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Relationship between cardiovascular disease morbidity, risk factors, and stress in a law enforcement cohort

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**Relationship between cardiovascular disease morbidity, risk factors, and stress
in a law enforcement cohort**

by

Sandra L. Ramey

A dissertation submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of
DOCTOR OF PHILOSOPHY

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For the Major Program

DEDICATION

To
my husband, Neil,
and my children,
Tim and Katie:
your
love,
encouragement,
and support
have made a
difference!

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ABSTRACT

It remains uncertain whether law enforcement officers (LEOs) have an increased incidence of cardiovascular disease (CVD), and, if so, the extent to which stress affects this relationship. To address this issue, the self-reported incidence of CVD and CVD risk factors among 2,818 currently employed male LEOs was compared to 9,650 male respondents. Perceived stress among the LEOs also was determined. The percentage for CVD incidence was lower in the LEO group than among the general population [2.3 (SD = .15) vs. 5.6 (SD = .23); $p = .001$]. The best predictor variables for CVD in the combined group were: physical inactivity ($p = .015$), hypertension ($p = .001$), and hypercholesterolemia ($p = .001$). In the LEO group, the best predictor variables for CVD were: perceived stress ($p = .032$), time in the profession ($p = .001$), and hypertension ($p = .001$). The prevalence of hypercholesterolemia (33.2 percent), overweight (82.6 percent; BMI > 25.0), and tobacco use (10.1 percent) in the LEO group exceeded those found in the general population. Stress was significantly associated with CVD ($p = .008$). Three CVD risk factors were significantly affected by stress: cholesterol ($p = .001$), hypertension ($p = .001$), and physical activity ($p = .001$). Perceived stress was affected by duration of time in the profession ($p = .004$) after adjusting for age ($p = .353$). These results suggest that stress may contribute to CVD among LEOs through potentiating several CVD risk factors.

CHAPTER 1. INTRODUCTION

Background of the Study

According to the American Heart Association (AHA), cardiovascular disease (CVD) has been the number-one killer of adults in America since 1900. More than 2,600 Americans die each day from CVD, which equates to a death every 33 seconds (AHA, 2000). CVD claims more lives each year than the next seven ranked causes combined. The prevalence of the disease is staggering. In America, 59,700,000 residents have one or more types of cardiovascular disease (AHA, 2000). A breakdown of these various diseases was outlined in a recent AHA publication and summarized in Table 1:

Table 1. Prevalence of cardiovascular diseases (1999-2000)

Type	Number
High blood pressure	50,000,000
Coronary Heart Disease	12,000,000
Myocardial Infarction	7,200,000
Angina Pectoris	6,300,000

Source: American Heart Association Statistics, 2000.

Less prominent cardiovascular disease entities include stroke, heart disease related to rheumatic heart illness, congestive heart failure, and congenital heart defects. Certain antecedents of CVD, called "risk factors," are directly related to the prediction of disease. Research has demonstrated that awareness and management of the risk factors enable Americans to intervene in the process of cardiovascular disease. The AHA defines risk factors as "traits and lifestyle habits that increase the risk of disease" (AHA, 2000). While

many risk factors such as family history of CVD, age, gender, and race are uncontrollable. some risk factors are manageable. Among the controllable factors are: (1) exposure to tobacco smoke; (2) blood pressure; (3) blood lipids; (4) weight (obesity); and (5) diabetes (AHA, 2000).

Research suggests that certain occupations are at increased risk for the development of CVD. Among the occupations identified to be at risk are law enforcement officers (LEOs) (Dubrow et al., 1988; Feuer & Rosemann, 1986; Guralnick, 1962; Pollock & Getteman, 1978; Williams & Petrallis, 1987). Increased presence of risk factors has been found among LEOs (Peters & Cady, 1983; Pollock & Getteman, 1978; Williams & Petrallis, 1987). These researchers also suggest there may be a disproportionate increase in the presence of risk factors with aging among LEOs.

Physiologic and emotional stressors associated with occupation as a LEO can increase catecholamine release and blood pressure, resulting in chronic stress to blood vessels and to the cardiovascular system (Ely & Mostardi, 1986; Piercecchi et al., 1999; Vena, 1986). In the presence of stress, risk factors such as obesity, smoking, and increased alcohol intake can be exacerbated (Conway et al., 1981; Dorian & Taylor, 1984; Kros & Hurrell, 1975; Richmond & Kehoe, 1999; Vena, 1986).

It is important to study health in different segments of the population, such as LEOs, to ascertain what risk factors are present. Even more importantly, what, if any, attributes of the environment or work settings contribute to the acquisition of the risk factors concomitant to disease development? Work organization and job design, as well as confounding variables such as job security and chemical or physical work hazards, can create job strain but have

rarely been assessed (Schnall, 1994). The hours employees work, their personality type, and their latitude for decision making within the job can affect morbidity (Harrington, 1994; Kaplan & Keil, 1993; Karasek et al., 1988; Knutsson et al., 1986; Mohandie & Hatcher, 1999; Schnall, 1994; Steenland & Johnson, 1997; Tortterdell & Smith, 1992; Tuchsén et al., 1996).

Shift-work and decreased physical activity are two risk factors that have been associated with stress in the general public as well as the occupation of law enforcement (Eklund et al., 1988; Ely & Mostardi, 1986; Franke & Anderson, 1994; Harrington, 1994; Knutsson et al., 1986; Paffenbarger & Hyde, 1993; Peters & Cady, 1983; Rohm, 1993; Spelten et al., 1993; Stamford & Weldman, 1978; Williams & Petrallis, 1987). Shift work has been associated with social and domestic disruption as well as diminished quality of sleep (Spelten et al., 1993). Knutsson et al. (1988) reported that, independent of age and smoking, the relationship between shift work and CVD is linear.

Ely and Mostardi (1986) proposed that shift work is correlated with higher norepinephrine levels among LEOs, “which if not controlled may lead to higher cardiovascular risk” (p. 77). With years of shift work, officers may become “habituated” to working at times other than during the day, with a “gradual lowering of subjective health” (Spelten et al., 1993, p. 308).

While a body of research exists recognizing that risk for CVD indeed may be present among LEOs (Feuer & Rosenman, 1986; Sardinas et al., 1986), previous studies have not directly identified what contributes to or precipitates the increased risk. A study of the law

enforcement population provides access to a group that otherwise might not be evaluated for the presence of risk factors of disease but who have an increased mortality rate from CVD.

While research supports that LEOs may be at an increased risk for the development of CVD, the existing literature is limited. Many of the studies have involved a small number of subjects and have eliminated examination of some prevalent risk factors (Calvert et al., 1999; Feuer & Rosenman, 1986; Franke et al., 1998; Sparrow et al., 1983; Vena, 1986). In addition, information provided in the literature on the incidence of CVD among LEOs is conflicting. Definitive evidence that the incidence of CVD is increased among LEOs is lacking, and it is not clear whether employment as a LEO is a factor in the development of CVD. Additional research needs to be done to clarify the relationship between CVD and employment as a LEO and increased presence of risk factors.

In previous studies, sample sizes were small and most research focused on mortality rather than morbidity (Calvert et al., 1999; Feuer & Rosenman, 1986; Forastiere et al., 1994; Paffenbarger & Hyde, 1993; Sparrow et al., 1983; Vena, 1986). More research needs to be done with larger samples sizes, focusing on incidence of disease, risk factors, and perceived stress levels.

Past research employed control groups to compare the risk for CVD among LEOs with the general population, and subsequently showed the risk to be similar between these two groups (Demers et al., 1992; Franke et al., 1997; Sparrow et al., 1983; Vena, 1986). Duration of employment as a LEO was not considered, yet it may be related to the increased presence of risk factors and incidence of disease (Franke et al., 1998). Analysis of sub-

groups should be done to identify differences in morbidity relative to employment duration intervals as a LEO.

Statement of the Problem

Employment in law enforcement may be associated with increased mortality and morbidity from cardiovascular disease. The problem in this study is to identify those unique aspects of law enforcement that may contribute to increased risk for, and development of, cardiovascular disease.

Need for the Study

Little research has been conducted addressing morbidity from CVD among law enforcement officers. Most studies have employed small cohorts of officers. Additional research is needed using larger sample sizes while comparing risk for CVD in this occupation with that found in the general population.

Purpose of the Study

The purpose of the study was to examine the risk of cardiovascular disease among male LEOs compared to risk for men in the general public. The study involved a larger sample of LEOs than ever studied before. The results of this study further defined the relationship between the risk for CVD and the profession of law enforcement.

Objectives of the Study

The two main objectives of the study were:

1. Determine what unique aspects of the law enforcement profession contribute to an increase in morbidity from cardiovascular disease.
2. Assess the relationship between stress, risk factors, and the incidence of cardiovascular disease.

Research Questions

Four research questions were formulated for the purpose of the study:

1. Is there a relationship between employment as a law enforcement officer and the risk for cardiovascular disease?
2. Does the risk of cardiovascular disease change over time with employment in law enforcement?
3. Is perception of stress related to risk for development of cardiovascular disease?
4. Is the risk for cardiovascular disease different in the law enforcement profession than in the general population?

Research Hypotheses

This study assessed the following hypotheses:

1. A higher incidence of morbidity from CVD will be present in the LEO group than in the general population.
2. A greater number of risk factors will be present in the LEO group compared to the general population.

3. A positive linear relationship will exist between perceived stress and the incidence of CVD risk factors.
4. The incidence of CVD risk factors will increase with time of employment as a LEO, adjusting for age.

Assumptions

The following assumptions were made for the purposes of carrying out the study:

1. Job tasks are homogeneous among LEOs.
2. Job tasks are homogeneous among LEOs across the states surveyed in this study.

Limitations

The study was conducted under the following limitations:

1. Responses to the survey were self-reported and may not provide an accurate portrayal of risk factors or disease incidence.
2. This study involved males employed in the profession of law enforcement residing in nine Midwestern states. Results may not be applicable to the entire LEO population in other regions of the U.S.
3. CVD incidence may be underreported because LEOs with CVD may take disability retirement.

Definition of Terms

The following terms are defined for the purpose of the study:

Cardiovascular Disease: Self-reported history of diagnosed coronary heart disease and/or history of a myocardial infarction, angina, or stroke.

Law Enforcement Officers: Sworn officers of a state Department of Public Safety.

Risk Factors: Traits and lifestyle habits that increase the risk of CVD.

CHAPTER 2. REVIEW OF THE LITERATURE

A body of research exists assessing mortality from CVD among LEOs (Calvert et al., 1999; Demers et al., 1992; Dubrow et al.; Feurer & Rosenman, 1986; Forastiere et al., 1994, 1988; Guralnick, 1962; Milham, 1983; Sardinas et al., 1986; Sparrow et al., 1983; Vena, 1986). However, few researchers have studied morbidity (Franke et al., 1998; Sparrow et al., 1983). Literature exists recognizing the increased presence of risk factors for CVD in several public service occupations, including law enforcement (Ekelund et al., 1988; Ely et al., 1986; Franke & Anderson, 1994; Franke et al., 1997, 1998; Kawachi & Sparrow, 1994; Lee et al., 1998; Paffenberger & Hyde, 1997; Peters, 1983; Piercecchi et al., 1999; Pollock & Getteman, 1978; Pyorola et al., 1998; Stamford & Weltman, 1978; Richmond et al., 1998; Williams & Petrallis, 1987; Wilson, 1998; Wood et al., 1982). This chapter is organized into the following subsections: (1) CVD incidence among LEOs, (2) CVD risk factors among LEOs, and (3) summary.

