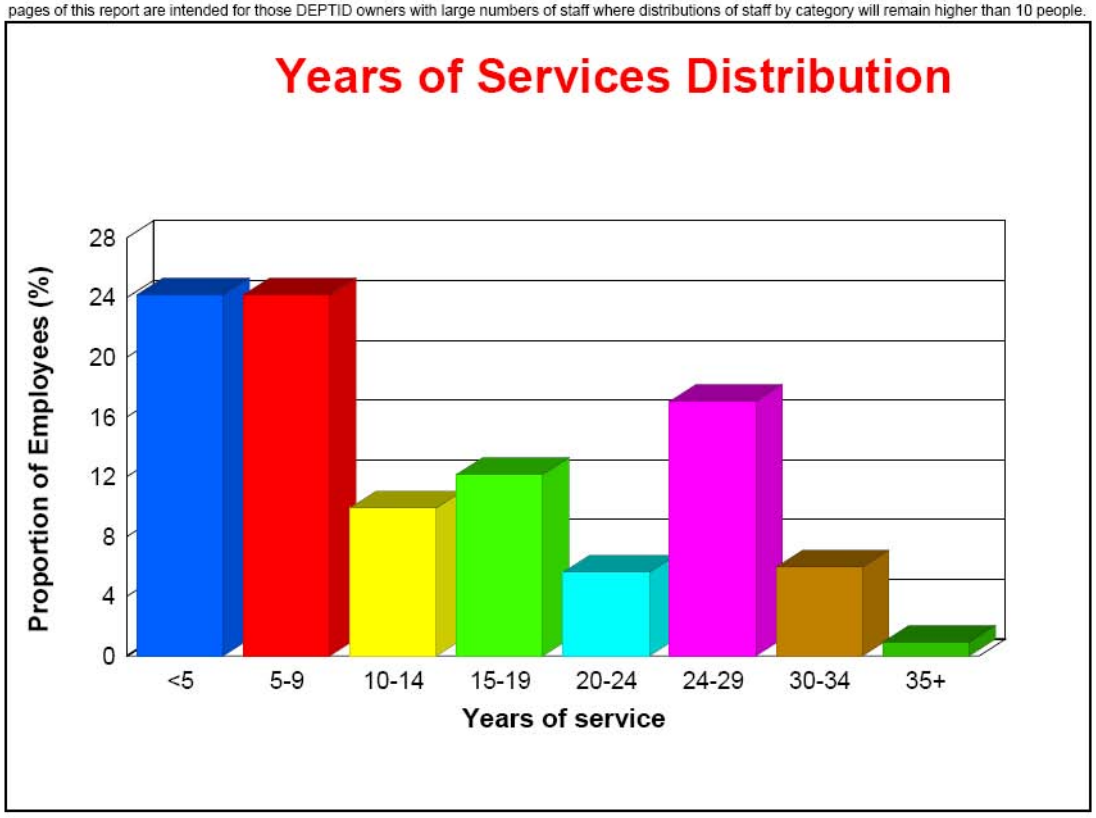
* Core Workforce includes employees classified as Permanent, Probation or Trial; Entire Workforce includes all classifications. NOTE: This report does not include prior pensionable service with another employer and assumes full time service. CAUTION: Averages provide limited information and may not reflect the unique characteristics of the workforce in question

** includes Alderanic Assistants, Contract with Benefits, and Elected Officials

Explanation and use of the Graphic Pages: Any age or years of service category with fewer than 10 people is suppressed for privacy reasons. The graphic pages of this report are intended for those DEPTID owners with large numbers of staff where distributions of staff by category will remain higher than 10 people.

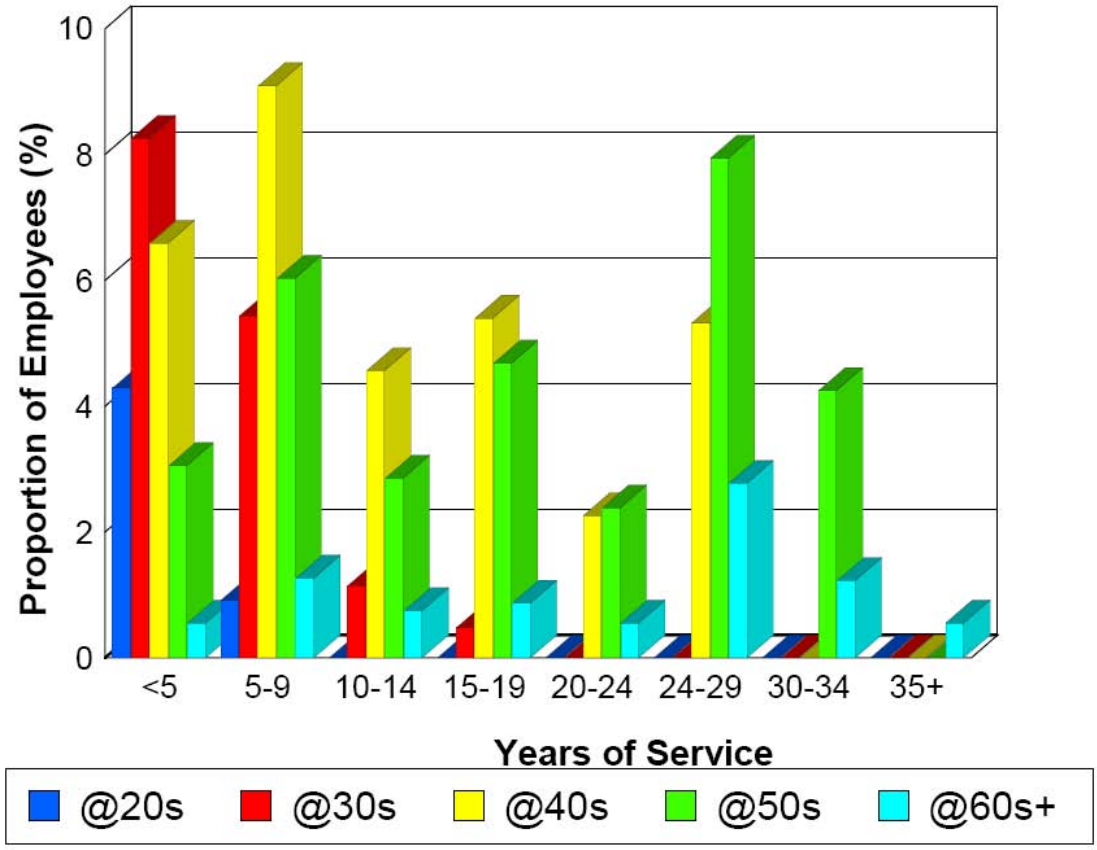


Explanation and use of the Graphic Pages: Any age or years of service category with fewer than 10 people is suppressed for privacy reasons. The graphic pages of this report are intended for those DEPTID owners with large numbers of staff where distributions of staff by category will remain higher than 10 people.



Explanation and use of the Graphic Pages: Any age or years of service category with fewer than 10 people is suppressed for privacy reasons. The graphic pages of this report are intended for those DEPTID owners with large numbers of staff where distributions of staff by category will remain higher than 10 people.

Age & Years of Service Distribution



APPENDIX D: Physical health normative values

Table 6. Canadian blood pressure, BMI and waist circumference norms.

Variable	Normative Values	Reference
Blood Pressure	Borderline high: 130-139/85 mmHg High: > 140/90	(Blood Pressure Canada et al., 2008)
BMI	Underweight: <18.5 Healthy: 18.5- 24.9 Overweight: 25-29.9 Obese I: 30-34.9 Obese II: 35-39.9 Obese III: 40+	(Health Canada, 2003)
WC	Women >88cm at risk Men>102cm at risk	(Heart and Stroke Foundation of Canada, 2009)

Table 7. Calgary Laboratory Services fasted lipid and glucose reference ranges.

Units	mmol/L				
Age (years)	Total Cholesterol	HDL-C	LDL-C	TG	Glucose
18-29	3.20-4.60	>0.90	1.70-3.00	0.60-2.30	3.9-6.1
30-49	3.80-5.20	>0.90	2.00-3.40	0.60-2.30	3.9-6.1
50-65	4.20-5.20	>0.90	2.20-3.40	0.60-2.30	3.9-6.1
66-150	4.20-6.20	>0.90	2.40-4.10	0.60-2.30	3.9-6.1

(Calgary Laboratory Services, 2009)

APPENDIX E: Missing Data

Table 12. Missing Data by variable.

Variable	Sample Size	Error	No data	Not applicable
ID	1059			
Sex	1059			
Date of Birth	1028	1	30	
Age at Assessment	1028	1	30	
Department	1035		24	
Session Name	1059			
Self Reported Health	153		906	
Systolic	961		98	
Diastolic	961		98	
BMI	994		65	
Waist Circumference	994		65	
Total Cholesterol	648		411	
HDL-C Cholesterol	648		411	
LDL-C Cholesterol	630		429	
Triglycerides	640		419	
Glucose	670		389	
Physical Activity	789	17	253	
Driving	806	20	233	
Sleep	818		241	
Energy	814		245	

Table 12 Con't. Missing Data by variable.

Variable	Sample Size	Error	No data	Not applicable
Nutrition	819		240	
Leisure Time	818		241	
Social Networks	813		246	
Concentration	811		248	
Work Life Balance	173		886	
Personal Control	172		887	
Job Definition	809		250	
Career Opportunity	809		250	
Job Control	169		890	
Work Hours	813		246	
Work Load	807		252	
Rewards	805		254	
Stress Level at Work	804		255	
Relationships with Co-workers	806	1	252	
Relationships with Supervisor	805		253	1
Relationships with Report staff	567	20	348	124
Shift Work	120		895	44

APPENDIX F: Variable Distributions

Histograms & Box Plots

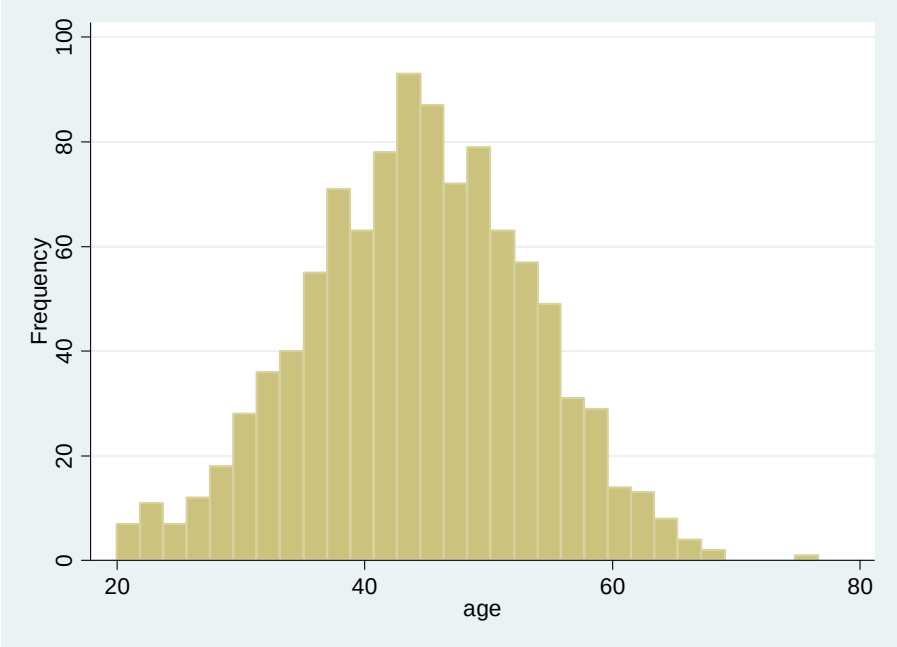


Figure 3. Data distribution of age for Calgary Transit.

