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Cardiovascular Disease in Korean Blue-Collar Workers: Actual Risk, Risk Perception, and Risk Reduction Behavior



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# Cardiovascular Disease in Korean Blue-Collar Workers:

# Actual Risk, Risk Perception, and Risk Reduction Behavior

by

Won Ju Hwang

DISSERTATION

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## DEDICATION

This dissertation is dedicated to my parents, Hak Jun Hwang (故) and Soon Deuk Lee, and the Hwang family: J.I., S.Y., and J.O. This work is also dedicated to the Shin family: H.H., Cho, S.S., J.C., D.H., and S.H. and especially to my husband, S.C., for his never-ending love and constant support of my academic aspirations.

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Cardiovascular Disease in Korean Blue-Collar Workers:

Actual Risk, Risk Perception, and Risk Reduction Behavior

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## ABSTRACT

**Background:** Blue-collar workers are at high risk for cardiovascular disease (CVD) due to shift and overtime work, and job stress. Despite the increased risk of CVD and the rising compensation for it in Korean blue- collar workers, little is known about the *actual risk of CVD, risk perception, and risk reduction behavior* in this group. The purpose of this study was to investigate the contribution of actual and perceived risks of CVD and individual, psychosocial, and work-related factors as predictors of CVD risk reduction behavior.

**Methods:** This is a cross-sectional study with a sample of 238 Korean blue-collar workers, aged 18 years or older, who worked in small companies. Data collection included th*e Health Promoting Lifestyle Profile II, Knowledge of CVD risk, Risk Perception Index, Family APGAR, Job Contents Questionnaire, and Effort-Reward Imbalance*; anthropometric and blood pressure measures; and blood sampling for lipid levels and glucose.

**Findings:** A multiple regression model showed that individual, psychosocial, and work-related factors, with risk perception for CVD, explained 33% of the variance in actual risk of CVD and that those individual, psychosocial, and work-related factors, with CVD actual risk, explained 28 % of the total variance in CVD risk perception. Waist-hip-ratio was found to be the strongest predictor of CVD actual risk. Finally, multiple

regression analyses showed that the model explained 30% of the variance in risk reduction behavior. The significant predictors of risk reduction behavior included higher education, better perceived general health, greater family function, higher social support, better job control, and non-shift work. Actual risk of CVD and risk perception did not predict risk reduction behavior.

**Conclusions**: CVD risk reduction behavior is influenced more by psychosocial and work-related factors than individual factors. Efforts to improve social support, job control, and shift work are important; enhancing workers' perceived general health and family function are also important strategies for cardiovascular health promotion. Further study is needed to support these results and to explain the lack of relationships of actual and perceived risk to risk reduction behaviors in blue-collar workers at elevated risk of CVD.

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| AHA | American Heart Association |
| APGAR | Adaptation, Partnership, Growth, Affection, and Resolve |
| BMI | Body Mass Index |
| BP | Blood Pressure |
| CDC | Centers for Disease Control and Prevention |
| CI | Confidence Interval |
| CHR | Committee on Human Research |
| CHD | Coronary Heart Disease |
| CVD | Cardiovascular Disease |
| DBP | Diastolic Blood Pressure |
| ERIQ | Effort-Reward Imbalance Questionnaire |
| HPLP II | Health Promoting Lifestyle Profile II |
| HPM | Health Promotion Model |
| IRB | Institutional Review Board |
| JCQ | Job Contents Questionnaire |
| KCDC | Korea Centers for Disease Control and Prevention |
| KFDA | Korean Food and Drug Administration |
| KNHANES | Korea National Health and Nutritional Examination Survey |
| KNSO | Korea National Statistical Office |
| KOSHA | Korea Occupational Safety and Health Agency |
| KOSIS | Korea Statistical Information Service |
| KSSO | Korean Society for the Study of Obesity |
| MI | Myocardial Infarction |
| NCEP-ATP III | National Cholesterol Education Program Adult Treatment Panel III |
| OR | Odds Ratio |
| RPI | Risk Perception Index |
| SBP | Systolic Blood Pressure |
| SES | Socioeconomic Status |
| TG | Triglyceride |
| WHO | World Health Organization |
| WHR | Waist-Hip Ratio |

# CHAPTER ONE

## Significance of the Problem

Cardiovascular disease (CVD) is a major cause of death and disability in the United States and Korea (Centers for Disease Control and Prevention [CDC], 2007; Korea National Statistical Office [KNSO], 2007). It also remains the number one killer of American workers (American Heart Association [AHA], 2007). In the United States, escalating health care costs for CVD reached $475.3 billion in 2006 and are estimated to reach $503.2 billion in 2010 (AHA, 2007; Lloyd-Jones, et al., 2010); in Asian pacific countries, these costs doubled between 2000 and 2005 (World Health Organization [WHO], 2008). In Korea, workers' compensation costs for CVD have increased dramatically because CVD, caused by overwork, has been recognized as a compensable work-related disease (Korean Occupational Safety and Health Agency [KOSHA], 2008; Korean Ministry of Labor, 2005). Cerebrovascular events, including stroke, have accounted for half of the total compensated occupational diseases in Korea (Kim, Choi, Chang, & Lee, 2003).

The high prevalence of CVD risk factors and inadequate health promotion strategies for workers may contribute to this problem. Numerous investigations have linked CVD risk with occupational factors: chemical hazards such as carbon disulfide, carbon monoxide, methylene chloride, nitroglycerin, and solvents (Levy & Wdgman, 2006); lead (Kristensen, 1989; Staessen, Roels, & Fagard, 1996); noise (Davies et al., 2005); and job stressors such as overtime work, shift work, and physical exertion (Chang, Koh, Cha, & Park, 2002; Fransson et al., 2004; Su et al., 2008; Wada et al., 2006). These occupational factors have an enormous effect on workers, particularly blue-collar

workers who are more likely to be exposed to high stress, unhealthy work environments, and unhealthy lifestyles (Williams, Mason, & Wold, 2001).

Blue-collar workers may be at high risk of CVD because they are exposed to toxic chemicals such as methylene chloride, and also more frequently exposed to irregular shift work (Su et al., 2008) and heavy workloads (Park et al., 2001). Workers in blue-collar occupations tend to have high rates of cigarette smoking and exposure to carbon monoxide, both of which are associated with an increased risk of CVD (Hall, 1999). Most risk factors associated with CVD are either preventable or modifiable through lifestyle changes (Copertaro, Bracci, Barbaresi, & Santarelli, 2008). However, mortality due to CVD among blue-collar workers has been shown to be higher than that of white-collar workers. The CVD mortality rate for blue-collar workers is estimated to be 192 per 100,000 person years compared with 117 per 100,000 person years for white-collar workers (Muntaner, Sorlie, O'Campo, Johnson, & Backlund, 2001). Workers in small companies tend to have little or no access to health screening or preventive health education programs. Thus, they may be unaware of their risk factors and may be at greater risk for CVD (U.S. Department of Health and Human Services [USDHHS], 2000).

Studies from Europe and the United States found that blue-collar workers had 3-times the risk of CVD (Netterstrom, Nielsen, Kristensen, Bach, & Moller, 1999) and ischemic heart disease (IHD; Chen, Cheng, Lin, & Hsiao, 2007) compared with white-collar workers. These studies provide evidence that workers from more disadvantaged groups and low socioeconomic classes are at higher risk of CVD. Thus, social inequality and its relationship to CVD has been documented in studies of Western populations, showing that blue-collar workers have an increased risk of IHD compared

with white-collar workers (Tuchsen & Endahl, 1999). Although the relation between job stress and CVD has been studied extensively, the extent to which the research results apply to Asian populations or Koreans remains largely unknown.

A growing body of literature suggests that a person's knowledge of and attitudes toward health influences his or her preventive therapy. Thus, it is necessary to investigate whether blue-collar workers are aware of the increased risk of CVD associated with job stress and the importance of risk reduction behavior. However, studies of *actual risk of CVD*, *risk perception*, and *risk reduction behavior* in industrial workers are quite limited. Risk reduction behavior is influenced not only by actual and perceived CVD risks but also by demographic factors such as gender, age, and disease severity; psychosocial factors such as social and family support; and work-related factors such as job stress (Chen, Wong, & Yu, 2008; Frijling et al., 2004; Lallukka et al., 2008).

This study makes an important contribution to the health of blue-collar workers, clinical practice, and future research in occupational health nursing. Although actual risk of CVD, risk perception, and risk reduction behavior, taken collectively, is a burgeoning area of research in occupational health nursing, blue-collar workers continue to be an understudied population, principally because most researchers have focused on the relationship between job stress and risk factors for CVD in the workplace. This research study expands nursing's knowledge of actual and perceived risks of CVD and risk reduction behavior in the context of environmental factors in the workplace. Its novel and innovative groundwork assesses a population that has been overlooked and underestimated and offers a strategy of preventive behavior for CVD in the occupational population.

# CHAPTER TWO

## Review of the Literature and Conceptual Framework

The literature review begins with CVD risk factors in the workplace and then proceeds to discusses research on actual risk of CVD risk, risk perception, and risk reduction behavior. The two theories, health belief model and health promotion model, were evaluated to incorporate the concept of risk perception and risk reduction behavior and, then, presented the modified framework in understanding CVD in blue-collar workers. Finally, the theoretical purpose of this study and specific aim as well as research questions were elaborated in this chapter.

### Work- related Risk Factors for CVD

The primary focus of this review was risk factors for CVD in the workplace, including work-related environmental and psychosocial factors. Individual risk factors will not be discussed in this review. A wide variety of worker populations were encountered in the literature review. Most studies included industrial workers from different worksites, although two studies included health care providers or nurses (Copertaro et al, 2008; Munakata et al., 2001). Statistically significant differences in the relative risk of CVD outcomes were reported in multiple studies (Fujino, Iso, & Tamakoshi, 2007; Kawachi et al., 1995; Liu & Tanaka, 2002; Nakanishi et al., 2001; Su et al., 2008; Yang, Schnall, Jauregui, Su, & Baker, 2006) regardless of the kind of risk factors being investigated. This review focuses on five work-related environmental factors and three psychosocial factors for CVD.

**Environmental factors.** Occupational environmental factors include work status and organizational factors such as coworker support, role clarification processes,

participatory decision-making in planning and developing these strategies, and working conditions (Baigi, Fridlund, Marklund, & Oden, 2002). However, the literature offers no consistent definition for work environmental factors related to CVD. Although work environmental work factors have received little attention in CVD research, they are presumably important in the causation of prevailing social class differences as a risk factor for CVD (Baigi et al., 2002). Job characteristics have been demonstrated to influence CVD risk. For example, shift work has been associated with an increased risk of CVD; in particular, night work affects the risk of CVD (Fialho, Cavichio, Povoa, & Pimenta, 2006; Haus & Smolensky, 2006). This review investigated the following factors: (a) shift and overtime work, (b) noise exposure, (c) chemical exposure, (d) passive smoking, and (e) occupational physical activity, and (f) sedentary behavior at work.

***Shift and overtime work.*** Shift work has been associated with an increased risk of CVD. Nurses who worked the night shift for 6 years or more have been shown to have a higher risk of coronary heart disease (CHD; RR = 1.51, 95% CI [1.12, 2.03]; Kawachi et al., 1995). Munakata and colleagues (2001) examined 18 healthy nurses in a Japanese hospital to determine whether psychological states following night work were related to alterations in CVD. The results showed that night shift work was associated with altered cardiovascular responses in healthy nurses. However, the study did not examine environmental factors such as increased workload due to housework and child care. Degrees of psychological stress and physical load related to the condition of hospital inpatients may also be involved, but were not examined. Su et al. (2008) also investigated the cardiovascular effects of 12 hr shifts, and changes in Blood Pressure

(BP) and heart rate variability (HRV) during the 36 hr rest time following 12hr shifts. The major findings of this study indicated that 12hr night shifts gave risk to significant cardiovascular effects change in BP, heart rate (HR), and HRV. Consistent findings of delayed recovery of systolic and diastolic BP on the first and second 12hr rest periods of night shift workers also correlated with these cardiovascular effects. Simple comparison, multivariate analysis, and long term effects corroborated these findings.

Furthermore, a recent cohort study explored how metabolic risk factors for CVD differed between shift workers and day workers in a cohort of 262 Italian healthcare providers (130 rotating shift nurses and 132 day shift nurses), 204 forestry workers, and 86 factory workers (Copertaro et al., 2008). The results showed shift work was significantly associated with high triglycerides and abdominal obesity after adjusting for gender, smoking, alcohol consumption, and job seniority (Copertaro et al., 2008). Disruptions of circadian rhythms, unhealthy lifestyles, and increased stress provided a worse profile of CVD risk factors among shift workers. However, the *healthy worker effect (HWE)*, a phenomenon observed initially in occupational disease studies, might make it more difficult to observe such a profile, particularly in prevalence studies.

Other concerns were reported by the National Institutes for Occupational Safety and Health (NIOSH) regarding the impact of overtime work (Caruso, Hitchcock, Dick, Russo, & Schmit, 2004). As a risk factor for CVD, overtime work is difficult to isolate from the more general literature on stress, because overtime work is generally considered to be stressful. A few recent studies suggest that long work hours increase the risk of CVD (Tobe et al., 2007; Yang et al., 2006). The most important studies to date attempt to separate the independent effects of long working hours and stress by measuring hours

worked (Liu & Tanaka, 2002; Nakanishi et al., 2001; Park et al., 2001). In these studies overtime work was associated with CVD risk (Liu & Tanaka, 2002; Park et al., 2001). In a case-control study of Japanese workers, overtime work during the previous month was shown to be associated with an increased risk for acute myocardial infarction (MI; Liu & Tanaka, 2002). The authors reported that 61 or more hours of work per week and fewer than two days off per month increased the odds of acute MI by two times or more. Furthermore, Park et al. (2001) used both a self-report questionnaire (working hours, health conditions, and fatigue) and measurements of BP and HRV to study the association between overtime work and CVD risk. They found no correlation between BP and work hours in Korean engineers whose work hours during the previous month ranged from 52 to 89 hours per week ($r = .07$, $p = .25$). However, when adjusted for age and hours of sleep, multivariate analysis found evidence of a possible link between long working hours (particularly in those who exceeded 52 hr a week) and the risk of significant health problems, including hypertension.

In contrast, Nakanishi et al. (2001) found that white-collar workers who reported 10 or more hours of work per day had a lower risk of developing hypertension when compared with workers reporting less than 8 hr of work per day. However, the studies used different criteria to determine the number of hours worked. For example, the criterion used to define the group with the lowest number of hours worked ranged widely from 39 to 60 hr per week across studies (Liu & Tanaka, 2002; Yang et al., 2006).

Based on findings from the literature, therefore, some evidence suggests that shift work and long working hours can increase BP and lead to increased CVD risk, independent of other stressful conditions at work (Kawachi et al., 1995; Liu & Tanaka,

2002; Munakata et al., 2001; Park et al., 2001; Su et al., 2008; Yang et al., 2006). Although these findings must be viewed as preliminary, they are intriguing enough to warrant further research on shift or overtime work and CVD.

***Noise exposure.*** Occupational conditions and psychological factors have been shown to play an important role in the pathogenesis of CVD. Their effect is often indirect through damage to the central nervous, respiratory, and neuroendocrine systems (Tomei et al., 2010). Noise has been shown to increase catecholamine and cholesterol concentrations in the blood, to affect plasma lipoprotein levels, and to increase HR, arterial BP, and risk of MI. Psychophysiological changes caused by long-term stress influence constant pathological changes in the central nervous, endocrine and cardiovascular systems (Lee, Kang, Yaang, Choy, & Lee, 2009; Maschke, Rupp, & Hecht, 2000).

A prospective cohort study (Fujino et al., 2007) assessed perceived noise exposure at work and CVD in male workers in Japan. The authors found that an increase in noise did not increase risk of CVD, although perceived noise exposure significantly increased the risk of intra-cerebral hemorrhage (HR = 2.38, 95% CI [1.2, 4.71]). In contrast, several epidemiologic studies have reported that exposure to noise was associated with CVD, including MI and CHD (Davies et al., 2005; Tomei et al., 2010). This association may be due to the fact that noise exposure enhances the development of hypertension (Lee et al., 2009).

***Chemical exposure.*** Exposure to some chemicals in the workplace have been conclusively related to CVD, including carbon monoxide, carbon disulfide, dioxin, and nitrate esters (Humblet, Birnbaum, Rimm, Mittleman, & Hauser, 2008; Kristensen, 1989).

Evidence for these exposures is strongest when the level of occupational exposure is high. After reviewing the epidemiologic research on CVD and the work environment, Kristensen (1989) concluded that the causal relationship between CVD and two chemicals, carbon disulfide and nitroglycerin/nitroglycol, was very well documented. Kristensen also found that lead and passive smoking were likely to have a causal relationship with CVD. More research is needed concerning exposure to other chemicals such as cobalt, arsenic, and antimony.

In the study of trucking industry in the United States, Laden and colleagues (2007) found that elevated rates of IHD were related to particulate matter exposure. However, no information was forthcoming on potential confounders such as sedentary lifestyle, being exposed to particulate matter outside of work, smoking, or diet. Another study of chemical exposure (Axelson, Selden, Andersson, & Hogstedt, 1994) found no evidence of an increased risk for CVD in workers because the risk of chemical exposure was also related to the duration and intensity of the exposure. Excessive risks were largely related to low level of exposure and short duration of exposure. The HWE is often prevalent in this type of cohort study in which workers who have CVD may leave the workplace. Thus, a decrease in the number of CVD deaths tends to contribute to this effect.

A Swedish cohort study (Persson et al., 2007) found a slightly increased risk of CVD among pulp and paper mill workers. Work with sulfate digestion, steam and power generation, and maintenance were all related to significantly increased risks of death from CVD. These risks were mainly due to deaths from IHD, although maintenance work was associated with an increased risk of death from CVD.

Somewhat problematic is the authors' comparison of the expected number of deaths from various causes with deaths in the general population, which includes urban populations. In addition, this study did not measure or account for other possible confounding risk factors such as smoking.

***Passive smoking.*** Sufficient evidence has established that passive smoking increases the risk of CVD (He et al., 2008; Lopez et al., 2007; Venn & Britton, 2007). Passive smoking is involuntary inhalation of tobacco smoke, usually in indoor environments. A review from France underlined the importance of passive smoking at work as a risk factor for CVD (Gignon, Manaouil, Jarde, & Dubois, 2007). Workers in airplanes, bars, night-clubs, and restaurants were particularly vulnerable and displayed significant increases in biological markers of exposure. The effects of passive smoking on health are now scientifically established (Venn & Britton, 2007).

A longitudinal cohort study conducted by Felber Dietrich and colleagues in Sweden used a 24-hour electrocardiogram to test the effect of environmental tobacco smoke on HRV and the role of HR and BP in this context. Increased HR and BP have been shown to increase the risk for CVD and death, and autonomic dysfunction (specifically reduced HRV) is a predictor of increased cardiac risk (Felber Dietrich, et al., 2007). Exposure to environmental tobacco smoke at home and work was shown to be associated with lower HRV and higher HR in an aging population. These findings suggest that exposure to environmental tobacco smoke increases cardiac risk through disturbances in the autonomic nervous system, such as a decrease of stroke volume and an increase of vascular resistance (Zhang, Liu, Shi, Larson, & Watson, 2002).

***Occupational physical activity.*** Uncertainty exists about the potential protection provided by different levels and types of physical activity on the job. Three specific physical occupational factors such as physical exertion, lifting, and vibration have been suggested as possible risk factors (Belkic, Schnall, & Ugljesic, 2000). While increasing the level of physical activity such as exercise or household work is beneficial in preventing CVD, irregular strenuous physical exertion has been shown to be associated with substantially increased risk of CVD (Fransson et al., 2004; Krause et al., 2007).

A case-control study by Fransson et al. (2004) estimated the influence of exercise, occupational physical activity, and household work on the risk of acute MI. Exercise, walking or standing at work, and doing demanding household work were all associated with a decreased risk of acute MI. The estimated relative risks ranged from 0.31 to 0.90 when all cases, fatal and nonfatal, were considered. In contrast, lifting or carrying at work, and an occupational workload perceived to be strenuous, were related to an increased risk of MI. Relative risks ranged from 1.10 to 1.57. Physical activities of daily life seemed to reduce the risk of MI, whereas occupational physical activities such as heavy lifting and physical exertion at work were related to increased CVD risk.

Consideration for occupational physical activity requires quantification of the work-related metabolic demand. Such studies have collected data separately on leisure time activity and work tasks. For example, Krause et al. (2007) assessed energy expenditure at work using predicted metabolic equivalents for work tasks, and for physical activity at leisure by self-report of hours spent exercising. When occupational physical activity was considered separately, however, the results were mixed with some studies demonstrating reduced CVD risk (Hu et al., 2007) and some demonstrating an

increase in risk (Kristal-Boneh, Silber, Harari, & Froom, 2000).

***Sedentary behavior at work.*** Because of negative effect of a lack of physical activity, sedentary work can be viewed as an occupational risk factor for CVD (Apostolopoulos, Sonmez, Shattell, & Belzer, 2010; Brown, Bauman, & Owen, 2009). The relative risk of death from CVD is about two times greater for those in sedentary compared with active occupation. Sedentary behavior is also more likely to occur in those with higher levels of education and in white-collar workers (Gal, Santos, & Barros, 2005). However, it is difficult to detect the sedentary behavior at work on CVD risk because the level of sedentary behavior in the working population may be modified overall, because of changes on the job and in transportation as well as sedentary behavior during leisure time.

A sample of workers in the US, adjusted for age and education, showed that sedentary behavior during leisure time was found to be significantly associated with CVD risk factors, however sedentary behavior at work was not strongly associated with metabolic syndrome or CVD risk factors in either men or women (Sisson, et al., 2009). Another study found no significant associations were found between sedentary leisure time, job strain, and the major dimensions of demand and social support (Pizzi, et al., 2008). Sedentary behavior may be an important CVD risk factor in the general population, but the effects of sedentary behavior in workers are inconclusive.

**Psychosocial factors.** Psychosocial factors have been examined for their relationships with CVD in many studies conducted in diverse occupational settings. Most of studies' outcomes were mediated by job stress (Ramey, 2003). Although the existing literature does not show consistent results across studies (Eller et al., 2009;

Guimont et al., 2006), a review study showed there to be considerable evidence of significant associations between job stress and CVD risk (Eller et al., 2009).

***Social support.*** A few studies have measured different aspects of social support. Social support at work might reduce the effects of job strain on CVD or BP (Guimont et al., 2006; Steptoe, 2000). In a review of the effect of social support on people with CVD (Christenfeld & Gerin, 2000), physiological evidence suggested that cardiovascular responses to stress are associated with the development of CVD, but it did not indicate how potential stress responses could be reduced by social support. Experimental work on social support and CVD overcomes many of these limitations. Recently, Hughes and Howard (2009) examined healthy people in a cross-sectional psychosocial screening study ($N = 211$). They used regression analysis to assess associations with psychometric indices of social support (perceived network size and perceived satisfaction with support), while controlling for a range of potential biometric and psychometric confounders. Overall, social support was found to be independently associated with reduced resting cardiovascular function.

***Job stress.*** Studies of occupational stress conducted throughout the world, provide strong evidence that job stress is a risk factor for CVD (Bosma, Peter, Siegrist, & Marmot, 1998; Ducher, Cerutti, Chatellier, & Fauvel, 2006; Kang et al., 2005; Tobe et al., 2007). Clearly, the workplace and the individual bear responsibility for management of CVD risk. Two mechanisms might explain the relationship between job stress and CVD: The direct mechanism increases left ventricular mass through physiological variables such as increased BP and serum cholesterol; the indirect mechanism works through behavioral risk factors such as smoking and alcohol consumption. Physiologic

effects of job stress suspected of increasing BP include sympathetic pathways (Ducher et al., 2006), pituitary-adrenocortical hormones (Kunz-Ebrecht, Kirschbaum, Marmot, & Steptoe, 2004), and a highly deleterious combination (Niedhammer et al., 1998).

Discrepancies between studies might be caused by population sampling, study design, duration of follow-up, or the measurement of BP such as diastolic BP, systolic BP, and ambulatory BP (Fauvel et al., 2003). Further, individual experience different levels of job strain over time, adding another confusing element. The effect of job stress on BP is difficult to evaluate because job stress varies with time (Landsbergis, Schnall, Pickering, Warren, & Schwartz, 2003). Both individual and work-related factors should be simultaneously studied to determine the independent influence of job stress on BP.

Psychosocial factors have been repeatedly associated with an increased risk of CVD. Job stress has mainly been evaluated using the job demand control model (Bosma et al., 1998; Ferris, Sinclair, & Kline, 2005) and the effort-reward imbalance model (Bosma et al., 1998; Peter, Siegrist, Hallqvist, Reuterwall, & Theorell, 2002). It has been associated repeatedly with an increased risk of CVD in both men and women (Bosma et al., 1998; Ducher et al., 2006; Kang et al., 2005; Peter et al., 2002). However, the effect of job stress on CVD is still debated (Fauvel et al., 2003; Ferris et al., 2005). Most but not all cross-sectional or short-term studies have reported that subjects exposed to high job stress have higher BPs or HRs.

The combined model of psychosocial and lifestyle stressors, such as job stress and marital factors, have previously been associated with a sustained increase in BP (Tobe et al., 2007). Subjects with high job stress and a less cohesive marriage showed an increase in systolic BP during one year, while those with job strain and a highly cohesive

marriage showed a reduction in systolic BP during the same time period. Marital cohesion consistently interacted with a sustained elevation of BP associated with job strain over time in men and women. However, job stress and marital cohesion are narrowly defined independent variables. Evaluating specific components of work and marriage may well exclude other potentially important factors that could have an impact on sustained BP.

A case-control study by Ducher et al. (2006) revealed a significant positive relationship between exposure to job strain and hypertensive status, as measured by ambulatory BP. Because the definition of hypertension was more rigorous, the odds ratio (OR) for job stress was increased correspondingly. Thus, job stress was shown to be positively associated with BP. Job stress was also shown to be associated with CVD in a cross-sectional study of law enforcement officers (Ramey, 2003). It was determined that perceived stress was significantly associated with three risk factors (cholesterol, hypertension, and physical inactivity) and CVD. Stress may contribute to the development of CVD among susceptible officers and contribute to other potential CVD risk factors (Ramey, 2003).

Studies of industrial workers have also suggested that psychosocial work factors independently contribute to CVD. Niedhammer et al. (1998) found significant associations between three psychosocial factors (psychological demands, decision latitude, and social support) and CVD risks such as hypertension, hyperlipidemia, and diabetes in a cohort study of French industrial workers ($N$ = 13,226). The cross-sectional results underline the potential psychosocial work characteristics on CVD risk factors and differences between the effects of job stress in men and women, and confirm

the direct and indirect mechanisms potentially involved in the relation between psychosocial work characteristics and CVD (Niedhammer et al., 1998). This study also investigated factors for CVD risk, defined as diseases within the previous 12 months. High psychological demands were statistically significantly associated with hyperlipidemia (OR = 1.32, 95% CI; 1.0, 1.72). However, psychosocial work factors and CVD risk factors were based on self-report, which reflect a partially objective work environment.

***Social class, occupational status, and CVD.*** Lower socioeconomic status (SES) is consistently associated with a wide variety of disease outcomes in developed countries, including hypertension and CHD (Landsbergis et al., 2003). Studies found that blue-collar workers had an increased risk of CVD such as MI (Netterstrom, Nielsen, Kristensen, Bach, & Moller, 1999) and IHD (Chen, Cheng, Lin, & Hsiao, 2007; Netterstrom, Kristensen, & Sjol, 2006; Tuchsen & Endahl, 1999) compared with white-collar workers. These studies provide evidence that workers from more disadvantaged groups and low socioeconomic classes are at higher risk of IHD. Thus, social inequality and its relationship to CVD has been documented in studies from working populations (Baigi et al., 2002).

In summary, the effects of job stress and social support on the risk of CVD are relatively well supported by the literature (Ducher et al., 2006; Kang et al., 2005; Tobe et al., 2007). This underscores the importance of primary prevention for CVD and the significant contribution of psychosocial components to CVD risk in workers. Furthermore, SES should not be overlooked as an independent risk factor for CVD, along with the causal criteria used in evaluating SES as a risk factor.

## Actual Risk of CVD, Risk Perception, and Risk Reduction Behavior

**Actual risk of CVD.** Actual risk is the calculated actual 10 year risk for CVD events using the Framingham risk score (Barroso et al., 2010). Three studies in this review incorporated actual risk and perceived risk (Barnhart et al., 2009; Christian, Mochari, & Mosca, 2005; Frijling et al., 2004; Homko et al., 2008). One showed an association between perceived risk and actual risk, demonstrating that actual risk predicted higher levels of perceived risk (Frijling et al., 2004). Christian et al. (2005) assessed perceived versus actual risk of CHD in people with no history of CVD. Only half of these people accurately perceived their risk as low. Participants' ability to correctly categorize their personal CHD risk improved significantly after a brief educational intervention. However, no association was found between perceived and actual risk. In addition, Homko et al. (2008) found no association between perceived risk and actual risk using the Framingham risk score.

A study suggested that the Framingham risk score should be re-calibrated to the other ethnic groups such as Asians and African American (D'Agostino, Grundy, Sullivan, & Wilson, 2001). Uncertainty was found about the performance of the Framingham score to predict actual risk for CVD events when applied in different populations. The KOSHA CVD risk assessment method was compared with the predicted 10-year risk of CVD developed by Jee in the manufacturing workers (Lee, 2009). Because the KOSHA CVD risk assessment was fairly well associated with Jee's predicted l0-year risk of CVD, it is believed to be a practical and convenient assessment method for preventing CVD in the workplace.

**Risk Perception.** Risk perception is a key motivator of change in personal behavior (Janz & Becker, 1984). According to the health belief model (HBM), perceived susceptibility or perceived risk refers to one's belief about the likelihood or probability of harm, namely, that a health problem will be experienced if no precautions or behavioral changes occur. The term *risk perception* has a different meaning for different groups of people, namely high risk groups and the public. Understanding workers' perception of their risk of developing CVD might elucidate how workers see CVD and how risk-related education and training are translated. This could facilitate the development of effective interventions to minimize the threat of risk factors.

Risk perception of CVD is defined as how a person perceives their likelihood of having a CVD event (Becker & Lavine, 1987). According to theories such as the HBM and protection motivation theory (Janz & Becker, 1984; Rogers, 1983), if perceived risk is an important precursor to engaging in risk reduction behaviors, many people may underestimate their risk and may not taking adequate to prevent adverse health outcomes. One of goal of this research is to investigate the variables that increase or decrease risk perception and comparative optimism.