CVD Incidence Among LEOs

Mortality and morbidity among LEOs

The 1950 census provided evidence that LEOs, specifically police, sheriffs, and marshals, die more often from CVD than do males in the general population. Analyzing mortality data from the 1950 census, Guralnick (1962) found that police officers have greater mortality than the general public. The age interval of 60-64 included a greater number of deaths for policemen. However, during this period no incidence of new cases of disease was

measured (Guralnick, 1962; Milham, 1983). Therefore, determination of disease risk was not possible, limiting the applicability of the mortality data to the general public.

Subsequently, some states considered development of CVD to be job related (Price et al., 1978). If a cardiac event occurs, some LEOs may be given the option of early retirement, thus removing them from the cohort of current LEOs. This may contribute to what is referred to as "the healthy worker effect" when sampling populations of LEOs (Howe et al., 1988). Underestimation of the numbers of LEOs with CVD may result, and samples may not be representative of the entire population.

In a longitudinal study utilizing a sub-group of the Normative Aging Study, Sparrow et al. (1983) found no significant difference between LEOs (n = 220) and non-LEOs (n = 1,428) regarding the presence of CVD. Odds ratio was used as a measure of association comparing police officers to non-police, with an adjusted risk ratio of 1.4 for CVD. While the presence of risk factors was increased with age, occupation was not found to be a significant predictor of CVD, after controlling for standard coronary risk factors. Although officers had an increased risk for disease, the incidence of ensuing cardiac event was not found to be significantly greater.

Vena (1986) studied LEO (n = 2,376) mortality and found that, initially, with 10-19 years of employment, the frequency of CVD in the LEO population does not exceed that of the general population. However, mortality increased proportionate to years of employment, and the risk ratio increased to 1.4 after 40 years of employment (Vena, 1986). Individual measures of stress were not employed. Recognizing the relationship between stress and CVD, it may be possible that prolonged exposure to stress (Dorian & Taylor, 1984) and/or

environmental hazards such as carbon monoxide exposure while in the vehicle or during traffic control, may contribute adversely to the health of LEOs and be precursors to disease (Aronow, 1975; Bisby, 1977; Radford, 1975).

Dubrow et al. (1988) studied the relationship between occupation as an LEO and death from CVD. Death records from Rhode Island (RI) and Utah (UT) showed that not only was the rate of death higher among LEOs but the odds ratio for acute myocardial infarction was 2.1 (95% CI 1.4,3.1) for both states in the age interval < 65 years old. More specifically, the odds ratio for officers >65 years of age was 0.9 in RI and 1.6 in UT. The researchers suggested this phenomenon might be attributable to stress, surmising that with a reduction in stress with retirement, the rate of death diminishes, especially from acute anterior myocardial infarction. These results are contrary to the findings of Vena (1986).

Feurer and Rosenman (1986) observed mortality resulting from CVD (1974-1980) among police and firemen (n = 830) from New Jersey. Overall, mortality from CVD was not higher for police or firemen when compared with the general population; however, analysis of sub-group data showed an inverse relationship between CVD and latency. The proportionate mortality rate (PMR) was increased among LEOs by 1.15; that is, death due to CVD in these groups was higher in the employment interval of < 22 years than in the 22-27 year or >27 year intervals. The explanation posed was that individuals most susceptible to CVD are affected early in their career, possibly due to unaccustomed exposure to physical and psychological stress as well as carbon monoxide. This finding of an inverse relationship between age and death from CVD concurs with the finding of Dubrow et al. (1988) but is not supported by Vena (1986).

Sardinas et al. (1986) studied mortality among police and firemen in Connecticut. The purpose of the study was to determine if there was a difference in mortality rates for the two occupations. From 1960-1978, 161 of 401 police deaths (age interval 25-59 years) were attributed to CVD. The mortality odds ratio (MOR) was 1.32 (95% CI; 1.16, 1.48) and the standardized mortality rate (SMR) was 1.49 (95% CI; 1.25, 1.73), which supports increased mortality for police from CVD when compared to firemen. Mortality rates for both occupations were high compared to other occupations. Overall, the authors considered the rate of mortality as "lower than expected when considering the healthy worker effect" (p. 1141). In addition, Sardinas et al. (1986) suggested that the results may be tentative due to the unavailability of the exact years of employment.

Forastiere et al. (1994) studied mortality rates among 3,868 policemen in Rome. An excessive risk of CVD was observed in officers <50 years old. The value of SMR was 1.63 (95% CI; 0.89, 2.73). Among the influences on the cardiovascular system addressed were: (1) occupation-related stress and strain; and (2) exposure to carbon monoxide, specifically its contribution to development of CVD. Exposure to carbon monoxide via exhaust fumes experienced by officers engaged in traffic control may contribute to the increased incidence in CVD mortality seen in younger officers, according to the authors. This study supports the findings of Feurer and Rosenman (1986) and Dubrow et al. (1988).

Franke et al. (1997) studied CVD risk factors in a group of LEOs in Iowa (n = 388) utilizing a control population defined by the cohort in the Framingham Heart Study (Anderson et al., 1991). Previous research supported that risk factors change with age among the LEOs (Peters & Cady, 1983; Pollock & Getteman, 1978; Williams & Petrallis, 1987).

This study explored the relationship between the change in risk factors in the LEO group and that observed in the general population. Results suggested that the 10-year probability of development of CVD in the Iowa LEO population was similar to that found in the Framingham population. This phenomenon was not attributable to conventional risk factors such as hypertension, hyperlipidemia, or tobacco. Neither perception of stress nor inactivity was considered when evaluating the risk or incidence of CVD. Nevertheless, inclusion of these independent variables is important given their direct impact on the development of CVD.

Franke, Collins, and Hinz (1998) found that employment as a LEO was associated with a higher incidence of CVD morbidity than that found in the general population. Self-reported incidence of CVD was 31% in the LEO group, compared to 18.4% in the general population. Effects of age, weight, diabetes, serum cholesterol levels, blood pressure, and smoking were considered; however, the association remained even after considering the aforementioned risk factors. Employment as a LEO was a factor in the increased incidence of disease, although it was uncertain what specific aspects of the occupation contributed to the higher incidence of CVD. The authors suggested that the association may be attributable to shift-work and occupational stressors.

Demers et al. (1992) studied the mortality rates of firefighters and police from three northwestern United States cities: Seattle and Tacoma, Washington, and Portland, Oregon. The longitudinal research studied employees who worked for these cities for at least one year from 1944-1979. Deaths associated with CVD were less than expected, according to the authors (SMR = 1.24, 95% CI 0.91, 1.64). The number of police studied (n = 3,676) was

less than the number of firemen ($n = 4,546$), yet the authors were aware that difference in sample size may affect the risk estimates and statistical stability with resultant wide confidence intervals. These findings agree with those of Sardinias et al. (1986).

Franke and colleagues (1997) found that, when comparing the age-associated change in risk for CVD in the LEO cohort, it was not different from the general population when using the Framingham Algorithm. However, obesity, stress, and physical activity were not included in the study. Data gathered in these areas showed that LEOs become “fatter quicker” (Franke & Anderson, 1994).

Calvert et al. (1999) studied mortality rates attributed to CVD among white- and blue-collar male workers 16-60 years of age using the National Occupational Mortality Surveillance System (NOMSS). The proportionate mortality ratio (PMR) was used to examine the association of CVD and occupation utilizing the NOMSS. A higher proportion of white-collar occupations died from CVD; however, among the blue collar occupations found to have the highest incidence of death attributed to CVD were: (1) sheriffs, PMR = 126, 95% CI. (11, 143); (2) correctional officers, PMR = 121, 95% CI (121, 136); and (3) policemen, PMR = 114, 95% CI (106, 121). In some states, development of CVD is assumed to be occupation-related. One limitation of Calvert’s study was that individuals taking early retirement or disability due to CVD were not included in the study, and this may have affected the results. Calvert recommended further study examining officers’ perception of psychosocial and occupational factors, implying that occupational stress may contribute to the mortality associated with public service.

CVD Risk Factors among LEOs

Stress

Dorian and Taylor (1984) studied the effects of stress on development of CVD in the general population. These authors suggested that a relationship exists between occupational environments and the development of CVD, and recommended initiatives such as stress management and modification to increase work satisfaction and diminish associated health risks. Stressors studied included anxiety, depression, and emotional drain, as well as a concept referred to as "overload," defined as "psychic exhaustion and emotional drain ... in the context of striving without joy or satisfaction" (p. 750).

Stress in the profession of law enforcement has been recognized for several decades. In the 1970s, the International Law Enforcement Stress Association (ILESA) was founded, which published a journal entitled, *Police Stress*. Davidson and Veno (cited in Cooper & Marshal, 1980) noted that, in the first issue of the journal, Hans Selye, who is sometimes referred to as the father of stress, stated: "Unlike most professions, it (law enforcement) ranks as one of the most hazardous, even exceeding the formidable stresses of air traffic control" (p. 132).

When embarking on a career in law enforcement, anticipated sources of stress include the obvious rigors entailed in performance of the job such as involvement in life-threatening situations and shift work. However, unanticipated sources of environmental stress realized and experienced by officers include the stress associated with the administrative climate within the paramilitary organization of law enforcement. According to a 1997 publication

written by Finn and Tomz and distributed by the National Institute of Justice (NIJ), chronic stress is perceived by LEOs to be perpetuated by factors within the organization, including: (1) excessive and unnecessary amounts of paperwork; (2) lack of input into policymaking and decision-making; (3) pressure to exude culturally competent law enforcement; (4) fiscal uncertainty, and (5) ineffective communication between subordinate LEOs and superiors, including lack of trust (p. 7).

During the development of the NIJ publication (Finn & Tomz, 1997), LEOs were interviewed and three additional sources of stress were recognized: (1) the increase in crime rate has expanded the challenges and taxed the resources of LEOs; (2) the increase in the negative perception of police expressed by some communities served; and (3) the embracing of a concept known as community policing, adopted by law enforcement during the past ten years

Community policing is a concept employed with the intent of empowering LEOs to make decisions and problem solve within the communities they serve. The goal is to develop positive relationships within the community, leading to improved relationships between law enforcement and the constituents serviced. However, some officers indicated they experience dissonance regarding the expectation to make decisions while questioning whether the decisions they make will be supported and accepted by administrative cohorts. According to Averill (1973), "stress educing or stress inducing properties of perceived control depend on the meaning of the control response for the individual." Averill also proposed that this meaning is dependent upon the context in which it is embedded (p. 301). Some officers

offered that it was “the lack of adequate training and not the new responsibilities that created the added stress” (Finn & Tomz, 1997, p. 12).

Identification with an organization is affected by interactions with all individuals within the unit. Ideally, communication is a dialogue between the administration and the subordinates within the unit based on trust, respect, and honesty. According to several authors, negative relationships within any organization are directly related to job satisfaction (Aron, 1992; Grier, 1982; Martelli, Waters, & Martelli, 1989). Long-term job satisfaction is integral to the well-being of the LEO.

According to Davidson and Veno (cited in Cooper & Marshall, 1980), disruption of social and family life, as well as police-community relations, contribute to LEO stress. The narrative reviewed job overload, physical danger, courts, and the organizational structure as well as the climate of law enforcement in the context of stress perception by LEOs. Stress within the job setting was recognized as a causal factor in the development of disease, including CVD, and stress was also associated with increased alcohol consumption and tobacco use. The researchers suggested that life events and their relation to stress should be studied as well as stressors related to personality types.