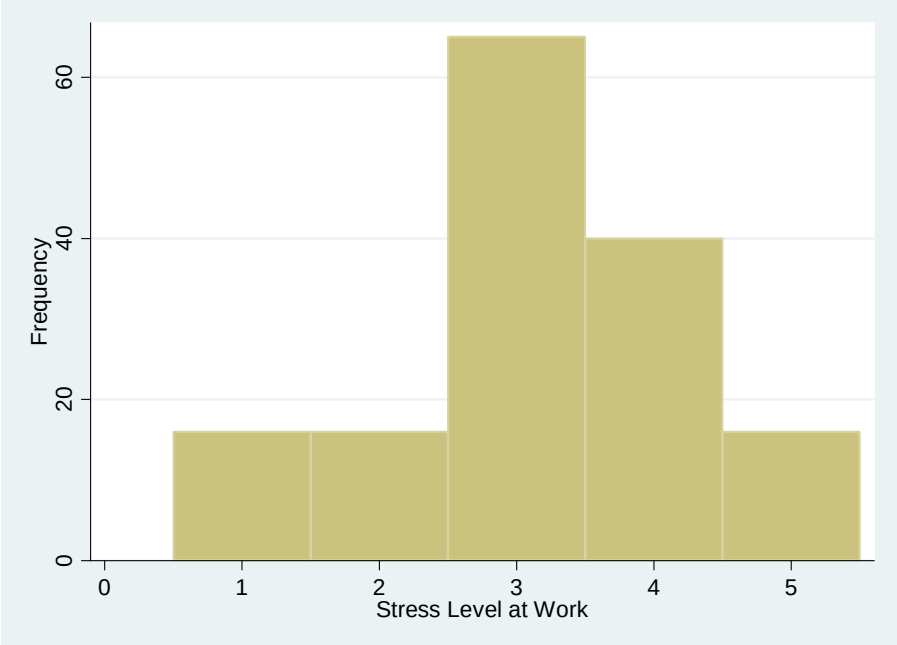


Figure 4. Data distribution of self reported health for Calgary Transit.

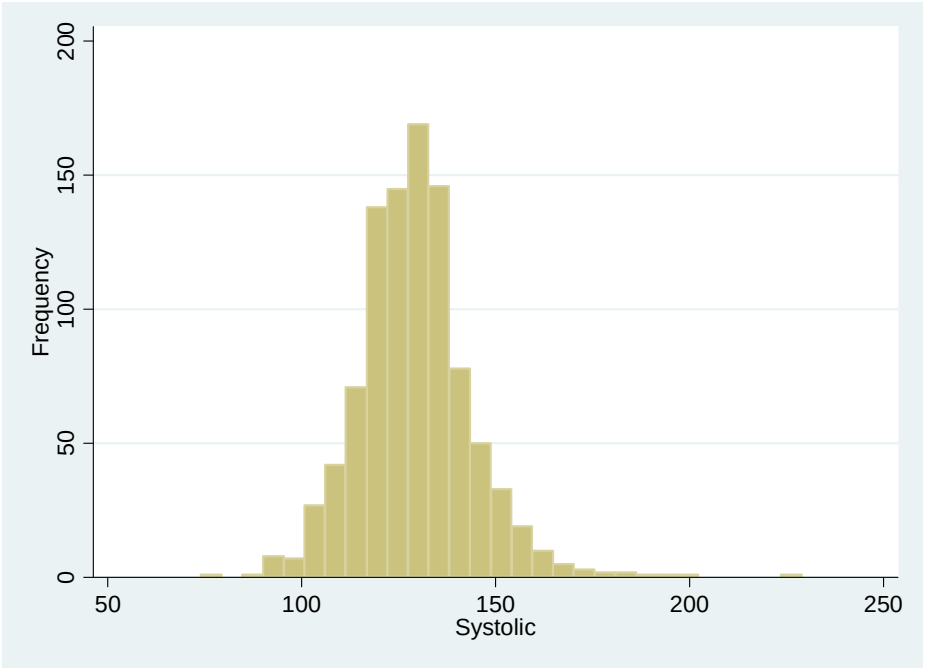


Figure 5. Data distribution of systolic blood pressure for Calgary Transit.

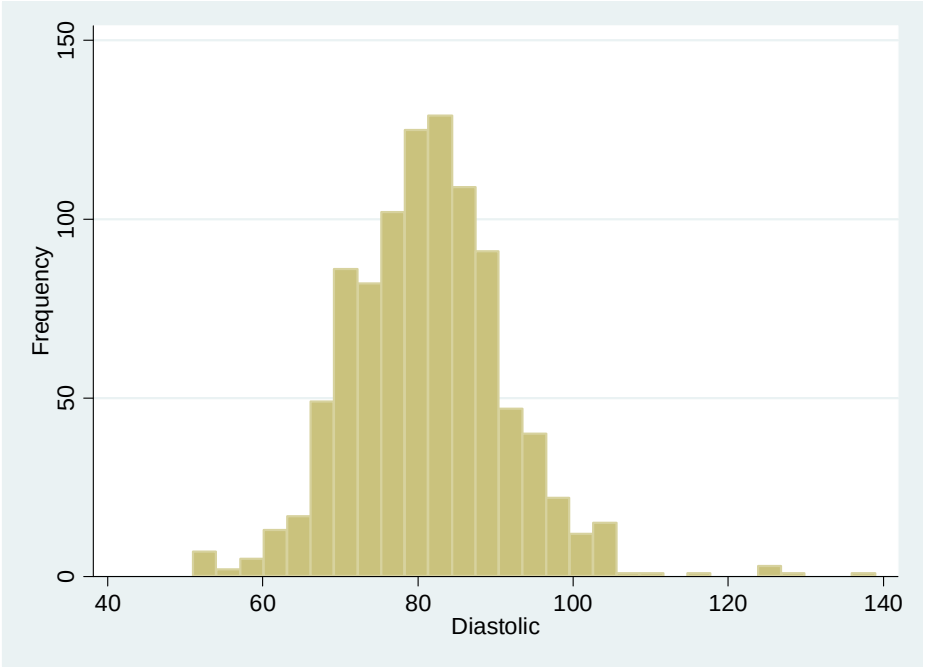


Figure 6. Data distribution of diastolic blood pressure for Calgary Transit.

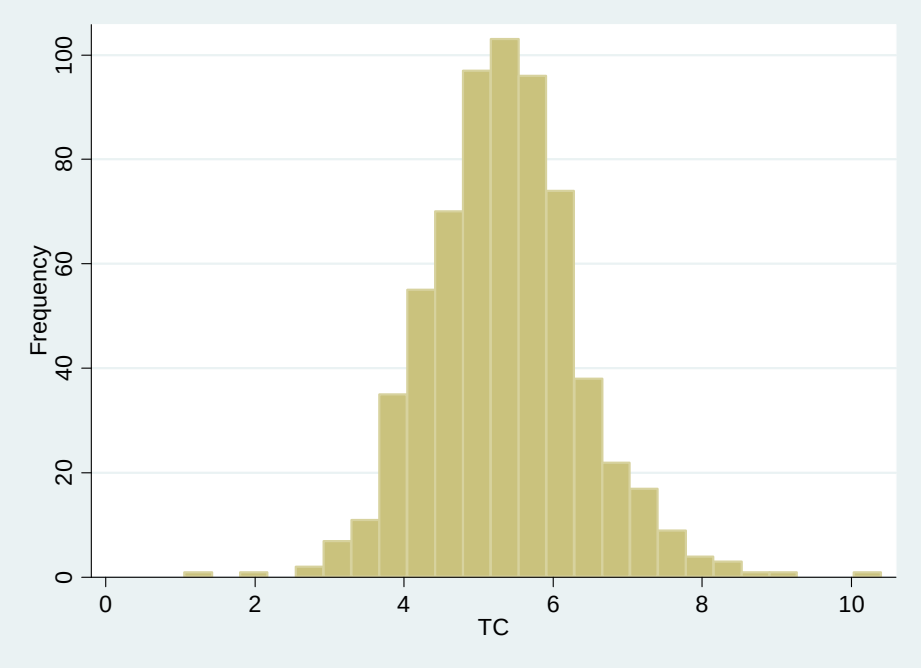


Figure 7. Data distribution of total cholesterol for Calgary Transit.

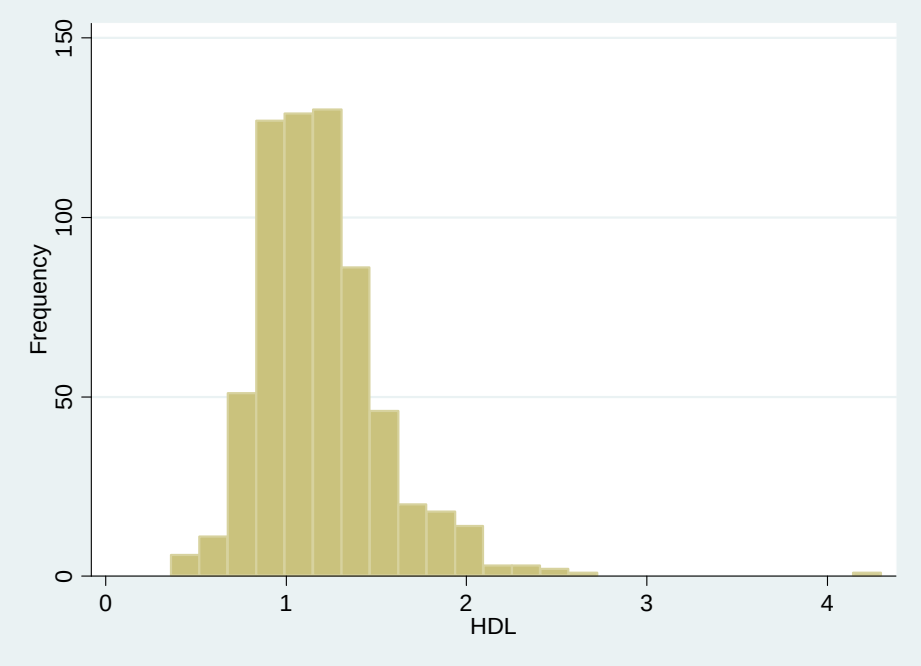


Figure 8. Data distribution of HDL-C for Calgary Transit.