***Risk perception and knowledge of CVD risk.*** Eight studies examined the relationship between knowledge of CVD risk and perception of CVD risk. Two of those studies, Oliver-Mcneil and Artinian (2002) and Becker and Lavine (1987) found that knowledge did not necessarily lead to or significantly affect risk perception. Knowledge of risk factors did not significantly affect risk perception. The individuals recruited by the researchers consisted of affected relatives and affected women. The latter's perception of risk may be somewhat different than that of unaffected people. On

the other hand, as expected, a relationship between knowledge of CVD risk and risk perception was found in six other studies (Choi, Rankin, Stewart, & Oka, 2008; Foss et al., 1996; Homko et al., 2008; Jones, Weaver, & Friedmann, 2007; Meischke et al., 2002; Nourjah, Wagener, Eberhardt, & Horowitz, 1994).

Of the above studies, Homko et al. (2008) recently compared knowledge of CVD risk factors and risk perception in inner city and rural underserved populations, with high CVD risk ($N = 465$). Urban participants had significantly higher actual risks than did their rural counterparts, but urban participants were significantly less knowledgeable about CVD and also perceived their risk to be lower than did rural participants. These results indicate a low perception of risk and CVD knowledge among urban participants. This survey is unique because it included individuals identified to be at high risk for CVD (> 10% on the Framingham risk assessment) and comprised a high percentage of individuals from minority and of lower SES. However, the survey sample was not compared with individuals at low risk for CVD (< 10% on the Framingham risk assessment) or with suburban populations. Similar gaps in risk perception and knowledge of CVD risk may exist among these groups.

***Over- and under- estimation of CVD risk.*** The concept of *optimistic and pessimistic bias* has been frequently mentioned in the risk perception literature (Katapodi, Lee, Facione, & Dodd, 2004). Weinstein (1980) defined that optimism is a tendency to adopt a positive view, and pessimism is to have a negative outlook. Unrealistic optimism is a belief that positive events are more likely to occur than they actually are, and negative events are less likely to occur than they actually are (Weinstein, 1982). Comparative optimism is described as a perception that positive events are more likely

for others than for oneself (Asimakopoulou, Skinner, Spimpolo, Marsh, & Fox, 2008).

A study by Cranney, Warren, and Walley (1998) showed that healthy people between the ages of 65 and 79 years overestimate the absolute risk of stroke for hypothetical patients with hypertension. Study participants were asked to estimate their own risk with the help of a visual aid and trained research assistants. It is unknown how accurately patients with hypertension or diabetes, but without known atherosclerotic disease, estimate their absolute risk of CVD events without the help of a health professional. In a study of patients with either diabetes or hypertension, Frijling et al. (2004) asked patients to self-report their 10-year risk of developing MI or stroke. Forty-five percent of those who were able to estimate their CVD risk overestimated their risk by more than 20%.

Conversely, Choi et al. (2008) conducted a cross-sectional study in a sample of Koreans with type 2 diabetes ($N$ = 143), which showed that participants had a low perception of CHD risk. Most (76.9%) indicated their risk to be the same or lower than that of people of the same age and sex in the general population. According to another study (Avis et al., 1989), people tend to rate their own risk as lower than that of their peers because those with diabetes, hypertension, and other chronic diseases were excluded from the study. This optimistic bias is confirmed when compared to objective risk such as actual risk.

***Risk perception for CVD in workers.*** Although industrial manufacturing work is associated with an increased risk of developing CVD (Williams, Mason, & Wold, 2001), there are few current studies examining workers' perception related to CVD risks. Limited information exists in the literature about CVD risk perception in workers. Risk

perception was included in three studies of industrial workers (Ansa et al., 2007, Jones et al., 2007 , and Pravikoff, 1997) and one qualitative study (Behera et al., 2000). However, the studies included risk perception as only one dimension of the variables of knowledge and perception of CVD risk, and did not examine the unique relationship between risk perception and CVD risk in workers.

A cross-sectional study of Nigerian university worker assessed their perception of CVD risk, knowledge of its risk factors, and adoption of preventive strategies (Ansa et al., 2007). This study found that knowledge of risk factors was low and was influenced by the level of educational attainment. In a focus group study of CVD risk among low-income African American women, Behera, Winkleby, and Collins (2000) also found low awareness of the prevalence of CVD.

In a prospective 3 month follow-up study, Pravikoff (1997) found that workers' perception is an important factor in health behavior. However, risk perception in these studies referred to awareness of CVD risk factors or perception about returning work, a somewhat different theoretical concept than perceived susceptibility and severity, as used in other studies reviewed.

Finally, Jones et al. (2007) used a quasi-experimental design to assess perceived susceptibility using a questionnaire on CVD knowledge and a single visual analog scale measure. The researchers found that 58% of participants improved their knowledge of CVD, and 50% increased their perception of susceptibility to CVD from the pre- to the post-intervention testing. The gains from this health education project for a large sample of minority municipal workers ($N$ = 58, 75% African American) were modest in terms of pre- and post-perceived susceptibility change, but were statistically significant

($r = -.29$, $p < .05$). A health education program for workers targeted at increasing their knowledge of CVD may also increase their perceptions of susceptibility to CVD. These data underscore the need to determine the factors related to risk perception.

***Factors influencing CVD risk perception.*** Several studies have reported that a family history of MI and hypertension significantly increased personal risk perceptions of CVD (Avis et al., 1989; Choi et al., 2008; Frijling et al., 2004). However, other studies have noted that a personal history of MI did not increase perception of risk (Meischke et al., 2002; van der Weijden, van Steenkiste, Stoffers, Timmermans, & Grol, 2007). A German study found that a positive family history of CVD was not a determinant of perceived high risk, even though patients with diabetes and a family history of CVD have by definition a high actual risk (van der Weijden et al., 2007). Hypertension, obesity, and smoking were determinants of perceiving CVD risk as high, while diabetic patients surprisingly did not report any anxiety about their CVD risk. Men were more likely than women to perceive incorrectly that their CVD risk was low (van der Weijden et al., 2007). These results contrast with those of other studies (Frijling et al., 2004; Jones et al., 2007). Risk perception is known to be primarily determined by emotions rather than facts (Paling, 2003). Frijling et al. (2004), however, did not record patients' psychological factors and suggested investigation into the influence of perceived stress, anxiety, depression, quality of life, and social status. One's emotional response to the risk of illness plays an important role in one's motivation to engage in risk reduction behaviors (Asimakopoulou et al., 2008).

Previous literature also suggests that demographic variables such as age, gender, level of education, and income are related to an increased perceived risk of CVD

(Christian et al., 2005; Frijling et al., 2004; Jones et al., 2007; van der Weijden et al., 2007). The effect of demographics on risk perception has resulted in diverse research findings. These findings may have important implications for the working population, because the underlying process and risk management for high risk groups and working groups are the same. More knowledge of CVD and poorer general health were associated with higher risk perception of CVD (Choi et al., 2008). Communicating the results and implication of health risk appraisal could effectively change the perception of those at high risk (Avis et al., 1989; Meischke et al., 2002).

Additionally, the number of CVD risk factors was significantly and positively related to risk perception, although the magnitude of the increased risk associated with each additional risk factor declined with age (Frijling et al., 2004). This suggests that people internalize their increased risk of having a CVD event, associated with the presence of multiple risk factors (Meischke et al., 2002). Awareness and knowledge of CVD risk factor may be a prerequisite for adopting healthy lifestyle behaviors (Frijling et al., 2004).

In summary, the literature offers inconsistent findings on the association between risk perception of CVD and influencing factors. Knowledge is related to perceived risk to some extent; greater knowledge is associated with greater perception of CVD risk (Becker & Levine, 1987; Choi et al., 2008; Meischke et al., 2002). The literature suggests that several factors are related to risk perception of CVD: knowledge and perception of general health (Oliver-Mcneil & Artinian, 2002); knowledge of CVD risk factors; self efficacy; social environment; and demographic variables such as age, education, and gender (Ansa et al., 2007; Choi et al., 2008; Frijling et al., 2004; Homko

et al., 2008; Jones et al., 2007; Rimal, 2001). A comprehensive understanding of CVD in the workplace is needed, therefore to develop better solutions. For example, none of the studies above considered the potential effect of perception of CVD risk in examining the association between environmental and psychosocial factors in the workplace and CVD in blue-collar workers. Research addressing this gap in knowledge would provide a better understanding of CVD risk in the work environment.

**Risk Reduction Behavior for CVD.** In this research study, CVD risk reduction behavior means promoting a healthy lifestyle. Risk reduction behaviors pursue the positive potential for health in workers (Lusk, Ronis, Kerr, & Atwood, 1994).

Five studies reviewed that used one or more of these theories related to risk perception examined the relationship between perception of CVD risk and risk reduction behavior, resulting in inconsistent findings (Avis et al., 1989; Mosca, Ferris, Fabunmi, & Robertson, 2004; Mosca et al., 2000; Newell, Modeste, Marshak, & Wilson, 2009; Oliver-Mcneil & Artinian, 2002; Rimal, 2001). Only three of those studies reported a positive relationship between perception of CVD risk and risk reduction behavior (Mosca et al., 2004; Newell et al., 2009; Rimal, 2001). The first study, Newell et al. (2008) used a cross-sectional study to test a model of CVD risk perception and health-related behavior in the United Kingdom. Participants had their BP checked regularly, limited salt intake, ate a diet high in fiber, and exercised at least 30 minutes 4 to 5 days a week ($N$ = 312). The study hypothesized that actual level of risk is determined by a combination of susceptibility and severity for risk reduction behavior in the community. Risk perception was the only variable that was significantly associated with risk reduction behavior after controlling for age, sex, family history of hypertension, education, and

country of birth.

The second study, a telephone survey of a nationally representative random household sample ($N$ = 1,024), found that higher perceived risk of CVD was associated with more frequent health-related behavior such as opportunities for patient-physician discussion (Mosca et al., 2004). Perceived risk of CVD was also shown to be improved compared with a prior study (Mosca et al., 2000). Between 2000 and 2003, the percentage of respondents identifying heart disease as the leading health problems increased among White respondents from 9% to 13% ( $p < .05$) and African-American respondents from 3% to 12% ($p < .05$; Mosca et al., 2004). However, perceived risk referred to knowledge of potential risk sources such as cancer and CVD, making this definition different from the theoretical concept of risk perception. Additionally, the survey included only households with telephones, potentially excluding people from low socioeconomic groups.

Witte's (1994) extended parallel process model attempts to account for fear by explaining when and why *fear appeals* work and when and why they fail. The model explains the moderating role that an individual's perceived ability plays in perceived risk and preventive action ($r = .12$, $p < .001$). The model posits that the interactive effect of perceived risk, people's perception about their susceptibility to diseases and self-efficacy, their confidence in their ability to exert personal control is such that individuals adopt fear control strategies when perceived risk is sufficiently high to induce fear. This model was used by Rimal (2001), who identified four groups of individuals according to their perceived risk and self-efficacy: "responsive (high perceived risk, high efficacy), proactive (low perceived risk, high efficacy), avoidant (high perceived risk, low efficacy),

and indifferent (low perceived risk, low efficacy)" (Rimal, 2001, p 638). In this third study, a significant interaction was found in the data waves between risk perception and self-efficacy on health related behaviors. These findings have been further confirmed by similar results over 2- and 6-year periods. However, risk reduction behavior was considered to be an individual's motivation to think about CVD, to use health information, and to acquire knowledge. Because this study's attrition rate was high (20% by year 2 and 56% by year 6), selection bias may be suspected.

On the other hand, a lack of relationship between perception of CVD risk and health-related behaviors has been demonstrated in several studies (Avis et al., 1989; Oliver-Mcneil & Artinian, 2002). Avis et al. (1989) conducted a survey in the United States that investigated predictors of behavioral change. Health-related behaviors such as smoking, exercise, weight reduction, and self-reported reduction in salt, fat, and calories were assessed at baseline and at 2 months ($n$ = 87). Results showed that those who increased their perceived risk of MI were not likely to change their behavior. Oliver-McNeil and Artinian (2002) tested risk reduction behaviors in 33 people with newly diagnosed CHD and also found no direct relationship between perceived risk of CVD and risk reduction behavior ($r$ = .05, $p$ = .55). The absence of relationships in two studies is most likely due to small sample sizes without much variation between minimum and maximum scores.

***Factors influencing risk reduction behavior.*** Pender et al, (1990) found that health was significantly related to practicing more health-promotion behaviors in their study of manufacturing workers ($N$ = 589) who had enrolled in health-promotion programs. Perceived self-efficacy, their definition of health, perceived health status,

and perceived control of health accounted for 31% of the variance in health-promoting lifestyle patterns. Perceived self-efficacy, the belief in one's personal competence to carry out a specific action, was positively related to the performance of health behaviors (Bandura, 1977; Pender et al., 1990) and to participation in exercise among sedentary adult women (McAuley & Jacobson, 1991). Weitzel (1989) also found that self-efficacy was the most important predictor of practicing health-promoting behaviors among Mexican American blue-collar workers, explaining 10% to 16% of variance, but it did not consider perceived risk.

A study of CVD in blue and white-collar workers (Nourjah et al., 1994) found that blue-collar workers had less knowledge about CVD risk factors, a less favorable risk factor status, and poorer risk reduction behaviors than did white-collar workers. Despite the differences in findings the relationship of knowledge to each group's risk factor status or health practices is similar. Knowledge is generally related to attempts to change behaviors (Nourjah et al., 1994). A cross-sectional survey (Foss et al., 1996) in the United Kingdom explored the relationship between a person's knowledge of CVD risk factors, his or her perception of personal risk and health behaviors, and their use of lifestyle interventions. The finding showed that levels of modifiable risk factors were high, although there was considerable variation by age and sex; most subjects had more than one CVD risk factor. Subjects with a lower standard of living were less likely to know CVD risks and less likely to improve their unhealthy habits. This study suggests that a targeted lifestyle intervention rather than general health promotion activities is needed in primary care.

The three observational studies above provide initial evidence of predictors of risk reduction behavior such as perceived health status (Pender et al., 1990), self-efficacy (McAuley & Jacobson, 1991; Pender et al., 1990; Weitzel, 1989), and knowledge of CVD risk factors (Foss et al., 1996; Nourjah et al., 1994), especially in the occupational setting. This evidence supports the importance of risk reduction behavior in reinforcing health promoting behaviors among individual workers. The significance of organizational involvement in supporting a health promotion program was shown by Pender et al. (1990).

***Risk reduction behavior, job stress, and family support.*** CVD risk reduction behavior may also be influenced by job stress and psychological factors such as social support and family support (Chen et al., 2008; Kim, 1998). The influence of family function, however, is not well studied in Korean blue-collar workers. Job stress is thought to be related with adverse health related behavior (Lallukka et al., 2008). Symptoms of job stress include anxiety, burnout, irritability, psychological distress, and psychosomatic health complaints. It occurs when external demands and conditions do not match a person's needs, expectations, or ideals, or when the demands exceed their physical capacity, skills, or ability to deal with a situation (Noblet & Lamontagne, 2006).

Chen and her colleagues (2008) examined the association of job stress and social support with health-related behaviors (alcohol drinking, physical inactivity, and smoking) among offshore oil workers of a Chinese company ($N = 561$). Perceived job stress and lack of social support from supervisors and friends were significantly and positively associated with physical inactivity after work (Chen et al., 2008). Age, educational level, marital status, duration of offshore work and job title were adjusted in multivariate

analysis. Smoking was significantly negatively related with perceived stress (OR = 0.74, 95% CI [0.58, 0.94]). Alcohol drinking was significantly positively related to perceived stress (OR = 1.32, 95% CI [1.02, 1.70]), but was significantly negatively related to emotional support from friends (OR = 0.54, 95% CI [0.62, 0.96]). The study suggests that psychosocial factors of job stress and social support might affect workers' health-related behaviors. This study, however, has several limitations. A self-reported questionnaire was used in the data collection process, leading to the possibility of information bias. The workers could have exaggerated perceived job stress to prompt management to improve work conditions. Another possible bias might be the underreporting of smoking and drinking. Furthermore, the amount of tobacco and alcohol use and the frequency of physical exercise were not quantified.

***Risk reduction programs in the workplace.*** Various interventions for CVD risk reduction behaviors have been conducted in the workplaces (Jones et al., 2007; Pender et al., 1990). Robroek and colleagues (2007) investigated a worksite health promotion program that offered individually tailored physical activity, nutritional advice, and individual counseling to increase compliance with lifestyle recommendations. Psychosocial intervention studies at the worksite to treat CVD were also initiated (Alderman 2007; Jones et al., 2007; Noblet & Lamontagne, 2006).

However, the interventions described above have not eliminated the risk of CVD in blue-collar workers. Many risks such as lack of physical exercise and poor diet require risk reduction behaviors that are appropriately implemented. Furthermore, workplace interventions are not easily implemented, and are not immediately available in many settings (Glasgow & Terborg, 1988; Schmitz, 2000). Individual interventions

may play a crucial role in preventing CVD in workers (Pender et al., 1990). Research on the roles of risk perception or lifestyle modification behaviors for CVD in workers may provide helpful information for designing more effective interventions for this population (Jones et al., 2007). Annual employee surveys and health checks such as those occurring in company-sponsored wellness programs provide a means of primary prevention and intervention (Nourjah et al., 1994).

CVD risk reduction programs that focus on individual employees are not cost-effective worksite programs (Schmitz, 2000). An alternative approach is to create an atmosphere at work that reflects the company's commitment to the norm of health by protecting employees from job-related hazards, and by instituting policy and environmental changes to support employees' risk reduction behavior (Schmitz, 2000). The development of a regulation on intervention, for example, signifies a corporate health commitment. Environmental changes for employees can include more nutritious food options in the cafeteria and running machines and weight scales in the fitness center. Beyond their interest in the structure and content of programs, nurses should assist small companies in beginning risk reduction activities.

In summary, the findings of the studies reviewed are inconsistent on the association between actual risk, risk perception of CVD, and risk reduction behavior and predictors of risk reduction behavior. The lack of definite relationships argues future studies with rigorous designs, larger sample sizes, and controls for confounders and covariates. The reviewed studies were conducted with different types of worker in industrial settings or with the general population in community settings. The studies used different measures of a range of risk reduction behaviors such as alcohol drinking,

physical exercise, stress management, smoking cessation, preventive nutrition, and physical inactivity (Chen et al., 2008; Jones et al., 2007; Nourjah et al., 1994; Pender et al., 1990).

The literature in the previous two sections addressed work- related risk factors for CVD and actual risk of CVD, risk perception, and risk reduction behavior. These concepts and their roles in linking CVD risk factors and CVD are still not fully understood. Furthermore, the literature on the predictors of risk reduction behaviors in blue-collar workers is limited. Further studies are needed to understand actual risk, perception of CVD risk, and risk reduction behavior based on theory, and their relation to other psychological components such as family and social support and work-related environmental components such as shift work, overtime work, job stress, and chemical exposures.

**Theoretical Framework**

Two theories, the health belief model (HBM) and the health promotion model (HPM), were evaluated as theoretical rationales for incorporating the variables of risk perception and risk reduction behavior into a modified framework for blue-collar workers at risk for CVD. The HBM attempts to explain risk perception and risk reduction behavior; the HPM provides theoretical guidance in understanding factors associated with health-promoting behavior such as situational influences and cognition factors. Briefly, the HBM proposes that individuals will engage in risk reduction behavior if they believe *not* doing something may cause serious consequences or if they believe it would be beneficial in reducing either their susceptibility or the severity of their condition. The HPM proposes that people are more likely to commit to and engage in health-promoting behaviors when they anticipate valued benefits and are competent to perform a given behavior. The model also proposes that situational influences in the external environment can increase or decrease health-promoting behavior.

A review of the HBM provides an understanding of risk perception and risk reduction behavior. Because the HBM was originally developed to explain preventive behavior, it has potential application in assessing risk perception of CVD and risk reduction behavior in blue-collar workers. CVD risk reduction behavior in workers could be influenced by perceived threat. For example, people will not adopt a new health behavior unless they know about a condition (e.g., hypertension or CHD), perceive themselves to be susceptible to the disease (e.g., risk perception of CVD), and believe that they can do something to prevent or treat it (e.g., risk reduction behavior), as reflected in the revised HBM (Janz and Becker, 1984).

As the HBM suggests, perception of personal risk for disease may be important for risk reduction behavior. An individual is likely to take recommended action if he or she perceives himself or herself to be at risk of developing a serious disease. The perceived threat of CVD has been positively related to the desire to adopt risk reduction behavior and actual behavioral changes (Silagy, Muir, Coulter, Thorogood, & Roe, 1993). Risk perception, a central construct in many health theories, is based on an individual's assessment of his or her health situation: realistic, optimistic, or pessimistic. Both optimistic and pessimistic biases have critical implications for illness prevention and disease management. People who underestimate their risk are more likely to disregard symptoms and warnings because they regard these warnings to be more applicable to other individuals (Ajzen, 1990). Studies have shown that blue-collar workers certainly have low perception of the risk of CVD (Ansa et al., 2007; Jones et al., 2007). Although recent studies have identified risk perception of CVD among workers, risk perception of CVD in blue-collar workers is not well-chronicled. Thus, including risk perception of CVD under cognitive perceptual factors in the HPM is important.

However, the HBM, as a theory to predict risk reduction behaviors in blue-collar workers, has several limitations. The model has shown weakness in clarity, consistency, and accessibility (Chinn & Kramer, 2008). Because the HBM's theoretical concepts are not clearly defined, researchers have had to use a diverse array of ways to operationalize the concepts. Accordingly, the model's predictiveness is of great concern, although it has been tested empirically. Perceived threat is the single major concept to predict risk reduction behavior. Environmental factors are not considered.

Finally, the HBM focuses on preventive behavior and not on health-promoting behavior. This is a critical point because the current research is avidly investigating blue-collar workers with the risk of CVD and their health behavior. Health behavior that encompasses both health promotion and risk prevention is a more appropriate focus because CVD is a lifelong disease, and health-promoting behaviors can enhance the life span of workers.

In reviewing the HPM, the researcher identified connections between cognitive, psychological, and situational influence components that affect health behaviors. The researcher also attempted to explore the role of risk reduction and the potential of using the HPM to examine risk reduction behavior in blue-collar workers at risk of CVD. The HPM seems better suited than the HBM to examine risk reduction behaviors in blue-collar workers for the following reasons. First, the HPM has been empirically tested using a variety of tools and has explained health-related behaviors in workers (Williams et al., 2001). In studies of CVD, the HPM has shown stronger and more consistent results than the HBM in tests of health-related behaviors. Second, the model includes multiple variables as determinants of health-related behaviors (Shin, Lee, Lee, Sa, & Jung, 1995; Sohng, Sohng, & Yeom, 2002). It also has cognitive and situational components that allow researchers to better integrate environmental associations underlying health-related behaviors. Finally, the model has the breadth to deal with health-promoting behavior and health-protective behavior.

Health-promoting behavior may be motivated by one's desire to protect health by avoiding illness (health protection) or the desire to improve one's health whether ill or not (health promotion). Health protection focuses on reducing health risks by

decreasing the probability of illness through active risk reduction and detection of health problems at an asymptomatic stage (Kasl & Cobb, 1966). Health-protecting behavior has three characteristics: (a) protection against illness and injury, (b) avoidance motivation, and (c) the prevention of illness (Pender et al., 2006). Health promotion focuses on increasing an individual or group's level of well-being. Health-promotion behavior also has three characteristics: (a) nonspecificity to illness or injury, (b) approach motivation, and (c) the purpose to expand the positive potential for health (Pender et al., 2006).

Although the HPM was developed to explain health-promoting behaviors such as exercise and weight control, it can also be used to investigate health-protecting behaviors (Pender et al., 2002; Pender et al., 2006). This is particularly important for diseases like CVD that may develop and worsen over a lifetime. Health-promoting behavior for CVD includes risk reduction behaviors such as participating in an exercise program designed to provide long-term cardiovascular benefits (Ronis, Hong, & Lusk, 2006). A study of blue-collar municipal workers that used a lifestyle profile to measure health-promoting behavior to evaluate CVD risk reduction behavior showed good predictive power for CVD risk reduction behavior in blue-collar workers (Oliver-Mcneil & Artinian, 2002).

Health-protection behaviors focus on preventing disease. Health promotion and health protection are both relevant to risk reduction behavior. Under some conditions such as the absence of disease, risk reduction behavior can be treated as inclusive of health-promotion behavior (e.g., diet, exercise, and smoking cessation). However, for those with a particular disease like CVD or diabetes, risk reduction

behavior seems to be closer to health protection than to health promotion. For example, the level of exercise may differ based on whether an individual is asymptomatic or has an active stage of disease. Emphasis on improving health, which in turn potentially improves health outcomes (e.g., CVD risk reduction), applies across one's life span. Because the HPM encompasses health-promoting behavior in addition to health-protecting behavior, it is the preferred model to explain health-related behavior in blue-collar workers at risk of CVD. Accordingly, the HPM has been selected as the baseline for a framework to explain CVD risk reduction behavior in workers. The modified framework includes individual and environmental characteristics, behavior-specific cognitions and affect, and behavioral outcomes and incorporates the HBM's concept of risk perception.

**Modified Theoretical Framework.** A proposed conceptual framework modified from the HPM is presented in Figure 7 (Appendix). The purpose of the modified model is to provide a theoretical framework for perception of CVD risk and CVD health-related behavior research in blue-collar workers. It posits personal factors and work-related situational influences under the construct of individual and environmental characteristics. The environmental factors are influenced by public policy and organizational factors such as management style, scheduling, and organizational culture. Work-related situational influences are derived from the HPM's situational influences and are restructured under individual and environmental characteristics. Work-related situational influences may affect CVD health-related behavior directly or indirectly. For example, people who have job stress are not likely to perform health-related behavior (Chen et al., 2008).

Individual and environmental factors may influence health-related behavior directly or indirectly through cognition and affect (perception of self-efficacy, interpersonal influences, and perception of CVD risk). The modified model posits perceived interpersonal influences, self-efficacy, and perception of CVD risk as three major cognition and affect factors. CVD health-related behavior may be modified by interpersonal influences such as perceived social support. Additionally, the model posits that CVD health-related behavior is influenced by a worker's perception of the risk of CVD. Thus, if the perceived level of CVD risk is high, one may hypothesize that a worker will choose a health-related behavior to reduce the risk of CVD (e.g., exercise, low fat diet, weight control, or smoking cessation). Finally, the outcome of CVD health-related behavior may provide feedback on behavior-specific cognitions and affect. Considering the added complexity, this feedback is not depicted in the modified framework.

**Conceptual Framework for This Study.** To determine predictors of CVD risk reduction behavior and the relationship between risk perception and actual risk and risk reduction behavior, this study used the conceptual framework presented in Figure 1. This conceptual framework, based on the modified HPM (Pender, 2002), helps one determine the effect of psychosocial and work-related factors on CVD risk reduction behavior. This framework posits that actual risk and risk perception is influenced by three factors: individual, psychosocial, and work-related factors. Risk reduction behavior is also influenced directly not only by these three factors but also by actual risk and risk perception. The conceptual framework serves as a guide to better explain actual risk of CVD, risk perception, and risk reduction behavior in blue-collar workers.

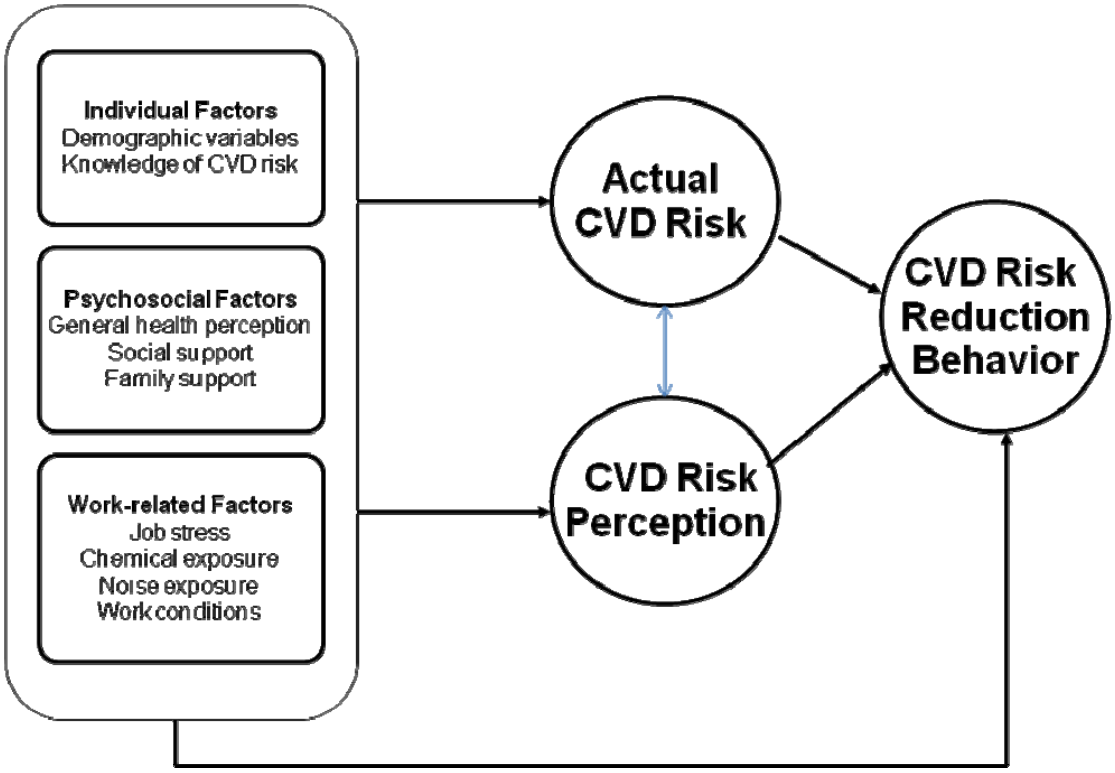


*Figure 1*. Conceptual framework between actual risk of CVD, risk perception, and risk reduction behavior.

**Study Purpose**

People engage in more risk reduction behavior when they perceive that the activities are beneficial to their health, taking into consideration the actual risk factors of the disease as well (Pender, Murdaugh, & Parsons, 2006). However, people with low risk perception of CVD may not necessarily exhibit risk reduction behavior. Actual risk is considered to be the calculated risk of CVD, which predicts perceived risk of CVD (Frijling et al., 2004). Perceived risk of CVD has been positively related to the desire to make risk reduction changes in behavior (Silagy et al., 1993; Winkleby, Flora, & Kraemer, 1994).