Kros (1976) elaborated on the effects of negative public image, conflicting values, inadequate resources, job ambiguity, and their relevance to LEO job performance. Kros called for stress awareness, and insight into self and education addressing specific skills empowering LEOs to manage stress reduction.

According to the literature to date, circumstances have not changed greatly for LEOs in the 21st century. Stress related to increased anxiety and anger has been reported in the law

enforcement population (Boltwood & Taylor, 1993; Ekeland et al., 1988; Ely & Mostardi, 1986; Kawachi & Sparrow, 1994; Kros & Hurrell, 1975; Russkek & King, 1990). Increased epinephrine levels as well as cortisol secretion have been related to anticipation of and exposure to stress (Ely & Mostardi, 1986; Piercecchi et al., 1999).

Mohandie and Hatcher (1999) studied the incidence of suicide and violence in the law enforcement profession. The suicide rate among LEOs is 2-3 times higher than that found in the general population (Vena, 1986; Watson, 1996, as cited in Mohandie & Hatcher, 1999). Among the specific factors that may contribute to violent behavior by LEOs is the repetitive exposure to situations where violence is employed, including investigation of situations involving assault, homicide, suicide, and the use of deadly force in problem solving. Mohandie and Hatcher (1999) hypothesized that repetitive exposure to these unique situations where violence has been realized, as well as the cultural indoctrination that violence may be necessary and reasonable to control some situations, might cause some LEOs to begin to view such behavior as "normal." These researchers further noted that LEOs utilize alcohol for stress relief more often than the general population and that domestic violence in the families of LEOs is reported at a higher rate than that found in the general public. This concurs with the earlier work of Kros and Hurrell (1975), who found that an estimated 25% of LEOs employed alcohol for the purpose of stress relief and cited an increased rate of job-related alcoholism in the LEO population.

In a study of an Akron police cohort (n = 331) by Ely and Mostardi (1986), stress was measured using recent life change unit scores (LCU) in an attempt to quantify the amount of change experienced by LEOs at a given time. The control group was comprised of 48 males

working in clerical positions within the city. Officers were surveyed about recent life change, life assets, and temperament patterns, and subsequently were categorized as “dominant” or “subordinate” according to specific behavioral profiles. Extrapolated data specific to stress indicators included increased norepinephrine (NE) levels and diastolic blood pressure readings. Officers who rotated shifts were found to have extremely high norepinephrine levels, with the researchers hypothesizing that this increase may lead to hypertension. Ely and Mostardi (1996) suggested that increases in NE among shift workers does not, however, account for the high NE levels seen in the officers as an entire cohort. According to the researchers, “even the day officers had values about twice the average reported in the literature (227pg/ml for normotensive subjects from 64 studies),” as reviewed by Goldstein (cited in Ely & Mostardi, 1996, p. 83). Additionally, Ely and Mostardi found the LEOs’ LCU scores to be higher than the control values, especially for those officers in what are referred to as “dominant” according to behavioral profiles. Dominant officers who had moderate-to-high LCU scores also had a higher incidence of cardiac risk factors compared to subordinate officers in the cohort.

These findings are consistent with the findings of Karasek et al. (1988), who studied more than 2,000 males surveyed with the Health Examination Survey (HES). Karasek et al. found that employees working in environments where low decision-making latitude and high psychological workload prevailed had increased prevalence of myocardial infarction (MI). However, Karasek et al.’s analysis did not control for factors such as blood pressure, blood lipid levels, or smoking. Controlling for age accounted for one-fourth to one-third of the prevalence of MI in the sample of 2,409 males. Another limitation to this study was that it

utilized only prevalence data, defined as the number of old and new cases of a disease or health problem existing at a given time, thereby increasing the difficulty of associating a direct causal effect with only this type of data. These researchers suggested that increased job demands lead to increasing protection from disease” ($p < .01$), and those with high control and high demand were “significantly protected” (p. 259). A limitation of the study was that the job characteristics were determined from description only without consideration of the uniqueness of specific job environments.

Other research in the general population, however, may conflict with the findings that decreased decision-making latitude and a dynamic work environment contribute to increased incidence of CVD. Steenland and Johnson (1997) found, in a longitudinal study of 3,575 males utilizing the National Health and Nutrition Survey (NHANES) (collected in 1971-1975, and followed through in 1987), that no increased risk for heart disease was associated with jobs involving high strain with low control. Steenland and Johnson noted that, among blue-collar workers, those with the “highest levels of job demands or job control” had the lowest risk for disease (0.71 95% CI, 0.54-0.93).

A longitudinal study of 1,326 males employed by the Helsinki Police Department (Finland) was begun in 1966. A second examination of the participants was conducted in 1971 and 1972. The purpose of the study was to evaluate the incidence of CVD and diabetes. During the 22-year follow-up, 276 of the participants died. CVD accounted for 210 of the deaths. Physiologic responses to stress can include an increase in blood glucose, triggering insulin secretion. Pyorola et al. (1998) conducted a follow-up study to this historic Helsinki

Policemen Study. Hyperinsulinemia was identified as a predictor of CVD; however, it became a less predictive value with extended follow-up time.

A retrospective study by Spelten et al. (1993) showed that when officers were asked to reflect on their stressful experiences, LEOs perceived situations as “more stressful” upon reflection than at the time of actual occurrence. Paired t-tests showed reflection on previous experiences to be “worse than” officers realized at the time the incident occurred. This might be indicative of underestimation of the incident at the time of occurrence.

Hills and Norvell (1991) studied 234 male highway patrol officers and found that PSS was an important and significant predictor of stress-induced consequences. Officers were given questions about perceived stress, including Cohen’s Perceived Stress Scale and the Hassles Scale, which is comprised of 117 items evaluating perception of everyday life. The Police Stress Inventory (PSI) was also administered to the officers. Hills and Norvell found that the independent variables employed in their model (PSS, Hassles, and PSI), “contributed significantly to the prediction of emotional exhaustion, physical symptoms and total job satisfaction” (p. 34). The mean score on the PSS was 22.24, and the SD 7.95, with a range of 2.00-43.00.

This compares with Cohen’s (1983) research on perceived stress employing the PSS with three different samples. Results showed males had scores of 22.38 (n = 121) and 21.73 (n = 60) for college students, and 24.0 (n = 27) for the community who were participating in a smoking cessation program. Standard deviations were 6.79, 8.42, and 7.80, respectively. The group most comparable to Hills and Norvell’s (1991) cohort was the community group,

with a mean age of 38.4 years. Most had an income greater than \$25,000 annually, and 74% had received formal education beyond high school.

Shift-work

Shift-work, defined as work patterns that occur outside of the usual daytime context, is associated with employment as a LEO (Eklund et al., 1988; Ely & Mastardi, 1986; Franke & Anderson, 1994; Paffenbarger & Hyde, 1993; Peters & Cady, 1983; Rohm, 1993; Spelton et al., 1993; Stamford et al., 1978; Williams & Petrallis, 1987). Shift work has been associated with social and domestic disruption as well as diminished quality of sleep (Spelton et al., 1993). Ely and Mastardi (1986) proposed that shift work correlated with higher norepinephrine levels among LEOs, “which if not controlled may lead to higher cardiovascular risk” (p. 77). With years of shift work, officers may become “habituated” to working at times other than during the day with a “gradual lowering of subjective health” (Spelton et al., 1993, p. 308).

Shift work has been connected with changes in mortality, morbidity, and the development of cardiovascular disease (Knutsson et al., 1986; Waterhouse et al., 1992). The effect of shift work on working, eating, and sleeping cycles is dynamic. Due to disruption in the “rhythmicity,” or circadian cycle, hormone secretion is affected. Stressors such as job demands, noise, and disturbance of sleep pattern due to shift work, have been demonstrated to contribute to occupation related stress. This alteration can lead to health issues for the employees involved in the shift work (Harrington, 1994).

According to Harrington (1994), shift work can diminish the total amount of sleep and result in diminished rapid eye movement sleep; the effects of sleep deprivation are believed to be cumulative. The length of shift the LEO is expected to work is related to health and well-being, according to Totterdel and Smith (1992). In the "Ottawa" shift plan piloted in Canada, officers work 10-hour days and 8-hour night shifts, with four 10-hour days followed by two "rest days." Seven 8-hour nights were followed by six days of rest. According to Totterdel and Smith this resulted in greater sleep duration and a perception of increased well-being by the LEOs.

Piercecchi et al. (1999) studied 18 LEOs, evaluating the relationship between behavior and hormonal systems, and found that hormone secretion and exposure to perceived stressful situations were related. The study involved recreation of hypothetical stressful events that LEO might encounter within the context of the law enforcement occupation. Epinephrine secretion, which can elevate heart rate and blood pressure, was found to increase at the onset of stressful situations, and epinephrine levels remained elevated throughout the duration of the encounter. Cortisol levels were related to "anticipation of the situation," according to Piercecchi et al.

The effects of stress (Kawachi & Sparrow, 1994; Piercecchi et al., 1999), reduced physical activity (Franke & Anderson, 1994), as well as other risk factors, including development of high blood pressure and increased cholesterol, have been studied to determine their relationship with the higher incidence of CVD among LEOs. Future research should examine the impact of the psychosocial work environment, including traffic control and shift work, on the health of LEOs. Biological factors such as alcohol and caffeine

ingestion by LEOs are mentioned in the literature (Conway et al., 1981; Richmond & Kehoe, 1999); however, the relationship between these factors and stress has not been widely studied. Individual perception of stress by LEOs should be considered and measured when evaluating the factors effecting risk for and development of CVD.

Physical inactivity

In a joint position statement, the American Heart Association, the Centers for Disease Control and Prevention, and the American College of Sports Medicine recommended that every American participate in a minimum of 30 minutes of moderate-intensity exercise on most, and optimally every, day of the week (cited in Pate & Pratt, 1995). Reduced physical activity has been identified as a risk factor for CVD. Research validates the presence of this in the law enforcement population (Demers et al., 1992; Franke & Anderson, 1994; Lee et al., 1998; Paffenberger & Hyde, 1993; Peters & Cady, 1983; Pollock & Getteman, 1978; Rohm, 1993; Stamford et al., 1978; Tuxsen et al., 1996).

Stamford et al. (1978) studied 136 police officers 20-55 years of age. They found that if officers did not continue to exercise after the training received initially at the academy, within one year the officers' fitness level would return to the level it was prior to training. These researchers concluded, "the physical demands of law enforcement are not high enough to permit maintenance of physical fitness" (p. 294). The researchers noted that this trend mirrors that found in the general population. Also of interest was the finding that, declining fitness levels (due to inactivity) was inversely related to body composition, which showed an increase in fat. According to Stamford et al., these variables reached a plateau in the age

interval of 30-49 years, after a rapid decline when compared with the age range of 20-29 years.

Peters and Cady (1983) studied men 35-55 years old in a sample of 2,779 firefighters and police officers. The researchers concluded that physical fitness might be an important factor in the development of CVD, especially when conventional risk factors, such as increased blood lipids, smoking, and hypertension, are concurrently present. During the initial evaluation, the treadmill test had to be stopped for 196 employees (due to potential danger signs). These researchers noted that, in the eight years of the study, 36 officers in this group of 196 subsequently incurred myocardial infarction (MI). The incidence of MI in these 196 officers was triple that of the remainder of the cohort, suggesting a link between cardiac risk and physical fitness. Regarding the impact of additional risk factors on the incidence of MI, it is noteworthy that 13 of the 36 officers incurring MI in the study had three or more risk factors present. The adjusted risk ratio among workers for high blood lipids was 4.4. In smokers it was 3.4, versus 5.1 for hypertensive individuals.