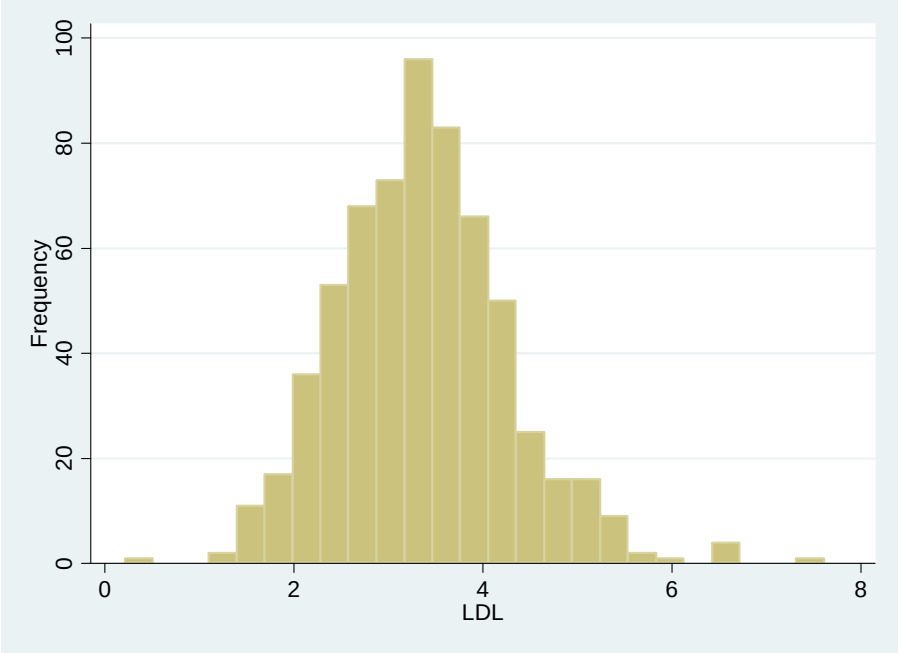


Figure 9. Data distribution of LDL-C for Calgary Transit.

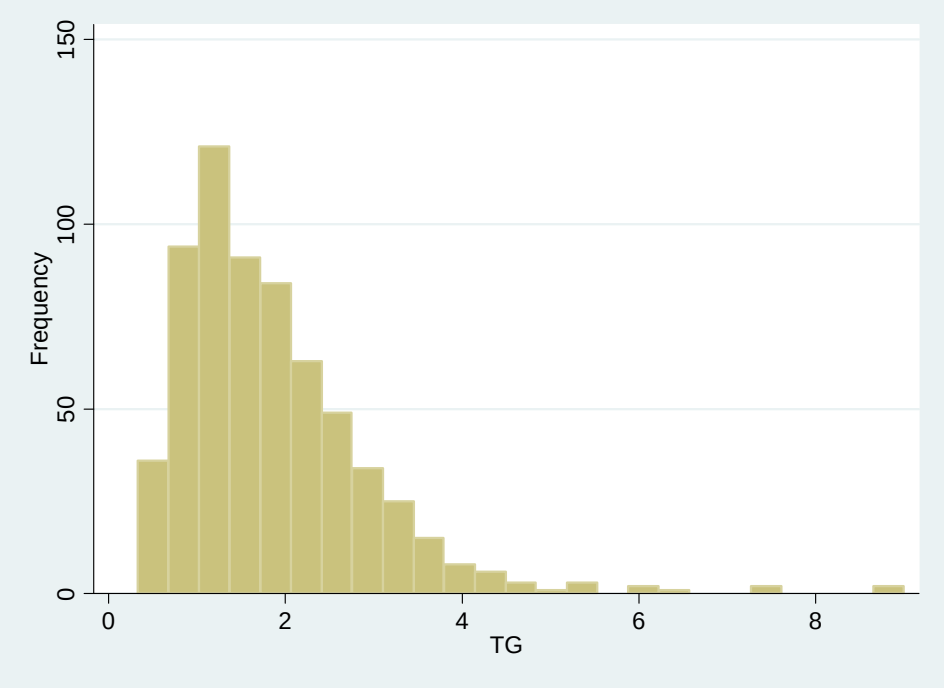


Figure 10. Data distribution of triglycerides for Calgary Transit.

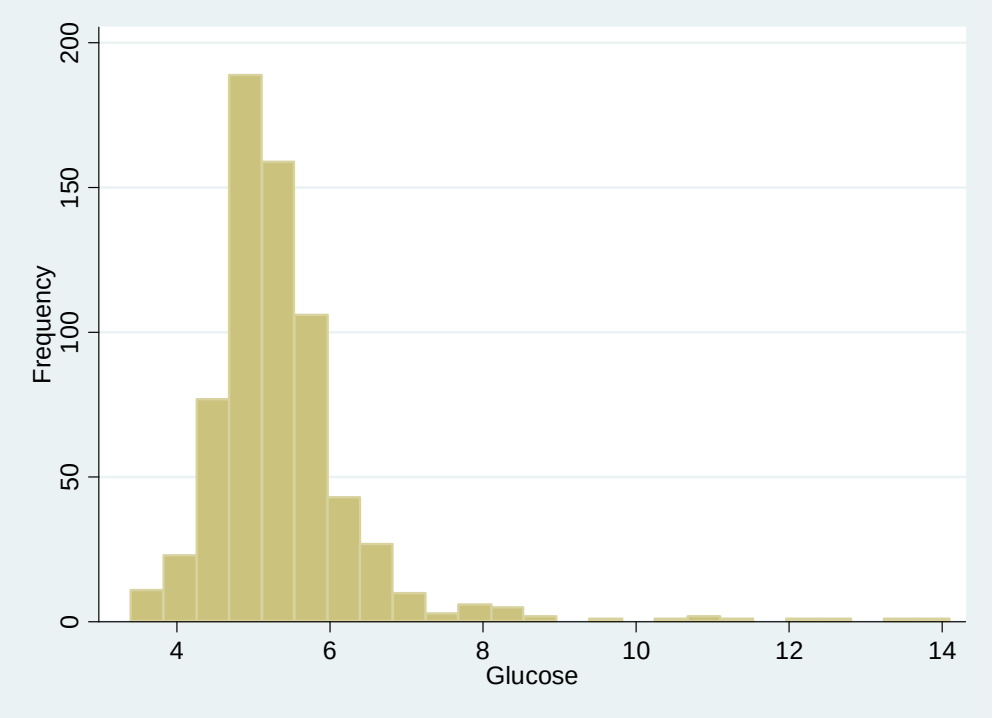


Figure 11. Data distribution of glucose for Calgary Transit.

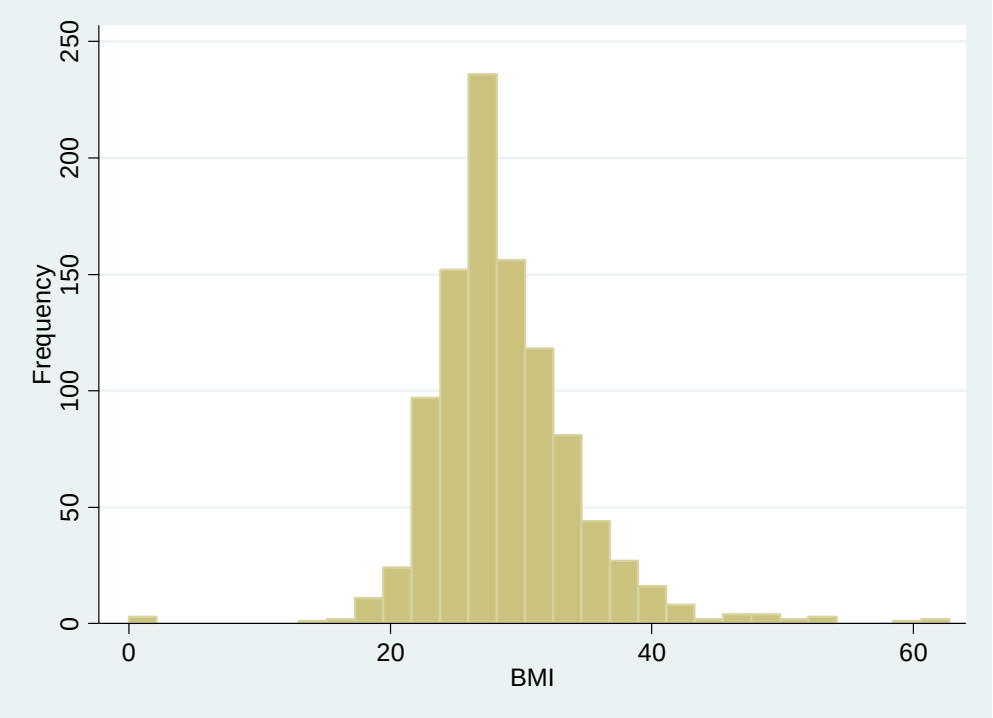


Figure 12. Data distribution of body mass index for Calgary Transit.