Workers, especially blue-collar workers, are at high risk of CVD due to overtime work, occupational physical activity, and job stress (Tuchsen & Endahl, 1999; Won, Ahn, Song, Koh, & Roh, 2007). Research has identified several work-related risk factors for CVD such as job stress, shift and overtime work, hazardous agents such as chemicals, heavy metals, and noise and reported that mortality due to CVD among blue-collar workers is higher than that of white-collar workers (Williams et al., 2001). Blue-collar workers have been understudied, and actual risk of CVD, risk perception, and risk reduction behavior in this population is a burgeoning area of research, especially in occupational health nursing. The influence of work-related factors is important for workers' personal, behavioral, and social growth. The relationship between work-related factors (shift and overtime work, exposure to noise, chemicals, and heavy metal, and job stress), actual risk of CVD, risk perception, and CVD prevention has not been studied in blue-collar workers.

This dissertation aims to investigate the contribution and unique function of actual and perceived risks of CVD, individual factors, psychosocial factors, and work-related factors as predictors of risk reduction behavior for CVD. The association between risk perception and actual risk as well as risk reduction behavior will also be studied in order to provide healthcare professionals a better understanding of the effect of work-related factors and psychosocial factors on Korean blue-collar workers. This study's specific aims and research questions follow.

**Study Aims and Research Questions**

**Study Aim 1.** Identify blue-collar workers' actual risk of CVD, risk perception, and risk reduction behavior.

**Research Question 1.**

(a) What are the demographic and work characteristics of the sample?

(b) What are the characteristics of the Korean blue-collar workers in relation to actual and perceived CVD risk, and risk reduction behavior?

**Study Aim 2.** Determine the association between individual factors, psychosocial factors, work-related factors, actual risk of CVD, risk perception, and risk reduction behavior.

**Research Question 2.**

(a) What are the relationship between individual factors, psychosocial factors, work-related factors, actual risk of CVD, risk perception, and risk reduction behavior?

(b) Is there a relationship between risk perception and risk reduction behavior?

(c) Do the individual factors, psychosocial factors, and work-related factors, along with risk perception predict actual risk of CVD?

(d) Do the individual factors, psychosocial factors, and work-related factors, along with actual risk of CVD predict risk perception?

(e) Do actual risk of CVD, perceived risk of CVD, the individual factors, psychosocial factors, and work-related factors predict risk reduction behavior?

Results from this study will provide a foundation for developing intervention strategies to prevent CVD and promote cardiovascular health among Korean blue-collar workers.

# CHAPTER THREE

## Methodology

### Study Design

The study used a cross-sectional design to understand the actual risk of CVD, risk perception, and risk reduction behavior in Korean blue-collar workers, and to investigate the relationship between risk reduction behavior and different factors including individual, psychosocial, and work-related factors. The selection of a research design depends on the research questions of interest. In this study, the research questions involve associations between CVD actual risk, risk perception, and risk reduction behavior as three dependent variables and multiple independent variables, including individual, psychosocial, and work-related factors. To identify correlations between risk reduction behavior and other variables along with actual risk and risk perception, a cross-sectional study design is needed; cross-sectional studies are appropriate for describing the status of phenomena or describing relationships among phenomena at a fixed point in time (Polit & Beck, 2004).

### Study Setting

The study setting was an occupational health center (OHC) in Incheon, South Korea, which provides by contract annual physical examination and occupational health services including an occupational injury prevention program for small companies with fewer than 300 employees (June, Hong, & Cho, 2003). Eight companies participated in the study. They represented five different sectors: (1) shipbuilding, (2) the manufacture of print chips, (3) electronics, (4) weaponry, and (5) the manufacture of butane gas. Most study subjects were involved in direct manufacturing. The researcher examined

an average of 30 participants at each company. The number of blue-collar participants ranged from 18 to 69 (see Table 1).

Table 1

*Location of Participant Recruitment*

| Company Name | Sector | *n* | % |
|---|---|---|---|
| Company A | 5 | 33 | 13.9 |
| Company B | 5 | 18 | 7.6 |
| Company C | 4 | 24 | 10.1 |
| Company D | 4 | 23 | 9.6 |
| Company E | 3 | 29 | 12.2 |
| Company F | 2 | 20 | 8.4 |
| Company G | 1 | 69 | 29.0 |
| Company H | 1 | 22 | 9.2 |

*Note***.** *n* = portion of the total sample**.**

**Study Sample**

**Sample size.** An estimate of sample size was determined by power analysis (Cohen, 1988). Sample size was determined based on a power of .80, a two-tailed alpha of .05, and with 10 independent variables. After estimating attrition to be about 40%, the required final sample size was determined to be 120 to detect an overall $R^2$ of at least .13, a medium effect size for the purpose of this study. Thus, the target of initial recruitment was 200 individuals.

**Inclusion and exclusion criteria.** The inclusion criteria: (1) Korean blue-collar workers working for small companies which have less than 300 employees; (2) aged 18 years or more; (3) no history of previous MI; and (4) no history of percutaneous transluminal coronary angioplasty. The target population for this study, blue-collar workers were identified as skilled or non-skilled manual workers based on Korean

standard classification of occupations (KNSO, 2007). Workers were excluded from the study if they failed to meet the inclusion criteria or had cognitive impairment. Eligibility of potential participants was determined by the researcher or the trained research staff using the inclusion and exclusion criteria at the time of initial contact, the physical check-up.

**Protection of Human Subjects**

The study was approved by both the Committee on Human Research of the University of California, San Francisco (see Appendix A) and the Investigation Review Board of Yonsei University Medical Center (see Appendix B for study approval). Written informed consent was obtained from all participants after careful explanation of the information sheet. Participants had the right not to answer any questions and to stop the data collection procedure at any point. All subjects were reassured about the confidentiality and anonymity of the information provided by them. The subject matter in the questionnaires could potentially be distressing. The procedures were designed to be entirely non-coercive. Participants could decline to answer any question he or she felt uncomfortable answering. Information on how to contact counseling services if desired was provided. Participation in the research study could result in a loss of privacy, but information was handled as confidentially as possible. Study information was coded and kept in a password-secured computer database in locked files at all times. Data collected from all participants were kept in strict confidence and only used in this study. The demographic data were presented in aggregate so that the identifiers were not linked. Only codes were used to identify participants, and their names and companies were not disclosed except to the researcher and research staff.

## Data Collection

**Data collection procedures.** The data collection procedure is depicted in Figure 2. Individuals were recruited primarily from the OHC in Incheon, South Korea during their annual health check-up, although some were also recruited at other worksites where the occupational health team conducted annual physical check-ups. Flyers posted at those facilities were the principal recruitment tool. After the study was explained, permission was obtained from the OHC's director and the workers' employers. An information sheet was provided that clearly explained the study's purpose and procedures.

Data collection was conducted from July to August 2010. Following informed consent, the participants were asked to complete a survey questionnaire at the OHC or at their workplace and to have anthropometric and BP measurements taken. Blood was drawn for lipid testing by registered nurses in the OHC. After successful completion of the questionnaire, anthropometric and BP measurements, and blood testing, participants were given a gift certificate of KRW 10,000 (approximately USD $8.30) for their participation in the study. Blood test results were available to those workers who wished them. Finally, the researcher performed a review of each participant's medical record.

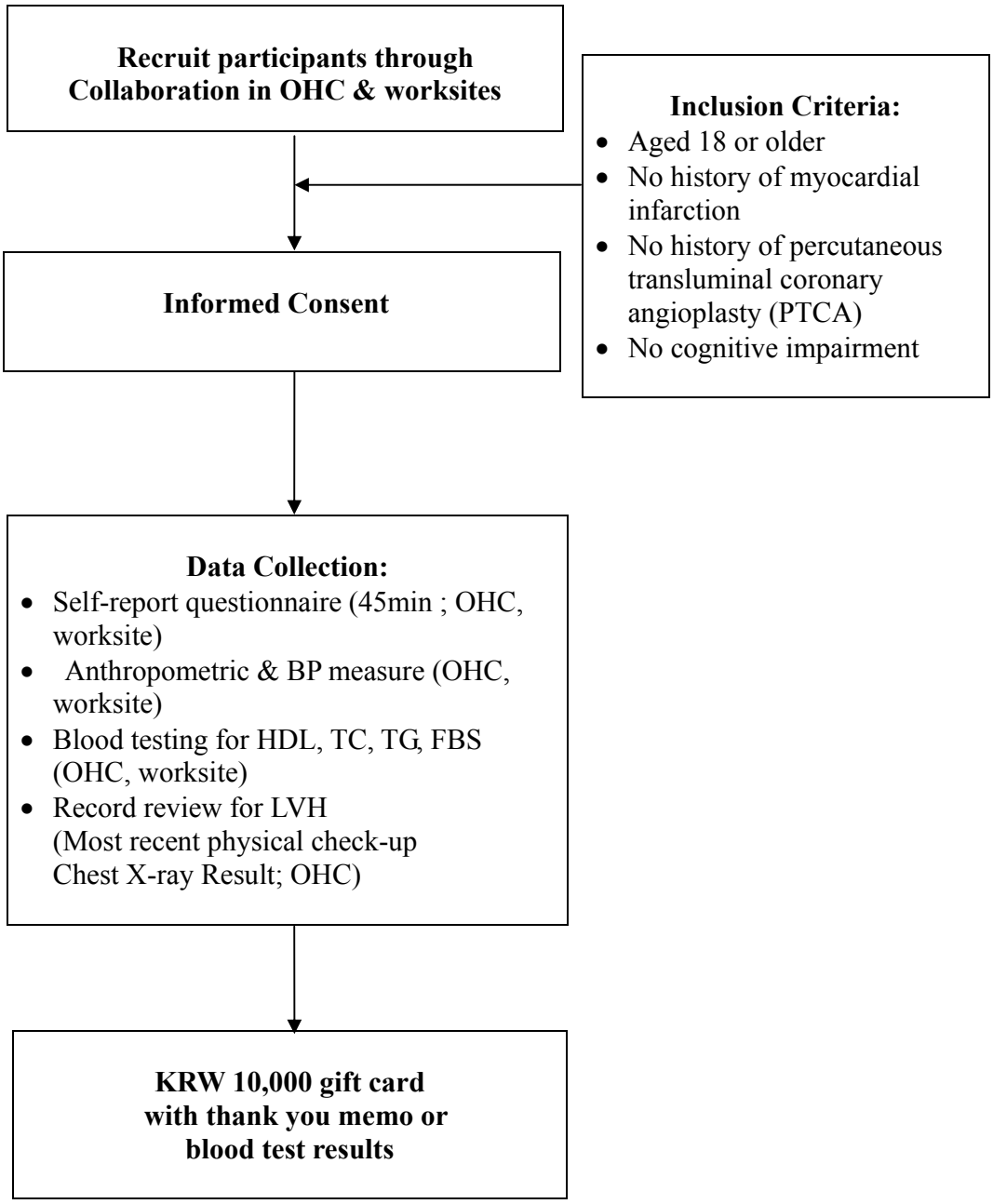


*Figure 2*. Flow chart of data collection procedure

**Data collection methods**. Four methods were used for data collection: (a) a survey (a self-administered questionnaire), (b) anthropometric and BP measurements, (c) blood testing, and (d) record review.

***Survey.*** The survey comprised five instruments: (1) the Health Promoting Lifestyle Profile II (HPLP II); (2) the Knowledge of CVD Risk and Risk Perception Index (RPI); (3) the Family Adaptation, Partnership, Growth, Affection, and Resolve (APGAR) Questionnaire; (4) the Job Contents Questionnaire (JCQ); and (5) the Effort-Reward Imbalance Questionnaire (ERIQ) (see Appendix E for samples of instruments) . The five measures have already been translated into Korean and validated; their reliability is found in Table 2. Sociodemographics and risk factors for CVD were designed for this study.

***Anthropometric and BP measurements.*** Anthropometric measurements of height, weight, and waist/hip circumferences were used to assess body mass index (BMI) and waist-hip ratio (WHR). Height, from bare feet to the top of the head, and weight were measured in centimeters using an automatic measuring instrument. Waist circumference was measured in centimeters by placing a nonstretchable measuring tape around the bare abdomen at the top of the iliac crest or just above the hip bone. The reading was taken at the end of expiration, making sure that the tape was secure but not too tight. The hip measurement was taken at the maximum circumference around the buttocks. The WHR was calculated by dividing the waist measurement by the hip measurement. BP was measured on the right arm with the subject in a supine position after 5 min of rest. It was measured with an electronic monitor using standardized procedures at first. Measurements were repeated after 2 min and then averaged by the

researcher. If the reading was more than 140/90 mm Hg, BP was measured again with a conventional sphygmomanometer and stethoscope, and the lower of the two readings was recorded.

***Blood testing.*** Blood samples were drawn if a participant's health check-up was due or if the blood test had been done more than 2 months before. Blood was drawn from the venae brachiales by a registered nurse in the OHC, transferred to two tubes, with or without anticoagulants such as sodium citrate/EDTA, and delivered to a certified laboratory for analysis. Blood lipids were determined enzymatically, after precipitation by phosphotungstic acid and magnesium chloride. All of the analyses were conducted by medical laboratories certified by the Korean Food and Drug Administration; the laboratory personnel were blinded to participant status. Total serum cholesterol and high-density lipoprotein cholesterol (HDL) were measured. When triglycerides were less than 400 mg/dl, low density lipoprotein cholesterol (LDL) was calculated using the *Friedewald* formulation (LDL=TC-HDL-TG/5); for triglycerides of 400 mg/dl or higher, the LDL should be estimated directly after ultracentrifugation of plasma and measurement of cholesterol in the bottom fraction (Wilson et al., 1998)

***Record review.*** A record review for each participant was extracted by the researcher, which included the results of chest X-rays taken during the annual physical check-up in the OHC to calculate actual risk of CVD based on the presence of left ventricular hypertrophy (LVH).

Table 2

*Reliability of Scale and Subscale (Cronbach's Alpha)*

| Characteristics | No. of items | Cronbach's Alpha in current study | Cronbach's Alpha in published study |
|---|---|---|---|
| **Risk Perception Index (RPI)** | **4** | **0.86** | **0.78** [a] |
| **Health Promoting Lifestyle Profile II (HPLP II)** | **52** | **0.93** | **0.86** [b] |
| Health responsibility | 9 | 0.84 | .81 [b] |
| Physical activity | 8 | 0.81 | .81 [b] |
| Nutrition | 9 | 0.70 | .80 [b] |
| Spiritual growth | 9 | 0.86 | .83 [b] |
| Interpersonal relations | 9 | 0.74 | .80 [b] |
| Stress management | 8 | 0.72 | .88 [b] |
| **Family Function (Family APGAR)** | **5** | **0.86** | **.94** [c] |
| **Job Contents Questionnaires (JCQ)** | | | |
| Psychological demand | 5 | 0.49 | .59 [d] |
| Decision latitude | 9 | 0.77 | .77 [d] |
| Skill discretion | 6 | 0.73 | .74 [d] |
| Decision authority | 3 | 0.70 | .70 [d] |
| Social support | 8 | 0.87 | .71 [e] |
| Coworker support | 4 | 0.77 | .63 [e] |
| Supervisor support | 4 | 0.87 | .69 [e] |
| **Effort Reward Imbalance (ERI)** | | | |
| Extrinsic effort | 6 | 0.81 | .71 [f] |
| Reward | 11 | 0.88 | .86 [f] |
| Self-esteem | 5 | 0.80 | N/A |
| Financial status | 4 | 0.76 | N/A |
| Job security | 2 | 0.71 | N/A |
| Over-commitment | 6 | 0.63 | .75 [f] |

*Note.* [a]Choi et al ., 2008. [b]Sohng, et al. , 2002. [c]Han, 2003. [d] JCQ Center, 2009 – Average Cronbach's alpha for men. [e]Eum et al., 2007a. [f]Eum et al., 2007b

## Variables and Measures

**Dependent variables.** The dependent variables of the study were CVD actual risk, risk perception of CVD, and risk reduction behavior related to CVD risk factors. Each variable also served as an independent variable for the other in separate analyses.

***Actual risk of CVD.*** The KOSHA CVD risk assessment score (KOSHA, 2003) was used to calculate CVD actual risk based on the guideline of World Health Organization International Society of Hypertension (WHO-ISH; Whitworth, 2003). The CVD actual risk score was calculated by adding the following CVD risk factors: age ≥ 55 years in men or age ≥ 65 years in women, total cholesterol ≥ 240 mg/dl or LDL ≥ 160 mg/dl, smoking, HDL ≤ 35, family history of CVD, BMI ≥ 30 or lack of physical activity, and the presence of LVH. The composite score (maximum: 7 points) for CVD risk was reduced by 1point if HDL ≥ 60 mg/dl. The CVD risk assessment scores were added.

LVH was checked through the most recent chest-X ray results of the individual record review. For physical activity, if participants exercise 30 min/day for more than three days per week, it was considered to be the appropriate exercise. A positive family history was defined as a report by participants of angioplasty, heart attack, high BP, stroke, or diabetes in any of the subject's biological parents and siblings. The assessment was classified as follows (see Table 3). In this study, the participants were stratified to the high risk or moderate risk group (normal, low, and medium risk group) because blue-collar workers in high risk for CVD should be assessed.

Table 3

*KOSHA CVD Risk Assessment Classification Criteria*

| Risk Group | Classification Criteria |
|---|---|
| Normal | No CVD risk factors |
| Low risk | CVD risk factor 0 or 1st degree hypertension (systolic BP ≥140mmHg, diastolic BP ≥ 90 mmHg) or taking antihypertensive medication. |
| Medium risk | 1-2 CVD risk factors or 2nd degree hypertension (systolic BP ≥160mmHg, diastolic BP ≥ 100 mmHg) |
| High risk | Three or more CVD risk factors, or 3rd degree hypertension (systolic BP ≥180mmHg, diastolic BP ≥ 110 mmHg) |

Source: KOSHA Code H-46-2008 (KOSHA, 2008)

***Risk perception of CVD.*** Risk Perception of CVD was measured by an index of relative risk perception developed and tested by Becker and Levine (1987) in a study of a high-risk population. This index has demonstrated good internal consistency with Cronbach's α of .80 in a U.S. sample (Becker & Levine, 1987) and .78 in a Korean immigrant sample (Choi et al., 2008). The index is comprised of four items that address a person's (1) frequency of concern over having CVD, (2) his or her estimate of the likelihood of having such an event in the next ten years, (3) the likelihood of having such an event in his or her lifetime, and (4) his or her estimated CVD risk compared with people of similar age and sex in the general population. Items 1-3 were measured on a 5-point Likert scale (1 = no concern at all or very low probability estimates of having an event, 5 = very high levels of concern and extremely high estimates of having an event). The response categories for the fourth item were much less, less, about the same, more, and much more risk than people in the working population of similar age and gender. Scores for the four items were summed up. A high score indicates a high level of perceived risk.

***Risk reduction behavior.*** Risk reduction behavior was defined as any action indicating motivation to reduce CVD risk factors, to increase well-being, and to actualize human health potential. CVD risk reduction behavior is the main outcome variable and was measured by HPLP II. The 52-item HPLP II developed by Walker et al. (1987), includes six subscales (8-9 items each) to measure health behaviors associated with exercise, nutrition, stress management, interpersonal support, health responsibility, and self-actualization. The profile measures health practices on each of these subscales using a 4-point Likert scale (1= never, 4= routinely). Good validity and reliability for the HPLP has been reported in the literature (Lee & Loke, 2005; Pender et al., 1990; Walker, Sechrist, & Pender, 1987). Alpha reliabilities obtained on the six subscales ranged from .70 to .88 in the published studies (Hulme et al., 2003; Sohng et al., 2002; Tang & Chen, 2002). The instrument was translated into Korean and tested to assess the health behavior of elderly Korean immigrants. The Korean version of the HPLP instrument demonstrated good reliability with Cronbach's alpha coefficient of .86 and subscale Cronbach's alpha coefficient ranging from .80 to .88 (Sohng et al., 2002). In the current study, the alpha reliability coefficient for the total score was 0.93, and coefficients for the subscales ranged from 0.70 to 0.86 (Table 2).

**Independent variables.** The independent variables were comprised of three factors such as individual, psychosocial, and work-related factors.

***Individual factors.***

*Demographics and CVD risk factors.* Demographics and CVD risk factors were obtained by survey. Variables included participants' age, gender, education level, marital status, income, type of employment, type of work, duration of employment, shift

work, and overtime work. *Alcohol drinking* was measured by self-report of alcohol consumption. If a worker was drinking alcohol, his or her response yes confirmed the alcohol consumption.

*Knowledge of CVD risk factors.* Knowledge of CVD risk factors was assessed using a single open-ended question with a list. CVD knowledge was assessed by asking participants to identify factors thought to be caused by or associated with CVD. Smoking, consumption of saturated fat or high serum cholesterol, high BP, family history, age, sex, sedentary lifestyle, stress, obesity, diabetes, chemical exposure, lead exposure, noise exposure, overtime work, and shift work in the lists are worth 1 point each on the scale if listed or checked. A total score could range from 0 to 15 points. A higher score indicates a higher level of CVD knowledge. This method was modified from the one used in the study of siblings of CVD patients and Korean immigrants (Becker & Levine, 1987; Choi et al., 2008).

***Psychosocial factors.***

*Perceived general health.* General health was measured by asking the participant about his/her perceived health status on a 5-point scale (1 = Excellent to 5 = Poor). This single-item measure came from the Medical Outcomes Study 36-Item Short form survey developed by (Ware & Sherbourne, 1992) and has been demonstrated to be a powerful predictor of later health outcomes (Boustrom & Fredlund, 2001).

*Social support*. Social support was defined as instrumental and emotional support from co-workers and supervisors. The perception of social support was measured by the subscale of the JCQ. The JCQ consists of 22-items that include psychological demands, skill discretion, decision authority, social support and is

measured on a 4-point Likert scale (1 = strongly agree, 4 = strongly disagree). The social support score was obtained by adding the scores of supervisor support and coworker support. Supervisor support was measured by four items: concerned about the welfare of those under him/her, pays attention to what others are saying, helpful in getting the job performed, and successful in getting people to work together. Coworker support was measured by four items: competent co-workers, coworkers' interest in me, friendly coworkers, and helpful coworkers. Cronbach's alpha coefficients were 0.87 for supervisor support and 0.77 for coworker support in this study, which were slightly higher than those ( .71) in the Korean version of JCQ of 157 Korean healthcare workers (nurses and pharmacists; Eum et al., 2007a).

*Family function.* Family function was measured by Family APGAR. The Family APGAR proposed by Smilkstein (1978) is the simplest instrument available to screen for family dysfunction. It is a self-report, five-item questionnaire designed to detect dysfunction in families. Adaptation, Partnership, Growth, Affection, and Resolve are the five areas of family support tested. Each question is scored 2, 1 or 0, corresponding to answers of "almost always," "some of the time," and "hardly ever," respectively. It has been proposed that an APGAR score of 7 to 10 suggests a highly functional family, a score of 4 to 6 suggests a moderately dysfunctional family, and finally, a score of 0 to 3 suggests a severely dysfunctional family (Rankin, Galbraith, & Huang, 1997; Smilkstein, 1978). Lee (1987) modified the scoring from a scale of 3 to 4 (0-3) and used in the study of Korean diabetic patients. Cronbach's alpha for the participants in this study was .86. Similarly, a test sample of graduate students ($n$ = 66) demonstrated Cronbach's alpha coefficients of .86 by Smilkstein (1978).

***Work-related factors.***

*Job strain.* Job stress was measured by the JCQ. Psychological demand and decision latitude scores were calculated using the formulas recommended by Karasek and colleagues (1998). The score for decision latitude was obtained by adding the subscale scores of skill discretion (six items), decision authority (three items). The job strain score was derived by dividing the score of psychological demands (five items) by the score of decision latitude. A high score represents a high level of perceived work demand and/or a high level of perceived decision latitude over the job. The reported internal consistency of the instrument ranged from .61 to .72 for the psychological demands subscale, from .73 to .81 for the decision latitude subscale, and .80 for the social support subscale (Karasek et al., 1998). Kang et al. (2005) evaluated the Korean version of JCQ in 160 male workers in Korea. The Cronbach's alpha levels remained within an acceptable range, with coefficients of .61 for work demand, and .87 for decision latitude, respectively. The other study by Eum and colleagues (2007) using Korean JCQ showed coefficients of .63 for psychological demand, and .74 for decision latitude (Eum et al., 2007a).

*Job stress (Effort-Reward Imbalance).* Job stress was also assessed by the validated Korean version using the original questionnaire containing 23-items (Eum et al., 2007b; Siegrist et al., 2004). The reported internal consistency for the Korean version was satisfactory with .71 for effort, .86 for reward, and .75 over commitment (Eum et al., 2007b). The ratio of effort to reward expresses the amount of perceived ERI at work and will be computed according to the formula [ERI ratio is E (effort score) / R (reward score) x C (correction factor; 0.5454 for 6 items)], as described by Siegrist (2004). A

value close to zero indicates relatively low effort and high reward. A value above 1.0 indicates a high amount of effort with little reward.

*Combined exposure to chemicals or noise.* Participants were asked to report whether they were exposed to listed chemicals such as carbon monoxide, carbon disulfide, lead, and solvents or noise. In case participants did not know the chemical exactly, the researcher checked the chemical name with managers and employers including material safety data sheets. Occupational noise exposure was assessed using the question "Have you ever worked in noisy work environment? Noisy work environment means when you have to raise your voice to communicate to a co-worker at one meter distance." If they are exposed to any listed chemicals or noise, the item was coded as "yes" to the combined exposure to chemicals and noise.

*Shift work.* Shift work related to work conditions were measured by self-report of rotation use at work. If a participant was working shifts including night shift, his or her yes response confirmed the shift work. Responses with shift work (including night shift) and shift work were coded as "shift work."

The instruments used, variables of the study, and number of items and response format are presented in Table 4.

Table 4

*Instruments and Variables in Dependent and Independent Variables*

| | **Instrument** | **Variable** | **# of Items** | **Response Format** |
|---|---|---|---|---|
| Dependent Variables | HPLP II | Exercise | 9 | Likert 4 choices |
| | | Nutrition | 9 | Likert 4 choices |
| | | Stress management | 8 | Likert 4 choices |
| | | Interpersonal support | 8 | Likert 4 choices |
| | | Health responsibility | 9 | Likert 4 choices |
| | | Self-actualization | 9 | Likert 4 choices |

| | | | | |
|---|---|---|---|---|
| Independent Variables | CVD actual risk | Blood pressure | 1 | range |
| | | Smoking | 1 | Yes/no |
| | | Diabetes | 1 | Yes/no |
| | | Blood test result (HDL/LDL/TG) | 3 | range |
| | | Overweight: BMI | 1 | Yes/no |
| | | Physical activity | 1 | Yes/no |
| | | Family history of CVD | 1 | Yes/no |
| | Risk Perception Index | Perception of CVD risk | | Summed score of 4 factors : range 0-20 |
| | | Concern having CVD | 3 | Likert 5 choices |
| | | Compare with others | 1 | Likert 5 choices |
| Individual factors | Demographics | Age | 1 | Age in years |
| | | Gender | 1 | Male/ Female |
| | | Education | 1 | 4 categories |
| | | Household status | 1 | 6 categories |
| | | Marital status | 1 | 4 categories |
| | | Income | 1 | range |
| | Knowledge Score | Knowledge of CVD risk factors | 1 | 0 -15 range |
| | | Alcohol drinking | 1 | Yes/no |
| Psycho-social factors | Health perception | General health perception | 1 | Likert 5 point scale |
| | JCQ | Coworker support | 4 | Likert 4 point scale |
| | | Supervisor support | 4 | Likert 4 point scale |
| | Family APGAR | Family support | 5 | Likert 4 point scale |
| Work-related factors | JCQ | Demand | 5 | Likert 4 point scale |
| | | Decision latitude | 9 | Likert 4 point scale |
| | ERIQ | Efforts | 6 | Likert 4 point scale |
| | | Rewards | 11 | Likert 4 point scale |
| | Chemical exposure | Chemical list reference | 1 | Yes/no |
| | Noise exposure | Occupational noise exposure | 1 | Yes/no |
| | Work conditions | Type of employment | 1 | Temporary/Regular |
| | | Duration | 1 | Work in years |
| | | Overtime work (> 60 h/week) | 1 | Yes/no |
| | | Shift work | 1 | Yes/no |

**Data Analysis**

Data analysis was conducted using the Statistical Package for Social Sciences, recently renamed PASW 18. The accuracy of the data was verified by reviewing questionable and missing data in the questionnaires. The latter were checked because they could affect the precision of the calculated statistics (Hulley, Cummings, Browner, Grady, & Newman, 2007).

Statistical techniques are available for imputing missing values based on other information that is available from the participant. Although these techniques are useful, particularly for multivariate analysis in which the accumulation of missing data across a number of predictor variables could otherwise lead to large proportions of participants unavailable for analysis, they do not guarantee conclusions free of nonresponse bias if there are substantial numbers of missing observations (Hulley et al., 2007). A desirable solution would be to design and conduct a study in a way that avoids missing data, for example, checking forms for completeness before a participant leaves the OHC or worksite, designing electronic data entry interfaces that do not allow skipped entries, and designing the database so that missing data are immediately noticed by the researcher.

Descriptive statistics were obtained for all study variables to check for data entry errors and outliers. Mean scores, standard deviation (*SD*), and range were obtained for each scale. Internal consistency reliability measures for the five instruments (the HPLP II, Knowledge of CVD and RPI, the Family APGAR, the JCQ, and the ERIQ) were calculated using Cronbach's alpha coefficients. Data analysis for each of the study's aims follows:

**Study Aim 1.** Identify blue-collar workers' actual risk of CVD, risk perception,

and risk reduction behavior.

**Research Question 1.**

a) What are the demographic and work characteristics of the sample?

b) What are the characteristics of the Korean blue-collar workers in relation to actual risk of CVD, risk perception, and risk reduction behavior?

***Analysis 1***. The sample as a whole and by age, gender, psychosocial factors, work-related factors, actual risk status, risk perception, and risk reduction behavior was reported using descriptive statistics such as means, *SD*, and ranges. The subscale scores of the six domains (exercise, nutrition, stress management, interpersonal support, health responsibility, and self-actualization) of the HPLP II were calculated. The mean and *SD* of each domain score was calculated to identify the risk reduction behavior performed the most frequently.

**Study Aim 2.** Determine the association between individual factors, psychosocial factors, work-related factors, actual risk of CVD, risk perception, and risk reduction behavior.

**Research Question 2.**

a) What are the relationship between individual, psychosocial, and work-related factors, actual risk of CVD, risk perception, and risk reduction behavior?

b) Is there a relationship between risk perception and risk reduction behavior?

c) Do the individual factors, psychosocial factors, and work-related factors, along with risk perception predict actual risk of CVD?

d) Do the individual factors, psychosocial factors, and work-related factors, along with actual risk of CVD predict risk perception?

e) Do actual risk of CVD, perceived risk of CVD, the individual factors, psychosocial factors, and work-related factors predict risk reduction behavior?