Williams and Petrallis (1987) studied 171 male police officers for the purpose of evaluating the severity of cardiac risk and any association present between exercise capacity and frequency of physical activity. Exercise capacity was evaluated with treadmill testing and leisure time activity was queried. While there appeared to be some increased risk associated with age, the officers with the greatest treadmill capacity demonstrated the least amount of cardiac risk factors. Williams and Petrallis noted an "excessive prevalence of selected risk factors in the officers" (p. 598), including increased blood lipids, smoking, and

obesity. This study supports an inverse relationship between physical activity and cardiovascular risk.

Franke and Anderson (1994) studied the relationship between fitness and exercise as it relates to CVD risk. Law enforcement officers in Iowa (n = 470) were studied utilizing maximal graded exercise testing and maximal oxygen consumption estimates as a measure of fitness. Tests of main effects showed that CVD was significantly more prevalent in non-exercisers older than 48 years. The study concluded that decreasing the risk for CVD by exercising is effective only in the LEO group of >48 years of age, but ignored the direct effect that physical activity has on CVD risk.

Ekelund et al. (1988) examined 4,276 men 30-69 years of age to assess whether physical fitness was associated with subsequent mortality from heart disease. The sample was comprised of participants at ten Lipid Research Centers in the U.S. and Canada. The survey covered 1972-76. Initially, treadmill testing was used as an assessment of fitness. After adjustment for age and other cardiovascular risk factors, Ekelund found that a higher risk for mortality from CVD was associated with a diminished fitness level. The relative risk ratio for death from CVD was 2.70 (95% CI; 1.4, 5.1; p = .003). It was postulated that the effects of regular exercise on the cardiovascular system, specifically a decrease in platelet aggregation, could decrease formation of plaque, thus retarding development of arteriosclerosis and thrombosis.

Paffenbarger and Hyde (1993) studied a group of Harvard alumni (n = 10,269) from 1962-77. Lifestyle changes and their relevance to mortality from CVD were studied.

Paffenbarger concluded that beginning a moderate exercise program at a minimum of 4.5

metabolic equivalents (METS) could result in decreased incidence of death from CVD in middle-aged and older men. This enhancement of health could be magnified by 23% ($p = 0.015$) by additional lifestyle modifications such as smoking cessation. One limitation of the study recognized by Paffenbarger was the absence of sufficient data to evaluate dietary patterns in the respondents.

Sorenson and Smolander (2000) studied a cohort ($n = 103$) of police cadets who attended the Finnish Police Academy in 1981 and again in 1996, after 15 years as an officer. The purpose of the study was to observe changes in fitness levels and body composition as the officers aged. Not surprisingly, aerobic capacity and muscle endurance were found to be less than in 1981 in both the policemen and the Finnish men. Maximal oxygen consumption and muscle performance obtained in 1996 correlated most strongly ($p < .001$; $p, .01$) with the leisure-time physical activity assessed in 1981 (p.5). More than 53% of the officers had increased their leisure time physical activity in the 15-year period. Waist circumference had increased: 64% of LEOs had measurements >94 cm and 33% of those measured had >102 cm. While negative changes such as weight gain and reduced fitness levels were observed, Sorenson and Smolander concluded that it is important for officers to adopt a physically active lifestyle early on to enhance health as an older adult.

Young and Steinhardt (1993) studied 415 officers, and found that physical activity must reach the threshold of “physical fitness” to demonstrate a positive effect on the reduction of cardiovascular risk for officers. Young and Steinhardt found “a stronger relationship between fitness and coronary risk factors than between leisure time physical activity and risk factors” (p. 377). Physical activity was self-reported and physical fitness

was assessed via treadmill testing. Higher levels of physical activity were associated with higher treadmill times, and a significant correlation was found between physical activity and fitness levels ($r = .59$ ($p < 0.001$)). Higher levels of fitness and activity also were associated with decreased coronary artery disease risk factor scores. The researchers maintained that activity must reach a fitness level to impact risk and that, because fitness can be measured more accurately than can physical leisure activity, fitness should be the measure of choice when assessing officer capability.

Smoking, hypertension, and blood lipids

Acute situational disturbances and life-style risks can be associated with increased morbidity from CVD. According to Dorian and Taylor (1984), these situations also result from increased use of food, alcohol, cigarettes, and caffeine, as well as decreased physical activity. Many of the aforementioned studies have alluded to the fact that the concomitant presence of other risk factors, such as decreased physical activity, smoking, and increased blood lipids and/or hypertension, exacerbate the incidence and severity of CVD.

Pollock and Getteman (1978) studied 213 male officers 21-52 years of age. Pollock found that 46% of the officers smoked cigarettes, and the values for blood lipids, body fat, and smoking were all considered higher than average for males of the same age interval in the general population. Of the 213 officers studied, 88% had at least one CVD risk factor.

Ely and Mostardi (1986) studied behavioral and physiologic risk factors that could lead to CVD in LEOs. The population studied was a group of 331 officers from the Akron, OH, City Police Department. The control group was a cohort of 48 men who were employed

in clerical positions within the city. Physiologic results included increased systolic (SBP) and diastolic blood pressure (DBP) ($p = 0.01$) in the individuals tested; 21-35% of officers had a DBP >95mm Hg, compared to 12-13% of males in the general population. During the second and third decades, the officers' body weight accounted for 7-18% of the SBP changes ($p = .008$).

Ekelund et al.'s (1988) study, involving 4,276 male clients ages 30-60 years from the Lipid Research Centers, found that the highest fitness levels were associated with the lowest low density lipoprotein levels (LDL). Ekelund et al. concluded that the risk of CVD could be reduced by physical activity, and that this reduction was independent of the effects of other cardiac risk factors such as hypertension, obesity, and smoking.

Paffenbarger and Hyde (1993) found that cigarette smoking and hypertension doubled the risk of death from CVD ($p < 0.001$). Individuals who were overweight had a 55% increased risk of death from CVD (95% CI, 5, 128). The risk was higher for men whose weight exceeded a body mass index of 26. Officers who stopped smoking added 1.46 years to their life span. This figure increased to 2.49 years if moderate physical activity was included in life-style change. Cessation of smoking decreased their risk of death from CVD by 49% ($p < 0.001$). Individuals who normalized their blood pressure decreased mortality resulting from CVD by 44% ($p = 0.052$).

Franke and Anderson (1994) found that 3% of exercising officers smoked more than one pack of cigarettes per week, while 13% of non-exercising officers smoked the equivalent. Additional findings included the fact that 80% of both these groups had blood lipid levels >200 mg/dL. Exercise had the effect of reducing the total cholesterol to high-density

lipoprotein ratio (TC/HDL), and 7% of exercisers had a ratio >7.0, while 59% of non-exercisers exhibited ratios >7.0. Approximately 10% of the exercisers had increased blood pressure recorded while undergoing the treadmill test, whereas the figure was 12% for non-exercisers. Decreased smoking improved the TC/HDL ratio. Franke et al. (1997) concluded that, in the presence of cardiovascular risk factors including hypertension, smoking, and increased blood lipids, the actual risk for development of CVD found among LEOs is similar to that in the general public.

Franke, Collins, and Hinz (1998) found that smoking, weight, and inactivity were not better predictors of CVD among LEOs than for the general population. This finding is contrary to the findings of Williams and Petrallis (1987) that "in combination, smoking, or hypertension and sedentary life style resulted in the highest relative risk of premature death" (p. 559) from CVD. Williams and Petrallis also found that LEOs had increased concentrations of blood lipids, were smokers, and were overweight, with the risk from these factors increasing proportionately with increased age.

Richmond et al. (1998) studied 956 police officers in Sydney, Australia. While the focus of the study was primarily alcohol consumption, other risk factors were assessed. Older officers >40 years were more likely to consider themselves overweight ($p < .001$). Of the total number of male officers surveyed, 27% smoked, and of this percentage 67% smoked 1-19 cigarettes per day while only 8% of the male officers surveyed self-reported not smoking cigarettes. Richmond noted that the percentage of LEOs found to be smokers was higher in this study than in previous reports, and also higher than the rate in the general population. Richmond commended the efforts of Australia to ban smoking in the workplace

and emphasized the need for other such efforts to perpetuate a reduction in the rate of smoking.

Richmond and Kehoe (1999), utilizing two divisions of the South Wales Police Service, employed a pre-intervention survey of risk factors such as smoking and alcohol consumption with a brief health promotion intervention followed by a post-test survey eight months later. In the experimental group of LEOs, 25.4% of males reported tobacco use initially, yet after eight months and a brief educational intervention, the figure was reduced to 20.2% reporting that they used cigarettes. The control group reflected that, initially, 28.6% of officers smoked, whereas at the end of eight months without intervention, 26.5% self-reported smoking. These percentages were still above those found in the general population, according to Richmond and Kehoe.

Summary

Information provided in the literature on the incidence of CVD among LEOs is conflicting. While it appears that the risk for LEOs is at least equivalent to that for the general population, definitive evidence that the incidence of CVD increases in the profession of law enforcement is lacking and it is not clear whether employment as a LEO is a factor in the development of CVD. Stress perpetuated by job environment (including shift work) and situations encountered may increase hormone secretion and the incidence of hypertension. Coping mechanisms, such as smoking and alcohol use, appear to be used more frequently among LEOs than in the general population, and there may be a connection between lifestyle behaviors such as decreased physical activity and incidence of risk factors. Additional

research needs to be done to clarify the relationship between employment as a LEO, the increased presence of risk factors, and CVD. Data on chronic disease or mortality are not as valuable as the data on trends and prevalence, defined as the total number of existing cases at any given time. Trends and prevalence data associated with today's risk factors, rather than mortality data, provide more reliable indication of chronic disease for morbidity prevention and intervention. Therefore, surveillance systems to monitor risk factors are necessary (Green & Marshall, 1991).

CHAPTER 3. METHODOLOGY

Population of the Study

The sample was comprised of sworn male LEOs from nine Midwestern states (n = 4,627) who were currently employed by their respective Department of Public Safety (DPS). The nine states (Iowa, Minnesota, Nebraska, Michigan, North Dakota, South Dakota, Missouri, Ohio, and Oklahoma) were selected based on: (1) close geographical proximity; (2) recent use of the CVD and exercise modules in the Behavioral Risk Factors Surveillance System (BRFSS); and (3) willingness to participate in the study.

Administrators of the DPS in each state were contacted for written permission to survey the officers. Some states requested that the surveys be mailed in bulk to the Human Resource Division for direct distribution to officers at their respective posts within each state, whereas other states preferred direct mailings to the LEOs and facilitated this by provision of address mailing information. A cover letter was attached to each survey, reinforcing the voluntary participation in the study (Appendix A). Consent of respondents to participate was implied by returning the survey in a prepaid return envelope. Human subjects approval was received from the Institutional Review Board (IRB) at Iowa State University (Appendix A).

The control group consisted of 9,647 respondents in the general public who answered the 1999 BRFSS questionnaire in the same states as the LEOs. Respondents in the control group were limited by gender and income. Data analysis involved only males with an income greater than \$15,000 annually, improving the comparability of the LEO and BRFSS populations. The BRFSS sample size varied from state to state but included numbers of

observations as follows: OK = 737, IA = 1,192, OH = 523, MI = 859, MN = 2,207, MO = 1,291, NE = 850, SD = 1,296, and ND = 692. The number of cases and the response rates by state for the LEO groups are found in Appendix C.