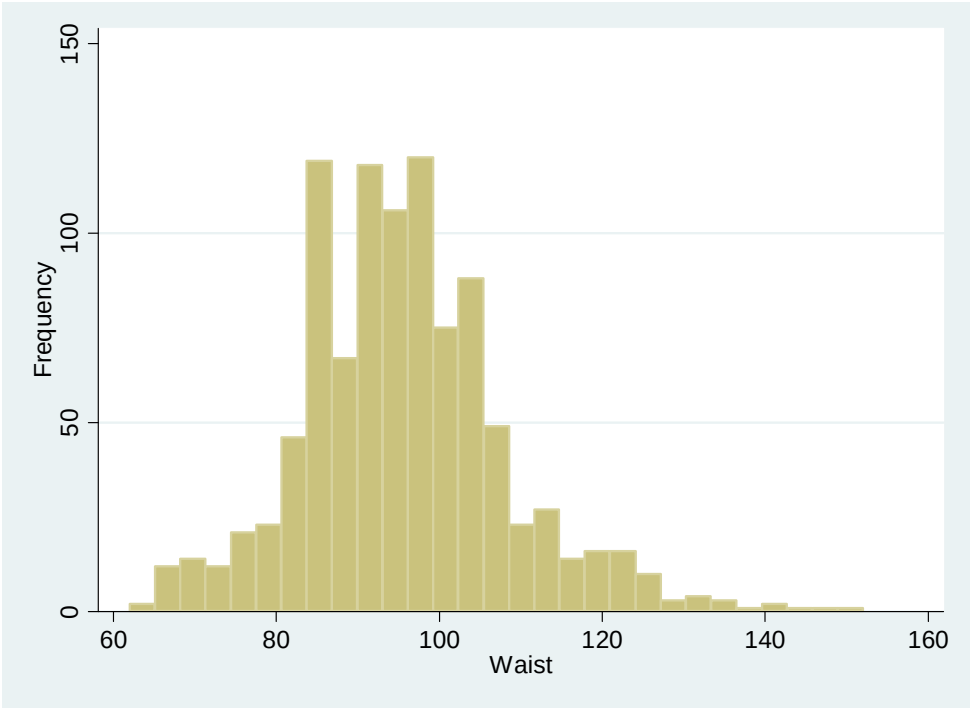


Figure 13. Data distribution of waist circumference for Calgary Transit.

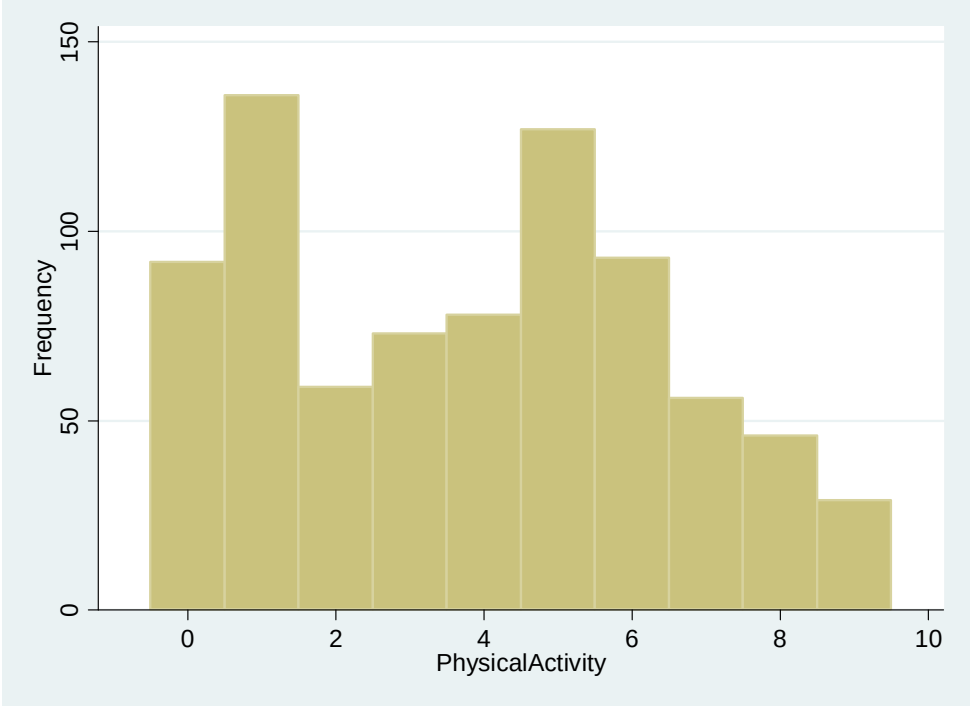


Figure 14. Data distribution of physical activity for Calgary Transit.

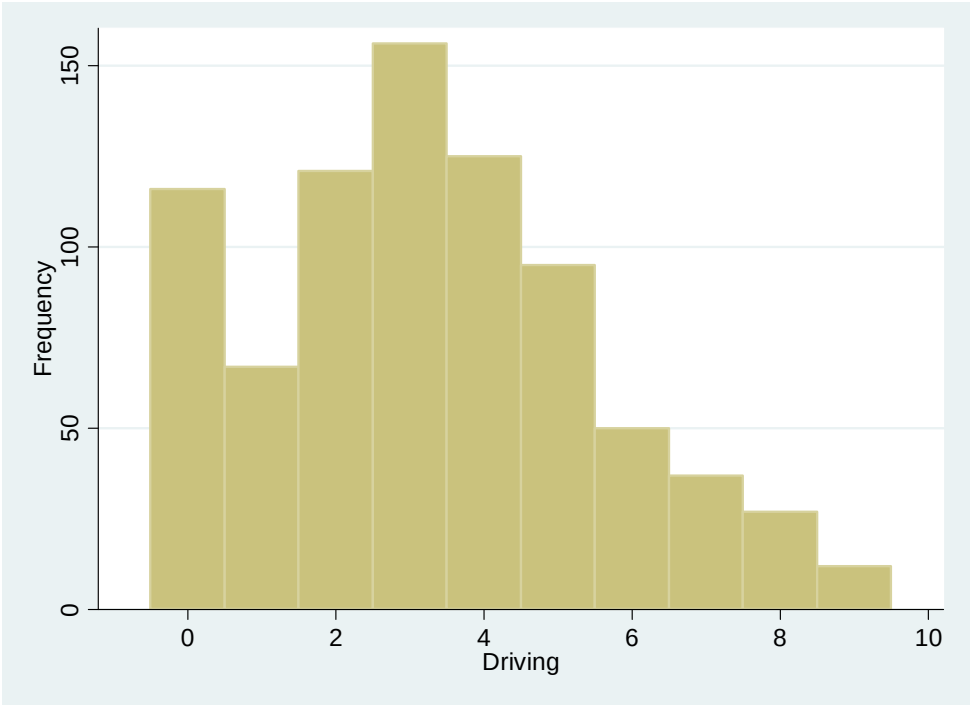


Figure 15. Data distribution of driving for Calgary Transit.

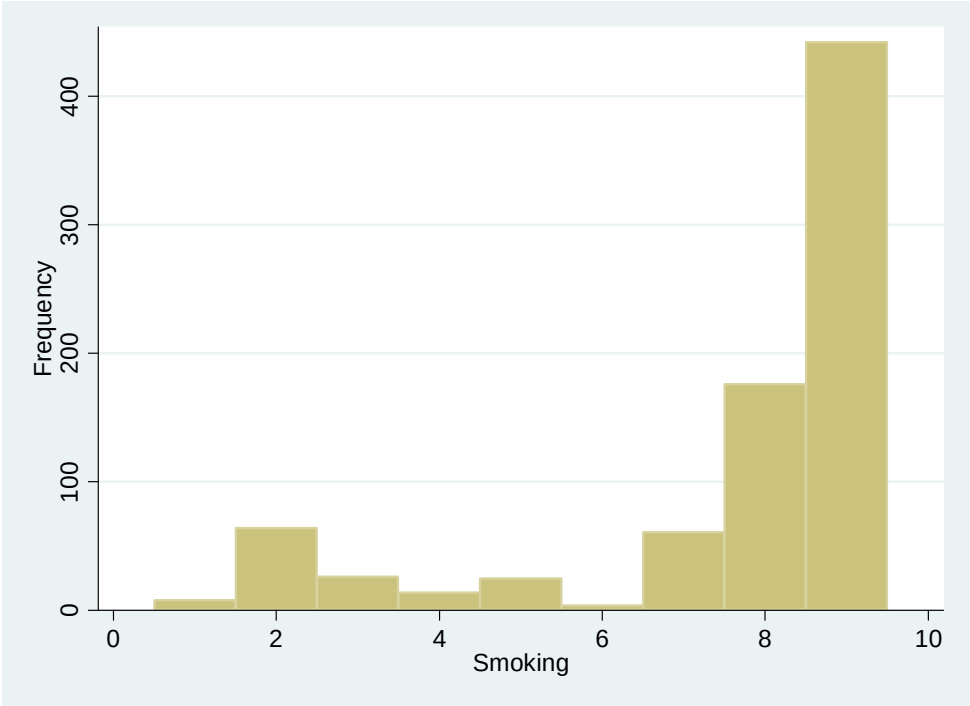


Figure 16. Data distribution of smoking for Calgary Transit.

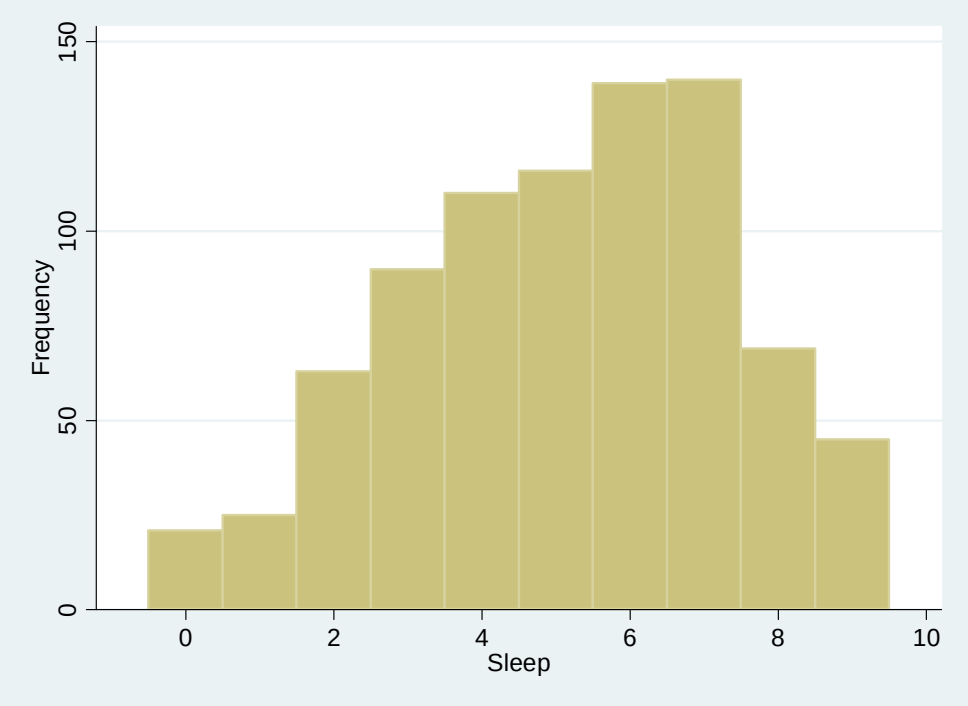


Figure 17. Data distribution of sleep for Calgary Transit.