***Analysis 2***. Statistical analysis was conducted using *t*-tests, ANOVA, and Pearson and Spearman's ρ correlation to examine associations between study variables. A correlation matrix was developed using the variables of interest. Scatterplots of each candidate variables with each outcome variable were created to assess whether the associations were linear. Multivariate regression analyses was then conducted to identify which combination of variables provided the greatest predictive power of the workers' actual risk, risk perception, and risk reduction behavior. Variables associated with $r > .2$ were considered candidate variables for the regression models (Pallant, 2007). Statistical significance level was set at $p = .05$. Additionally, A hierarchical linear regression model was constructed to examine the effects of each of the factors. Individual factors were entered in the first block. Psychosocial factors were entered in the second block. In the last block, the work-related factors were entered if the three factors provided the significant increase in the overall model $R^2$ change.

Multicollinearity can occur in multivariate regression models as a result of strong correlations between two or more independent variables. The existence of multicollinearity inflates the variances of the parameter estimates and may distort the magnitudes of regression coefficient estimates (Tabachmick & Fidell, 2007). In general, a correlation greater than .80 indicates a possible multicollinearity, and a correlation greater .95 indicates a serious problem. Job strain and job control assessed by the JCQ were found to be highly correlated ($r = .74$) because job control is a subscale of job strain. Thus, job strain was deleted from the model.

# CHAPTER FOUR

## Results

The findings of this cross-sectional study are organized by research question.

### Research Question 1a
### Demographic and Work Characteristics of the Study Participants

**Demographic and individual characteristics.** Two hundred fifty workers who met the study criteria were approached to participate in the study. Two hundred forty workers (95 %) agreed to participate in the study. Ten people declined to participate due to lack of time to complete questionnaires and blood testing. Over a two month period, the 240 blue-collar workers who met the criteria for participation in the study completed the self-report questionnaires, anthropometric and BP measurements, and blood testing. Data from two participants were eliminated from the analysis because they left more than half of one or more of the questionnaires unanswered. The final sample included 238 participants.

Table 5 shows the demographic characteristics of the participants. Most of sample was male (65.0%); the mean age was 37 years (*SD* = 8.50; range = 19 to 58). Participants were of low socioeconomic status, most (81.9%) had high school education or less. The remaining 43 (18.1%) participants had attended junior college or an institution of higher education; only 11 (4.4%) had attended a university. Most of the respondents (74.0%) had a monthly income less than KRW 2,000,000 (approximately US$1,670). Only 6 (2.5%) earned a monthly income KRW 3,000,000 (approximately US$2,500) or more. Their average of BMI and WHR were 23.6 (*SD* = 3.54) and 0.8 (*SD* = 0.06), respectively.

Of the 238 respondents, 105 (44.1%) reported having a household in which two persons earned income. Only 11 % of participants live alone, while nearly half (48.7%) were living with four or more people. More than half (62.0%) were married and more than two thirds (76.8%) drank alcohol. Most participants (84.0%) indicated that their general health was good, very good, or excellent, 17.2% reported fair health, and two reporting poor health.

Table 5

*Demographic Characteristics of the Study Participants (N = 238)*

| **Characteristics** | **Mean (*SD*)** | **Range** |
|---|---|---|
| Age | 36.65 (8.50) | 19 – 58 |
| BMI | 23.63 (3.54) | 17.18 – 41.24 |
| WHR | 0.81 ± 0.06 | 0.67 – 0.99 |
| | ***n*** | ***%*** |
| Gender (Male) | 156 | 65.0 |
| Marital Status | | |
| Never married | 80 | 33.3 |
| Married | 147 | 61.7 |
| Divorced or separated | 9 | 3.8 |
| Widowed | 2 | 0.8 |
| Education | | |
| Elementary school or less (0-6 grades) | 2 | 0.8 |
| Middle school (7-9 grades) | 16 | 6.7 |
| High school (10-12 grades) | 177 | 74.4 |
| Junior college/university or more | 43 | 18.1 |
| Monthly income (USD$1= KRW 1,200) | | |
| Less than KRW 1,500,000 | 80 | 33.6 |
| KRW 1,500,000 – KRW 2,000,000 | 96 | 40.4 |
| KRW 2,000,000 – KRW 2,500,000 | 46 | 19.3 |
| KRW 2,500,000 – KRW 3,000,000 | 10 | 14.2 |
| KRW 3,000,000 or more | 6 | 2.5 |
| Number of persons in the same household | | |
| 1 | 26 | 11.0 |
| 2 | 38 | 16.1 |
| 3 | 57 | 24.2 |
| 4 or more | 117 | 48.7 |
| Alcohol drinking (Yes) | 186 | 78.2 |
| General health status (self-reported) | | |
| Excellent | 23 | 9.6 |
| Very good | 31 | 12.9 |
| Good | 140 | 58.8 |
| Fair | 42 | 17.6 |
| Poor | 2 | 0.8 |

*Note. N* = total sample; *SD* = standard deviation; BMI = body mass index; WHR =waist-hip ratio; *n* = portion of the total sample; USD = United States dollar; KRW = Korean won.

**Work characteristics of the participants.** The participants' work characteristics are shown in Table 6. The participants were recruited from five manufacturing sectors: (1) shipbuilding (38.2%); (2) the manufacture of print chips (19.8%); (3) electronics (12.2%); (4) weaponry (8.4%); and (5) the manufacture of butane gas (21.4%). Most of the sample (92.9%) was employed as regular workers. More than a third of participants (36.6%) did shift work including night work, and about 43% of the participants worked overtime (more than 60 hr/week). The mean number of years employed in the current job was 7 years and average working hours per week 46 hr. The participants were exposed to various hazards: noise (36.1%), lead (18.9%), solvents (13.9%), and carbon monoxide or carbon disulfide (6.3%). About 46 % of the sample was exposed to the combined exposure of chemicals and noise.

In summary, the participants were primarily male (65%) with a mean age of 37 years and a high school education or less (82%). Most of the participants (74%) had a monthly individual income less than USD $1,650. More than one third of the participants (37%) were on shift work and about 43% worked overtime work.

Table 6

*Work Characteristics of the Study Participants (N = 238)*

| **Characteristics** | **Mean (*SD*)** | **Range** |
|---|---|---|
| Years of work | 6.80 (5.46) | 0.1 – 28 |
| Working hours per week | 45.89 (23.98) | 6 – 100 |
| | ***n*** | **%** |
| Type of Workplace* | | |
| Sector 1: shipbuilding | 91 | 38.2 |
| Sector 2: the manufacture of print chips | 47 | 19.8 |
| Sector 3: electronics | 29 | 12.2 |
| Sector 4: weaponry | 20 | 8.4 |
| Sector 5: the manufacture of butane gas | 51 | 21.4 |
| Type of employment | | |
| Temporary | 17 | 17.1 |
| Regular | 221 | 92.9 |
| Shift work (Yes) | 87 | 36.6 |
| Working hours | | |
| 60 hours or more | 73 | 42.7 |
| Less than 60 hours | 171 | 57.3 |
| Exposure to solvents (Yes) | 33 | 13.9 |
| Exposure to lead (Yes) | 45 | 18.9 |
| Exposure to CO, CS2 (Yes) | 15 | 6.3 |
| Exposure to noise (Yes) | 86 | 36.1 |
| Exposure to any chemicals and noise (Yes) | 109 | 45.8 |
| Hearing loss (Yes) | 4 | 1.7 |

*Note. N* = total sample; *SD* = standard deviation; *n* = portion of the total sample; CO = carbon monoxide; $CS_2$ = carbon disulfide

**Research Question 1b**
**The Characteristics of the Korean Blue-Collar Workers in Relation to Actual and Perceived CVD Risk, and Risk Reduction Behavior**

**Actual risk of CVD.** The status of CVD risk factors is presented in Table 7. More than one third had either a systolic BP (39.1%) or a diastolic BP (46.6%) higher than recommended level. Almost a third (29.0%) exceeded the obesity criteria of BMI (25 kg/m²) recommended by World Health Organization for Asians (WHO, 2004). A similar proportion of participants (29.0 %, 31.9%) exceeded total cholesterol (200 mg/dl) and fasting blood sugar (100 mg/dl) recommended control level. Less than a third (21.4%) exceeded triglyceride (150 mg/dl) and more than half (56.7%) exceeded LDL (100 mg/dl) recommended treatment goal. Around ten percent for men (7.7%) and twenty percent women (18.7%) did not reach the recommended HDL level, 40 mg/dl and 50 mg/dl respectively. Similarly, men (11.5%) and women (18.7%) exceeded the Korean Society for the Study of Obesity (KSSO) criteria for waist circumstance, 90 cm and 80 cm respectively. In addition to this, men (9.0%) and women (15.4%) exceeded the KSSO criteria for WHR, 0.9 and 0.85 respectively.

Additionally, more than half of the respondents (55.4%) said that they were current smokers (44.5%) or ex-smokers (10.9%). Many of them (75.6%) had no family history of hypertension or stroke. Only 5.2% reported that their father, 7.6% their mother, and 0.8% their sibling had a history of hypertension or stroke (data not shown).

The bolded variables in Table 7 shows CVD risk factor status based on the modified criteria of National Cholesterol Education Program Adult Treatment Panel III (NCEP- ATP III; Choi, et al., 2007). Waist circumferences were based on the guidelines of KSSO. The number of risk factors for CVD indicates the CVD risk factor

status for one participant. Most of the blue-collar workers (72.6%) had more than one CVD risk factor. More than half of the participants (52%) had more than two CVD risk factors, and more than 30% had three or more. One participant had all seven.

Moreover, the CVD risk factors in the KOSHA CVD risk assessment function is age, total cholesterol or LDL, smoking (yes/no), HDL, family history of CVD (yes/no), BMI or physical activity, and the presence of LVH. According to the KOSHA CVD risk assessment classification (see Table 3), about 60% were in medium risk group and 11.2% were in the high risk group: more than three risk factors and third-degree hypertension, although only two participants were revealed to have LVH. Overall, the participants in the present study had a high actual risk for CVD.

Table 7

*Summary of Actual CVD Risk Factors (N = 238)*

| Variable | *n* (%) |
|---|---|
| **SBP ≥ 130 mm Hg** | **93 (39.1)** |
| **DBP ≥ 85 mm Hg** | **111 (46.6)** |
| Total cholesterol ≥ 200 mg/dl | 69 (29.0) |
| **TG ≥ 150 mg/dl** | **51 (21.4)** |
| LDL ≥ 100 mg/dl† | 136 (56.7) |
| **HDL** | **M: 12 ( 7.7 )** |
| **(≤ 40 mg/dl men, ≤ 50 mg/dl women)** | **W: 17 (18.7)** |
| **Waist circumference‡** | **M: 18 (11.5)** |
| **(> 90 cm men, > 80 cm women)** | **W: 17 (18.7)** |
| WHR | M: 14 ( 9.0 ) |
| (> 0.9 men, > 0.85 women) | W: 14 (15.4) |
| **BMI ≥ 25 kg/m²§** | **69 (29.0)** |
| Family history of hypertension or stroke (Yes) | 58 (24.4) |
| Current smoking (Yes) | 106 (44.5) |
| **Fasting blood sugar ≥ 100 mg/dl** | **76 (31.9)** |
| Number of CVD risk factor * | |
| 0 | 65 (27.4) |
| 1 | 49 (20.6) |
| 2 | 47 (19.7) |
| 3 | 37 (15.5) |
| 4 | 22 (9.2) |
| 5 | 14 (5.9) |
| 6 | 3 (1.3) |
| 7 | 1 (0.4) |

*Note. N* = total sample; SBP = systolic blood pressure; DBP = diastolic blood pressure; TG = triglyceride; LDL = low density lipoprotein; HDL = high density lipoprotein; M = men workers; W = women workers; WHR = waist-hip-ratio; BMI = body mass index; CVD = cardiovascular disease.

† Calculation result of LDL = TC-HDL-TG/5; sample size for this variable was 236 due to 2 missing values (two male workers).

§ World Health Organization recommendation for Asians.

* Number of bolded variables; bolded variables are CVD risk factor status based on the modified criteria of the NCEP- ATP III and the Korean Society for the Study of Obesity.

**Risk perception of CVD.** Risk perception of CVD was estimated using RPI as seen in Table 8, the mean score for risk perception of CVD was 9.36 (*SD* = 4.31; median 8.0), indicating that the blue-collar workers had low CVD risk perception overall. The potential range of the risk perception index was between 4 and 20, with higher scores indicating a higher level of concern and higher probability for having a CVD. The distribution of the scores was normal distribution (skewness = .515, *SE* = .156), indicating that responses clustered around the low end. The mean of each perceived risk was 2.34 (*SD* = 1.08) and was significantly below the scale midpoint. In responses to a question about frequency of concern about having a CVD event, more than half of the participants (56.1%) responded *never* and *rarely*. Nearly two thirds (61.0%, 59.4%) indicated that the likelihood of their having a CVD event in the next 10 years and their lifetime was *not likely.* Similar proportions of participants (61.1%) reported that their CVD risk was the same as or lower than people in the working population of similar age and gender.

Table 8

*Description of Participants' Perceived Risk of CVD (N = 238)*

| **Characteristics** | **Mean (SD)** | **Range of score** | **Published Mean(SD)** |
|---|---|---|---|
| **Risk Perception Index (RPI)** | 9.36 (4.31) | 4-20 | 8.14 (2.56)[a] |
| Frequency of concern over having CVD | 2.46 (1.37) | 1-5 | |
| Likelihood of having such an event in 10 years | 2.30 (1.26) | 1-5 | |
| Likelihood of having such an event in his/her lifetime | 2.34 (1.26) | 1-5 | |
| Estimated CVD risk compared with other workers | 2.25 (1.23) | 1-5 | |

*Note. N* = total sample*; SD* = standard deviation
[a]Choi et al ., 2008.

**Risk reduction behavior for CVD**. Risk reduction behavior for CVD was measured by HPLP II. The mean scores of the scale and six subscales were presented (see Table 11). With the 52-item Korean version of the HPLP II measure, the mean summed score for this study was 106.71 (*SD* = 20.11). On the whole, based on the total mean score of the subscale, respondents in this study did poorly in physical activity (mean = 13.86, *SD* = 4.40) and achieved the highest score in spiritual growth (mean = 20.80, *SD* = 5.36) in risk reduction behavior. Additionally, the total mean score for HPLP II item were 2.06 (*SD* = 0.39) and subscale scores are also presented in Table 9. In this study, among the 52 items, the highest item score obtained was in the spiritual growth subscale (mean = 2.30, *SD* = 0.60). The item means with lowest score was health responsibility (mean = 1.73, *SD* = 0.50).

Table 9

*Descriptive Statistics for HPLP II Scale and Subscales (N = 238)*

| **Scale** | **Item score** | | **Total item score** | | **No. of** |
|---|---|---|---|---|---|
| **and Subscales** | **Mean (SD)** | **Range*** | **Mean (SD)** | **Range** | **items** |
| **HPLP II** | **2.06 (0.39)** | **1.17-3.40** | **106.71 (20.24)** | **52-208** | **52** |
| Health responsibility | 1.73 (0.50) | 1.00-3.78 | 15.52 (4.49) | 9-36 | 9 |
| Physical activity | 1.75 (0.56) | 1.00-3.50 | 13.86 (4.40) | 8-32 | 8 |
| Nutrition | 2.22 (0.48) | 1.00-3.67 | 19.94 (4.30) | 9-36 | 9 |
| Spiritual growth | 2.30 (0.60) | 1.00-4.00 | 20.80 (5.36) | 9-36 | 9 |
| Interpersonal relations | 2.23 (0.43) | 1.00-4.00 | 20.16 (3.79) | 9-36 | 9 |
| Stress management | 2.06 (0.49) | 1.00-3.75 | 16.45 (3.80) | 8-32 | 8 |

*Note. N* = total sample*; SD* = standard deviation; HPLP II, health promotion lifestyle profile II
*Range of scores obtained in this study

**Individual factors.** Only knowledge of CVD risk among individual factors was presented as follows: other individual factors were shown in demographic and individual factors in Research Question 1a.

***Knowledge of CVD risk.*** Knowledge of CVD risk, number of persons who identifies risk factor giving correct answer was summarized in Table 10. The mean total CVD knowledge score was 8.34 (*SD* = 4.5; range = 0 to 15), indicating that participants had a low level of knowledge on risk factors associated with CVD. The level of CVD knowledge was based on the potential range (Becker & Levine, 1987). The highest score was 15, given correctly by only one respondent, whereas the lowest score was 0, indicating no answers about CVD risk factors on the list. Most identified risk factors were stress (80.7%), smoking (79.4%), and consumption of saturated fat or high serum cholesterol (77.2%) as factors associated with or thought to cause CVD. Slightly lower proportions indicated sedentary lifestyle (74.0%), obesity (72.8%), and family history (68.8%) to be risk factors. About half of the participants thought work-related factors such as overtime work, chemical exposure, and shift work were risk factors for CVD, although just a third thought noise (39.2%) and lead exposure (34.4%) played a role as a risk factor. More than a third (40.3%) thought age was a risk factor for CVD, but just 23.5% thought male gender is one of risk factors for CVD.

Table 10

*Knowledge of Cardiovascular Disease Risk Factors (N = 238)*

| **Risk Factors** | **Number of Persons who Identified Risk Factor** | ***%*** |
|---|---|---|
| 1. Stress | 192 | 80.7 |
| 2. Smoking | 189 | 79.4 |
| 3. Consumption of saturated fat or high serum cholesterol | 184 | 77.3 |
| 4. Sedentary lifestyle | 176 | 73.9 |
| 5. Obesity | 174 | 73.1 |
| 6. High blood pressure | 162 | 68.1 |
| 7. Family history | 134 | 56.3 |
| 8. Diabetes | 123 | 51.7 |
| 9. Overtime work | 112 | 47.1 |
| 10. Chemical exposure | 107 | 45.0 |
| 11. Shift work | 103 | 43.3 |
| 12. Age | 96 | 40.3 |
| 13. Noise exposure | 81 | 34.0 |
| 14. Lead exposure | 94 | 39.5 |
| 15. Male gender | 56 | 23.5 |

*Note. N* = total sample, Mean of knowledge of CVD risk: 8.34 (*SD* = 4.5; range = 0 to 15)

**Psychosocial and work-related factors.** Descriptive statistics for psychosocial and work-related factors are presented in Table 11. Psychosocial factors comprised of perceived health status, family function, and social support. Other psychosocial and work-related factors were presented in work characteristics in Research Question 1a.

***Family function.*** The modified 5-item Family APGAR was used to measure participants' perceived family functioning. The actual range of scores obtained was from 0 to 15 (mean = 10.43, *SD* = 3.36).

***Job stress and social support.*** Job stress was measured by the JCQ (psychological demand, decision latitude, and social support) and the ERIQ (effort, reward, job security, and over-commitment) scales (see Table 10). Mean scores for the JCQ scales were 32.28 (*SD* = 5.07) for psychological demand, 58.65 (*SD* = 11.21) for decision latitude, and 21.76 (*SD* = 3.99) for social support. Decision latitude was obtained by adding the subscale scores of skill discretion (mean = 28.32, *SD* = 5.97) and decision authority (mean = 30.11, *SD* = 7.29). Social support was also comprised of coworker support (mean = 11.21, *SD* = 2.0) and supervisor support (mean = 10.55, *SD* = 2.52). The mean job strain, the ratio of psychological demand to decision latitude, was 0.58 (*SD* = 0.16). The mean ERIQ scores were 13.75 (*SD* = 5.41) for effort, 21.47 (*SD* = 8.28) for reward, job security 4.54 (*SD* = 2.18), and 13.99 (*SD* = 2.73) for overcommitment. The mean ERI ratio was 1.26 (*SD* = 0.49), and 67.6 % of respondents showed an ERI ratio greater than 1.0, indicating an effort reward imbalance.

Table 11

*Description of Participants' Psychosocial and Work-related Variables (N = 238)*

| Characteristics | Mean (SD) | Range of score | Published Mean(SD) |
|---|---|---|---|
| **Psychosocial factors** | | | |
| **Family Function (Family APGAR)** | 10.43 (3.38) | 0-15 | 7.06[a] |
| Family adaption | 2.27 (0.83) | 0-3 | |
| Partnership | 2.15 (0.80) | 0-3 | |
| Growth | 2.22 (0.80) | 0-3 | |
| Affection | 2.21 (0.83) | 0-3 | |
| Resolve | 1.57 (0.97) | 0-3 | |
| **Work-related factors** | | | |
| **Job Contents Questionnaires (JCQ)** | | | |
| Psychological demand | 32.28 (5.07) | 12-48 | 34.5 (4.6)[b] |
| Decision latitude | 58.43 (11.18) | 24-96 | 58.4 (10.9)[b] |
| Skill discretion | 28.32 (5.97) | 12-48 | 29.8 (5.2)[b] |
| Decision authority | 30.11 (7.29) | 12-48 | 28.6 (6.9)[b] |
| Job Strain | 0.58 (0.16) | 0.13-2.0 | N/A |
| Social support | 21.76 (3.99) | 8-32 | 23.2 (2.9)[b] |
| Coworker support | 11.21 (2.00) | 4-16 | 11.9 (1.3)[b] |
| Supervisor support | 10.55 (2.52) | 4-16 | 11.3 (2.4)[b] |
| **Effort Reward Imbalance (ERI)** | | | |
| Extrinsic effort | 13.80 (5.32) | 6-30 | 11.71 (3.93)[c] |
| Reward | 21.37 (8.26) | 11-55 | 47.96 (6.26)[c] |
| Self-esteem | 9.05 (3.74) | 5-25 | N/A |
| Financial status | 7.79 (3.48) | 4-20 | N/A |
| Job security | 4.54 (2.18) | 2-10 | N/A |
| Over-commitment | 13.99 (2.73) | 6-24 | 13.58 (2.29)[c] |
| Effort reward imbalance ratio | 1.27 (0.49) | 0.2-5.0 | 0.48 (0.26)[c] |

*Note. N* = total sample*; SD* = standard deviation*;* APGAR = adaptability, partnership, growth, affection and resolve.
[a]Han, 2003. [b]Eum et al., 2007a. [c]Eum et al., 2007b.

**Research Question 2a**
**Relationship Between Individual Factors, Psychosocial Factors, Work-Related Factors, Actual Risk of CVD, Risk Perception, and Risk Reduction Behavior**

Statistical analyses were conducted to examine significant associations between three dependent variables (DVs; actual risk of CVD, risk perception, and risk reduction behavior), and independent variables (IVs; individual, psychosocial, and work-related factors) and the findings are presented (see Tables 12 – 16).

**Independent variables and CVD actual and perceived risk**. The correlation matrix is shown in Tables 12 and 13. Correlation among CVD knowledge score was found to be positively correlated with actual risk of CVD ($r = .11$, $p = .043$), and risk perception of CVD ($r = .19$, $p = .002$). Also, significant correlation was found between actual risk of CVD and RPI ($r = .25$, $p = .005$). Female gender negatively correlated with actual risk of CVD ($r = -.14$, $p = .019$). The strongest positive correlation was found between WHR and actual risk of CVD ($r = .51$, $p < .001$). The results suggest a higher WHR is related to more actual risk of CVD. WHR is also positively related to risk perception ($r = .15$, $p = .012$). Results indicated that the increased risk perception correlated with increased actual risk of CVD. Risk perception was significantly associated with work-related factors such as job control ($r = .13$, $p = .022$), job stress ($r = -.15$, $p = .012$), and shift work ($r = -.23$, $p < .001$). Positive correlations were found between risk perception and education ($r = .11$, $p = .046$), alcohol drinking ($r = .19$, $p = .002$), and perceived general health ($r = .33$, $p < .001$).

Table 12

*Correlations Among Independent Variables and Actual Risk of CVD (N = 238)*

| | *Variables* | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Actual CVD Risk | - | | | | | | | | | | | | | |
| 2. | Age | .003 | - | | | | | | | | | | | | |
| 3. | Gender | -.136** | .466** | - | | | | | | | | | | | |
| 4. | Education | .008 | -.123* | -.228** | - | | | | | | | | | | |
| 5. | Knowledge of CVD risk | .113* | -.129* | .049 | .036 | - | | | | | | | | | |
| 6. | Alcohol Drinking | .057 | -.215** | -.227** | -.006 | -.001 | - | | | | | | | | |
| 7. | WHR | .513** | -.123* | -.434** | .048 | -.089 | .113* | - | | | | | | | |
| 8. | General Health | -.062 | .258** | .166** | -.024 | -.158** | -.099 | -.134* | - | | | | | | |
| 9. | Social Support | .079 | -.079 | -.054 | -.050 | .175** | .026 | .049 | -.023 | - | | | | | |
| 10. | Risk Perception | .250** | .000 | -.013 | .111* | .185** | .188** | .147* | .334** | -.036 | - | | | | |
| 11. | Job Control | .082 | -.050 | -.304 | .059 | -.043 | .231** | .115* | .076 | .343** | .132* | - | | | |
| 12. | Job Stress | .069 | .033 | .084 | -.068 | -.084 | .003 | -.038 | -.158** | .276** | -.147* | .092 | - | | |
| 13. | Exposure to chemical, noise | .041 | -.091 | -.255** | -.003 | -.235** | .098 | .262** | -.007 | .073 | -.029 | .155** | -.134* | - | |
| 14. | Shift Work | .006 | -.315** | -.301** | -.163* | -.103 | .066 | .137* | -.048 | .119* | -.226** | .155** | .011 | .287** | - |

CVD, cardiovascular disease. *$p$< .05, 2-tailed. ** $p$< .01 2-tailed, ***$p$< .001, 2-tailed

Table 13

*Correlations Among Independent Variables and CVD Risk Perception (N = 238)*

| | *Variables* | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | CVD Risk Perception | - | | | | | | | | | | | | | |
| 2. | Age | .000 | - | | | | | | | | | | | | |
| 3. | Gender | -.013 | .466** | - | | | | | | | | | | | |
| 4. | Education | .111* | -.123* | -.228** | - | | | | | | | | | | |
| 5. | Knowledge of CVD risk | .185** | -.129* | .049 | .036 | - | | | | | | | | | |
| 6. | Alcohol Drinking | .188** | -.215** | -.227** | -.006 | -.001 | - | | | | | | | | |
| 7. | WHR | .147* | -.123* | -.434** | .048 | -.089 | .113* | - | | | | | | | |
| 8. | General Health | -.334** | .258** | .166** | -.024 | -.158** | -.099 | -.134* | - | | | | | | |
| 9. | Social Support | -.036 | -.079 | -.054 | -.050 | .175** | .026 | .049 | -.023 | - | | | | | |
| 10. | High CVD risk group | .170** | -.107* | -.251** | -.055* | -.002 | .042 | .363** | .092 | .139* | - | | | | |
| 11. | Job Control | .132* | -.050 | -.304 | .059 | -.043 | .231** | .115* | .076 | .343** | .132* | - | | | |
| 12. | Job Stress | -.147* | .033 | .084 | -.068 | -.084 | .003 | -.038 | -.158** | .276** | .136* | -.092 | - | | |
| 13. | Exposure to Chemical, noise | -.029 | -.091 | -.255** | -.003 | -.235** | .098 | .262** | -.007 | .073 | -.029 | .155** | -.134* | - | |
| 14. | Shift Work | -.226** | -.315** | -.301** | -.163* | -.103 | .066 | .137* | -.048 | .119* | -.226** | .155** | .011 | .287** | - |

CVD, cardiovascular disease. *$p$< .05, 2-tailed. ** $p$< .01 2-tailed, ***$p$< .001, 2-tailed

**Independent variables and CVD risk reduction behavior.** The results of correlation between IVs and CVD risk reduction behavior is presented (see Table 14). Bivariate analyses were also presented in Tables 15 and 16. Significant positive correlations were found in five variables (age, education, family function, job control, and job stress), although significant negative correlation were discovered for perceived general health, exposure to chemicals and noise, and shift work. However, there was no significant correlation between risk reduction behavior and actual risk ($r$ = .05, $p$ = .240), and risk perception ($r$ = -.04, $p$ = .279).

Among individual factors, age and education were significantly associated with risk reduction behavior. Risk reduction behavior associated with age ($r$ = .12, $p$ = .006). When compared with participants who had no college education, workers who had attend college or had received even more education reported more risk reduction behavior ($t$ = 3.61, $p$ < .001; Table 15).

Correlation between psychosocial factors and risk reduction behavior was found: Significant correlation between perceived general health, family function, and social support in the workplace and risk reduction behavior were found. A moderate and positive correlation was found between risk reduction behavior and perceived general health ($r$ = .28, $p$ < .001). In contrast, moderate and positive correlations were found between risk reduction behavior and family function ($r$ = .24, $p$ < .001), and social support ($r$ = .26, $p$ < .001). Workers who perceive more good general health were more likely to engage in risk reduction behavior ($F$ = 19.03, $p$ = .001)

Of the work-related factors, job control, job stress, shift work, and exposure to chemicals and noise were significantly associated with risk reduction behavior. The job

stress by ERI ratio was negatively correlated with risk reduction behavior ($r$ = -.12, $p$ = .038). The decision latitude was also positively correlated with risk reduction behavior ($r$ = .18, $p$ = .003). The results suggest higher job stress is related to more risk reduction behavior, and higher job control is positively related to risk reduction behavior. A moderate and negative correlation was also found between risk reduction behavior and shift work ($r$ = -.18, $p$ = .002), and exposure to chemicals and noise ($r$ = -.15, $p$ = .013). Shift workers are less likely to adopt risk reduction behaviors ($t$ = 2.92, $p$ = .004; Table 16). Additionally, risk reduction behavior tended to be higher in exposure to chemicals and noise ($t$ = 2.21, $p$ = .028) or exposure to CO, $CS^2$ ($t$ = 2.18, $p$ = .030).