Experimental Design

This quantitative study consisted of two parts. First, sworn officers of the aforementioned Departments of Public Safety (DPS) (n = 4,627) in the nine Midwestern states were requested to complete a questionnaire evaluating the presence of CVD risk factors (Appendix B). The survey contained questions about tobacco smoke exposure, increased cholesterol levels, hypertension, physical activity, obesity, and diabetes. Questions addressing LEOs' perception of stress, measuring the degree to which environmental demands exceed abilities to cope, were included on the survey (Cohen, 1983; Cohen & Williamson, 1988, p. 37).

Second, the results of the survey were compared with data obtained from the general public via the BRFSS administered in all of the United States. Comparison data specifically related to risk factors or health risk behaviors were obtained from the state BRFSS coordinators in the states in which LEOs were surveyed and from the data available on CD ROM from the Centers for Disease Control and Prevention (CDC).

The BRFSS was developed in 1984, to provide a way to track CVD risk factors on a state-by-state basis. Questions for the BRFSS were developed by a group of state coordinators and personnel from the CDC. The BRFSS Survey is comprised of three parts: (1) 15 sections of categorized core questions; (2) optional modules containing questions; and

(3) state-added questions. The reliability and validity of these questions have been established, as they are used nationwide on the BRFSS (Bowlin et al., 1993; Remington et al., 1988; Stein et al., 1993).

The questionnaire has been used extensively and several studies have examined empirically the reproducibility of the BRFSS. Stein et al. (1993) found that the BRFSS has coverage bias; that is, not all possible respondents have telephones. Homes with telephones have been shown to have fewer health risks than households without telephones (Wolf, 1979, as cited in Anda et al., 1989). Bowlin et al. (1993) studied the reliability of cardiovascular risk factor questions on the BRFSS. These include tobacco use (0.92), diabetes (0.79), cholesterol (0.74), hypertension (0.79), and obesity (0.97) (Bowlin et al., 1993; Stein et al., 1993). Bowlin and colleagues (1993) suggested that blood pressure, height, weight, tobacco use, and cholesterol are best measured physiologically to minimize misclassification and to facilitate the best prediction for community prevalence estimates. Bowlin et al. concluded that, with the exception of hypertension control (0.44), the reliability of most risk factors was fair to excellent. Validity was found to be lowest for self-reported hypertension and cholesterol, which was attributed to the chosen cut-off points of 140/90 mm/Hg and 200 mg/dl (with the physician perhaps using higher values for diagnosis). Stein et al. (1993) found that the value of Cohen's kappa exceeded 0.50 for all variables on the BRFSS with the exception of chronic alcohol consumption ($k = .31$) and driving after alcohol consumption ($k = .30$).

BRFSS data are collected via a telephone-administered questionnaire in every state. States can choose the modules they include in their questionnaire as well as specific

questions asked. There are 17 optional modules. It is at the discretion of individual states which modules and module questions to include on the survey. Some states rotate the modules included, whereas others may eliminate certain modules due to length or select specific questions from the modules. The results are used differently in each state but they provide evidence for state- and county-level public health programs as well as disease prevalence estimates.

A pilot study was conducted with 432 LEOs employed by the Iowa Department of Public Safety. The CVD survey was distributed to the officers when they attended Iowa State University for their annual physical examination. Results of the pilot study are reported in Table 2. The incidence of CVD was low (1.6%), and therefore a decision was made based on the pilot study to shift the focus of analysis from the incidence of CVD to the strength of

Table 2. Comparison of cardiovascular disease risk factors by Iowa LEOs and the general population

Risk factor	Response			
	2000 Iowa LEO (n = 432)		1999 BRFSS gen. pop. (n = 1,195)	
	No. (total)	Percent	No. (total)	Percent
Hypertension	91 (421)	21.6	280 (1190)	23.5
Hypercholesterolemia	173 (420)	41.3	275 (862)	31.9
Diabetes	7 (429)	1.6	75 (1194)	6.3
Tobacco Use	28 (120)	6.5	6 (374)	1.6
BMI				
Overweight (25-29.9)	200 (404)	49.5	506 (1191)	42.4
Obese (>30.0)	137 (404)	33.9	334 (1191)	28.1
CVD	7 (429)	1.6	118 (1177)	5.9
No Physical Activity	58 (427)	13.6	348 (1361)*	25.6*

*Indicates 1997 data.

Note: Numbers in parentheses indicate total responses for that individual item.

the relationship between stress and ensuing consequences such as the increased presence of risk factors for CVD. While it appeared that the Iowa LEO group was coping adequately as measured by the PSS (see Appendix C), the prevalence of CVD risk factors remained elevated when compared to the general population. According to Cohen et al. (1983), while the PSS might identify risk for disease, coping does not discount physical symptomatology.

Statistical Analysis

Multiple logistic regressions were used to demonstrate any existing relationships between the presence of risk factors and occupation as an LEO over time while controlling for age. Logistic regression was used in the presence of dichotomous variables, such as CVD, which is measured in either of two mutually exclusive categories: self-reported as “yes” or “no.” Statistical significance was defined by a *p* value not exceeding 0.05. All variables on the BRFSS were recoded to treat “don’t know” or “refused” responses as missing data.

A two-way contingency table analysis was conducted to correlate specific risk factor presence with prominence of CVD morbidity. R-squared and R-squared change were used to analyze the effects of different combinations of predictor variables. Simple percentages of disease incidence and risk factor prevalence were calculated using cross-tabulation and were reported using the BRFSS and LEO data.

Independent variables tested included: (1) obesity, defined as body mass index (BMI) >27; (2) hypertension; (3) diabetes; (4) increased cholesterol (self-reported), measured as a categorical variable; (5) employment as a LEO; (6) physical activity; (7) stress; and (8)

smoking, defined as number of cigarettes smoked daily (continuous). Responses to the stress questions asked on the survey were grouped and compared to the ensuing correlation with CVD incidence. The odds ratio (risk ratio) was calculated with a 95% confidence interval for the incidence of CVD among the LEO respondents, compared to the incidence in the general population as reported in the BRFSS. The dependent variable employed was defined as self-reported history of CVD.

Limitations

Disease associated with CVD is considered job-related in many states. Therefore, officers who develop morbidity from CVD are likely to be removed from the work force and placed on disability. This limits the number of officers who completed the survey to those who were working and may not have CVD.

Only a small percentage of the states' populations answers some questions on the BRFSS. This may underestimate the prevalence of some morbidity variables in the general population. In addition, only residents with telephones can participate in the BRFSS. The Third National Health and Nutrition Examination Survey found that people without telephones are more likely to be obese and have diabetes (Harris & Flegal, 1998). Therefore, some BRFSS comparison results may be underreported.

With the exclusion of ineligible BRFSS subjects, including all females and those with incomes less than \$15,000 regardless of gender, the number of responses to some variables measured in the survey was small. Small sample sizes can increase the standard error.

Questions, for example, that ask for amounts of alcohol consumed do not specify an amount for “a drink,” and this may underestimate alcohol consumption. Because the sample is limited to males and by income, the results do not reflect patterns that might be observed in the general public. Responses to the BRFSS are self-reported. BMI presents particular problems of inaccurate reporting. People generally will underestimate their weight and overestimate their height (personal communication, Jessica Davila , Iowa BRFSS Coordinator, October, 1, 2000). Height and weight were used to calculate BMI; thus BMI may be underestimated.

Conditions such as lowering cholesterol may not reflect an improvement attributable to healthy behavior, but rather the widespread use of cholesterol-lowering drugs that are prescribed currently. Assumptions often cannot be verified easily about why a variable increases or decreases. Physicians use different thresholds to classify individuals as hypercholesterolemic. Sometimes a slightly higher cholesterol level is tolerated in older adults. Therefore, when asked, “Have you ever been told you have high cholesterol?” some respondents may not self-report “yes” as the answer. This may result in under-reporting of increased blood lipid levels.

Diabetes classification is based on a blood glucose level. The parameters for the diagnosis of diabetes changed in 1995. The threshold has been reduced from a blood glucose level of 140 mg/dl to 126 mg/dl (6.7 mmol/l). According to the American Diabetes Association (ADA), this change occurred because researchers and a panel of experts agreed that, at the 126 mg/dl threshold, serious metabolic abnormalities may exist that result in

complications. The new parameter allows for earlier diagnosis and possible intervention; however, this may account for some of the increase in self-reported diabetes.

The survey was self-reported, and may not reflect an accurate portrayal of risk factors or disease incidence. This study involves males employed in the profession of law enforcement residing in nine Midwestern states. Job responsibilities differ among LEOs and are affected by the geographic location of the law enforcement agencies. Results may not be applicable to the entire population.

Conclusion

Increased prevalence of risk factors and disease is a concern because it diminishes the quality of life experienced by individuals, is costly to the general population, and may result in decreased mortality for certain cohorts of people. Study of the risk factors present in these individuals may result in increased and earlier risk factor awareness and detection, to facilitate primary intervention before disease onset. Currently, research appears to support the premise that LEOs may be at increased risk for CVD. Clearly, the presence of risk factors among these officers needs further investigation. Further study is necessary with larger data sets to replicate and build upon earlier research. If larger numbers of LEOs are studied the results may be generalizable to larger groups. The effects of mandatory health and wellness screenings and physical maintenance programs for LEOs should be studied (Superko & Bemauer 1988; Wood et al., 1982). Other recommendations include promotion of healthy lifestyles to diminish the incidence of mortality from CVD in occupations experiencing high occupational stress (Calvert et al., 1999).

**CHAPTER 4. RELATIONSHIP BETWEEN CARDIOVASCULAR DISEASE
MORBIDITY, RISK FACTORS, AND STRESS IN A LAW ENFORCEMENT
COHORT**

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Abstract

It remains uncertain whether law enforcement officers (LEOs) have an increased incidence of cardiovascular disease (CVD), and, if so, the extent to which stress affects this relationship. To address this issue, the self-reported incidence of CVD and CVD risk factors among 2,818 currently employed male LEOs was compared to 9,650 male respondents. Perceived stress among the LEOs also was determined. The percentage for CVD incidence was lower in the LEO group than among the general population [2.3 (SD = .15) vs. 5.6 (SD = .23); $p = .001$]. The best predictor variables for CVD in the combined group were: physical inactivity ($p = .015$), hypertension ($p = .001$), and hypercholesterolemia ($p = .001$). In the LEO group, the best predictor variables for CVD were: perceived stress ($p = .032$), time in the profession ($p = .001$), and hypertension ($p = .001$). The prevalence of hypercholesterolemia (33.2 percent), weight (82.6 percent; BMI > 25.0), and tobacco use (10.1 percent) in the LEO group exceeded those found in the general population. Stress was significantly associated with CVD ($p = .008$). Three CVD risk factors were significantly affected by stress: cholesterol ($p = .001$), hypertension ($p = .001$), and physical activity ($p = .001$). Perceived stress was affected by duration of time in the profession ($p = .004$) after

adjusting for age ($p = .353$). These results suggest that stress may contribute to CVD among LEOs through potentiating several CVD risk factors.

Background

Few researchers have studied cardiovascular disease (CVD) morbidity in the law enforcement cohort (1, 2). Sparrow (2) found that morbidity among law enforcement officers (LEOs) is similar to that in the general population. Franke (1) suggested that employment as a LEO is associated with increased CVD morbidity and that the relationship persists after considering conventional risk factors.