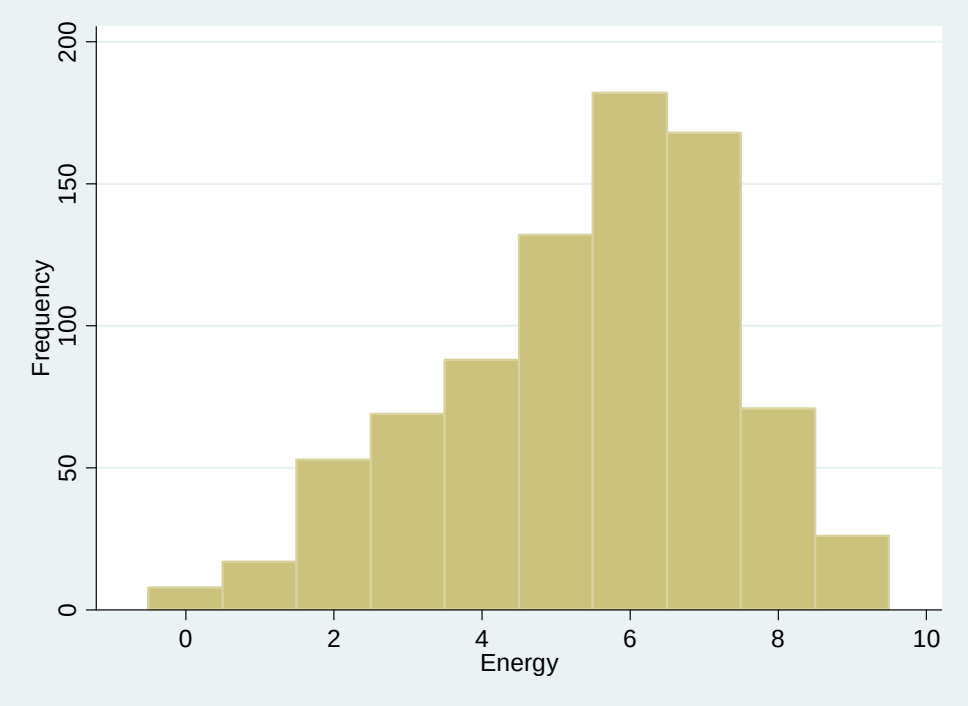


Figure 18. Data distribution of energy for Calgary Transit.

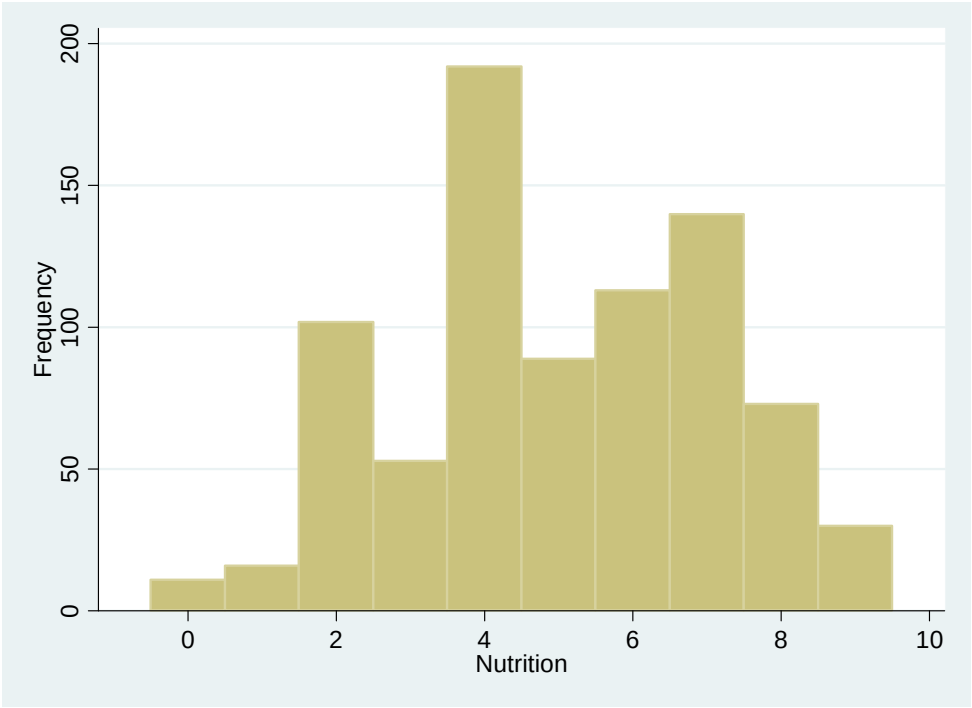


Figure 19. Data distribution of nutrition for Calgary Transit.

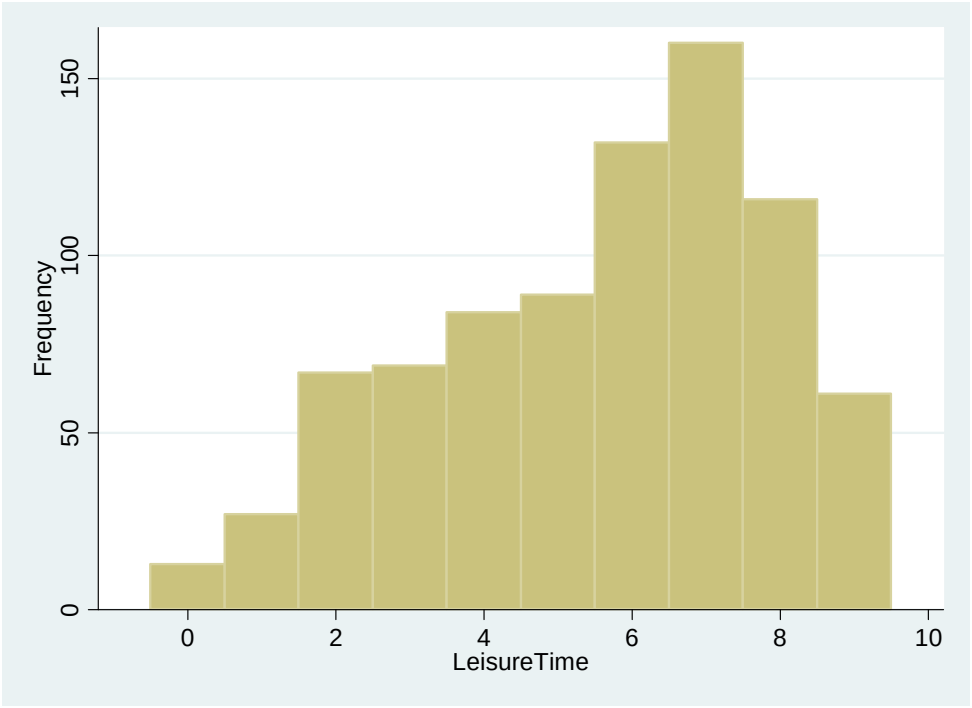


Figure 20. Data distribution of leisure time for Calgary Transit.

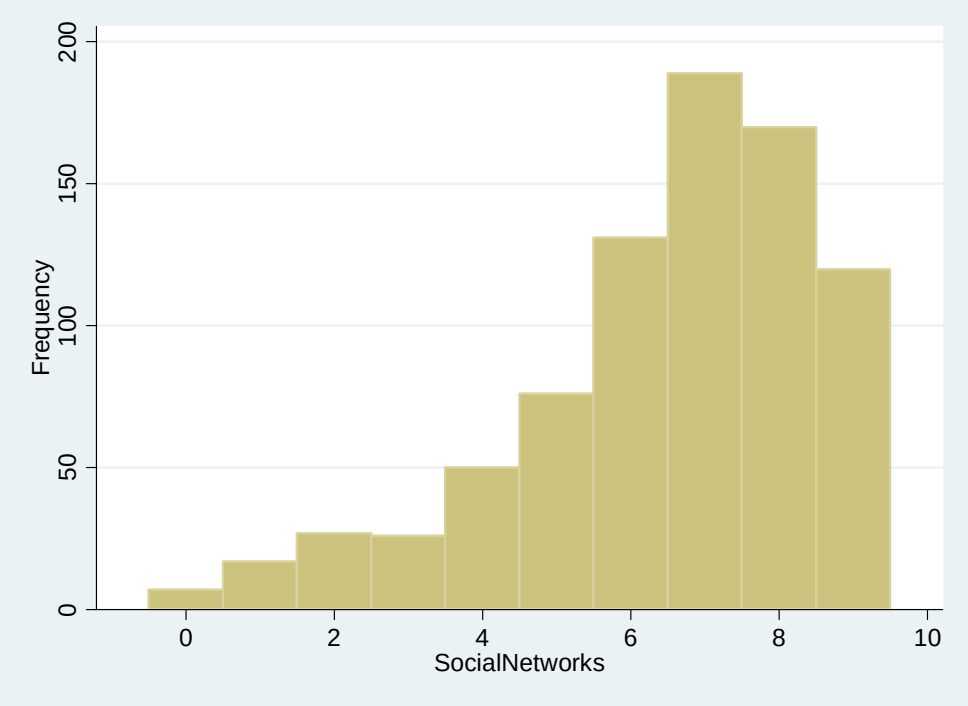


Figure 21. Data distribution of social networks for Calgary Transit.