Table 14

*Correlations Among Independent Variables and CVD Risk Reduction Behavior (N = 238)*

| | *Variables* | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Risk Reduction Behavior | - | | | | | | | | | | | | | | |
| 2. | Age | .117* | - | | | | | | | | | | | | | |
| 3. | Gender | .101 | .466** | - | | | | | | | | | | | | |
| 4. | Education | .226** | -.123* | -.228** | - | | | | | | | | | | | |
| 5. | Knowledge of CVD risk | .015 | -.129* | .049 | .036 | - | | | | | | | | | | |
| 6. | Alcohol Drinking | -.072 | -.215** | -.227** | -.006 | -.001 | - | | | | | | | | | |
| 7. | General Health | .277** | .258** | .166** | -.024 | -.158** | -.099 | - | | | | | | | | |
| 8. | Family Function | .237** | .143* | .075 | .121* | -.085 | -.082 | -.225** | - | | | | | | | |
| 9. | Social Support | .258** | -.079 | -.054 | -.050 | .175** | .026 | -.023 | .026 | - | | | | | | |
| 10. | Risk Perception | -.038 | .000 | -.013 | .111* | .185** | .188** | .334** | -.030 | -.036 | - | | | | | |
| 11. | Actual CVD risk | .060 | .003 | -.136** | .008 | .113* | .057 | .062 | -.023 | .079 | .250** | - | | | | |
| 12. | Job Control | .178** | -.050 | -.304 | .059 | -.043 | .231** | .076 | -.012 | .343** | .132* | .082 | - | | | |
| 13. | Job Stress | .116* | .033 | .084 | -.068 | .084 | -.003 | -.158** | .178** | .276** | -.147* | .069 | .092 | - | | |
| 14. | Exposure to chemical, noise | -.146* | -.091 | -.255** | -.003 | -.235** | .098 | -.007 | -.067 | .073 | -.029 | .041 | .155** | -.134* | - | |
| 15. | Shift Work | -.184** | -.315** | -.301** | -.163* | -.103 | .066 | -.048 | -.079 | .119* | -.226** | .006 | .155** | .011 | .287** | - |

CVD, cardiovascular disease. *$p$< .05, 2-tailed. ** $p$< .01 2-tailed

Table 15

*Risk Reduction Behavior by Demographic Characteristics (N = 238)*

| **Characteristics** | | ***r*** | ***p*** |
|---|---|---|---|
| Age | | .117 | .006* |
| BMI | | .055 | .419 |
| WHR | | .007 | .917 |
| | **Mean (*SD*)** | ***t or F*** | ***p*** |
| Gender | | | |
| Male | 105.26 (19.89) | 1.52 | .129 |
| Female | 109.46 (20.72) | | |
| Marital status | | | |
| Married | 107.82 (20.40) | 1.18 | .238 |
| Never married | 104.53 (20.19) | | |
| Education | | | |
| Less than high school | 104.51 (20.18) | 3.61 | < .001* |
| College/university or more | 116.41 (17.63) | | |
| Monthly income (USD$1= KRW 1,200) | | | |
| Less than KRW 1,500,000 | 111.27 (20.04) | 6.97 | .138 |
| KRW 1,500,000 – KRW 2,000,000 | 105.34 (19.97) | | |
| KRW 2,000,000 – KRW 2,500,000 | 101.74 (19.65) | | |
| KRW 2,500,000 – KRW 3,000,000 | 103.31 (25.58) | | |
| KRW 3,000,000 or more | 111.46 (17.82) | | |
| Alcohol drinking | | | |
| Yes | 105.89 (19.86) | 1.18 | .240 |
| No | 109.63 (21.48) | | |
| Perceived health status (self-reported) | | | |
| Excellent | 119.02 (20.77) | 19.03 | .001* |
| Very good | 112.11 (21.20) | | |
| Good | 106.04 (19.05) | | |
| Fair | 99.49 (19.13) | | |
| Poor | 80.00 (24.04) | | |

*Note. N* = total sample*;* BMI = body mass index; WHR = waist-hip ratio;*$p < .05$, 2-tailed.

Table 16

*Risk Reduction Behavior by Work Characteristics (N = 238)*

| **Characteristics** | | ***r*** | ***p*** |
|---|---|---|---|
| Years of work | | -.014 | .830 |
| Working hours per week | | -.024 | .713 |
| | **Mean (*SD*)** | ***t or F*** | ***p*** |
| Type of employment | | | |
| Temporary | 112.16 (19.51) | 1.15 | .250 |
| Regular | 106.29 (20.28) | | |
| Shift work | | | |
| Yes | 101.74 (21.14) | 2.92 | .004* |
| No | 109.58 (19.19) | | |
| Working hours | | | |
| 60 hours or more | 103.17 (20.55) | 1.76 | .079 |
| Less than 60 hours | 108.24 (20.08) | | |
| Exposure to solvents | | | |
| Yes | 109.29 (22.97) | .79 | .431 |
| No | 106.29 (19.79) | | |
| Exposure to lead | | | |
| Yes | 107.20 (18.79) | -.41 | .684 |
| No | 106.13 (21.90) | | |
| Exposure to CO, $CS_2$ | | | |
| Yes | 117.65 (19.41) | 2.18 | .030* |
| No | 105.97 (20.12) | | |
| Exposure to noise | | | |
| Yes | 103.39 (18.66) | 1.91 | .057 |
| No | 108.59 (20.91) | | |
| Exposure to any chemicals or noise | | | |
| Yes | 112.82 (16.21) | 2.21 | .028* |
| No | 105.36 (20.82) | | |
| Hearing loss | | | |
| Yes | 118.50 (23.12) | -1.15 | .251 |
| No | 106.80 (20.12) | | |

*Note. N* = total sample*;* CO = carbon monoxide; $CS_2$ = carbon disulfide;*$p < .05$, 2-tailed.

**Research Question 2b**
**Relationship Between Risk Perception and Risk Reduction Behavior**

There was no significant correlation between risk reduction behavior and risk perception ($r$ = -.002, $p$ = .98; Figure 3).

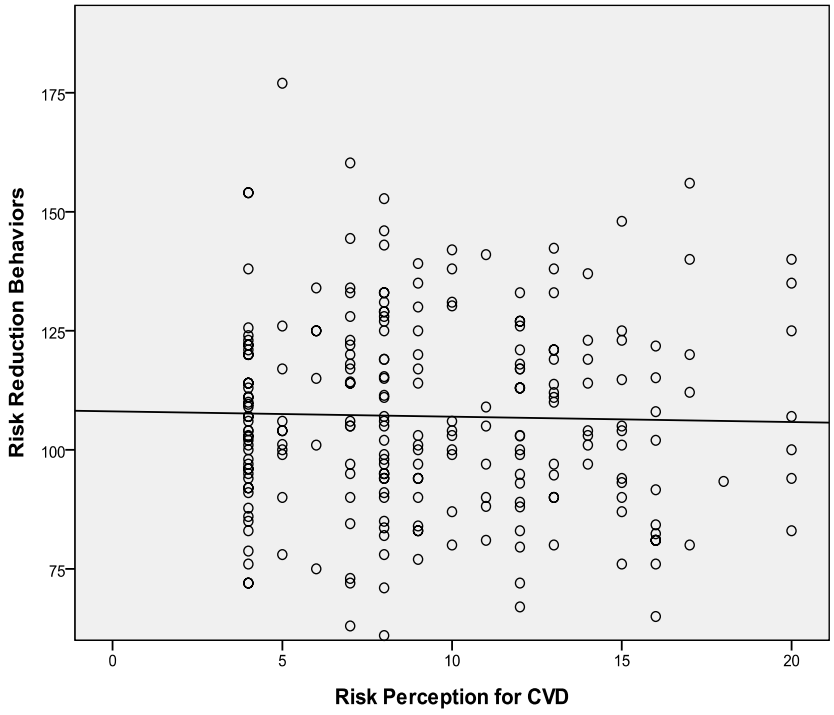


*Figure 3.* Scatterplot between CVD risk reduction behavior and risk perception with linear regression line ($N$ = 238, $r$ = -.002, $p$ =.98).

In sum, the Korean blue-collar workers are at high CVD actual risk. The participants also showed low level of CVD risk knowledge and perception for CVD risk, with over 60% indicating their risks would be lower than those in the worker population of similar age and gender. They did not practice risk reduction behavior regularly. The result also showed that there is no relationship between CVD actual and perceived risk, and risk reduction behavior.

**Research Question 2c**
**Do Individual Factors, Psychosocial Factors, Work-Related Factors, Along With Risk Perception Predict Actual Risk of CVD?**

**Multiple regression analyses for actual risk of CVD.** The independent variable includes individual, psychosocial, and work-related variables in the regression model. The full model explained 33% of the total variance in actual risk of CVD; $R^2$ = .33, F (13, 224) = 8.49, $p$ < .0001, adjusted $R^2$ = .30 (see Table 17 and Figure 4). Four variables had a unique contribution of over 1% to the variance of CVD actual risk: WHR (19.4%), risk perception (2.1%), knowledge of CVD risk (2.0%), and ERI (1.2%). Thus, higher WHR, increased risk perception and CVD knowledge, and higher ERI ratio (job stress) independently predict CVD actual risks controlling for all the other variables.

Table 17

*Summary of Multiple Regression Analyses of CVD Actual Risk† (N = 238)*

| | *Variables* | $R^2$ | *Beta* | $R^2$ *change* | *df* | *F* | *p* |
|---|---|---|---|---|---|---|---|
| | Overall | .334 | | | 13, 224 | 8.49 | .000 |
| 1. | Age | | .046 | .001 | 1, 224 | 0.45 | .796 |
| 2. | Gender | | -.020 | .001 | 1, 224 | 0.07 | .504 |
| 3. | Education [a] | | -.002 | .000 | 1, 224 | 0.00 | .969 |
| 4. | Knowledge of CVD risk | | .152 | .020 | 1, 224 | 6.51 | .011* |
| 5. | Alcohol drinking | | .007 | .000 | 1, 224 | 0.01 | .913 |
| 6. | WHR | | .508 | .194 | 1, 224 | 63.82 | .000*** |
| 7. | Perceived general health [b] | | .037 | .001 | 1, 224 | 0.60 | .552 |
| 8. | Social support | | .000 | .000 | 1, 224 | 0.00 | .994 |
| 9. | CVD risk perception | | .167 | .021 | 1, 224 | 6.82 | .010* |
| 10. | Decision latitude (job control) | | .020 | .001 | 1, 224 | 0.10 | .757 |
| 11. | ERI ratio (job stress) | | .117 | .012 | 1, 224 | 3.89 | .050* |
| 12. | Exposure to chemical or noise [c] | | -.015 | .001 | 1, 224 | 0.07 | .118 |
| 13. | Shift work [d] | | .022 | .001 | 1, 224 | 0.11 | .739 |

*Note.* CVD = cardiovascular disease; *N* = total sample; WHR = waist-hip ratio; ERI = effort-reward imbalance.

†Actual risk was calculated by the modified NCEP-ATPIII and KSSO guidelines

[a] Recoded into two groups: college or more vs. less than high school. [b] High score is better health.

[c] Recoded into two groups : exposure vs. non exposure.

*$p$ < .05, 2-tailed. ** $p$ < .01 , 2-tailed, ***$p$ < .001, 2-tailed

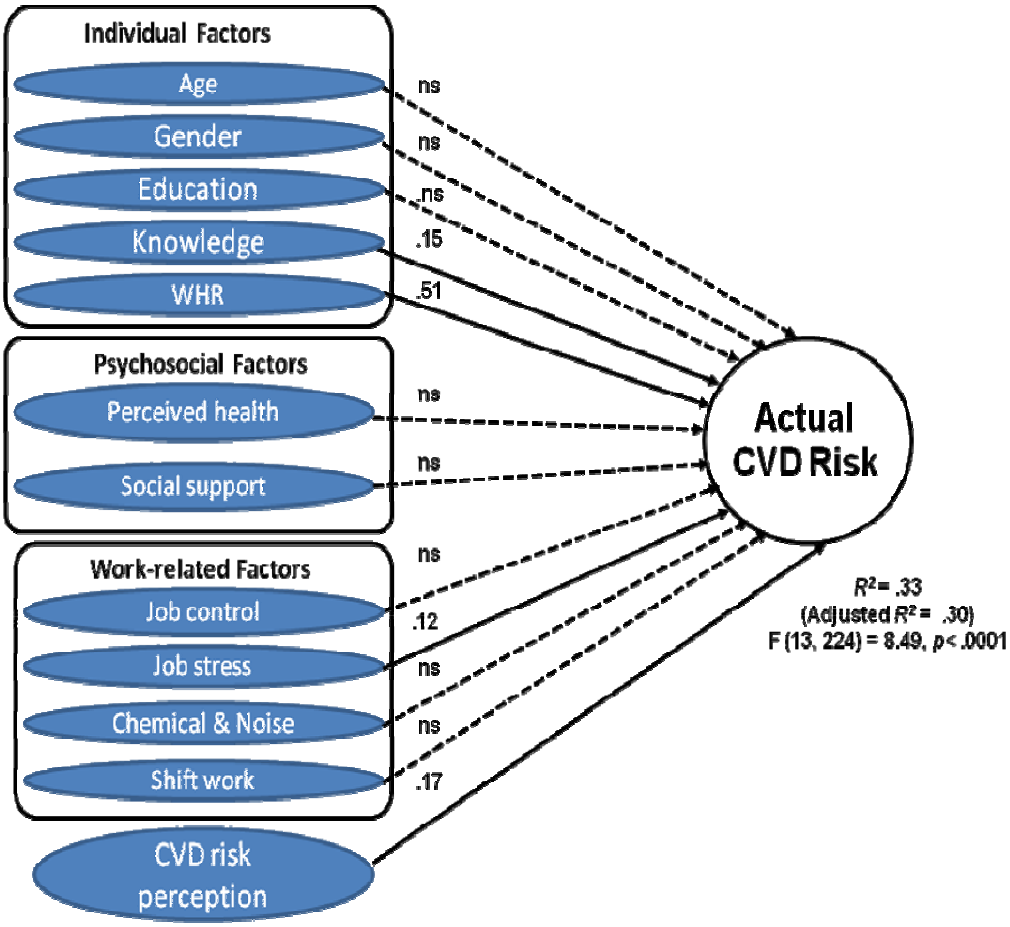


*Figure 4*. Multiple regression analyses diagram of CVD actual risk.

WHR = waist-hip ratio; CVD = cardiovascular disease; ns = nonsignificant

**Research Question 2d**
**Do the Individual Factors, Psychosocial Factors, Work-Related Factors, and Actual CVD Risk Predict Risk Perception?**

**Multiple regression analyses for CVD risk perception.** Table 18 presents the results of the multiple regression analyses. The model explained roughly 28 % of the variance in risk perception of CVD ($R^2 = .28$, $F_{13, 224} = 6.65$, $p < .0001$, adjusted $R^2 = .24$) (Figure 5). High CVD risk group, knowledge of CVD risk factors, alcohol drinking, perceived general health, decision latitude, ERI, and shift work were significant predictors of CVD risk perception. A higher level of CVD knowledge and alcohol drinking were associated with higher levels of CVD risk perception, although better perceived health status was associated with lower levels of CVD risk perception. Higher decision latitude (job control) and lower ER ratio (job stress) were associated with increase of risk perception.

Overall, the individual factors (knowledge of CVD risk and alcohol drinking), psychosocial factors (perceived general health), and work-related factors (job control, job stress, and shift work) with high CVD risk group predicted risk perception.

Table 18

*Summary of Multiple Regression Analyses of CVD Risk Perception (N = 238)*

| | *Variables* | $R^2$ | *Beta* | $R^2$ *change* | *df* | *F* | *p* |
|---|---|---|---|---|---|---|---|
| | Overall | .282 | | | 13, 224 | 6.65 | .000 |
| 1. | Age | | .044 | .001 | 1, 224 | 0.39 | .535 |
| 2. | Gender | | .153 | .012 | 1, 224 | 3.74 | .054 |
| 3. | Education [a] | | .094 | .038 | 1, 224 | 2.34 | .128 |
| 4. | Knowledge of CVD risk | | .141 | .017 | 1, 224 | 5.33 | .022* |
| 5. | Alcohol Drinking | | .163 | .023 | 1, 224 | 7.22 | .008** |
| 6. | WHR | | .107 | .008 | 1, 224 | 2.46 | .118 |
| 7. | General Health [b] | | -.252 | .053 | 1, 224 | 4.05 | .000*** |
| 8. | Social Support | | -.074 | .004 | 1, 224 | 1.27 | .261 |
| 9. | High CVD risk group | | .178 | .025 | 1, 224 | 7.72 | .006** |
| 10. | Decision Latitude (Job control) | | .157 | .027 | 1, 224 | 5.57 | .004** |
| 11. | ERI ratio (Job stress) | | -.126 | .013 | 1, 224 | 4.06 | .045* |
| 12. | Exposure to chemical or noise [c] | | -.058 | .003 | 1, 224 | 0.95 | .118 |
| 13. | Shift Work [d] | | -.186 | .019 | 1, 225 | 8.03 | .005** |

*Note.* CVD = cardiovascular disease; *N* = total sample; WHR = waist-hip ratio; ERI = effort-reward imbalance.

[a] Recoded into two groups: college or more vs. less than high school. [b] High score is better health. [c] Recoded into two groups : exposure vs. non exposure.

*$p$ < .05, 2-tailed. ** $p$ < .01 , 2-tailed, ***$p$ < .001, 2-tailed

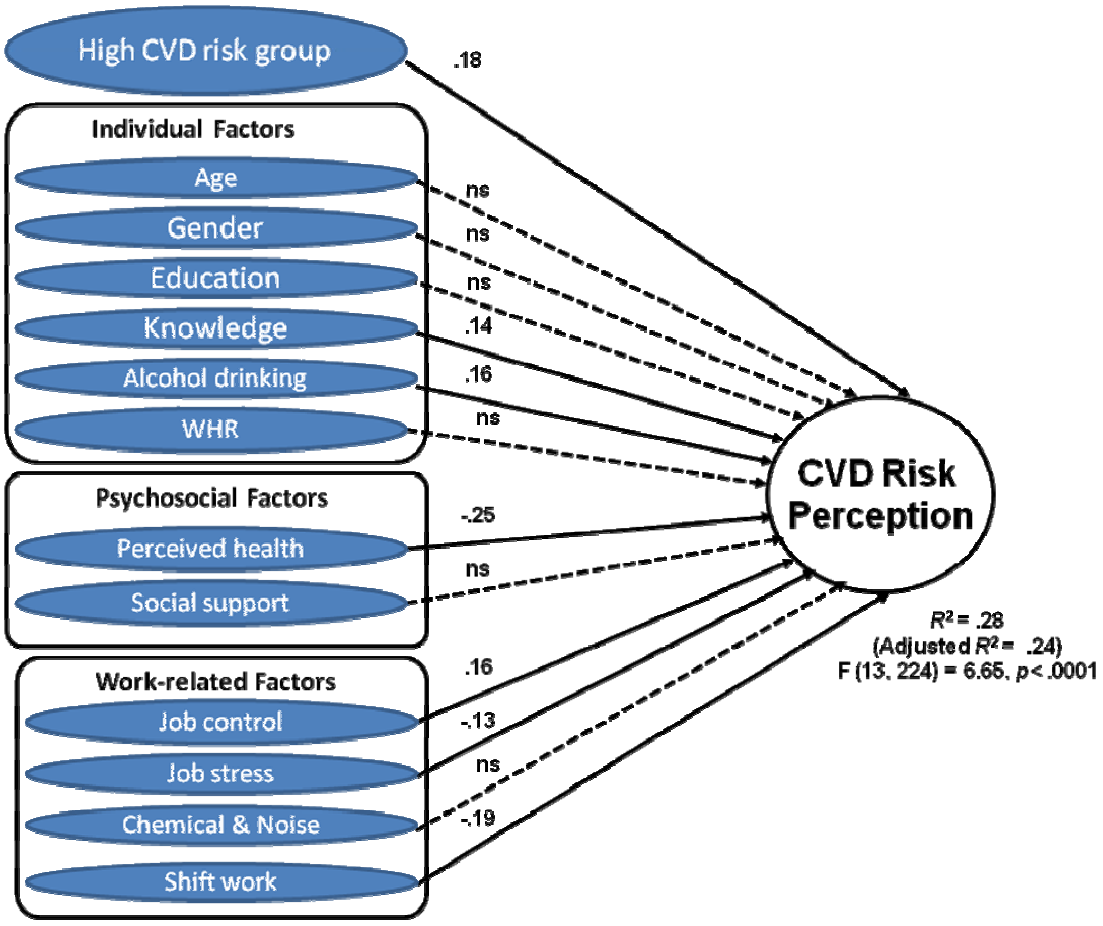


*Figure 5.* Multiple regression analyses diagram of CVD risk perception.

WHR = waist-hip ratio; CVD = cardiovascular disease; ns = nonsignificant

**Research Question 2e**
**Do Actual Risk of CVD, Risk Perception, the Individual Factors, Psychosocial Factors, and Work-Related Factors Predict Risk Reduction Behavior?**

**Multiple regression analyses for CVD risk reduction behavior.**

The model included actual risk of CVD, risk perception, individual (age, gender, education, knowledge of CVD risk factors, and alcohol drinking), psychosocial (perceived general health, family function, and social support), and work-related factors (decision latitude, job stress, exposure to chemicals or noise, and shift work).

If independent variables that were found to be associated with the dependent variable with a coefficient of 0.2 or higher in the correlations were put into the multiple regression model, work-related factors such as decision latitude, and exposure to chemicals and noise and actual risk of CVD, and risk perception would be put in the regression model based on the conceptual framework (see Figure 1). The regression included all the 12 variables of the three factors plus actual risk of CVD and risk perception: (1) CVD actual risk, (2) risk perception, (3) age, (4) gender, (5) education, (6) knowledge of CVD risk, (7) alcohol drinking, (8) perceived general health, (9) family function, (10) social support, (11) decision latitude (job control), (12) ERI ratio (job stress), (13) exposure to chemicals and noise, and (14) shift work. The model as a whole explained 30 % of the total variance of health-promoting behavior, which was interpreted as CVD risk reduction behavior ($R^2 = .30$, $F_{14, 223} = 6.72$, $p < .0001$, adjusted $R^2 = .26$) (see Table 19 and Figure 6). The six variables that significantly contributed to the total variance in CVD risk reduction behavior were education (3.8%), perceived health status (4.8%), family functioning (1.4%), social support in the workplaces (4.0%), decision latitude (2.7%), and shift work (1.6%). For shift work, the beta coefficient

showed a negative sign suggesting the more shift work one reported, the less CVD risk reduction behavior would be found in that individual workers. CVD actual risk and risk perception were not significant in this model.

Finally, I constructed a hierarchical linear regression to examine the effects of the each of three factors. As a result, individual factors increase $R^2$ change .04, psychosocial factors increase $R^2$ change .12, and work-related factors increase $R^2$ change .06 controlling all the other variables. Thus, CVD risk reduction behavior was influenced by more psychosocial factors and work-related factors than individual factors.

In summary, higher education, better family functioning, better perceived general health, higher social support, and non-shift work (compared with shift work) were significant predictors of CVD risk reduction behavior. Actual risk of CVD and perceived CVD risk failed to predict risk reduction behavior.

Table 19

*Summary of Multiple Regression Analyses of CVD Risk Reduction Behavior (N = 238)*

| | *Variables* | $R^2$ | *Beta* | $R^2$*change* | *Factor* $R^2$*change* | *df* | *F* | *p* |
|---|---|---|---|---|---|---|---|---|
| | Overall | .300 | | | | 14, 223 | 6.72 | .000 |
| 1. | Actual CVD risk | | .076 | .005 | | 1, 223 | 1.58 | .210 |
| 2. | CVD Risk Perception | | -.037 | .001 | | 1, 223 | 0.31 | .576 |
| 3. | Age | | -.038 | .001 | .043 | 1, 223 | 0.28 | .597 |
| 4. | Gender | | .116 | .008 | | 1, 223 | 2.44 | .120 |
| 5. | Education [a] | | .213 | .038 | | 1, 223 | 12.04 | .001** |
| 6. | Knowledge of CVD risk | | -.032 | .001 | | 1, 223 | 0.26 | .605 |
| 7. | Alcohol drinking | | -.046 | .002 | | 1, 223 | 0.57 | .453 |
| 8. | Perceived general health [b] | | .250 | .048 | .121 | 1, 223 | 15.07 | .000*** |
| 9. | Family function | | .125 | .014 | | 1, 223 | 2.08 | .039* |
| 10. | Social support | | .229 | .040 | | 1, 223 | 12.44 | .001** |
| 11. | Decision latitude (job control) | | .192 | .027 | .061 | 1, 223 | 8.31 | .004** |
| 12. | ERI ratio (job stress) | | .020 | .001 | | 1, 223 | 0.10 | .748 |
| 13. | Exposure to chemicals, noise [c] | | -.118 | .011 | | 1, 223 | 3.56 | .061 |
| 14. | Shift work [d] | | -.163 | .019 | | 1, 223 | 5.84 | .016* |

*Note.* CVD = cardiovascular disease; N = total sample; ERI = effort-reward imbalance. [a] Recoded into two groups: college or more vs. less than high school. [b] High score is better health. [c] Recoded into two groups : exposure vs. non exposure.

*$p < .05$, 2-tailed. ** $p < .01$ , 2-tailed, ***$p < .001$, 2-tailed

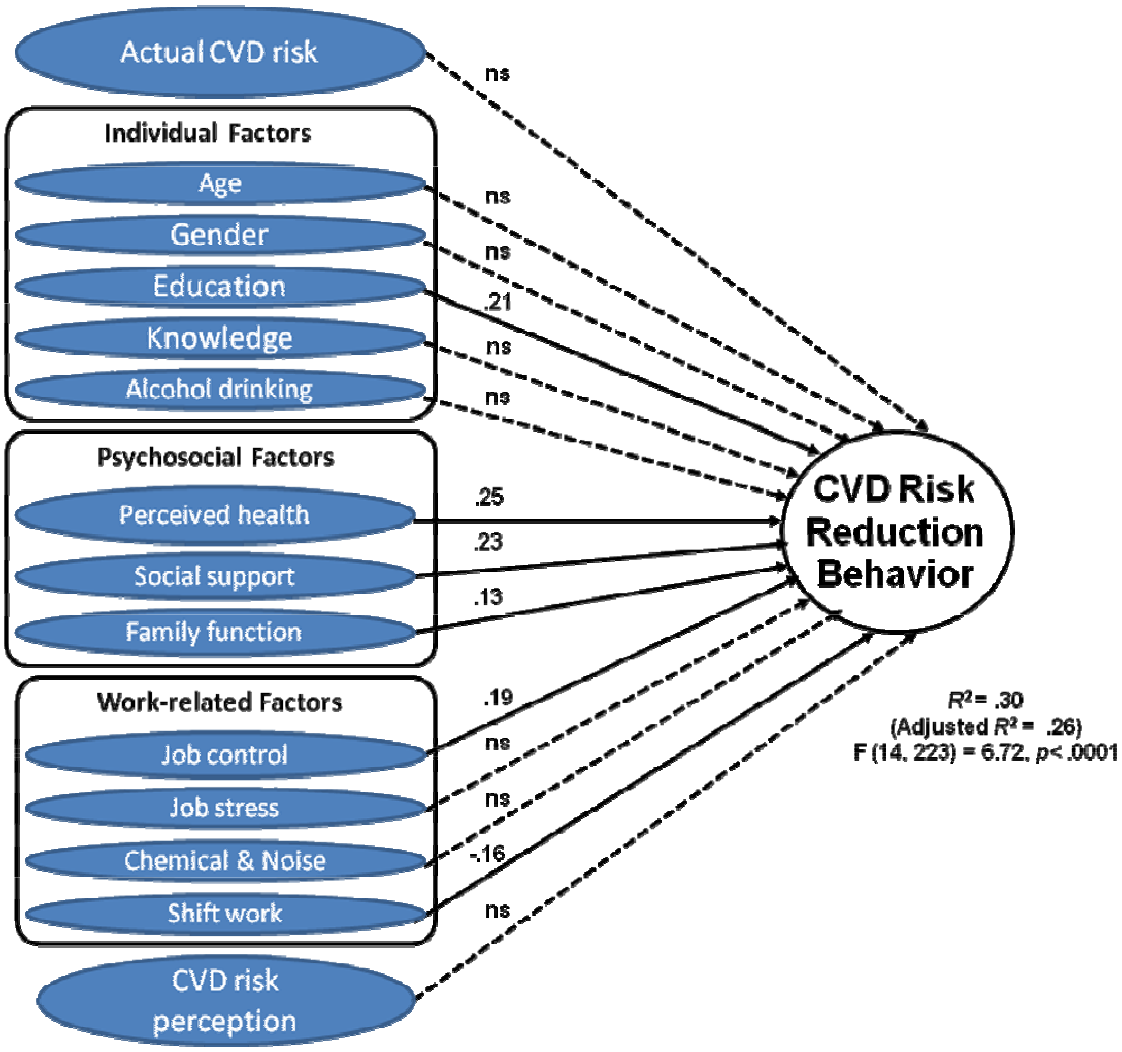


*Figure 6*. Multiple regression analyses diagram of CVD risk reduction behavior.

CVD = cardiovascular disease; ns = nonsignificant

# CHAPTER FIVE

## Discussion

### Interpretation of the Study's Results

This study investigated the factors that influence actual risk of CVD, risk perception, and risk reduction behavior for CVD and examined their relationship in 238 blue-collar workers in Korea.

The work setting included manufacturing industries and several areas where industrial work for small or large companies is provided. The study sample was limited to blue-collar workers in eight diverse companies having less than 300 employees. Typically, blue-collar workers in small companies produce products that require physically demanding, manual processes. They are often required to perform shift work and to work overtime and are exposed to toxic chemicals and noise produced by the manufacturing process. The "small" manufacturing sector has been identified as the area with the highest risk of CVD (Williams et al., 2001; Hwang, 2010), with overwork (Park et al., 2001; Wada et al., 2006), with shift work (Kawachi et al., 1995; Lin, Hsiao, & Chen, 2009), and also with chemical exposure (Kristensen, 1989). Chang et al. (2006) reported that chemicals such as carbon disulfide are risk factors for CVD in a manufacturing company.

This chapter (a) interprets the study's principal findings, strengths, and limitations, (b) discusses the implications for nursing practice, and (c) recommends areas for future research. The results were compared with those of previous studies and were interpreted by the study's specific aims.

**Sociodemographic and work characteristics in context.** Because convenience sampling was used to recruit the study's participants, the basic sociodemographic characteristics of the 238 blue-collar workers were compared with the working population using data from the 2008 Korean National Health and Nutrition Survey (KNHANS). Comparable characteristics included gender, education, marital status, household size, and monthly income. A high proportion of participants were of low socioeconomic status. As for the educational levels of the general working population, 31% had attended college or had higher academic training compared with 18.1 % of the present study's subjects. Compared with the KNHANS's population data, the participants of this study tended to cluster in the secondary school categories (middle school and high school): 74.4% in secondary and 7.5% in primary schooling compared with 33% and 35% respectively for the Korean working population. These statistics confirm that more blue-collar workers than general workers have a low level of education in Korea. The average household size of Korean population was smaller than that of this study (2.9 vs. 3.4; Korea Statistical Information Service, 2009). Most of the participants (74.0%) had a monthly income of less than KRW 2,000,000 (approximately USD $1,670), which is far less than the minimum average monthly income of KRW 3,690,000 (based on four urban households) in 2008 and KRW 3,894,000 (based on three households) and KRW 4,276,000 (based on four households) in 2009. Only six (2.5%) of the participants earned a monthly income of KRW 3,000,000 (approximately USD $2,500) or more. Most lacked financial resources and had a low educational level. A higher percentage of blue-collar workers were overweight (BMI $\geq$ 23 kg/m$^2$) in this study compared with the working population in the KNHANS's data, 76.1 % versus 58.4 %,

respectively.