Some researchers have indicated that LEOs have an increased incidence of mortality from CVD when compared to the general public (3-7). However, other researchers have suggested that the risk for CVD among LEOs is similar to that found in comparison groups (2, 8-10, 11). Few researchers have studied CVD *per se* in the law enforcement cohort (1, 2). In studying active LEOs, Sparrow (2) found that morbidity among LEOs is similar to that in the general population. Franke (1) suggested that employment as a LEO is associated with increased CVD morbidity among retired LEOs and that the relationship persists after considering conventional risk factors.

A heightened presence of CVD risk factors may account for this increased incidence of CVD in the law enforcement community (12-27). Unique aspects of this profession may also contribute to the increased risk. The association of stress with the profession of law enforcement has been studied previously (4, 12-13, 16, 20, 29, 30). In one study, LEOs had higher stress levels than did workers in other cohorts (13). Chronic stress related to shift work and life events has also been reported (13, 31). Other sources of job-related stress

within the profession include job demands, excessive and unnecessary amounts of paper work, lack of input into decision-making, and communication issues within the law enforcement organization (32). Hills (33) studied 234 highway patrol officers and determined that perceived stress was an important and significant predictor of stress-induced consequences.

Increased stress levels among officers may be a factor in the development of risk factors for CVD and CVD mortality; however, little research has been conducted addressing the effects of stress on CVD morbidity or risk factors in the LEO population. Previous research evaluating this relationship typically employed small sample sizes and was less systematic than desirable. The present study addressed these issues by comparing the incidence of CVD and risk factors among a large group of LEOs in nine Midwestern states with a larger sample in the general population in the same states and how they related to perceived stress in this LEO group. The purpose of this study was to examine the relationship between CVD morbidity, risk factors, and the perception of stress among male LEOs compared to men in the general population.

The main objectives of the study were to: (1) compare the incidence of CVD and risk factors in the LEO group with that found in the general population; (2) assess the relationship between stress, risk factors, and the incidence of cardiovascular disease among LEOs; and (3) examine the relationship between CVD risk factors and duration of employment in the profession of law enforcement while adjusting for age.

Materials and Methods

Study design

The experimental design of this study consisted of two parts. First, sworn officers completed a questionnaire evaluating the presence of CVD risk factors. The survey included questions about tobacco smoke exposure, increased cholesterol levels, hypertension, physical activity, obesity, and diabetes. The questions closely resembled those asked on the Behavioral Risk Factor Surveillance System (BRFSS) questionnaire. Officers also completed the Perceived Stress Scale (PSS) which measured LEOs' perception of stress by quantifying the degree to which environmental demands exceeded abilities to cope (34).

Second, the results of the LEO survey were compared with data obtained from the general public via the BRFSS administered in the respective states in 1999. Comparison data specifically related to risk factors or health risk behaviors were obtained from the state BRFSS coordinators in the states in which LEOs were surveyed and from the data available on CD ROM from the Centers for Disease Control and Prevention.

Subjects

Potential subjects were the 4,627 sworn male LEOs currently employed by their respective Departments of Public Safety (DPS) in nine states (Iowa, Minnesota, Nebraska, Michigan, North Dakota, South Dakota, Missouri, Ohio, and Oklahoma). The control group consisted of 9,650 respondents from the general public who answered the 1999 BRFSS questionnaire in the same states as the available LEOs. Respondents in the control group were limited by gender and income. Data analysis involved only males with an income

generally similar to DPS officers. Four of the nine states ($n = 3,147$) included questions related to CVD incidence on the 1999 BRFSS.

Subjects were considered to have provided informed consent by completing the written survey. The study was approved by the respective state DPSs and was conducted in accordance with the ethical standards for research involving human subjects of the Institutional Review Board at Iowa State University.

Statistical analysis

Initial screening of the data was conducted for missing values and outliers. Outliers were treated as missing data. All variables on the BRFSS and LEO surveys were recoded to treat “don’t know” or “refused” responses as missing data. LEO data from the nine states were weighted to adjust for the differences in response rates across states. The weight for each state was calculated with reference to the combined LEO response rate across all nine states, with this value (0.609034) divided by the response rate in each state. Thus, states in which LEO response rates were below average had weights greater than one, to bring their representation in the sample to that state’s proportional share of all LEOs for the nine states.

Simple percentages were cross tabulated to compare the incidence of risk factors in the LEO cohort with that found in the general population. Multicollinearity was evaluated by examining the correlation matrix for evidence of high correlations among predictor variables.

Respondents who self-reported a history of angina, myocardial infarction, or stroke were categorized as having CVD. Categorical independent variables included hypertension, cholesterol, diabetes, physical activity, tobacco use and body mass index (BMI, $>25 \text{ kg/m}^2$). Self-reported answers of *no* were coded as “0” while *yes* answers were coded as “1”. Years

of experience as a LEO and perception of stress were treated as continuous independent variables.

Stress scale data were available only on the LEOs and perceived stress was determined according to methods described by Cohen (34). The effect of perceived stress on the risk factors and CVD incidence was estimated in a one-way repeated measures analysis of variance (ANOVA). The eta-squared value (η^2) was read as the -2 Log Likelihood value associated with the predictor variable(s). The within subjects variables were: CVD, diabetes, cholesterol, hypertension, physical activity, and BMI; total score on the PSS was entered as a covariate.

Logistic regression was used to generate the best subset regression model to predict membership in the group with CVD and the group without CVD. Initially, full model logistic regression was used to predict group membership for classification with seven independent variables. Stepwise selection (backward elimination) methodology also were employed subsequently to select the model with the best ability to predict CVD group membership.

The effects of duration of time in the profession on CVD and CVD risk factors, while adjusting for age, were estimated using a repeated measures ANOVA. The within subjects variables were: CVD, diabetes, cholesterol, hypertension, physical activity, stress, and BMI; and age and duration of time in the profession (LEO) were entered as covariates. The Statistical Package for the Social Sciences (SPSS) was employed as the general use computer program. The results are expressed as mean (SD); statistical significance was set at $p < 0.05$.

Results

Results of the study were based on the 2,818 of 4,627 (61 percent) LEOs who returned surveys and 9,650 respondents to the respective states' 1999 BRFSS survey. Respondents employed by the DPSs included officers from the areas of criminal investigation ($n = 230$), Fire Marshall's office ($n = 9$), narcotics enforcement ($n = 33$), the state highway patrol ($n = 2,470$), and 57 LEOs from other entities within the DPS. Respondents ranged in age from 21 to 65 years, with a mean age of 37.3 ($SD = 8.7$). The mean years of employment in law enforcement was 13.7 years ($SD = 8.5$), with a range of 1-40 years of employment. Risk factors and CVD incidence between the LEO group and the general population are reported in Table 1. The LEOs had a lower percentage incidence of CVD than did the general population [2.3 ($SD = .15$) vs. 5.6 ($SD = .23$); $p = .001$]. The LEOs were younger [37.3 ($SD = 8.7$) vs. 45.3 ($SD = 16.2$); $p < .001$] and had a greater prevalence of hypercholesterolemia, increased body mass index, and tobacco use compared to the general population.

Using logistic regression while controlling for risk factors, it was found that the profession of law enforcement was a significant (measured by $p = .001$ for Group) predictor for CVD in the combined analysis of LEOs and the general population. However, the low incidence of CVD makes it difficult to predict with a high degree of certainty who will have CVD, but who will not have CVD can be predicted much more accurately owing to the much greater frequency in the data of non-CVD outcomes. "Group membership" is one component of that prediction equation. Results are reported in Table 2. The best model for prediction of CVD identified physical activity ($p = .015$), hypertension ($p = .001$), and cholesterol ($p = .001$) as the best contributors to CVD for the combined LEO and general population analysis.

Table 1. Percent incidence (number in each group) of self-reported CVD and risk factors for LEOs and the general population, with significance levels from t-tests for equal group means

Risk factor	Response				
	Nine States LEO (<i>n</i> = 2,818)		1999 BRFSS gen. pop. (<i>n</i> = 9,650)		Sig. level
	No. (total)	Percent	No. (total)	Percent	
Hypertension	594 (2,773)	21.4	2,183 (9,609)	22.7	.149
Hypercholesterolemia	899 (2,711)	33.2	1,963 (6,552)	30.0	.002*
Diabetes	41 (2,801)	1.5	522 (9,642)	5.4	.001*
Tobacco Use	219 (2,168)	10.1	56 (2,556)	2.2	.001*
BMI > 25.0	2,281 (2,761)	82.6	6,721 (9,611)	74.7	.001*
Cardiovascular Disease	64 (2,799)	2.3	174 (3,108)	5.6	.001*
No Physical Activity	295 (2,784)	10.6	815 (2,935)	27.8	.001*

Notes: Numbers in parentheses indicate total responses for that individual item.

**p* = 0.05 level of significance

Table 2. Logistic regression coefficients for risk factors by combined LEO and general population (*n* = 3,472)

Risk factor	B	Wald	df	<i>p</i>	Odds ratio	95.0% C.I.
Group	1.385	42.337	1	<.001	3.994	2.632, 6.061*
Phys Activity	.521	5.883	1	.015	1.684	1.105, 2.566*
Hypertension	-.941	21.599	1	<.001	.390	.262, .581*
Cholesterol	-.837	17.335	1	<.001	.433	.292, .642*
BMI	-.297	1.647	1	.199	1.346	.855, 2.117
Diabetes	.482	2.011	1	.156	.618	.317, 1.202
Constant	-2.579	48.659	1	<.001	.076	

**p* = 0.05 level of significance

When the regression was repeated, removing group as a variable, diabetes ($p = .004$) and BMI ($p = .016$) became significant contributors to CVD in the combined analysis of LEOs and the general population. A separate regression model, generated using only the LEO cohort and including all variables, showed that the best contributors were duration of time in the profession ($p = .003$) and hypertension ($p = .001$). Results of that LEO-only model are reported in Table 3. While the significance value for the stress variable was borderline in the full model, subsequent regression models, using forward stepwise selection and backward elimination showed stress ($p = .032$) was a significant contributor to CVD. Results are reported in Table 4.

Table 3. Full model logistic regression coefficients for risk factors by LEOs ($n = 2,572$)

Risk factor	B	Wald	df	p	Odds ratio	95.0% C.I.
Stress	.039	3.572	1	.059	1.040	.999, 1.084
Time as LEO	.060	9.067	1	.003	1.061	1.021, 1.103*
Hypertension	-1.021	10.319	1	.001	.360	.193, .672*
Diabetes	-1.126	2.951	1	.086	.324	.090, 1.172
Cholesterol	-.291	.823	1	.364	.748	.399, 1.401
BMI	-.291	.293	1	.588	.748	.261, 2.142
Phys Activity	.315	.594	1	.441	1.370	.615, 3.049
Constant	-3.903	17.450	1	.000	.020	

* $p = 0.05$ level of significance.

For continuous predictors (time in the profession and stress), the odds ratio represents the increase (or decrease if the OR is less than 1) in odds of having or not having CVD when the predictor variable increases by 1. For the categorical predictors (hypertension, diabetes, cholesterol, and BMI), the odds ratio measures the increase (or decrease if the OR is less

Table 4. Stepwise selection (backward elimination) logistic regression coefficients for risk factors by LEOs ($n = 2,572$)

Risk factor	B	Wald	df	<i>p</i>	Odds ratio	95.0% C.I.
Stress	.044	4.589	1	.032	1.045	1.004, 1.088*
Time as LEO	.068	12.661	1	.001	1.070	1.031, 1.110*
Hypertension	-1.097	12.196	1	.001	.334	.180, .618*
Constant	-11.251	6.305	1	.012	.000	

* $p = 0.05$ level of significance.

than 1) in the odds of having or not having CVD for different categories of that predictor variable. While the OR is useful for interpretation of model effects, due to the low incidence of CVD in the LEO group the Wald chi-square statistic may be a better indicator of the most significant risk factors contributing to CVD. The Wald chi-square functions as a partial F-test, to ascertain which model components make statistically significant contributions to explaining variation in CVD. In the LEO group (Table 4) the Wald statistics indicated that stress, time as a LEO, and hypertension significantly contributed to CVD. However, the ORs for these variables indicated little change in the likelihood of CVD development.