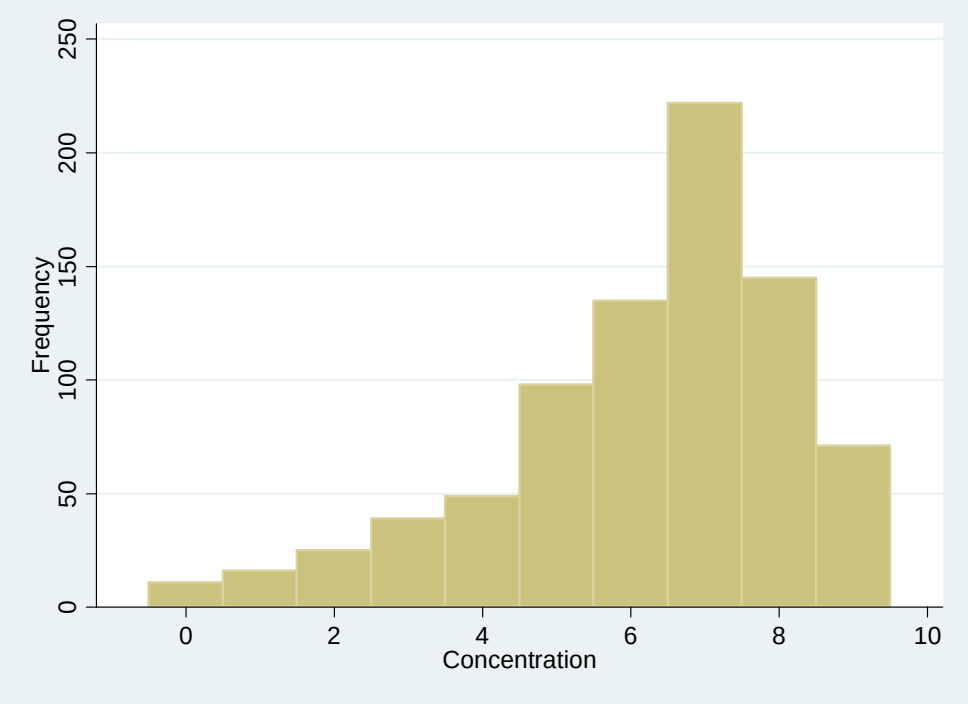


Figure 22. Data distribution of concentration for Calgary Transit.

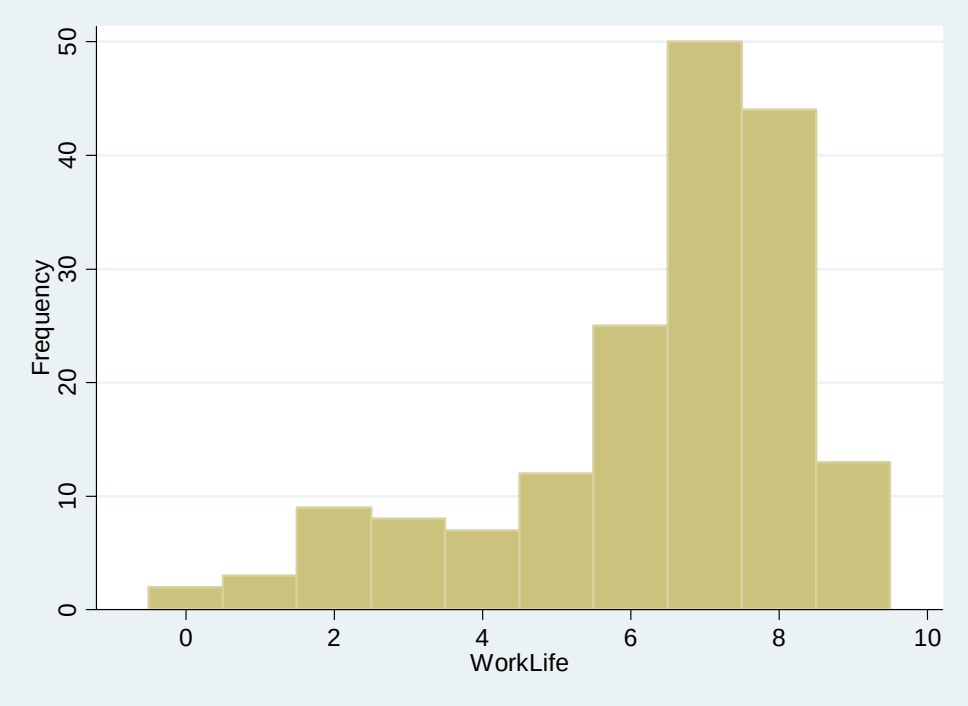


Figure 23. Data distribution of work life balance for Calgary Transit.

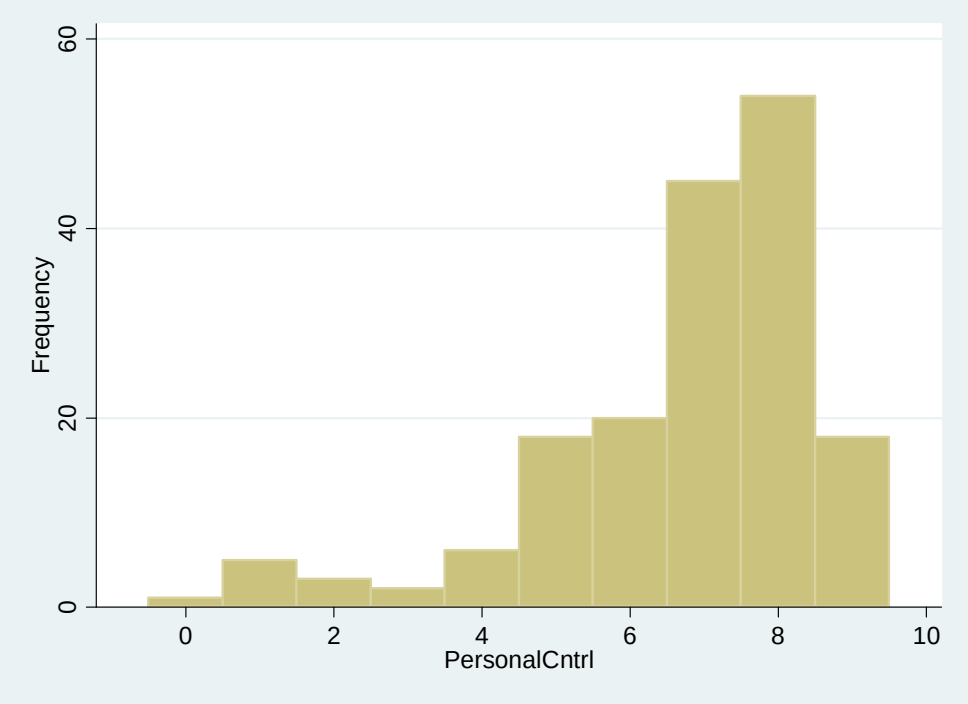


Figure 24. Data distribution of personal control for Calgary Transit.

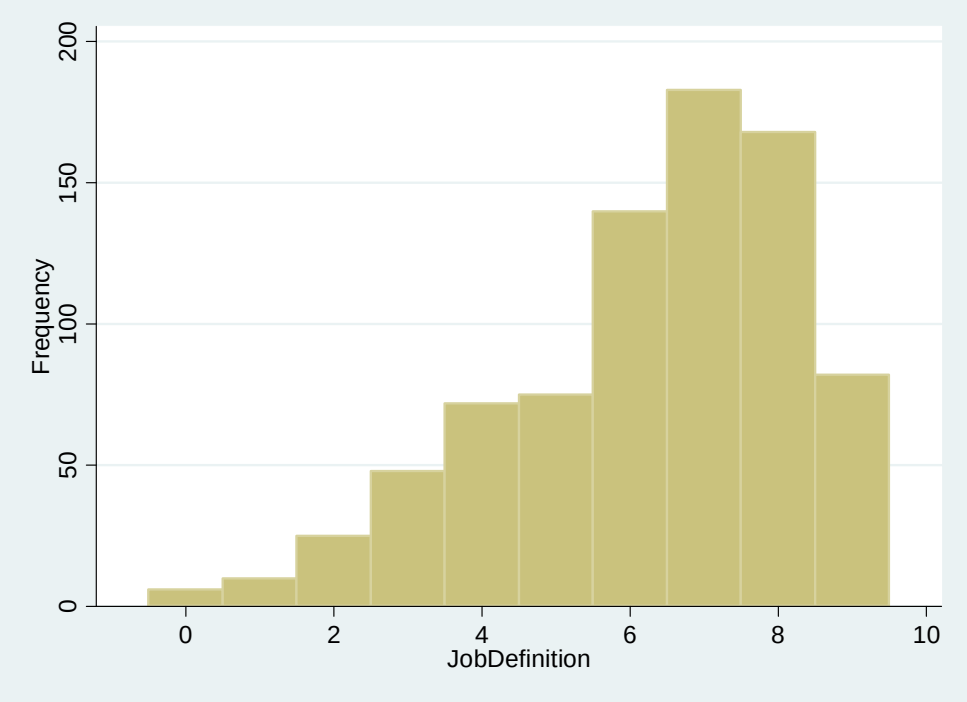


Figure 25. Data distribution of job definition for Calgary Transit.

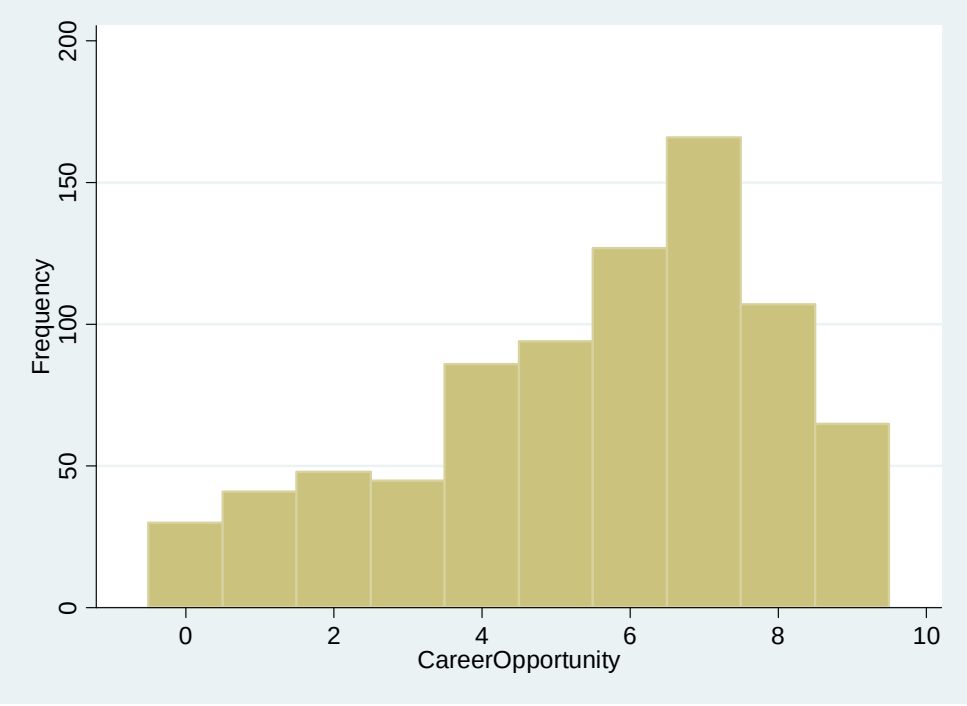


Figure 26. Data distribution of career opportunities for Calgary Transit.