More blue-collar than general workers in Korea performed shift work (36.6% vs. 23.8%) and overtime (42.7% vs. 23.3%). This observation reflects the fact that more blue-collar than general workers do shift and overtime work in Korea. In Korea's current economic climate where job insecurity in small companies (subcontract factories) is high and incomes are low (Koh et al., 2004), blue-collar workers are inevitably forced to do more shift and overtime work than general workers (Benach, Benavides, Platt, Diez-Roux, & Muntaner, 2000; Won et al, 2007).

**Principal Findings**

**Study Aim 1.** Identify blue-collar workers' actual risk of CVD, risk perception, and risk reduction behavior. The first study aim addressed actual risk of CVD, risk perception, and risk reduction behavior in Korean blue-collar workers. A further discussion of risk perception and risk reduction behavior will be provided later in this paper.

***Actual risk of CVD.*** Actual risk of CVD in this study was based on two criteria: the KOSHA's CVD risk assessment and the modified NCEP-ATP III and KSSO guidelines. According to the KOSHA's CVD risk assessment classification, about 60% of the study's participants were in the medium risk group and more than 10% (11.2%) were in the high-risk group, which includes those with more than three risk factors or third-degree hypertension requiring aggressive treatment. Corresponding numbers using the same assessment, the medium-risk and high-risk groups were 6.9% and 5.7%, respectively, among male-workers (Kim et al., 2010).

Moreover, a third of the participants had three or more CVD risk factors according to the modified NCEP-ATP III and KSSO guidelines. In this study, the percentage of people with metabolic syndrome was significantly higher than the 21% of the Korean general working population who participated in the 2008 KNHANS study and the 11.7% of male white-collar workers who worked in a laboratory (Yoon et al., 2007).

Such a high rate of actual risk of CVD in this study's population of blue-collar workers is a serious concern. Work-related CVD risk factors such as shift work, overtime work, and job stress substantially affected the workers' productivity and their quality of life and increased the considerable cerebrovascular disease-related compensation costs. The findings demonstrate the urgent need to improve the management of CVD risk factors in Korean blue-collar workers. Actual risk of CVD is not the same as the *CVD risk factor state* because the former is the occurrence of CVD events or outcomes such as MI and stroke (Frijling et al., 2004). Research on the CVD risk factor state may provide information about the role of actual risk of CVD and risk perception.

***CVD risk perception.*** The perceived risk measure was adopted from two studies: Becker and Levine (1987) and Choi et al. (2008). With the same measuring scale, the mean score on the RPI in this sample, 9.36 (*SD* = 4.31, range 0-20), was slightly higher compared with the results in Choi et al.'s study of Korean immigrants with diabetes, 8.14 (*SD* = 2.56). It is plausible that the participants of this study were relatively young and healthy subjects without a CVD event and that participants recruited from occupational settings were more likely to rate their risk as low, even in the presence of work-related CVD risk factors, which is similar to the previous study (Oliver-Mcneil

& Artinian, 2002). However, more than half of the participants estimated that their CVD risk was lower than other workers and peers in this study.

The low perception of CVD risk in this study is consistent with previous studies of CVD risk perception in high-risk populations such as patients with diabetes, adults with at least one CHD risk factor (Barnhart et al., 2009; Choi et al., 2008; Homko et al., 2008), workers (Ansa et al., 2007), and the general population (Behera et al., 2000). Furthermore, when compared with a recent national study of general workers in Korea and the United States, the proportion of the high-risk group (i.e., having more than three CVD risk factors) was much higher than in Korean general workers (33% vs. 21%) and U.S. workers (33% vs. 20%; Davila et al., 2010). This finding is an indirect indicator that participants underestimated the objective risk of CVD. This information is critical because risk perception of CVD that is not appropriate to actual risk may prevent blue-collar workers from adopting and engaging in risk reduction behavior.

***CVD risk reduction behavior.*** The blue-collar workers in this study did not practice risk reduction behavior regularly. This is borne out by comparing the study's findings with those of Oliver-McNeil and Artinian (2002) and Thanavaro et al. (2006), who reported mean item scores on the HPLP II of 2.44 with known CHD or 2.62 without prior history of CHD, as compared with 2.06 (*SD* = .39) in this study. The blue-collar participants engaged in risk reduction behavior closer to *sometimes* (mean = 2.06 out of 4; 1 = *never*, 4 = *routinely*). The mean item scores on HPLP II were also smaller than findings for industrial workers in Korea (mean = 2.47; Kim, 1998) and in the United States (mean = 2.82; Pender et al., 1990, mean = 2.44; Oliver-McNeil & Artinian, 2002) or Korean elderly immigrants (mean = 2.54; Sohng et al., 2002), indicating that blue-

collar workers did not practice risk reduction behavior on a regular basis. Using the 52-item Korean version of the HPLP II, the mean summed score for this study was 106.71 (*SD* = 20.11), compared with women without a prior history of CHD (mean = 136.4; *SD* = 24.2; Thanavaro et al., 2006). Subscale scores also differed among these studies. Oliver-McNeil and Artinian reported the highest mean item scores in the subscale of stress management. However, the participants in this study had the highest mean item score in spiritual growth (mean = 2.30, *SD* = .60) and the lowest mean item score in health responsibility (mean = 1.73, *SD* = .50), which differs from the findings of other reports (Kim, 1998; Pender et al., 1990).

This study's participants, and those in the studies cited, reported using fewer health-promoting behaviors in related to stress management (Pirincci, Rahman, Durmus, & Erdem, 2008; Thanavaro et al., 2006). Possibly, stress management behaviors in the current study (mean = 2.06, *SD* = .49) were more difficult for workers to adopt than other risk reduction behaviors, although the number of workers who identified stress as a risk factor for CVD was high (81%) on the knowledge of CVD risk. Blue-collar workers may not control stress adequately because of high job stress and low job control and lack of appropriate programs and facilities in the workplace (Nourjah et al., 1994).

**Study Aim 2.** Determine the association between individual factors, psychosocial factors, work-related factors, actual risk of CVD, risk perception, and risk reduction behavior. The second study aim investigated the relationship between risk perception and risk reduction behavior and determined the factors influencing actual risk of CVD, risk perception, and risk reduction behavior.

***CVD risk reduction behavior and risk perception.*** The results of the multiple regression analysis hypothesized that participants who perceived CVD risk might be more likely to engage in risk reduction behavior because they wished to avoid the adverse effects of CVD in their personal and work life. However, no association was found between CVD risk perception and risk reduction behavior in this study. This finding is differ from the results of previous studies of minority adults (Barnhart et al., 2009; Newell et al., 2009) and women (Mosca et al., 2004), but is consistent with other studies conducted in the US and Europe (Avis et al., 1989; Claassen, Henneman, Kindt, Marteau, & Timmermans, 2010; Oliver-Mcneil & Artinian, 2002).

This nonsignificant association is supported by a meta-analysis that reviewed the relationship between health behavior and risk perception (Katapodi et al., 2004). The investigators found that risk perception was not significantly associated with health behaviors. In the current study, use of the RPI might explain the nonsignificant relationship between risk perception and risk reduction behavior among blue-collar workers: The RPI may not be the best instrument to capture context-specific risk perception related to risk reduction behavior. It has been used to identify risk perception and risk reduction behavior relationships in patients and high risk groups not necessarily to identify risk perception and risk reduction behavior relationships in workers such as blue-collar workers. A worker-specific risk perception measurement may be more effective in capturing the relationship between risk perception and risk reduction behavior in Korean blue-collar workers.

Another possible explanation of the nonsignificant relationship may be that most participants had not yet started appropriate risk reduction behaviors. Although blue-

collar workers may have perceived high CVD risk, they had yet to start risk reduction behavior or to change behavior that might have forced them to perceive their vulnerability. Because of the cross-sectional study design, the researcher could not detect changes in the blue-collar workers' behavior. Their risk reduction behavior might occur at a later time.

On the other hand, Weinstein (1988) has suggested that risk perception of CVD is a necessary but not sufficient condition for risk reduction behavior. The decision to actively reduce risk depends on the interaction of numerous factors such as perceived general health, social support, family function, and other work-related factors such as job control and shift work. In this study, perceived general health and job control influenced both risk perception and risk reduction behavior. Thus, perceived risk appears to have an indirect effect on risk reduction behavior. The association between risk perception and risk reduction behavior in Korean blue-collar workers needs further investigation, preferably prospective studies using more reliable measurement.

***Predictors of actual risk of CVD.*** This study found that actual risk of CVD in Korean blue-collar workers was predicted by WHR, risk perception, the knowledge of CVD risk, and job stress.

WHR was found to be the strongest predictor of overall actual risk of CVD in Korean blue-collar workers. Waist circumstance and BMI emerged as predictors of actual risk of CVD. The relationship between WHR and CVD risk has rarely been examined. However, several studies have shown that waist circumstance is related to CVD risk (Schulze et al., 2006; Yap, Yang, Wang, Bacon, & Campbell, 2006). Furthermore, Korea has adopted a regulation that requires a worker's annual physical

check-up to include the anthropometric measurement of waist circumstance (Yoon, Yi, Oh, & Lee, 2007); as yet, it has not required the WHR to be part of the physical check-up. WHR has been shown to be a better predictor of atherosclerosis and diabetes than BMI and is emerging as an effective anthropometric measurement to assess the risk of CVD (Schulze et al., 2006). In Asian populations, WHR is positively associated with BP and percent body fat and shows better predictive power than BMI (Sakurai et al., 2006; Yang et al., 2007). Thus, workers who have a higher WHR may have more risk of CVD events.

In this study, risk perception of CVD emerged as a significant predictor of actual risk of CVD, considering the psychosocial and work-related factors in the model. This finding is consistent with other studies, which have reported an association between actual risk of CVD and risk perception (Barnhart et al., 2009; Frijling et al., 2004). Because of the high prevalence of actual risk of CVD and low risk perception, any strategy to prevent the risk of CVD should begin by explaining the severity of CVD and an individual's susceptibility to it. It should include personalized information about risk perception to dispel misconceptions, enhancing risk talks, and improving actual risk of CVD. Nevertheless, more insight is needed about which kinds of risk communication are the most effective.

CVD knowledge is another predictor of actual risk of CVD. The low level of CVD knowledge among study participants was consistent with findings in the literature that indicate that workers do not fully understand the risk factors for CVD (Foss et al., 1996; Homko et al., 2008; Jones et al., 2007; Meischke et al., 2002; Nourjah et al., 1994). When compared with a recent study of Korean immigrants (Choi et al., 2008) and a study

of women (Thanavaro et al., 2006), the CVD knowledge score in this study (mean = 8.34, range 0 to 15, 56%) was lower than that in those two studies (mean = 8.82, range 0 to 12, 73%; mean = 12, range 0 to 20, 60%, respectively), although the item included additional work-related risk factors for CVD: overtime work, shift work, and exposure to chemical, lead, and noise. In this study, the knowledge of CVD risk was significantly and positively related to actual risk of CVD. Curiously, increased knowledge of CVD risk was associated with high levels of actual risk of CVD. One possible interpretation of this finding is that workers with high risk of CVD may be more concerned about their risk and, thus, are more likely to learn about CVD risks. However, Homko et al. (2008) found the reverse, demonstrating a significant association between high knowledge of CVD risk and low levels of actual risk of CVD. It is assumed that having knowledge of CVD risk may have enhanced risk perception and, as a result, reduced actual risk. This study also found that workers with more knowledge of CVD risk perceived greater risk of CVD. Thus, additional studies are needed to validate this study's finding on the contribution of knowledge of CVD risk factors to actual risk.

The final predictor of actual risk of CVD among blue-collar workers was job stress evaluated by the ERI ratio (effort/reward), although it is of borderline ($p$ = .05) significance. A value above 1.0 indicates a high amount of effort with little reward, accounting for 70% in this sample. This ratio is an estimate of the costs and gains experienced at worksites that are not subject to explicit reasoning about effort and reward by working people, while the ERI measurement explains each effort and reward. Thus, the ERI ratio may objectively predict job stress that would be missed by the more subjective evaluation of the ERI measurement (Siegrist et al., 2004). Job stress in this

study was shown to be a predictor of actual risk of CVD. Landsbergis et al. (2003) reported that job stress is positively associated with BP. Many studies have reported that job stress significantly increases the risk of CVD (Bosma et al., 1998; Peter & Siegrist, 2000; Xu, Zhao, Guo, Guo, & Gao, 2009), indicating that it may be an important risk factor independent of the traditional risk factors for CVD. The finding of a significant association between job stress and actual risk of CVD in blue-collar workers is important because one of this study's goals is to prevent the development of CVD. In the rapidly changing labor market in Korea, job stress caused by the lack of reciprocity between effort and reward at work is strongly associated with actual risk of CVD.

***Predictors of CVD risk perception.*** This study found that actual risk of CVD, knowledge of CVD risk, alcohol drinking, perceived general health, job control, job stress, and shift work were significant predictors of risk perception of CVD.

High level of actual risk of CVD, which was defined as having three or more CVD risk factors or third-degree hypertension based on the KOSHA's CVD risk assessment, predicted risk perception of CVD. Blue-collar workers in the high CVD risk group were assumed to perceive their vulnerability and susceptibility to CVD. This finding concurs with that of Barnhart et al. (2009) and Frijling et al. (2004), who found that actual risk of CVD was significantly and positively related to risk perception. Feedback on actual risk has been found to improve risk perception (Frijling et al., 2004). Based on these findings, any strategy to prevent the risk of CVD should begin with a discussion about CVD's severity and a worker's susceptibility to the disease.

Lack of CVD knowledge may contribute to a low level of risk perception. The level of CVD knowledge in this study was associated with and predictive positively of

risk perception. This finding differs from that of previous studies that reported *no* relationship between knowledge of CVD risk and risk perception (Becker & Levine, 1987; Oliver-Mcneil & Artinian, 2002). It has been suggested that informing workers about occupational risk factors for CVD draws more attention to worksite risk, heightening the workers' risk perception of CVD as a result. About half of the participants thought work-related factors such as overtime work, chemical exposure, and shift work were risk factors for CVD; just a third thought noise and lead exposure were. Educational programs on work-related risk factors for CVD, designed for blue-collar workers, should be part of a worksite intervention program (Schmitz, 2000).

Perceived general health was found to be strongly associated with risk perception of CVD, suggesting that blue-collar workers who report their general health to be good feel less vulnerable to contracting any disease, including CVD. This finding was also reported in previous studies (Allen, Purcell, Szanton, & Dennison, 2010; Barnhart et al., 2009; Frijling et al., 2004; Kim, 1998; Meischke et al., 2000). Occupational health nurses and professionals must emphasize the risk of CVD to blue-collar workers, particularly those who believe that they have good health. Future studies should investigate effective ways to communicate the risk of CVD to blue-collar workers so that they understand their risk of CVD and adopt risk reduction behaviors.

Another significant predictor of CVD risk perception in Korean blue-collar workers was alcohol drinking. To the researcher's knowledge, no studies have examined the relationship between risk perception and alcohol drinking. Conversely, many studies have found that alcohol drinking clearly affects the risk of CVD (Greenlund et al., 1995; Leon, Shkolnikov, McKee, Kiryanov, & Andreev, 2010). Thus, an increase

in perceived risk accompanying increased alcohol drinking may reflect an appropriate awareness of the risk of CVD. However, the precise mechanism linking alcohol to the risk of CVD remains unclear (Leon et al., 2010). More than half of the participants in this study drank alcohol, and most were heavy drinkers. Although high risk workers perceive alcohol drinking to be a risk factor for CVD, Hwang and Lee (2005) found that the workers did not stop or reduce drinking alcohol, largely because alcohol drinking with colleagues is a social activity in Korean society (Chang, Shrake, & Rhee, 2008).

Previous research suggests that demographic variables such as age, gender, level of education, and income are related to an increased perceived risk of CVD (Christian et al., 2005; Frijling et al., 2004; Jones et al., 2007; Legato et al., 1997; van der Weijden et al., 2007). These factors, however, were not found to be significant predictors of CVD risk perception in this study. High level of education and knowledge of CVD risk were related to high risk perception in this study's bivariate analyses. However, after controlling for all the other factors, workers with a high level of knowledge of the risk of CVD risk were more likely to perceive the high risk of CVD, although the researcher did not find differences in the level of education. The lack of relation between educational attainment and risk perception in the final model can be attributed to the intercorrelation with knowledge of the risk of CVD (Jones et al., 2007). Based on this finding, that the knowledge of CVD risk not the fixed educational attainment contributed to risk perception, occupational health professionals should develop intervention programs to increase blue-collar workers' knowledge of the risk of CVD.

In addition to individual or psychosocial factors, work-related factors (job control and job stress as measured by the JCQ and the ERIQ, respectively) predicted risk

perception. Job control was found to be the strong predictor of overall risk perception among the work-related factors. The relationship between work-related factors and risk perception of CVD has been rarely examined. Instead, many studies have shown that job stress affects actual CVD such as CHD and stroke (Bosma et al., 1998; Xu et al., 2009). Furthermore, job stress has been significantly associated with CVD among health care workers and industrial workers (Kang et al., 2005; Li, Yang, Liu, Xu, & Cho, 2004; Tobe et al., 2007). Workers in high stress jobs may feel more vulnerable about their health or be more aware of the negative aspects of their working conditions, leading to perceptions of an elevated risk of CVD. An alternative interpretation is also plausible: The awareness of high risk at work results in increased negative psychological loading and thus reports of higher job stress. However, job stress was inversely associated with risk perception of CVD in this study, indicating that high job stress decreased risk perception of CVD. Indeed, the opposite conclusion could have been expected. In this study, job control measured by the JCQ was a better model for predicting risk perception than job stress measured by the ERI ratio in the ERIQ, which reflects stressful experiences on the job (Bosma et al., 1998). This finding suggests that risk perception of CVD may be more strongly related to job control about work conditions than job stress caused by effort-reward imbalance. However, further research is needed to support these findings and interpretations.

Shift work was found to be negatively associated with risk perception of CVD in Korean blue-collar workers, which means shift workers reported less risk perception of CVD than nonshift workers. Shift work is well-known to be a significant risk factor for CVD in Asian countries and in the United States (Munakata et al., 2001; Su et al., 2008;

Suwazono et al., 2008). Only 40% of participants in this study correctly answered that shift work is a risk factor for CVD. The finding that blue-collar workers who are currently involved in shift work are not aware of their risk of CVD is important. They should be targeted to improve their risk perception of CVD because risk perception and knowledge of CVD risk may be prerequisites for adopting healthy lifestyle behaviors (Frijling, et al., 2004). Higher perceived risk of CVD and knowledge of CVD risk factors were associated with more health-related behavior in the several studies (Choi et al., 2008; Mosca et al., 2004; Newell et al., 2009; Rimal, 2001). These results are particularly telling because they were obtained even after potential controlling for confounding factors. These factors included not only personal factors but also psychosocial work conditions (i.e., job control, job stress, and social support in the workplace).

***Predictors of CVD risk reduction behavior.*** The findings of this study, conducted with blue-collar workers working for small companies, showed that higher education, better perceived general health, higher social support, greater family function, better job control, and non-shift work predicted CVD risk reduction behavior.

Perceived general health was found to be the strongest negative predictor for risk reduction behavior among blue-collar workers as shown in previous studies (Kim et al., 1997; Pender et al., 1990), suggesting that individual workers who report their general health to be good may perform more risk reduction behavior. Self-rated poor general health has constantly been found to be an independent predictor of low risk reduction behavior in workers (Alexy, 1991; Pender et al., 1990). Thus, perceived health status is likely to be of importance in carrying out risk reduction behavior in blue-collar workers.

Among individual factors, only educational level was found to be positively associated with a significant determinant of CVD risk reduction behavior in this study. Higher educational attainment was associated with better risk reduction behavior. This finding concurs with that of previous studies in the United States (Christian et al., 2005; Thanavaro et al., 2006) and in Korea (Kim et al., 1998) but differs from other studies that reported no relationship between educational level and risk reduction behavior (Oliver-Mcneil & Artinian, 2002). This study also found no relationship between knowledge of CVD risk factors and risk reduction behavior. Greater knowledge of CVD risk factors was not an indication that workers were engaging in risk reduction behavior. Higher levels of education did not mean greater knowledge of CVD. Several other researchers have found that knowledge does not necessarily lead to risk reduction behavior (Avis et al., 1999; Oliver-Mcneil & Artinian, 2002).

Another significant predictor for risk reduction behavior in Korean blue collar workers was social support. Few studies have examined social support in the workplace (Chen et al., 2008). On the other hand, a number of studies have demonstrated that social support affects health behaviors (Allen, Markovitz, Jacobs, & Knox, 2001; (Fischer Aggarwal, Liao, & Mosca, 2008; Williams et al., 2008). Family function has had a positive impact on risk reduction behavior in the previous studies (Berkman, Buxton, Ertel, & Okechukwu, 2010; Kushner, 2007; Pardeck & Yuen, 2001). Over all, family function and social support were influenced by the interpersonal or social environment in the community and workplace. Family relationships are vital in Korean culture. Koreans adhere to traditional Confucian principles of family organization, viewing harmony as the source of family well-being. Filial piety plays a significant role

in care giving practices, and workers have both an obligation to care for their family members and benefit from being supported by the family. Although socioeconomic conditions may redefine the role of each family member and cause changes in the traditional family structure and dynamics (Kim & Theis, 2000), family was found to be a strong influence on risk reduction behavior in Korean blue-collar workers because their culture values familial and group collectivism.

In addition to psychosocial factors, decision latitude (job control), which is one dimension of job stress, defined as a combination of psychosocial demand and job control, was a significant predictor of risk reduction behavior. According to the demand-control model, having low decision latitude is related to CVD risk (Belkic, Landsbergis, Schnall, & Baker, 2004). In the first comparative study using the demand-control model and the ERI model, Bosma (1998) showed independent predictive effects for new CHD in a component of the demand/control model (e.g., low job control) and ERI, in a cohort of English white-collar worker. However, only job control, not job stress by ERI, predicted risk reduction behavior in this study. Only one study has identified a relationship between job stress and health behaviors (Chen et al., 2008). Although job control is relatively low for Korean blue-collar workers, increased job control was associated with risk reduction behavior. Indeed, this study found that blue-collar workers with higher job control perceived themselves at higher risk of CVD, according to the KOSHA's CVD risk assessment. One possible interpretation of this finding is that blue-collar workers who have high levels of job control may feel more responsibility at work and thus are more likely to perceive their risk of CVD and perform risk reduction behavior. However, risk perception of CVD was not related to risk reduction behavior

in this study.

The final predictor of risk reduction behavior in Korean blue-collar workers was shift work. Non-shift work was associated with high levels of risk reduction behavior in this study. Shift workers, however, did not engage in risk reduction behavior (Kim et al., 1997; Shin et al., 1995; Yamada, et al., 2001), even though shift work is an important risk factor for CVD (Kawachi et al., 1995; Munakata et al., 2001, Su et al., 2008). This finding suggests that shift workers need encouragement to participate in risk reduction behavior and strategies to continue their commitment to change. Thus, the role of occupational health professionals is pivotal in motivating and empowering blue-collar workers with the knowledge and skills to participate in risk reduction behavior to prevent CVD.

Overall, CVD risk reduction behavior was influenced by psychosocial factors such as perceived general health, social support and family support (Chen et al., 2008; Kim, 1998), and work-related factors such as job control and shift work. The findings also support the observation that psychosocial and work-related factors are more important than any other individual factors in predicting CVD reduction behavior in Korean blue-collar workers. In the CVD risk and health behavior study, work-related factors were not considered or involved significantly (Oliver-Mcneil & Artinian, 2002). However, three variables (social support combining coworker and supervisor support in the workplace, shift work, and job control-related work conditions) were identified to be significant predictors of risk reduction behavior in this study. Thus, work-related factors should be carefully considered in CVD risk and prevention research and programs, targeting the population of blue-collar workers.

According to the results, improving risk reduction behavior in blue-collar workers can be accomplished in several ways. First, the major factor influencing risk reduction behavior is perceived general health. Although most blue-collar workers reported that their health was good, occupational health educators must emphasize to blue-collar workers, particularly those who feel unhealthy or have poor health status, the importance of risk reduction behavior to prevent CVD. Second, social support and family function were the significant predictors of risk reduction behavior in this study. The results indicate that a sense of belonging and intimacy, social integration, and care and assistance must be provided in risk reduction behavior interventions for Korean blue-collar workers. Occupational health professionals must realize that health promotion rests not only on the individual blue-collar worker but also on his or her family, workplace, and community. Finally, low job control and shift work were found to be significant predictors of low risk reduction behavior in Korean blue-collar workers. Because only 43 % recognized shift work as a risk factor for CVD, these findings are not surprising. Without understanding these risk factors, workers are poorly prepared to adopt risk reduction behavior. Special attention for shift workers and workers who have low job control is needed. They should be targeted for enrollment in CVD prevention programs.

In summary, this study identified and reinforced the need for effective CVD intervention programs for Korean blue-collar workers. The actual risk of CVD was high, and its effect on risk perception, family, worksites, and social and economic costs must be addressed. Moreover, risk reduction behavior among blue-collar workers is poor. Without appropriate intervention, quality of life cannot be protected. Thus, efforts to

improve social support, job control, and shift work in the workplace and to enhance workers' perceived general health and family function in the community should be considered a strategy for cardiovascular health promotion in blue-collar workers.

**Significance and Strengths**

This is the first study examining the relationships among CVD actual risk, risk perception, and risk reduction behavior in Korean blue-collar workers. Specifically, the findings of this study can provide a baseline for future studies of the variance of risk reduction behavior in this population. By increasing the collective understanding of the psychosocial and work-related factors as well as the traditional individual factors that contribute to CVD actual risk, risk perception, and risk reduction behavior in blue-collar workers, the findings from this study may, in combination with the results from other scientific inquiry, be useful for designing future effective CVD prevention programs targeting blue-collar workers.

The use of comprehensive measures, objective measures and self-report is another key strength of this research. The standardized BP and anthropometric measurements, and the results of certified blood tests used may be more valid measures compared to subjective measures such as self-report questionnaires. Furthermore, the biological measurements taken at the same data collection point in this study significantly reduced measurement or information bias (Iribarren, Sharp, Burchfiel, Sun, & Dwyer, 1996). Measurement bias occurs when information collected as a study variable is inaccurate or collected at a different time.

Third, this study tested a theoretical model, the modified HPM, to conceptualize the relationship between three concepts: actual risk of CVD, risk perception, and risk reduction behavior. To improve risk reduction behavior in blue-collar workers, one must first identify those factors or variables that contribute to risk reduction behavior in blue-collar workers. The current study found that individual, psychosocial, and work-

related factors were statistically associated with actual risk of CVD, risk perception, and risk reduction behavior in blue-collar workers. These findings suggest that high risk of CVD may be decreased when occupational health professionals and clinicians intervene in the path of vulnerability by improving identifiable predictors for risk reduction behavior. Moreover, because this research is one of the first to study this vulnerable population, these exploratory findings provide a useful foundation for future research from which to investigate theory-based interventions.

Finally, the findings support the observation that psychosocial and work-related factors account for more variance than individual factors and have important practical consequences for risk reduction behavior and health promotion. Individual factors such as age, gender, and education are not modifiable factors. Psychosocial and work-related factors, on the other hand, can be modified. The possibility exists, therefore, that an improvement in risk reduction behaviors can occur by changes in psychosocial factors (perceived general health, social support, and family function) and work-related factors (job control and shift work condition). Intervention studies that focus on psychosocial and work-related factors as a means of altering behaviors have already been reported (Gomel et al., 1993; Jones et al., 2007). Such studies have great potential in guiding the design of interventions to improve risk reduction behavior.

In addition, the work-related factors that were identified are assumed to be relatively modifiable and within the power of health professionals to change. For instance, CVD risk reduction programs that focus on individual employees are not cost-effective as worksite programs (Schmitz, 2000). An alternative approach is to create a work atmosphere that reflects a company's commitment to health: protecting employees

from job-related hazards and instituting policy and environmental changes to support employees' risk reduction behavior (Schmitz, 2000). Developing a regulation on intervention signifies a corporate health commitment. Environmental changes in the workplace can include more nutritious food options in the cafeteria and running machines and weight scales in a fitness center. Beyond their interest in the structure and content of educational programs for employees, occupational health professionals should assist small companies in implementing risk reduction behavior interventions.

**Limitations**

This study has several limitations. First, because it used a cross-sectional design, the research cannot determine if the relationship between risk perception and risk reduction behaviors was due to recent changes in health habits; for that analysis, a prospective study is required. Longitudinal research or experimental designs are more likely to provide better insights into causal relationships than cross-sectional studies that identify descriptive data or associations (Lynn, 2009). A prospective cohort study may provide great insights into the etiologic effect of workers' actual risk of CVD and risk perception on risk reduction behavior over time.

Second, potential selection bias, sampling only those blue-collar workers who participated in the annual physical check-up at the OHC and workplace, is a limitation. Because this sample may be healthier, it may not be reflective of those who may have left the workplace because of job stress, working conditions, or CVD events. Also, the study's findings might have limited generalizability because it surveyed a convenience sample of participants working in small companies registered with the OHC. Participants from large companies and rural areas were not recruited. The

characteristics of participants working in large companies may be different than that of blue-collar workers working in small companies in Korea. Risk reduction behavior and health promotion programs can vary between large and small companies (Oberlinner, Humpert, Nawroth, Zober, & Morcos, 2008). Thus, a future study with a larger and more representative sample of workers including white-collar workers from large companies is needed to potentially increase generalizability.

Third, although the study attempted to use comprehensive measures (objective and subjective measures), the self-report survey limits the findings by under- and over-reporting the variables related to affectivity or social desirability. Self-reported health behaviors are often overestimated. Specifically, self-report of chemical and noise exposure may not represent actual exposure, may contain error, and may under or overestimate actual chemical exposure. Biomarkers are often used as relatively ideal standards in some types of assessment because they do not rely on self-report.

In addition, the median summary score was used to define high versus low risk perception of CVD. This arbitrary cut point might vary in larger studies. The measure of perceived job control, a dimension of job stress (psychological demand and job control), was significantly associated with CVD risk, but not psychological demand. Many studies have reported that job stress is positively associated with actual risk of CVD. Furthermore, the relationship between job control and CVD risk factors was consistent, but the relationship between psychological demand and risk factors for CVD was not. Finally, null results were reported between job stress and CVD risk factors.