The cross-tabulated odds ratio (OR) and 95 percent confidence interval (CI) for CVD risk associated with the profession were .395 (95 percent CI = .295, .528). Cross-tabulated comparative risk in the combined general population and among LEOs results for OR and 95 percent CI estimates of the OR are reported in Table 5.

In assessing the relationship among stress, CVD, and CVD risk factors in the LEO group, CVD was directly associated with stress ($\eta^2 = .003$; $p = .008$). Several CVD risk factors were affected significantly by stress: cholesterol ($\eta^2 = .007$; $p = .001$), hypertension

Table 5. Odds ratios and 95 percent confidence intervals for independent contributors to self-reported CVD

Risk factor	Odds ratio	95% confidence interval
Tobacco Use	5.016	3.718, 6.767*
BMI >25.0	2.043	1.835, 2.276*
Cholesterol	1.160	1.054, 1.277*
Hypertension	.927	.837, 1.027
Diabetes	.260	.188, .358*
LEO Profession	.395	.295, .528*
Physical Activity	3.244	2.805, 3.751*

*Significant ($p < .05$)

($\eta^2 = .006$; $p = .001$), and physical activity ($\eta^2 = .014$; $p = .001$). Multivariate tests from the model indicated an overall significant effect of stress on the combination of the seven CVD variables.

When testing whether CVD and CVD risk factors are affected by duration of time in the profession of law enforcement, while adjusting for age, it was found that CVD was affected by age only ($p = .022$). However, stress was affected by duration of time on the job ($p = .004$). Cholesterol, hypertension, and diabetes were affected by both age and time in the profession of law enforcement. Weight (BMI) and physical activity were affected by age only. Tobacco use was not affected by age or time in the profession.

Initially, tobacco use was entered as an independent variable in all the logistic regression models. No significant association was found among tobacco use, stress, and CVD. Moreover, inclusion of the tobacco use variable in the regression models significantly increased the number of missing cases due to low response to the tobacco question both in the general population and in the LEO group. Therefore, the tobacco use variable

subsequently was omitted in the regression models after initial evaluation of its contribution to explaining variance.

Discussion

The purpose of this study was to examine the relationship among CVD morbidity, risk factors, and the perception of stress among male LEOs compared to men in the general population. This study was considered worthwhile because CVD morbidity may be a more useful endpoint than mortality and because the unique characteristics of law enforcement may increase a LEO's risk for CVD, exclusive of conventional risk factors. We hypothesized that perceived stress might be a factor in the increased incidence of CVD risk in the LEO group.

The main findings of this study included: (a) a lower incidence of CVD among LEOs than that found in the general male population; (b) higher incidence of hypercholesterolemia, weight, and tobacco use among LEOs compared to the general male population; (c) a direct association between greater stress and increased incidence of CVD, as well as increased levels of some CVD risk factors; and (d) duration of time in the profession contributed to perceived stress levels but not to CVD.

The law enforcement profession *per se* appeared to be unassociated with CVD morbidity in the combined analysis of employed LEOs and the general adult male population. A caveat to this statement is that the low incidence of CVD in the two groups precludes predicting who will have CVD; we can predict who will not have CVD and recognize that group membership is one component of the prediction equation. Members employed in law enforcement were one-fourth less likely to develop CVD than were

members of the general male population. However, it was an expected finding that the incidence of CVD would be lower in the LEO cohort than in the general population. Diagnosed CVD is considered to be job-related in many states by the respective DPSs. Therefore, officers who develop morbidity from CVD are likely to have been removed from the work force and placed on medical disability. This “healthy worker effect” (35) limited the number of officers who completed the survey to those who were working and thus may not have CVD. In this context, one could argue that the incidence of CVD in the LEO group actually was higher than expected.

These findings support the conclusion of Sparrow (2), who, when comparing CVD mortality and morbidity among 220 LEOs and 1,428 non-policemen, concluded that the risk for CVD in law enforcement was not significantly different from that found in the general population (OR = 1.4). However, this finding of diminished risk in the LEO group is contrary to the findings of Franke (1), who suggested that employment as a LEO is associated with increased CVD morbidity and that the relationship persists after considering conventional risk factors. An important difference between these studies was the age range of the officers studied. Franke’s (1) study included retirees while the cohorts of the present study and Sparrow’s were active, younger officers (2). Moreover, the current study employed a much larger sample size than that used in the other studies. The LEO respondents in this study were younger [37.3 (SD = 8.72) years] compared to Franke’s (1) study group [65.5 (SD = 7.1) years] and Sparrow’s (2) cohort (1983) [40.7 (SD = 8.1) years].

Several well-recognized risk factors were associated with the rate of CVD incidence that was observed in the present combined analysis of LEOs and the general population.

Other researchers have indicated similarly that an increased presence of CVD risk factors may account for an increased incidence of CVD in the law enforcement profession (12-27).

In the LEO group, stress appeared to be associated with CVD both directly and indirectly. Stress can affect CVD in two ways: (1) directly by influencing the incidence of CVD; and (2) indirectly by exacerbating risk factors that contribute to the development of CVD. It appears that several risk factors (cholesterol, hypertension, and physical activity) are affected when a LEO perceives a greater level of stress compared to others in the cohort. This finding is congruent with that of Dorian and Taylor (36), who suggested, "vulnerability to job stress is affected by the perception of the work environment" (p. 753). Other researchers have recognized that stress may be related to shift work as well as to the environment surrounding and within the profession of law enforcement (4, 13, 16, 20). According to Tennant (37) work stress has clear implications for the health and welfare of employees and may be a significant influence on the incidence of CVD.

It is possible that employment in the profession of law enforcement may increase CVD incidence indirectly by perpetuating increases in conventional risk factors (e.g., lipids, blood pressure, and body fat) in a time-dependent manner (21, 25). In the present study, stress clearly was associated with several other risk factors. Increased stress may result in excessive ingestion of food, including foods with a higher fat content, increased use of tobacco products, and decreased participation in physical activity (11).

This premise is reinforced by the observed increase in prevalence of hypercholesterolemia, increased body mass, and tobacco use among LEOs when compared with the general adult male population. These risk factors can affect CVD directly, independent of their impact on other risk factors. Obesity can increase CVD risk indirectly

by potentiating hypertension, hypercholesterolemia, and diabetes (38). Tobacco use can contribute directly to hypertension and CVD.

Franke (1) noted that 89 (32 percent) of 232 LEOs surveyed believed that employment in law enforcement increased their risk for CVD; the most common risk factors identified by the LEOs as contributing to the risk were stress (81 percent) and poor eating habits (24 percent). According to Everson (39), the progression of atherosclerotic lesions appears to be associated with an exaggerated cardiovascular reactivity to stress and high job demands.

As demonstrated in this study, there is a statistically significant association among increased perceived levels of stress, CVD, and several risk factors among LEOs. While causality cannot be implied from these results, it does appear that cholesterol, hypertension, and physical inactivity are affected when a LEO perceives a greater level of stress. Tennant (37) suggested that work stress is associated with CVD risk factors, including hypercholesterolemia and hypertension, and may be a significant factor influencing CVD. Among susceptible LEOs, the stress associated with law enforcement may contribute to increased risk for CVD.

The range of total scores on the PSS was 2-52. The mean score for the LEOs in this cohort was 19.19 (SD = 7.26). This is low when compared to Cohen's (34) male community smoking cessation group, which had a mean total score of 24.0 ($n = 27$, SD = 7.80) and two groups of male college students with mean scores of 22.38 ($n = 121$, SD = 6.79) and 21.73 ($n = 60$, SD = 8.42) (34). However, because the cohorts employed in Cohen's (34) research using the PSS involved small sample sizes, it is unclear whether those results constitute

normative values or if the results obtained from this LEO cohort are more likely to establish a standard.

In the LEO group, while adjusting for age, this study showed that CVD was not associated with duration of time in the profession, but was associated with age only ($p = .022$). This finding is congruent with previous research showing that the risk for CVD as well as other chronic diseases increases significantly with age (11, 19, 21, 25, 40). The disassociation between duration of time in the profession and CVD may have occurred due to the low incidence of CVD in the LEO group.

The variables most closely associated with CVD in this comparison of LEOs and the general population were physical activity, hypertension, and cholesterol. Physical activity can increase CVD risk directly (18) and also may influence other risk factors indirectly. Physical activity is related inversely to obesity and is related directly to maintaining cholesterol levels among LEOs (14).

In the full model, the significance value for stress ($p = .059$) was borderline. However, using stepwise selection (backward elimination) methodology in the LEO group, stress, duration of time in the profession, and hypertension were linked most closely with CVD. Perceived stress was directly associated with CVD incidence in the LEO cohort. Stress also affected CVD incidence in the LEO group indirectly by its association with several risk factors (hypercholesterolemia, hypertension, and physical activity).

LEOs encounter sources of stress unique to their profession such as high-speed chases, and exposure to violence and ensuing consequences including risk of death. However, chronic exposure to other insidious forms of stress encountered within the profession likely contributes to an increase in perception of stress by the LEOs. These

sources of stress are often linked to the hierarchical command structure of most DPSs and the “bureaucracy” of law enforcement, such as excessive paperwork, lack of input into decision-making, and poor communication practices (32).

This is an important finding, not only considering the direct and indirect effects of stress on CVD but also because individuals with an impaired ability to cope with stress and life events may incur illness more often than their counterparts who cope more efficiently.

Based on these findings, law enforcement organizations should consider the impact of perceived stress on LEOs and encourage interventions to facilitate healthier behavior practices among LEOs. Health policies, such as prohibiting officers from eating in the patrol vehicles, should be reconsidered to encourage healthier and more regular eating patterns. Some policies already in place, such as no smoking in the vehicles, may help to perpetuate and reinforce healthy behavior employed by LEOs. Consideration of changes within the organizational structure, such as integration of transformational leadership and empowerment of officers to have a “voice” in decision-making, could decrease the stress perceived by some LEOs.

An important limitation of the present study is the low response rate to some questions on the BRFSS, and thus a large proportion of missing observations for key variables. This may lead to underestimates of the prevalence of some morbidity variables in the general population. In addition, only residents with telephones can participate in the BRFSS. The Third National Health and Nutrition Examination Survey found that people without telephones are more likely to be obese and to have diabetes (41). Therefore, some BRFSS comparison results may be underreported.

In conclusion, more than 95 percent of the LEOs surveyed considered their general health to be good to excellent. However, there is dissociation between this perception and reality, as the overall health of this cohort of LEOs was typified by increased cholesterol levels, excess weight, and tobacco use. Exacerbation of risk factors, perpetuated by stress (which increased with time spent in the profession), likely puts officers at increased risk for developing CVD. In susceptible LEOs the stress associated with law enforcement activities may contribute to an increased risk of CVD without greatly affecting the overall incidence for CVD. If the risk factors identified in the present study were exacerbated by increased stress, it would follow that providing officers with an improved ability to cope might affect the incidence of risk factors and the prevalence of CVD.