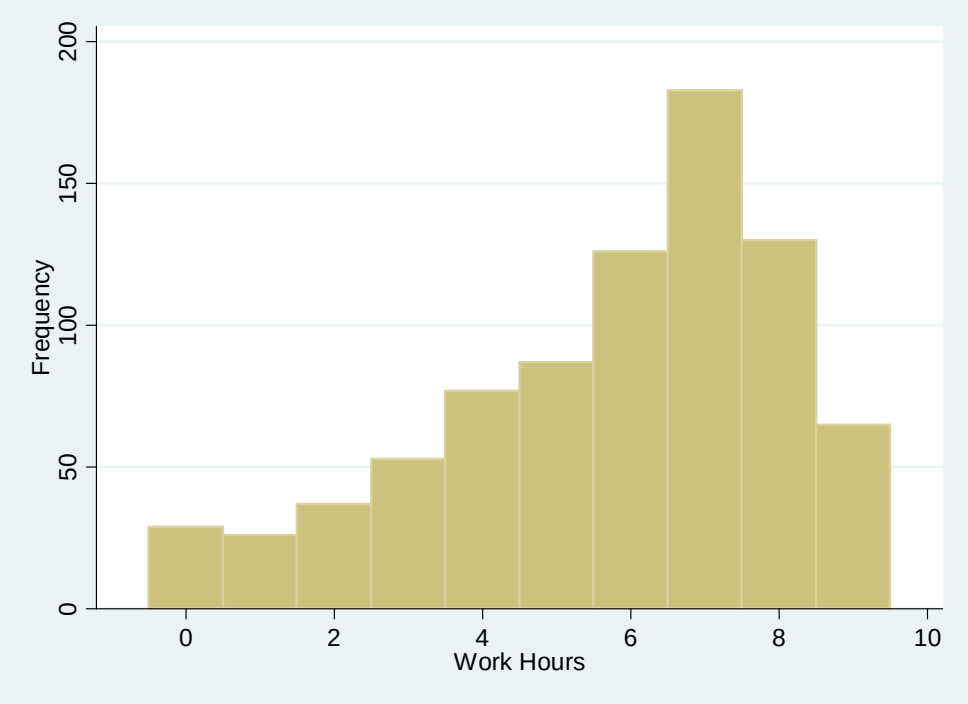


Figure 27. Data distribution of work hours for Calgary Transit.

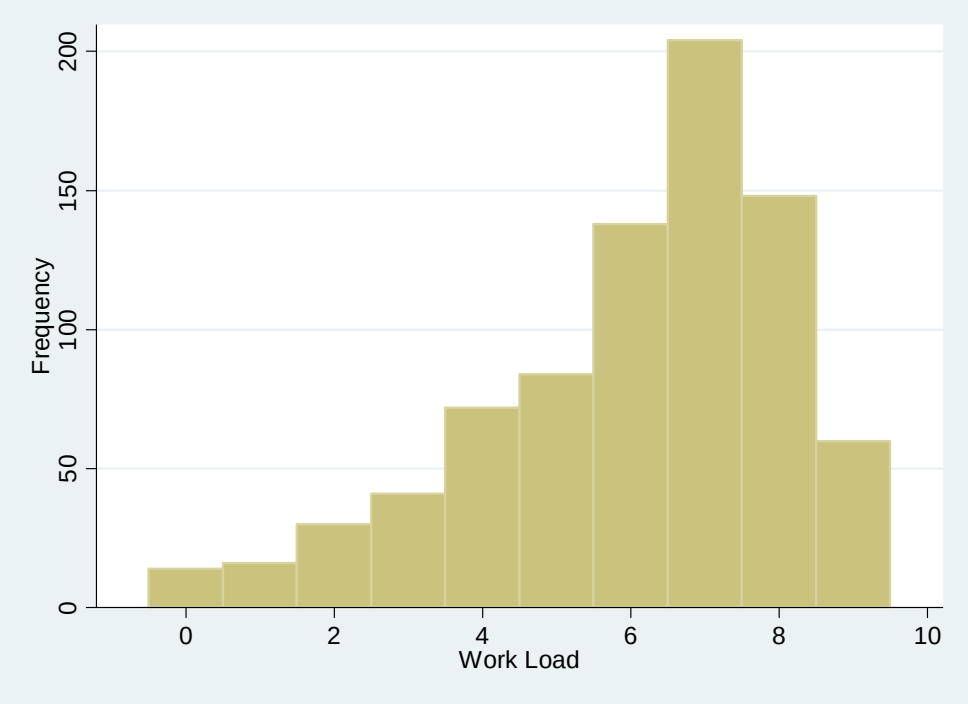


Figure 28. Data distribution of work load for Calgary Transit.

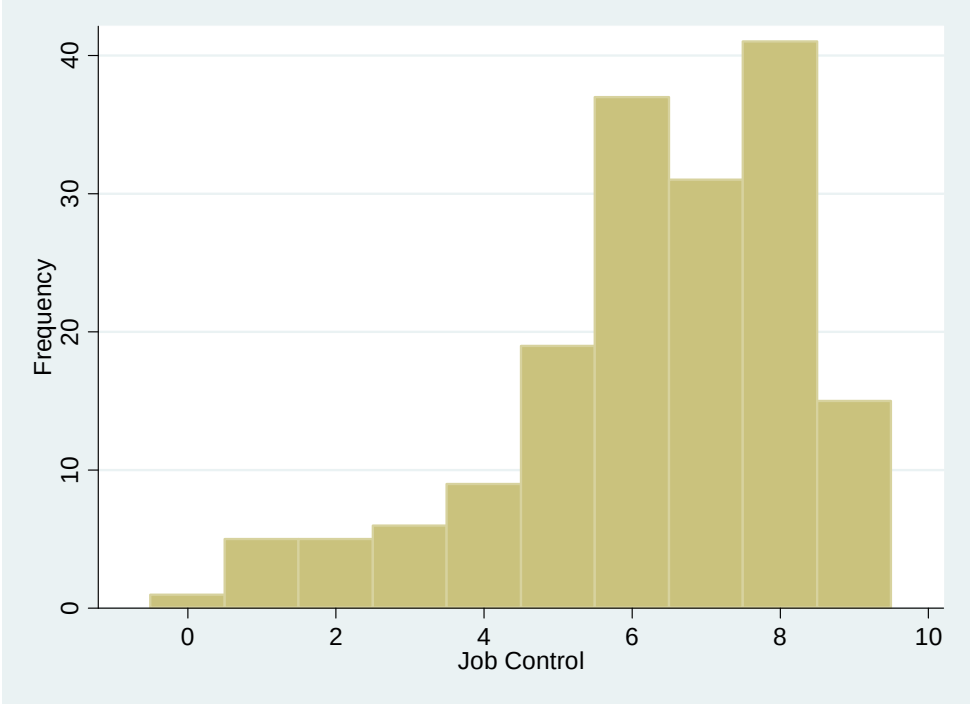


Figure 29. Data distribution of job control for Calgary Transit.

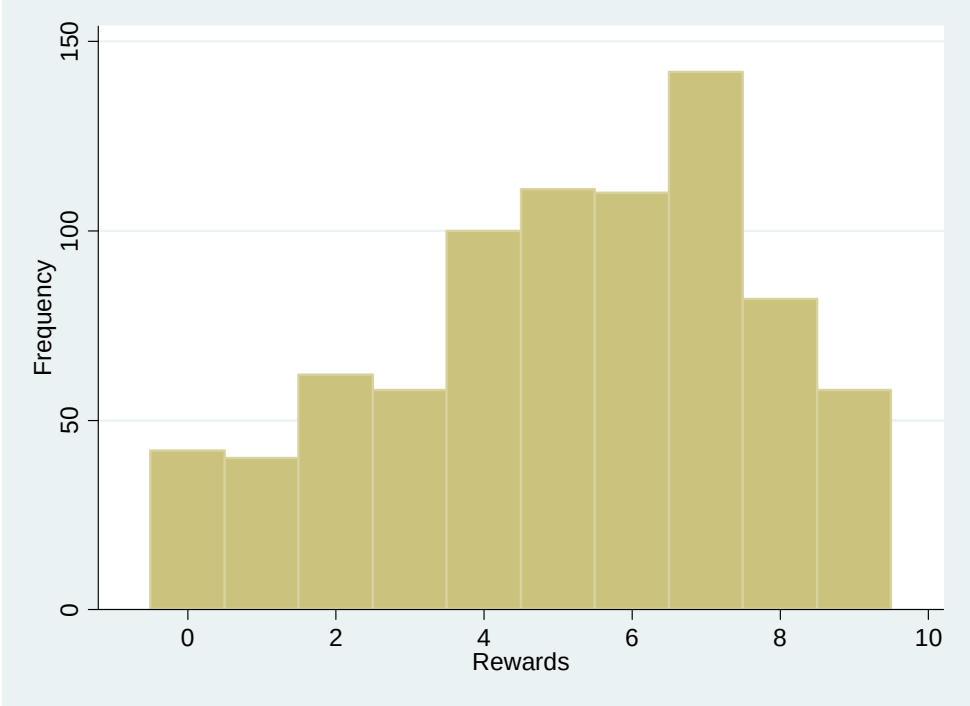


Figure 30. Data distribution of rewards for Calgary Transit.