**Implications for Nursing Practice**

The study's limitations notwithstanding, this is the first trial identifying actual risk of CVD, risk perception, and risk reduction behavior in blue-collar workers in South Korea. Most important are the findings of a relationship between work-related factors and actual risk of CVD, risk perception, and risk reduction behavior in this vulnerable population of blue-collar workers. The findings may inspire future nursing practice and research studies with this population. Specifically, on the basis of this proposition, significant predictors found in this study could be selected to develop nursing interventions, while subject outcomes such as quality of life could be measured to evaluate their effectiveness. Through further studies, nursing interventions to enhance perceived general health, family function, or social support (health educational programs, counseling, support group meetings) could be developed and evaluated.

The participants reported that their risk reduction behaviors were sufficient to lower their risk of CVD, although many were at a high level of actual risk of CVD and had a low level of risk perception. Disease prevention can only occur if self-assessment of health status is accurate and realistic. Furthermore, effective CVD prevention in underserved populations requires knowledge of CVD risk and sensitivity to risk perception. Thus, the results have important implications for risk reduction intervention. Although this study of risk reduction behavior will require further refinement in its implementation, the researcher has attempted to address the observation that blue-collar workers have low perception regarding their risks of CVD and to propose strategies to tailor risk reduction behavior interventions.

Identifying factors such as job control and shift work that are related to risk reduction behavior among Korean blue-collar workers will be useful to occupational nurses and other health care professionals in designing behavioral interventions to enhance risk reduction behaviors. For instance, occupational health nurses and professionals must emphasize risk reduction behavior to blue-collar workers, particularly those who have high job control and perform shift work. In the light of limited knowledge about CVD risk and perceived low risk to a plan for reduction behavior in Korean blue-collar workers, both predictors and path development are important ongoing research activities. Future studies also need to investigate effective ways to communicate CVD risk to blue-collar workers so that these individuals understand the risk and adopt risk reduction behaviors.

Finally, the findings suggest that blue-collar workers are less involved in risk reduction behavior. This social class comprises individuals who are usually less well-educated and less affluent and who are typically targeted by wellness programs. Thus, further validation of these results and the CVD risk perception and risk reduction behavior of blue-collar workers would support recommendations for health-promotion programs designed for these individuals at work sites and other appropriate settings.

**Recommendations for Future Research**

Replication of this study is needed to confirm the findings of this study and expand the knowledge about actual risk of CVD, risk perception, and risk reduction behavior in other populations such as white-collar workers in large companies as well as other racial/ethnic groups. Future testing will clarify the unique contribution of work-related factors to CVD risk and risk reduction behavior in vulnerable populations.

Moreover, prospective studies are needed to establish causal relationship between risk perception and risk reduction behavior. They could also clarify whether risk perception predicts risk reduction behavior, controlling for individual, psychosocial, and work-related factors in a diverse sample of industrial workers. Exploring the effect of work-related CVD risk factor interventions implemented by occupational health professionals to reduce CVD events will add to what is currently known about work-related factors and CVD.

Future research is required to explore unexplained variance in actual risk of CVD, risk perception, and risk reduction behavior. Despite an appropriate sample size, determined by the power analysis used in this study, the model explains only 20-30% of the variance of actual risk of CVD, risk perception, and risk reduction behavior in Korean blue-collar workers. Thus, other variables may be able to explain the remained variance of risk reduction behavior. The need also remains for theory-based studies using reliable and valid instruments to identify important variables predicting health related behavior in workers.

Further examination of actual risk of CVD and risk perception is warranted, because these variables have been suggested as the factor most related to risk reduction behavior. If workers did not perceive themselves at risk, that is, they did not perceive high numbers of personal risk factors, they had no incentive to perform risk reduction behavior. Investigation of risk perception in specific areas such as CVD risk reduction and prevention programs may be especially valuable. Finally, from an individual perspective, further investigation into exposure to chemicals and noise and its relationship to actual risk of CVD may be warranted to determine if such exposure affects

actual risk in workers differently than in those who are not exposed. Likewise, investigating WHR and its relationship to the actual risk of CVD in other representative occupational groups may be of value.

Finally, future researchers should conduct a comparison study of blue- and white-collar workers on the actual risk of CVD, risk perception, and risk reduction behavior. This study has suggested that several factors may contribute to actual risk of CVD, risk perception, and risk reduction behavior. To better understand and potentially substantiate the theory-based relationships, future researchers should study these relationships by comparing two dominant groups of white- and blue-collar workers. Furthermore, the ultimate goal of future research is to conduct a multinational study, including the United States, to prevent CVD in blue- and white-collar workers.

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# APPENDICES

Appendix A: Committee on Human Research Approval

**COMMITTEE ON HUMAN RESEARCH**
OFFICE OF RESEARCH, Box 0962
UNIVERSITY OF CALIFORNIA, SAN FRANCISCO
www.research.ucsf.edu/chr/Apply/chrApprovalCond.asp
chr@ucsf.edu
(415)476-1814

**CHR APPROVAL LETTER**

**TO:** Oisaeng Hong, PhD, RN
Box 0608

Wonju Hwang, MPH ; Ph Dc
Box 0608,

**RE:** Cardiovascular Disease Actual Risk, Risk Perception, and Risk Reduction Behavior in Korean Blue Collar Workers

The Committee on Human Research (CHR) has reviewed and approved this application to involve humans as research subjects. This included a review of all documents attached to the original copy of this letter.

Specifically, the review included but was not limited to the following documents:
**Korean Consent Form, Dated 3/25/10**
**English Consent Form, Dated 3/25/10**

The CHR is the Institutional Review Board (IRB) for UCSF and its affiliates. UCSF holds Office of Human Research Protections Federalwide Assurance number FWA00000068. See the CHR website for a list of other applicable FWA's.

**APPROVAL NUMBER**: H59198-35829-01. This number is a UCSF CHR number and should be used on all correspondence, consent forms and patient charts as appropriate.

**APPROVAL DATE:** April 13, 2010 **EXPIRATION DATE:** April 13, 2011 **Expedited Review**

**GENERAL CONDITIONS OF APPROVAL**: Please refer to www.research.ucsf.edu/chr/Apply/chrApprovalCond.asp for a description of the general conditions of CHR approval. In particular, the study must be renewed by the expiration date if work is to continue. Also, prior CHR approval is required before implementing any changes in the consent documents or any changes in the protocol unless those changes are required urgently for the safety of the subjects.

**HIPAA "Privacy Rule" (45CFR164):** This study does not involve access to, or creation or disclosure of Protected Health Information (PHI).

Sincerely,

Charles B. Cauldwell, M.D.
Vice Chair, Committee on Human Research

cc:

Appendix B: Institutional Review Board Approval

# Report of Institutional Review Board

Requester : **University of California**

This letter is to inform you of the results of your confidential.

| | | | |
|---|---|---|---|
| Type of Review | □ first approval ■ approval with condition □ complement □ return<br>□ object on □ change on protocol □ interim report □ end of study report<br>□ final report □ cancellation of protocol □ others | | |
| IRB No | 4-2009-0699 | Date of approval | March 19, 2010 |
| Title of Proposal | Cardiovascular disease Actual risk, Risk Perception, and Risk Reduction Behavior in Korean Blue Collar Workers. | | |
| | Protocol No - | Version No - | |
| Investigator | Principal Investigator: Dr. Jong Wook Woo / Associate Professor<br>/ Department of Preventive Medicine, Yonsei University College of Medicine | | |
| Generic name | - | Brand Name | - |
| Phase | □ Phase I □ Phase II □ Phase III □ Phase IV<br>□ Biological equivalence test ■ Others | | |
| Proposed period of study | Approval date of IRB ~ for 12 months | | |
| Contents of Review | A written answer of initial review result<br>※ Lists of initial review<br>1. Application Form<br>2. Protocol synopsis<br>3. Protocol<br>4. Case Report Form (Questionnaire)<br>5. Informed Consent Forms<br>6. Financial Information<br>7. Recruitment for participant | | |
| Date of Review | March 19, 2010 | | |
| Result of Review | ■ Approved □ Approval with condition □ Require to re-reviewed □ Disapproved | | |
| Comment | none | | |

Severance Hospital IRB is organized and operates according to ICH-GCP and the applicable laws and regulations.

March 19, 2010
Seung Min Kim, MD, PhD
Chairperson of Institutional Review Board
Severance Hospital
Yonsei University College of Medicine
Seoul 120-752, Korea

Appendix C: Instrument Approval Letter

University of Massachusetts
UMASS Lowell

One University Ave Kitson 200
Lowell, Massachusetts 01854-5109
tel: 978.934-3250
Fax: 978-452-5711
Web site: http://www.uml.edu/college/she/WE/

DEPARTMENT OF WORK ENVIRONMENT

December 17, 2009

Wonju Hwang
Coomunity Health Systems
2 Koret Way 510A
San Francisco CA 94143-0610

Dear Ms. Hwang:

Thank you for your interest concerning the "Job Content Instrument: Questionnaire and User's Guide." We have received your "JCQ Data Base Form" and your signed permission form.

I hereby send our questionnaire and validation report and research literature as requested. We look forward to supplying you with information that may assist in your research.

You may find more references and information in our book, Robert Karasek and Tores Theorell: Healthy Work, published by Basic Books, 1990.

Sincerely,

Robert Karasek

Robert A. Karasek, Ph.D.
Professor, Work Environment

Enclosures:
JCQ User's Guide and Questionnaire
w/Global Economy and new Psychological Strain Scales
w/Karasek, et al, NIOSH, 1982
Karasek, et al (1983/ U.S., QES 1970's) Validation Report
Karasek and Thorell (1990 Healthy Work, Appendix 1)
Karasek, Schwartz, Theorell, Final NIOSH Report (1982)
Kristenssen (1995) Stress Med.
Kristenssen (1996) J Occ Hlth Psych
Schnall, Landsbergis, Baker (1994) Annual of Pub. Health.
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Karasek (1979), Administrative Science Quarterly

**UNIVERSITY OF CALIFORNIA, SAN FRANCISCO**
**CONSENT TO BE IN A RESEARCH STUDY**

**Study Title:** Cardiovascular Disease in Korean Blue Collar Workers: Actual Risk, Risk Perception, and Risk Reduction Behaviors

This is a research study to explore how workers who work in small companies are at risk for cardiovascular disease (CVD). Both actual and perceived CVD risk and how the actual risk and perception of CVD risk influence your health behaviors will be studied. The study researchers, Won Ju Hwang, RN, a doctoral candidate and Oisaeng Hong, RN, PhD, Professor from the UCSF Department of Community Health Systems, will explain this study.

Research studies include only those who choose to take part. Please take your time to make your decision about whether or not you would like to participate. You may discuss your decision with your family and colleagues and with your health care team. If you have any questions, you may ask the researchers.

You are being asked to take part in this study because you are working in a company as a blue collar worker.

## Why is this study being done?

The purpose of this study is to identify blue-collar workers' individual factors, psychosocial factors, work-related factors, CVD actual risk, risk perception, and risk reduction behavior. The association between risk perception and actual risk as well as risk reduction behavior will also be studied in order to provide healthcare professionals further understanding of the effect of work-related factors and psychosocial factors on blue-collar workers.

## How many people will take part in this study?

About 200 blue collar workers will take part in this study. The population will be Korean blue collar workers aged more than 18 years and those who work in small companies (less than 300 employees).

## What will happen if I take part in this research study?

If you agree to participate in this study, the following will occur:

1. Ms. Hwang will contact you about your actual risk, perception of CVD risk and risk reduction behaviors through survey, anthropometric measure (height, weight, waist and hip circumstances), and blood pressure measure.

2. Blood testing results will be reviewed to calculate actual CVD risk. Blood samples will be drawn when health check-up date is near or the blood test was done more than 2 months ago. Blood will be sampled by a registered nurse.
3. A survey questionnaire will be given to you and you will complete a survey at work place. The survey asks you about perception for CVD risk, risk reduction behaviors, your health perception, and how you feel about your work.
4. It will take you about 45 minutes to complete the survey.
5. When the survey is completed, you will return the completed survey to the researcher directly or using the pre-stamped envelope mailed with the questionnaire.
6. If you allow her to, Ms. Hwang will review and calculate actual CVD risk using your blood test results such as HDL/ Triglyceride/blood sugar and Chest X-ray result in the occupational health center. You are aware that the results of the blood test while Ms. Hwang review will constitute data collection for her study.

## How long will I be in the study?

Participation in the study will take a total of about 60-90 minutes. The total hours of participation depend on the survey (45 minutes), anthropometric and blood pressure measures, and blood draw.

## Can I stop being in the study?

Yes. You can decide to stop at any time. Just tell the study researcher right away if you wish to stop being in the study. Also, the study researcher may stop you from taking part in this study at any time if he or she believes it is in your best interest, if you do not follow the study rules, or if the study is stopped.

## What side effects or risks can I expect from being in the study?

1. Some of the survey questions may make you feel uncomfortable or raise unpleasant memories. You are free to skip any question.
2. The researcher may make you feel uncomfortable. You can choose not to allow her to do anthropometric and blood pressure measures, or blood drawing.
3. There may be a minimum risk from drawing blood. Possible side effects include faintness, inflammation of the vein, pain, bruising, or bleeding at the site of the puncture.
4. For more information about risks and side effects, ask the researcher.

## Are there benefits to taking part in the study?

There will be no direct benefit from participation in this study. However, the anticipated future benefit is that this study will lead to increased understanding by heath care professionals about how workers think about their actual and perceived risk, which may also influence risk reduction behaviors.

## What other choices do I have if I do not take part in this study?

Your other choices may include not participating in this study. If you decide not to take part in this study, there will be no penalty to you. You will not lose any of your regular benefits, and you can still get your care from our institution the way you usually do.

## Will information about me be kept private?

We will do our best to make sure that the personal information gathered for this study is kept private. However, we cannot guarantee total privacy. Your personal information may be given out if required by law. If information from this study is published or presented at scientific meetings, your name and other personal information will not be used.

Organizations that may look at and/or copy your research records for research, quality assurance, and data analysis include:

1. UCSF's Committee on Human Research
2. YUMC (Yonsei University Medical Center) Institutional Review Board
3. UCSF School of Nursing Faculty (Won Ju Hwang's dissertation committee members)

Participation in research may involve a loss of privacy, but information about you will be handled as confidentially as possible under the law. No individual identities will be used in any reports or publications resulting from this study. Study records and medical record abstract will be kept in locked files at all times during the study, and only study personnel will have access to the data. After completing this study, the medical record review abstracts will be destroyed thoroughly.

## What are the costs of taking part in this study?

You will not be charged for any of the study treatments or procedures.

## Will I be paid for taking part in this study?

In return for your time, effort and travel expenses, you will be paid a 10,000 won gift certificate for taking part in this study.

## What are my rights if I take part in this study?

Taking part in this study is your choice. You may choose either to take part or not to take part in the study. If you decide to take part in this study, you may leave the study at any time. No matter what decision you make, there will be no penalty to you in any way. You will not lose any of your regular benefits, and you can still get your care from our institution the way you usually do.

## Who can answer my questions about the study?

You can talk to the researcher(s) about any questions, concerns, or complaints you have about this study. Contact the researcher, Won Ju Hwang, at 1-415-531-8321 / wonju.hwang@ucsf.edu

If you wish to ask questions about the study or your rights as a research participant to someone other than the researchers or if you wish to voice any problems or concerns you may have about the study, please call the Office of the Committee on Human Research at 415-476-1814.

Please read each sentence below and think about your choice. After reading each sentence, put check mark in the "Yes" or "No" box. If you have any questions, please talk to the researcher, or call our research review board at the IRB phone number. No matter what you decide to do, it will not affect your care.

1. Blood test results and Chest X-ray result may be abstracted or blood draw may be performed for use in research to calculate CVD actual risk.

| YES | NO |
|---|---|

2. Audiometric test results may be abstracted for use in research to learn about, prevent CVD.

| YES | NO |
|---|---|

## CONSENT

You have been given a copy of this consent form to keep.

PARTICIPATION IN RESEARCH IS VOLUNTARY. You have the right to decline to be in this study, or to withdraw from it at any point without penalty or loss of benefits to which you are otherwise entitled.
If you wish to participate in this study, you should sign below.

_____ _____
Date Signature of Participant

_____ _____
Date Signature of Person Obtaining Consent (Study representative)

Appendix 1:

# Socio-demographics data sheet

1. Age: _____ years old. What is your date of birth?
   Date __/__/__ (mm/dd/year)

2. Gender:
   □ Male □ Female

3. Educational attainment:
   How many years of education have you finished?_____ years
   a. □ Elementary school or less (0-6 grades) b. □ Middle school (7-9grades)
   c. □ High school (10-12grades) d. □ Collage
   e. □ University school f. □ Graduate school & above

4. Marital status:
   a. □ Single b. □ Married c. □ Divorced/Separated
   d. □ Widowed e. □ Others

5. Smoking status:
   Have you ever smoked cigarettes fairly regularly (Practically every day)?
   a. □ Non-smoker b. □ ex-smoker c. □ Smoker
   On average, how many cigarettes do you smoke each day for last month? ___ea/day
   If you are smoker, for how many years have you smoked cigarettes regularly?___years
   If you are non-smoker, go to next question.

6. Alcohol consumption:
   a. □ No b. □ Yes
   How many times do you drink for last month?___time/month
   If you drink, how much do you drink when you drink (beer 1can, 350cc= soju 1.4 glass)?
   a. Soju 1-2 (beer 1 and half can)
   b. Soju 3-4 (beer 3 can)
   c. Soju 5-6 (beer 4 and half can)
   d. Soju 7-9 (beer 6 can)
   e. Soju more than 10 (bear 7 can)

7. Have you been diagnosed or treated by a doctor concerning the following health problems for last one year?
   a. □ Diabetes □ Yes □ No
   b. □ Hypertension □ Yes □ No
   c. □ High blood cholesterol level □ Yes □ No
   d. □ Others, please specify:_____

| Drug treatment | Yes | No |
|---|---|---|
| 7-1 Are you taking diabetes medicine? | □ | □ |
| 7-2 Are you taking hypertension medicine? | □ | □ |
| 7-3 Are you taking hyperlipidemia medicine? | □ | □ |

8. Has anyone of your immediate family (i.e. parents and siblings) when they are less than 50 years old ever had the following health problems? high BP, stroke, heart attack, or diabetes

| Diseases | father | mother | brothers | sisters | others |
|---|---|---|---|---|---|
| 8-1 Hypertension, stroke | □ | □ | □ | □ | □ |
| 8-2 MI, heart attack, and heart failure, and other heart diseases | □ | □ | □ | □ | □ |
| 8-3 Diabetes | □ | □ | □ | □ | □ |

9. Monthly Income:
How much money do you earn in a month (after the Tex deduction)?

a. □ Below KW 1,000,000 ($1,000 )
b. □ KW 1,000,000 – 1,500,000 ($1,000-1,500)
c. □ KW 1,500,000 – 2,000,000 ($1,500-2,000)
d. □ KW 2,000,000 – 2,500,000 ($2,000-2,500)
e. □ KW 2,500,000 – 3,000,000 ($2,500-3,000)
f. □ KW 3,000,000 – 3,500,000 ($3,000-3,500)
g. □ KW 3,500,000 – 4,000,000 ($3,500-4,000)
h. □ KW 4,000,000 – 4,500,000 ($4,000-4,500)
i. □ KW 4,500,000 – 5,000,000 ($4,500-5,000)
j. □ KW 5,000,000 ($ 5,000) or more

9-1. How much money (all kinds of income) do your household earn in a year 2009 ?
9-2.How many family members in your household (including you)?
9-3. How many family members earn money (including you)?

10. What is your current occupation?

□ Please specify: What _____
□ Tools or material _____
□ How _____

11. What type of employment you work in?

□ Temporary □ Permanent

12. How long have you been in current job? _____ years

13. How many hours per week did you work? _____ hours/week

14. Do you work shift time/or night time work?
□ Yes □ Yes (including night shift) □ No

15. Do you agree that you are satisfied with your work?
□ Strongly agree □ Agree □ Disagree □ Strongly disagree

16. Do you deal with the following chemicals, lead, or noise in your worksite?
a. □ Solvents (methylene chloride) □ Yes □ No
ex) painters
b. □ Chemical skin contact □ Yes □ No
ex) steel, iron foundries, petroleum refineries, pulp and paper mills
c. □ Lead □ Yes □ No
ex) lead smelter, battery-manufacturing plants, plastic-compounding factories, and nonferrous foundries
d. □ CO, $CS_2$ (carbon monoxide or disulfide) □ Yes □ No
ex) viscose rayon workers, steel, iron foundries, petroleum refineries, pulp and paper mills
e. □ Noise □ Yes □ No
ex) manufacturing factory
f. □ Others, please specify_____

17. How do you feel about noise when you work ?
□ Very severe □ Somewhat severe □ Not severe □ Never

18. How many times did you exercise vigorously for 30 or more minutes during the last month excepting work time?
□ Yes (3 or more times/week) □ Yes (2 times/week)
□ Yes (1 time/week) □ No

19. In general, how would you state your health condition?
□ Excellent □ Very good □ Good
□ Fair □ Poor

Appendix 2:

# Health Promoting Lifestyle Profile II (52 items)

| | Question | Never | Sometimes | Often | Routinely |
|---|---|---|---|---|---|
| Health Respons-ibility (9 items) | 3. Report any unusual signs or symptoms to a physician or other health professional. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 9. Read or watch TV programs about improving health. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 15. Question health professionals in order to understand their instructions. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 21. Get a second opinion when I question my health care provider's advice. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 27. Discuss my health concerns with health professionals | ☐1 | ☐2 | ☐3 | ☐4 |
| | 33. Inspect my body at least monthly for physical changes/danger signs. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 39. Ask for information from health professionals about how to take good care of myself. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 45. Attend educational programs on personal health care. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 51. Seek guidance or counseling when necessary.. | ☐1 | ☐2 | ☐3 | ☐4 |
| Physical Activity (8 items) | 4. Follow a planned exercise program. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 10. Exercise vigorously for 20 or more minutes at least three times a week (such as brisk walking, bicycling, aerobic dancing, using a stair climber). | ☐1 | ☐2 | ☐3 | ☐4 |
| | 16. Take part in light to moderate physical activity (such as sustained walking 30-40minutes 5 or more times a week) | ☐1 | ☐2 | ☐3 | ☐4 |
| | 22. Take part in leisure-time (recreational) physical activities. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 28. Do stretching exercise at least 3 times per week | ☐1 | ☐2 | ☐3 | ☐4 |
| | 34. Get exercise during usual daily activities | ☐1 | ☐2 | ☐3 | ☐4 |
| | 40. Check my pulse rate when exercising. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 46. Reach my target heart rate when exercising. | ☐1 | ☐2 | ☐3 | ☐4 |
| Nutrition (9 items) | 2. Choose a diet low in fat, saturated fat, and cholesterol. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 8. Limit use of sugars and food containing sugar (sweets). | ☐1 | ☐2 | ☐3 | ☐4 |
| | 14. Eat 6-11 servings of bread, cereal, rice and pasta each day. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 20. Eat 2-4 servings of fruit each day. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 26. Eat 3-5 servings of vegetables each day. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 32. Eat 2-3 servings of milk, yogurt or cheese each day. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 38. Eat only 2-3 servings from the meat, poultry, fish, dried beans, eggs, and nuts group each day. | ☐1 | ☐2 | ☐3 | ☐4 |

| | Question | Never | Sometimes | Often | Routinely |
|---|---|---|---|---|---|
| | 44. Read labels to identify nutrients, fats, and sodium content in package food. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 50. Eat breakfast. | ☐1 | ☐2 | ☐3 | ☐4 |
| Spiritual Growth (9 items) | 6. Feel I am growing and changing in positive ways. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 12. Believe that my life has purpose. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 18. Look forward to the future. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 24. Feel content and at peace with myself. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 30. Work toward long-term goals in my life. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 36. Find each day interesting and challenging. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 42. Am aware of what is important to me in life. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 48. Feel connected with some force greater than myself. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 52. Expose myself to new experiences and challenges. | ☐1 | ☐2 | ☐3 | ☐4 |
| Interpersonal Relations (9 items) | 1. Discuss my problems and concerns with people close to me. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 7. Praise other people easily for their achievements. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 13. Maintain meaningful and fulfilling relationships with others | ☐1 | ☐2 | ☐3 | ☐4 |
| | 19. Spend time with close friends. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 25. Find it easy to show concern, love and warmth to others. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 31. Touch and am touched by people I care about | ☐1 | ☐2 | ☐3 | ☐4 |
| | 37. Find ways to meet my needs for intimacy. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 43. Get support from network of caring people. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 49. Settle conflicts with others through discussion and compromise. | ☐1 | ☐2 | ☐3 | ☐4 |
| Stress Manage-ment (8 items) | 5. Get enough sleep. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 11. Take some time for relaxation each day. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 17. Accept those things in my life which I cannot change. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 23. Concentrate on pleasant thoughts at bedtime. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 29. Use specific methods to control my stress. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 35. Balance time between work and play. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 41. Practice relaxation or meditation for 15-20 minutes daily. | ☐1 | ☐2 | ☐3 | ☐4 |
| | 47. Pace myself to prevent tiredness. | ☐1 | ☐2 | ☐3 | ☐4 |

Appendix 3:

# Knowledge and Perception of CVD Risk

1. Please indicate as many common risk factors of CVD you think in the below lists.

_____ _____ _____
_____ _____ _____
_____ _____ _____
_____ _____ _____
_____ _____ _____

Lists:

(1) smoking, (2) consumption of saturated fat or high serum cholesterol, (3) high blood pressure, (4) family history, (5) age, (6) sex, (7) sedentary lifestyle, (8) stress, (9) obesity, (10) diabetes, (11) chemical exposure, (12) lead exposure, (13) noise exposure, (14) shift work, and (15) overtime work

2. The following are questions concerning your perception of risk for CVD by yourself (CVD risk perception index)

| | | No concern at all | | | | Very high level of concern |
|---|---|---|---|---|---|---|
| (a) | How frequently do you concern over having a CVD event yourself. | ☐1 | ☐2 | ☐3 | ☐4 | ☐5 |
| | | Very low probability | | | | Extremely high probability |
| (b) | How likely is it that you will have such an event in the next ten years | ☐1 | ☐2 | ☐3 | ☐4 | ☐5 |
| | | Very low probability | | | | Extremely high probability |
| (c) | How likely is it that you will have such an event in your life time | ☐1 | ☐2 | ☐3 | ☐4 | ☐5 |
| | | Much less | Less | Same | More | Much more |
| (d) | How likely is it that your own CVD risk compared to other people of your age and gender in the working population | ☐1 | ☐2 | ☐3 | ☐4 | ☐5 |

Appendix 4:

# ERI Questionnaire (23 items)

| | | Disagree | Agree | Not at all Distressed | Somewhat Distressed | Moderately Distressed | very Distressed |
|---|---|---|---|---|---|---|---|
| Extrinsic Effort (6 items) | I have constant time pressure due to a heavy work load. | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| | I have many interruptions and disturbances in my job. | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| | I have a lot of responsibility in my job. | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| | I am often pressured to work overtime. | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| | Over the past few years, my job has become more and more demanding. | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| | My job is physically demanding. | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| Reward (11 items) | | | | | | | |
| Self esteem (5 items) | I receive the respect I deserve from my superiors. | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| | I receive the respect I deserve from my immediate coworkers.. | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| | I experience adequate support in difficult situations. | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| | I am treated unfairly at work | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| | Considering all my efforts and achievements, I receive the respect and prestige I deserve at work. | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| Financial/ Status (4 items) | My job promotion prospects are poor. | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| | My current occupational position adequately reflects my education and training. | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| | Considering all my efforts and achievements, my prospects for job advancement are adequate. | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| | Considering all my efforts and achievements, my salary/income and benefits are adequate. | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| Job security (2 items) | I have experienced or expect to experience an undesirable change in my work situation | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| | My job security is poor. | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |

| | | Disagree | Agree | Not at all Distressed | Somewhat Distressed | Moderately Distressed | very Distressed |
|---|---|---|---|---|---|---|---|
| Overcommittment (6 items) | I get easily overwhelmed by time pressures at work | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| | As soon as I get up in the morning, I start thinking about work problems. | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| | When I get home, I can easily relax and 'switch off' work. | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| | People close to me say I sacrifice too much for my job. | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| | Work rarely lets me go, it is still on my mind when I go to bed. | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |
| | If I postpone something that I was supposed to do today, I'll have trouble sleeping at nignt. | ☐1 | ☐2 | ☐1 | ☐2 | ☐3 | ☐4 |

Appendix 5:

# Job Content Questionnaire (22 items)

| | | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|---|
| Psychological Demand (5 items) | My job requires working very fast. | ☐1 | ☐2 | ☐3 | ☐4 |
| | My job requires working very hard. | ☐1 | ☐2 | ☐3 | ☐4 |
| | I am not asked to do too much work. | ☐1 | ☐2 | ☐3 | ☐4 |
| | I have enough time to get the job done. | ☐1 | ☐2 | ☐3 | ☐4 |
| | I am free from conflicting demands that others make on me. | ☐1 | ☐2 | ☐3 | ☐4 |
| Decision latitude (9 items) | | | | | |
| Decision authority (3 items) | My job allows me to make a lot of decisions on my own. | ☐1 | ☐2 | ☐3 | ☐4 |
| | On my job, I have very little freedom to decide how I do my work. | ☐1 | ☐2 | ☐3 | ☐4 |
| | I have a lot of say about what happens on my job. | ☐1 | ☐2 | ☐3 | ☐4 |
| Skill discretion (6 items) | My job requires that I learn new things. | ☐1 | ☐2 | ☐3 | ☐4 |
| | My job involves a lot of repetitive work. | ☐1 | ☐2 | ☐3 | ☐4 |
| | My job requires me to be creative. | ☐1 | ☐2 | ☐3 | ☐4 |
| | My job requires a high level of skill. | ☐1 | ☐2 | ☐3 | ☐4 |
| | I get to do a variety of different things on my job. | ☐1 | ☐2 | ☐3 | ☐4 |
| | I have an opportunity to develop my own special abilities. | ☐1 | ☐2 | ☐3 | ☐4 |
| Social support (8 items) | | | | | |
| Coworker support (4 items) | People I work with know how to do their jobs. | ☐1 | ☐2 | ☐3 | ☐4 |
| | People I work with take a personal interest in me. | ☐1 | ☐2 | ☐3 | ☐4 |
| | People I work with are friendly. | ☐1 | ☐2 | ☐3 | ☐4 |
| | People I work with are helpful in getting the job done. | ☐1 | ☐2 | ☐3 | ☐4 |
| Supervisor support (4 items) | My supervisor is concerned about the well-being of those under her. | ☐1 | ☐2 | ☐3 | ☐4 |
| | My supervisor pays attention to what I am saying. | ☐1 | ☐2 | ☐3 | ☐4 |
| | My supervisor is helpful in getting the job done. | ☐1 | ☐2 | ☐3 | ☐4 |
| | My supervisor is successful in getting people to work together. | ☐1 | ☐2 | ☐3 | ☐4 |

Appendix 6:

# Family Function

The following are questions concerning your perception of family relationship (APGAR score for family measurement)

| | | Always | Almost always | Hardly ever | Never |
|---|---|---|---|---|---|
| (a) | I am satisfied that I can turn to my family for help when something is troubling me. | □1 | □2 | □3 | □4 |
| | | Always | Almost always | Hardly ever | Never |
| (b) | I am satisfied with the way my family talks over things with me and shares problems with me. | □1 | □2 | □3 | □4 |
| | | Always | Almost always | Hardly ever | Never |
| (c) | I am satisfied that my family accepts and supports my wishes to take on new activities or directions. | □1 | □2 | □3 | □4 |
| | | Always | Almost always | Hardly ever | Never |
| (d) | I am satisfied with the way my family expresses affection and responds to my feelings, such as anger, sorrow, and love. | □1 | □2 | □3 | □4 |
| | | Always | Almost always | Hardly ever | Never |
| (e) | I am satisfied with the way my family and I share time together. | □1 | □2 | □3 | □4 |

Appendix 7:

# Data Abstraction Tool &
# Workers' Heights, Weights, Waists, & Hip

| **BMI** | | **W/H ratio** | |
|---|---|---|---|
| **Date measured:** | | **Date measured:** | |
| **Height** | **Weight** | **Waist** | **Hip** |
| cm | kg | cm | cm |

| **Type of Information** | **List Level of BP** | **Most Recent Date of Information** |
|---|---|---|
| **Worker's Level of Blood Pressure** | 1.<br>2. | |

| **Type of Information** | **List Level of lipid & Name of Medication(s)** | **Most Recent Date of Information** |
|---|---|---|
| **Worker's Level of Blood Pressure** | 1.<br>2. | |
| **HDL** | | |
| **Triglyceride** | | |
| **Total cholesterol** | | |
| **Blood sugar** | | |
| **Left Ventricular Hypertrophy** | | |
| **Chemical Exposure** | | |
| **Etc.(Audiometric test results)** | | |

# 설문지

**연구제목: 심혈관 질환에 대한 육체노동자의 발병 위험, 위험 인식 및 건강증진 행위에 관한 연구**

**설문지 작성방법**

근로자님의 소중한 의견은 한국의 육체 노동자의 심혈관 질환 위험요인 및 건강행위를 이해하는데 큰 기여를 할 것입니다.

설문지를 읽고 해당하는 칸에(X) 표시를 하거나 질문에 대한 대답을 기입하여 주시면 됩니다. 설문지에 근로자님의 성명이나 사업장을 기입하지 않습니다.

설문지 작성을 모두 마치시면 연구자에게 돌려주시면 감사하겠습니다.

본 연구에 참여해주셔서 정말 감사합니다.

본 연구에 대한 의문사항이 있으시면 캘리포니아 주립대학, 샌프란시스코 황원주 (wonju.hwang@ucsf.edu)로 연락해 주시기 바랍니다.

**일반적 사항과 관련된 설문**

1. 나이: 만_____ 세, 귀하의 생년월일은 언제입니까? _____년 월 일
2. 성별: □ 남자 □ 여자
3. 학력 :
   □ 초등학교졸 이하 □ 중학교 졸 □ 고등학교 졸
   □ 전문대졸 □ 대학교졸 □ 대학원졸
4. 결혼 상태:
   □ 미혼 □ 기혼 □ 이혼/별거 □ 사별 □ 기타

5. 흡연 상태:
   a. □ 비흡연 b. □ 과거 흡연 c. □ 흡연
5-1. 지난 한달간 하루 평균 흡연 개피수:_____개피/일
5-2. 총 흡연 기간:_____년

6. 음주 상태:
   a. □ 안마신다 b. □ 마신다
6-1. 지난 한달간 평균 음주 횟수:_____회/월
6-2. 1회 음주시 음주량
□ 소주 1-2잔 (맥주 1병 이하) □ 소주 3-4잔 (맥주 3병) □ 소주 5-6잔 (맥주 4병) □ 소주 7-9잔 (맥주 6병 이하) □ 소주 10잔 이상 (맥주 7병)

7. 지난 12개월 동안 아래의 질병에 대해 의사로부터 진단 혹은 치료를 받은 적이 있습니까?
   a. □ 당뇨 □ 있다 □ 없다
   b. □ 고혈압 □ 있다 □ 없다
   c. □ 고지혈증 □ 있다 □ 없다
   d. □ 기타, 질병명을 기입해 주세요:_____

| 약물치료 | 있다 | 없다 |
|---|---|---|
| 7-1 현재 당뇨병(혈당) 치료제를 복용하고 계십니까? | □ | □ |
| 7-2 현재 고혈압 치료제를 복용하고 계십니까? | □ | □ |
| 7-3 현재 고지혈증 치료제를 복용하고 계십니까? | □ | □ |

8. 귀하의 가족관계중 의사로부터 다음의 진단을 **50세 이전에** 받은 적이 있습니까? 있는 경우에 해당란에 V표시해 주시기 바랍니다.

| 질병명 | 아버지 | 어머니 | 형제 | 자매 | 기타 |
|---|---|---|---|---|---|
| 8-1 고혈압이나 뇌졸증 (중풍) | □ | □ | □ | □ | □ |
| 8-2 협심증, 심근경색, 심부전등의 심장질환 | □ | □ | □ | □ | □ |
| 8-3 당뇨병 | □ | □ | □ | □ | □ |

9. 주로 일하시는 데서 버는 월평균 소득은 얼마입니까?

a. □ - 100만원 미만 b. □ 100-150만원 미만 c. □ 150-200만원 미만
d. □ 200-250만원 미만 e. □ 250-300만원 미만 f. □ 300-350만원 미만
g. □ 350-400만원 미만 h. □ 400-450만원 미만 i. □ 450-500만원 미만
j. □ 500만원 이상

9-1. 귀하의 2009년 연간 총 가계수입 (모든 수입)은 얼마입니까?_____백만원

9-2. 지금 현재 같이 살고 계신 가족 (본인포함)은 모두 몇 명입니까?_____명

9-3. 소득이 있는 가구원 (본인포함)은 총 몇 명입니까?_____명

10. 귀하의 현재 직업은 무엇입니까? 두 가지 이상의 일을 하시는 경우, 더 많은 시간 동안 하시는 일로 말씀해 주십시오.

a. 무슨 일을:_____
b. 장비나 도구:_____
c. 어떻게:_____

11. 직업 형태는 어디에 속합니까?

□ 임시직 □ 정규직

12. 현재의 일을 얼마나 하셨습니까? _____년
13. 대개 일주일에 평균 몇 시간 정도 일하십니까? _____시간
14. 귀하는 교대근무를 하십니까?
☐ 아니오 ☐ 예 (밤근무 제외) ☐ 예 (밤근무 포함)
15. 귀하는 대체로 자신의 직업에 대해 얼마나 만족하십니까?
☐ 전혀 그렇지 않다 ☐ 가끔 그렇다 ☐ 그렇다 ☐ 정말 그렇다
16. 귀하는 일할 때 다음과 같은 요인에 어느 정도 노출이 되십니까?
a. ☐ 솔벤트, 신너와 같은 유기용제 들이마심 ☐ 예 ☐ 아니오
b. ☐ 화학물질이 피부에 접촉됨 ☐ 예 ☐ 아니오
c. ☐ 납(lead)을 다룸 ☐ 예 ☐ 아니오
d. ☐ 일산화탄소(CO), 이산화황($CS_2$)에 노출됨 ☐ 예 ☐ 아니오
(예: 제철소, 석유 정제, 종이, 직물공장에서 일함)
e. ☐ 옆사람과 이야기할 때 목소리를 높여야 할 정도의 소음 ☐ 예 ☐ 아니오

| | 근무시간 내내 | 거의 모든 근무시간 | 근무시간 3/4 | 근무시간 절반 | 근무시간 1/4 | 거의 안됨 |
|---|---|---|---|---|---|---|
| 16-1 솔벤트, 신너와 같은 유기용제 들이마심 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 16-2 화학물질이 피부에 접촉됨 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 16-3 납(lead)을 다룸 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 16-4 일산화탄소(CO), 이산화황($CS_2$)에 노출됨 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 16-5 옆사람(1m거리)과 이야기할 때 목소리를 높여야 할 정도의 소음 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

17. 귀하가 근무 중 주관적으로 느끼는 소음은 어느 정도입니까?
□ 매우 심하다 □ 약간 심하다 □ 별로 심하지 않다 □ 거의 느끼지 못한다

18. 지난 한달 동안 근무시간 외에 땀에 젖고 숨이 가쁠 정도의 운동을 하루에 30분 정도 얼마나 자주하셨습니까?
□ 전혀 하지 않았다 □ 주 1회 □ 주 2회 □ 주 3회 이상

19. 귀하의 현재 건강상태에 대하여 어떻게 생각하십니까?
□ 매우 건강하다 □ 약간 건강하다 □ 보통이다
□ 약간 건강하지 않다 □ 매우 건강하지 않다

**건강행위 이행에 관한 설문지**

다음은 귀하의 현재 생활 상태나 개인적 습관에 관한 질문입니다. 각 문항에 가능하면 한 문항도 빠짐없이 정확하게 응답해 주십시오. 귀하가 취하는 행동의 빈도에 해당되는 곳에 표시를 해 주십시오.

| □1 | □2 | □3 | □4 |
|---|---|---|---|
| 전혀 하지 않는다 | 가끔 한다 | 자주 한다 | 규칙적으로 한다 |

| | | | | | |
|---|---|---|---|---|---|
| 1 | 나의 문제와 관심사에 대해 가까운 사람들과 이야기를 나눈다. | □1 | □2 | □3 | □4 |
| 2 | 지방과 콜레스테롤이 적은 식사를 선택한다. | □1 | □2 | □3 | □4 |
| 3 | 비정상적인 증상이 있으면 의사나 다른 의료인에게 보고 한다. | □1 | □2 | □3 | □4 |
| 4 | 계획된 운동 프로그램을 따른다. | □1 | □2 | □3 | □4 |
| 5 | 충분한 수면을 취한다. | □1 | □2 | □3 | □4 |
| 6 | 나는 긍정적으로 성장하고 변화한다고 느낀다. | □1 | □2 | □3 | □4 |
| 7 | 다른 사람의 성공을 쉽게 칭찬해 준다. | □1 | □2 | □3 | □4 |
| 8 | 설탕과 단 음식의 섭취를 줄인다. | □1 | □2 | □3 | □4 |
| 9 | 건강증진 관련 TV프로그램과 신문을 본다. | □1 | □2 | □3 | □4 |
| 10 | 주 3회, 1회 20분 이상 활발하게 운동한다 (활발하게 걷기, 자전거타기, 에어로빅 운동, 계단 오르내리기) | □1 | □2 | □3 | □4 |
| 11 | 매일 휴식하는 시간을 갖는다. | □1 | □2 | □3 | □4 |
| 12 | 나의 삶은 목적이 있다고 믿는다. | □1 | □2 | □3 | □4 |
| 13 | 다른 사람들과 의미 있고 만족한 관계를 유지한다. | □1 | □2 | □3 | □4 |
| 14 | 적당량의 빵, 밥이나 국수 종류를 매일 먹는다. | □1 | □2 | □3 | □4 |
| 15 | 지시사항을 잘 이해하기 위해 의료인에게 질문을 한다. | □1 | □2 | □3 | □4 |
| 16 | 가벼운 혹은 중정도의 신체활동에 참여한다. (주 5회 이상, 30-40분 간 지속적으로 걷기 등) | □1 | □2 | □3 | □4 |
| 17 | 나의 삶에서 바꿀 수 없는 것을 받아들인다. | □1 | □2 | □3 | □4 |
| 18 | 미래를 기대한다. | □1 | □2 | □3 | □4 |
| 19 | 친한 친구와 종종 시간을 보낸다. | □1 | □2 | □3 | □4 |
| 20 | 매일 적당량의 과일을 먹는다. | □1 | □2 | □3 | □4 |

| | | | | | |
|---|---|---|---|---|---|
| 21 | 의료인의 견해에 의문이 있을 때는 다른 의사의 진단도 받아본다. | □1 | □2 | □3 | □4 |
| 22 | 여가를 즐기는 신체활동 (예: 등산, 춤, 산책, 자전거)에 참석 한다. | □1 | □2 | □3 | □4 |
| 23 | 잠자리에서는 좋은 생각을 한다. | □1 | □2 | □3 | □4 |
| 24 | 나 자신에 대하여 충만하고 평화롭게 느낀다. | □1 | □2 | □3 | □4 |
| 25 | 다른 사람에게 관심, 사랑과 온정을 쉽게 나타낼 수 있다. | □1 | □2 | □3 | □4 |
| 26 | 매일 적당량의 채소를 먹는다. | □1 | □2 | □3 | □4 |
| 27 | 나의 건강관심사에 대해 의료인과 의논한다. | □1 | □2 | □3 | □4 |
| 28 | 주 3회 이상 유연성 운동(스트레칭)을 한다. | □1 | □2 | □3 | □4 |
| 29 | 스트레스를 조절하기 위해 특별한 방법을 사용한다. | □1 | □2 | □3 | □4 |
| 30 | 삶의 장기적인 목표 달성을 위해 일한다. | □1 | □2 | □3 | □4 |
| 31 | 관심 있는 사람과 서로 신체적인 접촉을 한다. | □1 | □2 | □3 | □4 |
| 32 | 매일 적당량의 우유, 요구르트, 치즈를 먹는다. | □1 | □2 | □3 | □4 |
| 33 | 신체의 변화나 위험한 증상이 있는지 알아보기 위해 한 달에 한번 이상 신체 상태를 살펴본다. | □1 | □2 | □3 | □4 |
| 34 | 일상생활 중에 운동을 실시한다. (예: 점심식사 후 걷기, 가까운 거리 걸어가기, 먼 곳에 주차하고 걷기) | □1 | □2 | □3 | □4 |
| 35 | 일과 여가시간의 균형을 맞춘다. | □1 | □2 | □3 | □4 |
| 36 | 매일 흥미 있고 도전적인 것을 발견한다. | □1 | □2 | □3 | □4 |
| 37 | 친밀하게 지내고자 하는 요구를 충족시킬 수 있는 방법을 발견한다. | □1 | □2 | □3 | □4 |
| 38 | 매일 적당량의 고기, 생선, 콩류, 계란, 견과를 먹는다. | □1 | □2 | □3 | □4 |
| 39 | 의료인으로부터 어떻게 하면 건강관리를 잘 할 수 있는지에 대한 정보를 얻는다. | □1 | □2 | □3 | □4 |
| 40 | 운동할 때 맥박을 체크한다. | □1 | □2 | □3 | □4 |
| 41 | 매일 15-20분간 이완이나 명상을 실시한다. | □1 | □2 | □3 | □4 |
| 42 | 삶에 있어서 나에게 중요한 것이 무엇인지 알고 있다. | □1 | □2 | □3 | □4 |
| 43 | 필요시 봉사단체에게 도움을 요청한다. | □1 | □2 | □3 | □4 |
| 44 | 포장된 식품을 살 때는 상표를 보고 영양성분, 지방, 염분이 얼마나 들어 있는지 확인한다. | □1 | □2 | □3 | □4 |
| 45 | 건강관련 교육 프로그램에 참석한다. | □1 | □2 | □3 | □4 |
| 46 | 운동할 때 목표 심박동수에 도달하도록 한다. | □1 | □2 | □3 | □4 |
| 47 | 지치지 않도록 자신을 조절한다. | □1 | □2 | □3 | □4 |
| 48 | 나 자신보다 더 큰 어떤 존재와 연결되어 있다고 느낀다. | □1 | □2 | □3 | □4 |

| | | | | | |
|---|---|---|---|---|---|
| 49 | 대화와 타협을 통해 다른 사람과의 갈등을 해결한다. | □1 | □2 | □3 | □4 |
| 50 | 아침을 꼭 먹는다. | □1 | □2 | □3 | □4 |
| 51 | 필요하다면 상담을 받는다. | □1 | □2 | □3 | □4 |
| 52 | 나 자신을 새로운 경험과 도전에 노출시킨다. | □1 | □2 | □3 | □4 |

## 심혈관 질환에 대한 지식 및 인식에 관한 질문

1. 다음의 항목 중 심혈관 질환에 대한 위험요인이라고 생각하는 것을 있는 대로 나열하세요 (해당항목의 번호를 쓰세요).

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

항목: (1) 흡연, (2) 고지방 및 고 콜레스테롤 섭취, (3) 고혈압, (4) 심혈관 질환에 대한 가족력, (5) 나이, (6) 성별, (7) 운동부족 생활습관, (8) 스트레스, (9) 비만, (10) 당뇨, (11) 화학물질 노출, (12) 소음 노출, (13) 납 노출, (14) 교대 근무, (15) 초과 근무

다음은 심혈관 질환에 대한 인식에 관한 질문입니다 (해당항목에 V 표시를 하세요).

| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | 심혈관 질환 발병에 대하여 어느 정도 걱정하십니까?<br>1. 전혀 걱정하지 않는다<br>5. 매우 많이 걱정한다 | □1 | □2 | □3 | □4 | □5 |
| 3 | 10년 이내에 당신에게 심혈관 질환이 발병할 가능성이 어느 정도라고 생각하십니까?<br>1. 매우 낮은 가능성<br>5. 매우 높은 가능성 | □1 | □2 | □3 | □4 | □5 |
| 4 | 일생 동안 당신에게 심혈관 질환이 발병할 가능성이 어느 정도라고 생각하십니까?<br>1. 매우 낮은 가능성<br>5. 매우 높은 가능성 | □1 | □2 | □3 | □4 | □5 |
| 5 | 당신의 심혈관 질환 위험은 같은 나이 및 성별의 동료에 비하여 어떻다고 생각하십니까?<br>1. 매우 낮은 위험<br>5. 매우 높은 위험 | □1 | □2 | □3 | □4 | □5 |

**노력-보상에 관한 설문지**

노력-보상에 관한 설문지는 총 17 문항으로 구성되었습니다. 먼저 ☐N '그렇지 않다', ☐Y '그렇다'를 선택한 후 오른쪽 항목 에 해당하는 경우만 화살표 다음에 표시하시기 바랍니다.

| | | | | | | |
|---|---|---|---|---|---|---|
| ■N | ☐Y | → | ☐1 | ☐2 | ☐3 | ☐4 |
| ☐N | ■Y | → | ☐1 | ■2 | ☐3 | ☐4 |
| ☐Y | ■N | ••▶ | ☐1 | ■2 | ☐3 | ☐4 |
| | | | 전혀 괴롭지 않다 | 조금 괴롭다 | 괴롭다 | 매우 괴롭다 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 나는 일이 많아 항상 시간에 쫓긴다. | ☐N | ☐Y | → | ☐1 | ☐2 | ☐3 | ☐4 |
| 2 | 나는 일하다가 중단되거나 방해를 받는 경우가 많다. | ☐N | ☐Y | → | ☐1 | ☐2 | ☐3 | ☐4 |
| 3 | 나는 일하는데 있어 책임이 막중하다. | ☐N | ☐Y | → | ☐1 | ☐2 | ☐3 | ☐4 |
| 4 | 나는 자주 근무시간을 넘겨서까지 일하도록 압박을 받는다. | ☐N | ☐Y | → | ☐1 | ☐2 | ☐3 | ☐4 |
| 5 | 나의 일은 신체적으로 힘이 든다. | ☐N | ☐Y | → | ☐1 | ☐2 | ☐3 | ☐4 |
| 6 | 지난 수년동안, 나의 일은 점점 힘들어졌다. | ☐N | ☐Y | → | ☐1 | ☐2 | ☐3 | ☐4 |
| 7 | 나는 상사로부터 제대로 존중을 받고 있다. | ☐Y | ☐N | ••▶ | ☐1 | ☐2 | ☐3 | ☐4 |
| 8 | 나는 동료로부터 제대로 존중을 받고 있다. | ☐Y | ☐N | ••▶ | ☐1 | ☐2 | ☐3 | ☐4 |
| 9 | 나는 어려움에 처했을 때 적절한 지원을 받는다. | ☐Y | ☐N | → | ☐1 | ☐2 | ☐3 | ☐4 |
| 10 | 나는 직장에서 부당한 대우를 받고 있다. | ☐N | ☐Y | → | ☐1 | ☐2 | ☐3 | ☐4 |
| 11 | 나의 일은 승진할 전망이 나쁘다. | ☐N | ☐Y | → | ☐1 | ☐2 | ☐3 | ☐4 |
| 12 | 나의 근무조건에 바람직하지 못한 변화가 있었거나 있을 것으로 예상된다. | ☐N | ☐Y | → | ☐1 | ☐2 | ☐3 | ☐4 |
| 13 | 나의 직업은 안정적이지 못하다. | ☐N | ☐Y | → | ☐1 | ☐2 | ☐3 | ☐4 |
| 14 | 나의 현재 직위는 내 교육 및 경력 수준에 적절하다. | ☐Y | ☐N | ••▶ | ☐1 | ☐2 | ☐3 | ☐4 |
| 15 | 나의 모든 노력과 업적을 고려할 때, 나는 직장에서 제대로 존중과 위신을 얻고 있다. | ☐Y | ☐N | ••▶ | ☐1 | ☐2 | ☐3 | ☐4 |
| 16 | 나의 모든 노력과 업적을 고려할 때, 나의 일의 전망은 적절하다. | ☐Y | ☐N | ••▶ | ☐1 | ☐2 | ☐3 | ☐4 |
| 17 | 나의 모든 노력과 업적을 고려할 때, 내 봉급/수입은 적절하다. | ☐Y | ☐N | ••▶ | ☐1 | ☐2 | ☐3 | ☐4 |

**직무 스트레스에 관한 설문지**

직무 스트레스에 관한 설문지는 총 28 문항으로 구성되었습니다. 각 항목을 주의깊게 읽고, 가장 적절한 문항에 표시를 해주시기 바랍니다.

☐1 전혀 그렇지 않다 ☐2 그렇지 않다 ☐3 그렇다 ☐4 정말 그렇다

| | | | | | |
|---|---|---|---|---|---|
| 1 | 내 업무는 매우 빠른 속도로 해야 한다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 2 | 내 업무는 굉장히 열심히 해야 되는 일이다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 3 | 내게 지나치게 많은 업무량을 주지는 않는다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 4 | 나는 시간 안에 내 업무를 충분히 끝낼 수 있다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 5 | 사람들이 상반되는 요구를 해서 갈등이 있는 경우는 거의 없다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 6 | 내 업무는 많은 부분에서 내 스스로 결정할 수 있다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 7 | 내 업무에 있어 작업방식을 결정할 권한이 내게는 거의 없다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 8 | 내 업무와 관련하여 벌어지는 일에 대해서 많은 권한이 있다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 9 | 내 업무를 수행하기 위해서는 새로운 것을 배워야 한다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 10 | 내 업무는 반복적인 일이 매우 많다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 11 | 내가 하는 업무를 수행하려면 창조적인 사람이어야 한다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 12 | 내 업무는 고도의 기술을 필요로 한다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 13 | 내 업무를 수행하기 위해서는 이것저것 다양한 일을 하게 된다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 14 | 내 자신의 전문적인 능력을 발전시킬 수 있는 기회가 있다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 15 | 나와 함께 일하는 사람들(동료)은 자기 일에 유능한 사람들이다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 16 | 나와 함께 일하는 사람들(동료)은 나에 대한 개인적인 관심을 가지고 있다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 17 | 나와 함께 일하는 사람들(동료)은 친절하다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 18 | 나와 함께 일하는 사람들(동료)은 업무 수행에 도움을 준다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 19 | 우리 상사는 아랫사람들의 복지에 관심을 가지고 있다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 20 | 우리 상사는 내가 하는 말을 귀담아 듣는다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 21 | 우리 상사는 업무를 수행하는데 도움을 준다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 22 | 우리 상사는 사람들이 같이 일을 잘 할 수 있도록 한다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 23 | 나는 흔히 일하면서 시간에 쫓겨 하게 된다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 24 | 아침에 일어나자마자 일에 대한 문제부터 생각하게 된다. | ☐1 | ☐2 | ☐3 | ☐4 |
| 25 | 집에 가면, 쉽게 긴장을 풀고 일을 잊을 수 있다. | ☐1 | ☐2 | ☐3 | ☐4 |

| | | | | | |
|---|---|---|---|---|---|
| 26 | 내 가까이 있는 사람들은 내가 일 때문에 너무 많이 희생을 한다고 말한다. | □1 | □2 | □3 | □4 |
| 27 | 일에서 벗어나지 못해서, 잠자리에 들어도 일이 마음을 떠나지 않는다. | □1 | □2 | □3 | □4 |
| 28 | 오늘 해야 할 일을 미루면 밤에 잠을 이룰 수 없을 것이다. | □1 | □2 | □3 | □4 |

**가족 기능에 관한 설문지**

가족 기능에 관한 설문지는 총 5 문항으로 구성되었습니다. 각 항목을 주의깊게 읽고, 가장 적절한 문항에 표시를 해주시기 바랍니다.

□1 만족한다 □2 거의 만족한다 □3 거의 만족하지 않는다 □4 전혀 만족하지 않는다

| | | | | | |
|---|---|---|---|---|---|
| 1 | 내게 문제가 있을 때 가족에게서 받는 도움에 만족한다. | □1 | □2 | □3 | □4 |
| 2 | 가족이 나와 여러 가지 일에 대해 의논하고 고통을 나누는 방법에 만족한다. | □1 | □2 | □3 | □4 |
| 3 | 내가 어떤 새로운 활동을 시작할 때 가족이 나를 받아주고 지지해 주는데 대해 만족한다. | □1 | □2 | □3 | □4 |
| 4 | 나의 희로애락에 대한 가족들의 느낌의 표현 방법에 대해 만족한다. | □1 | □2 | □3 | □4 |
| 5 | 가족과 함께 보내는 방법과 시간의 양에 만족한다. | □1 | □2 | □3 | □4 |

**설문지 작성에 협조해주셔서 정말 감사합니다!**

**본 연구의 연구주제에 관해서 조언해주실 말씀이 있으시다면 아래에 기입해주시면 감사하겠습니다.**

## 자료 입력 양식

| 체질량 지수 | | 허리/엉덩이 둘레비 | |
|---|---|---|---|
| 측정일: | | 측정일: | |
| 키 | 몸무게 | 허리둘레 | 엉덩이 둘레 |
| cm | Kg | cm | cm |

| | 임상검사 정보 및 화학물질 폭로 | 기타 최근 정보 |
|---|---|---|
| 혈압 | 1.<br>2. | |
| 혈액검사 | HDL(고비중 지단백) 콜레스테롤 : | |
| | 트리글리세라이드 : | |
| | 총콜레스테롤 : | |
| | 혈당 : | |
| 죄심실 비대 유무 | | |
| 화학물질 폭로 | | |
| 기타 | | |

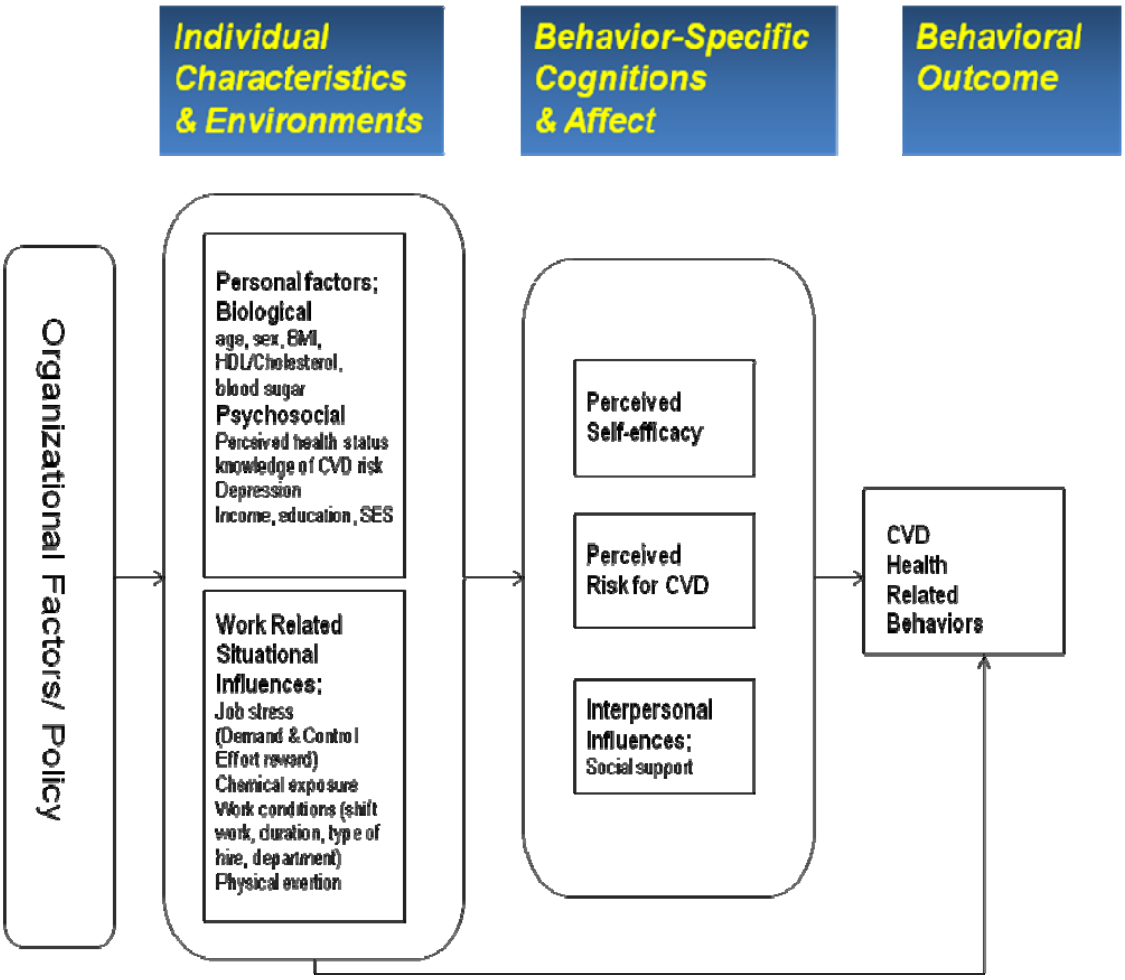


*Figure 7*. Modified Framework for CVD health related behavior in blue-collar workers: Potential determinants of CVD risk perception & risk-reduction behaviors Adapted from the Health Promotion Model

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Date