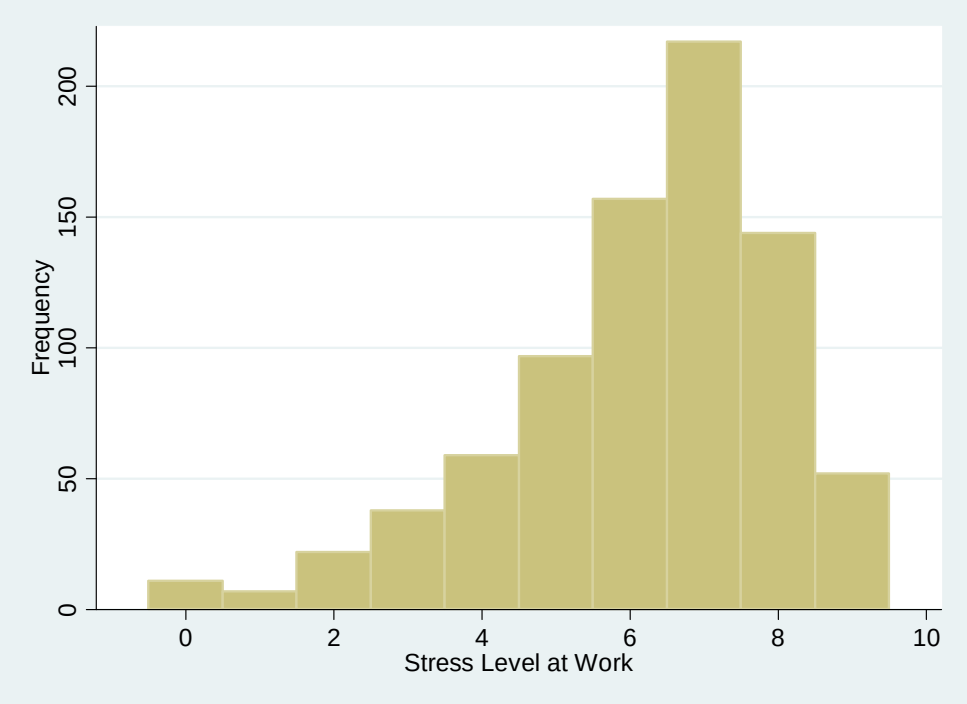


Figure 31. Data distribution of stress level at work for Calgary Transit.

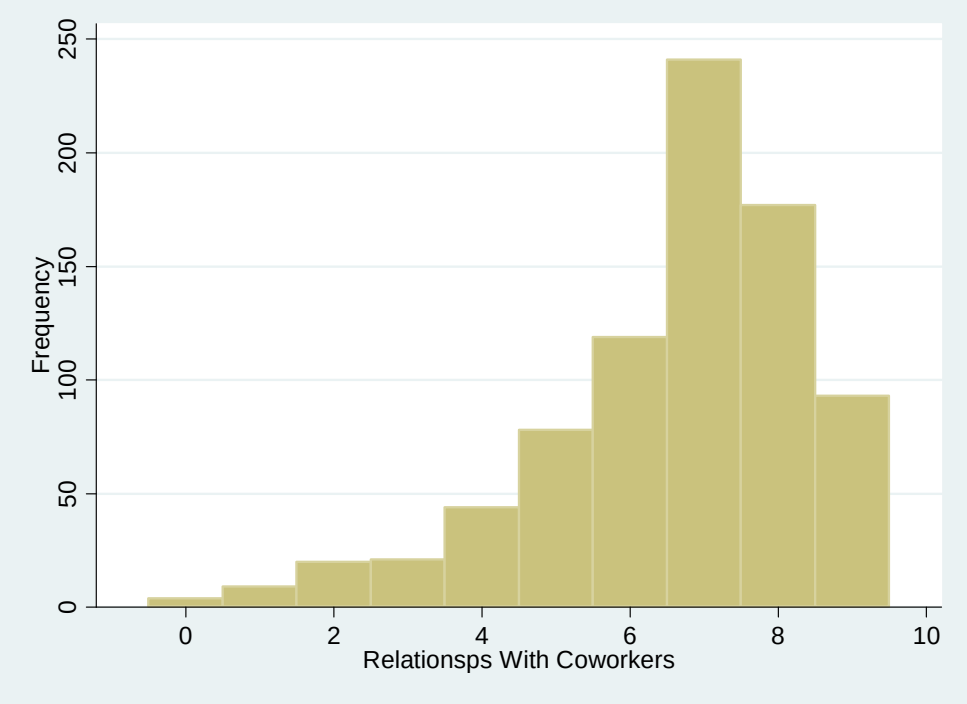


Figure 32. Data distribution of relationships with co-workers for Calgary Transit.

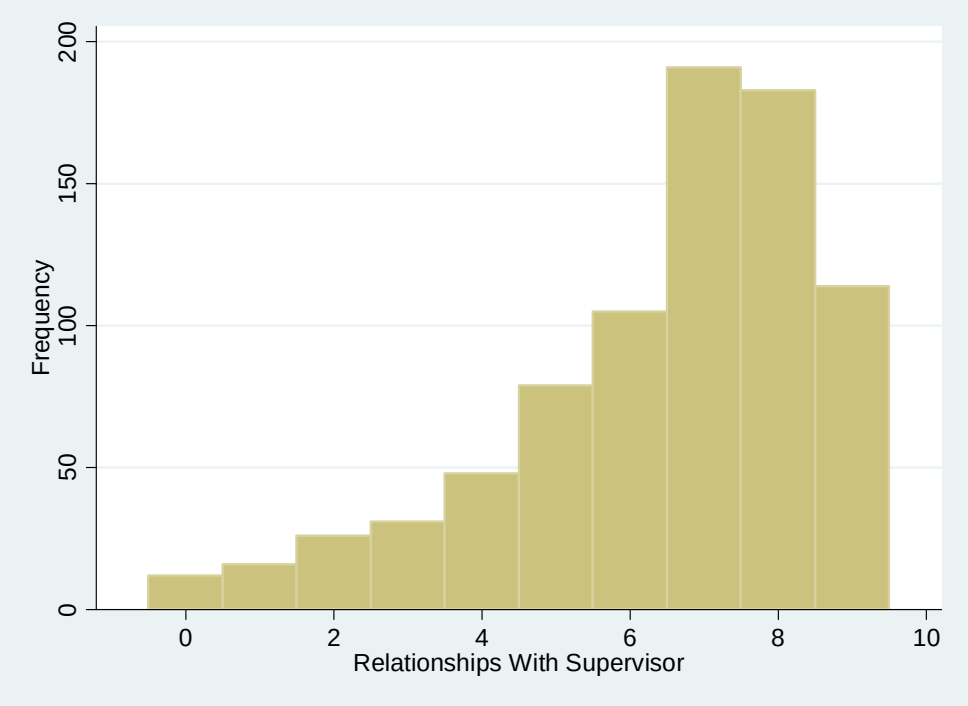


Figure 33. Data distribution of relationships with supervisors for Calgary Transit.

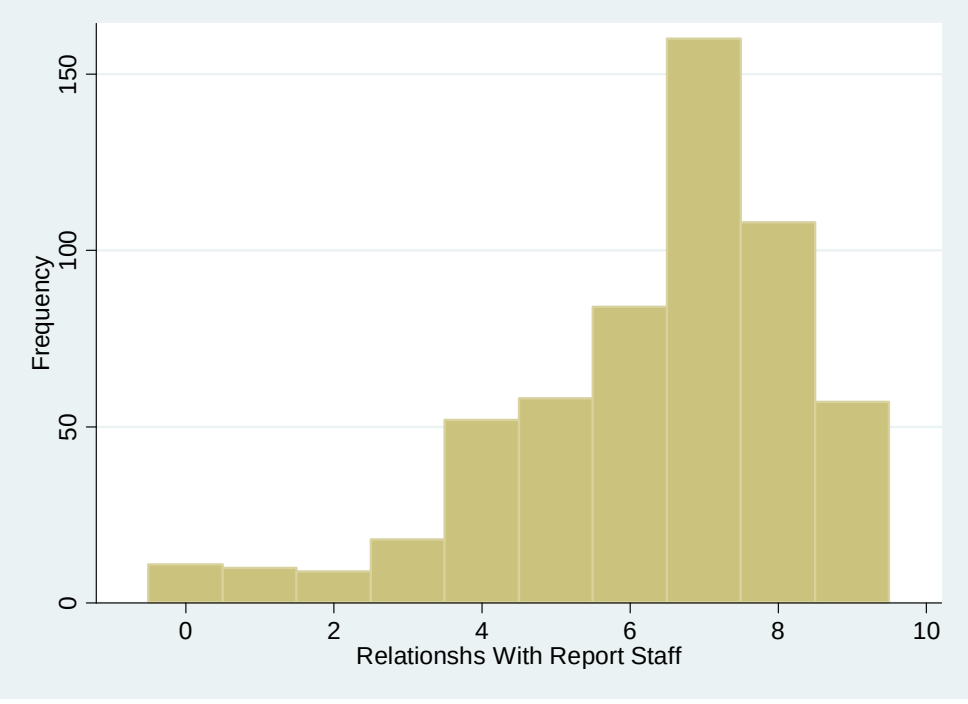


Figure 34. Data distribution of relationships with report staff for Calgary Transit.

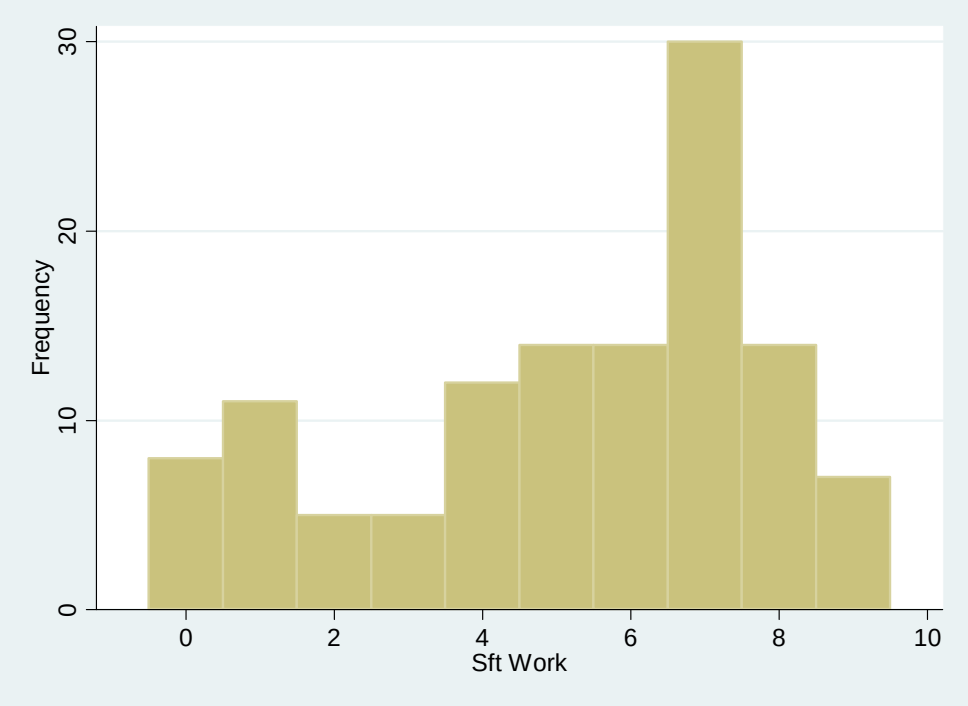


Figure 35. Data distribution of shift work for Calgary Transit.