The small number of self-reported CVD cases in this study leads to the suggestion that future research should include surveying the retirees of the respective DPSs. The retiree cohort may contain officers who self-selected out of this study group as well as those who were forced to leave the LEO ranks for various reasons including health. In combination with the present LEO sample, this cohort may provide a more complete picture of the relationships between LEO traits and morbidity.

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**CHAPTER 5. APPLICATION OF THE PRECEDE-PROCEED PLANNING MODEL
FOR CARDIOVASCULAR DISEASE RISK REDUCTION EFFORTS AMONG LAW
ENFORCEMENT OFFICERS**

A paper to be submitted to Health Promotion Practice

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Abstract

Rates of coronary heart disease tend to vary across different occupations, but it is unclear if this is due to the nature of the profession or some form of self-selection. Regardless, efforts are needed to develop strategies to reduce risks of CHD among law enforcement officers. This study applied the Precede-Proceed community-based planning approach to chronic disease prevention using a target population of law enforcement officers (LEOs) employed by the Iowa State Patrol, a division of the Iowa Department of Public Safety (DPS). A qualitative (inductive) approach was used in an attempt to understand and explain the perception of health as embraced by the LEOs. Results indicate that organizational stress is clearly an issue within the DPS, and that the organizational environment appears to contribute to the stress perceived by the LEOs. Social and environmental intervention strategies are offered to improve the overall health of the LEOs and to decrease the incidence of chronic disease while considering the perception of health as embraced by the target population.

Background

The Precede-Proceed Community-based Planning approach was applied to chronic disease prevention using a target population of law enforcement officers (LEOs). Within this model, community is defined as a group or geographical area with common values and mutual concerns (Green & Kreuter, 1993), and the workplace is recognized as a determinant of health. The model was used in this study to identify relevant behavioral and environmental factors associated with cardiovascular disease (CVD). It is important to understand the application and utility of models such as Precede-Proceed so that a comprehensive assessment of the workplace can occur and subsequently the most pertinent intervention strategies might be identified. The goal of the program planning was to improve the overall health of the community of LEOs while considering the unique aspects of the participants.

Employment of a planning model such as Precede-Proceed is valuable for two reasons. First, during the past decade, health promotion efforts have shifted to the “ecological” (determinants) perspective which recognizes that distal determinants, including social conditions and policies, may affect disease by reinforcing or perpetuating risk for chronic disease. Second, interest in social-ecological approaches to chronic disease prevention has encouraged the use of planning models such as Precede-Proceed, to help determine effective targets for interventions.

Among the chronic diseases currently requiring attention is CVD. CVD is the leading cause of death in the United States and most developed countries. According to the American Heart Association (AHA, 2000), approximately 59,700,000 U.S. residents have one or more types of cardiovascular disease. Antecedents of CVD, called “risk factors,” are

perceived to predict the likelihood of developing the disease. Research has demonstrated that awareness and management of risk factors can enable Americans to intervene in the process of cardiovascular disease. The AHA defines risk factors as "...traits and lifestyle habits that increase the risk of disease" (AHA, 2000, p. 1). The major risk factors include smoking, high cholesterol, hypertension, and physical inactivity. The AHA recently added obesity as a primary risk.

Rates of cardiovascular disease (CVD) tend to vary across different occupations, but it is unclear if this is due to the nature of the profession or some form of self-selection. Research suggests that certain occupations are at increased risk for developing CVD. Among the occupations with the highest documented rates is that of law enforcement. Several studies have concluded the law enforcement profession, specifically sheriffs and police, to be among the occupations most at risk for mortality from ischemic heart disease (Calvert, 1999; Dubrow, Burnett, & Gute, 1988; Feurer & Rosenman, 1986; Franke, 1994; Sardinas, 1986; Sparrow, 1983; Stamford, 1978; Vena, 1986). It has been suggested that the association may be attributable to shift-work and occupational stressors (Franke et al., 1998). It is important to study different cohorts of people to ascertain what risk factors are present, and even more importantly, if attributes of the environment or worksite contribute to acquisition of the risk factors concomitant to disease development. The unique aspects of this profession may contribute to the increased risk. While these behaviors are certainly involved, the most distinguishing characteristic of the law enforcement profession is the high level of job-related stress.

Stress related to increased anxiety and anger has been reported in the law enforcement population in a number of studies (Boltwood, 1993; Ekland, 1988; Ely, 1986;

Kawachi, 1994; Russek, 1990; Sarason, 1979). Stressors such as job demands, noise, and disturbance of sleep pattern due to shift work have been implicated as major contributors to this occupational stress (Ekeland, 1988; Ely, 1986; Hill, 1991; Paffenbarger, 1993; Peters, 1983; Rohm, 1993; Stamford, 1978; Williams & Petrallis, 1987).

In addition to the physical and psychological sources of stress that come with the job (e.g., involvement in life-threatening situations and shift work), there are environmental sources of stress that come from the administrative climate and the paramilitary organization of law enforcement. Interviews with LEOs have been utilized to identify these sources of stress (Finn & Tomz, 1997). The combination of expected, job-related stress with organizational stress might account for the high rates of CVD in the LEO population. Regardless, efforts are needed to develop strategies to reduce risks of CVD among law enforcement officers (LEOs).

This study employed the first five phases of the Precede-Proceed Planning Model using a target population of LEOs employed by the Iowa State Patrol, a division of the Iowa Department of Public Safety (DPS). We hypothesized that aspects of the environment within law enforcement perpetuate the stress that is perceived by the LEOs. Through collaboration among professionals from the DPS and researchers on the project, we developed potential intervention strategies that could address the individual and organizational risks within the law enforcement profession. While the recommendations are designed specifically for the Iowa State Patrol, the authors envision the results (and process) might be relevant to others interested in worksite health promotion.

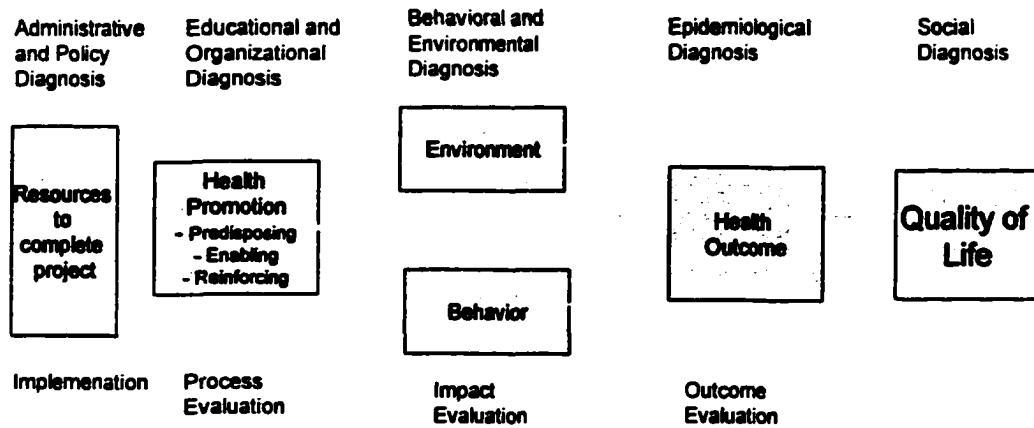
Problem-solving framework

A methodological framework was sought initially to aid in identifying key determinants of behavior, specifically risk factors that might contribute to the incidence of CVD in LEOs. Furthermore, this study attempted to identify work-related “sources” of risk and health impairment beyond the identification of conventional risk factors. In its entirety, the study employed both qualitative and quantitative methodology, however, this paper focuses primarily on the qualitative aspects of the study, specifically the perception of health as embraced by the LEOs.

The Precede-Proceed framework, developed by Green and Kreuter (1993) was used to provide a community-based approach for health promotion and education by focusing on outcomes at the onset of the program development, and recognizing that the factors relevant to an outcome must be assessed before health promotion interventions can be drafted. The Precede-Proceed model originally began as an evaluation model and later evolved as a planning framework; therefore, evaluation was embedded in all phases of the planning model.

The first component (Precede) is designed to help the user identify the specific needs in the target population and the most effective ways of addressing these needs. The second component (Proceed) includes the implementation and evaluation of the health promotion program that is developed. The directional framework enables the user to plan appropriate process, impact and outcome evaluations to assess the different aspects of the program (see Figure 1).

PRECEDE



PROCEED

Figure 1. Precede-Proceed model

The Iowa State Patrol had the option to employ the phases encompassed in the Proceed portion (program evaluation and assessment of outcome achievement) of the planning model after reviewing the proposed interventions. The steps encompassed in Precede-Proceed are depicted in Figure 1; however, this paper focuses primarily on the first five steps of the Precede portion of the model. The recommendations to the Iowa State Patrol were developed based on the contents of the qualitative interviews obtained from key informants, results of the statistical analysis of survey data, and information found in the literature about LEOs.

Method

Participants

Contact with the officers who participated in the study was made through the administration of the DPS. This contact was facilitated by an ongoing relationship between the DPS and the Department of Health and Human Performance (HHP) at ISU. LEOs were familiar with ISU in the context of obtaining their annual physical examinations at the University. An effort was made to encompass different age groups in the pool of respondents. Two of the officers interviewed had served in law enforcement for over twenty years each, whereas one respondent had been a LEO for less than five years. Officers were selected according to time in the profession and their willingness to communicate openly with the interviewer. Human subjects approval was obtained from the Institutional Review Board at Iowa State University.

Procedure

This paper emphasizes the interpretation of the findings from the qualitative research since the interviews with key informants provided more specific information regarding the collective needs of the LEOs with respect to health. Exploration of what is significant in a situation was facilitated by a qualitative (inductive) methodology. Narrative interviews were conducted with three officers employed by the Iowa State Patrol. Three open-ended questions were proposed to the LEOs.

1. Describe to me what a typical day is like for you.
2. Tell me the story of a particular day that you perceived as stressful.
3. What do you believe to be true regarding shift work?

The data were collected over a period of three months in the context of the officers' worksite. The LEOs were interviewed at their respective district headquarters. Observations were made before and during the interviews. The interviews consisted of a minimum of two sessions of approximately forty-five minutes each. The officers were encouraged to speak freely about their perceptions of the relationship between their workplace, job, and health. Data analysis was accomplished by using comparison methodology. Extensive field notes were recorded (Van Maanen, 1988) and a reflective journal was kept (Blenner, 1995). Factual and analytic trueness were maintained using member and peer checking (Kathwohl, 1998).

Results

When evaluating the first five phases of Precede, the LEOs were recognized as "stakeholders" in the process to improve the overall health of the department. This qualitative information, obtained from key informants, was used along with literature written over the past thirty years, and quantitative survey data to identify mortality and morbidity indicators in the law enforcement cohort.

Social and environmental diagnosis

The social assessment phase of Precede-Proceed contributes to define problems and priorities subjectively from the perspective of the target population. Social indicators gleaned from the interviews included concerns about weight and inactivity. Cultural and lifestyle-influenced dietary habits may also be contributing factors to the increased risk for these workers. The research data obtained from published studies indicate that, generally, LEOs are over-weight. While these behaviors may certainly contribute to negative outcomes

for the LEOs, a most distinguishing characteristic of the law enforcement profession (compared with other professions) is its high level of job-related stress.

Epidemiological diagnosis

In the epidemiological assessment phase, the specific health problems were recognized and ranked according to the issues identified by the target population. These problems became the issues at which scarce resources would be directed. Through analysis of the interviews, it became clear that stress contributed to and exacerbated the problems voiced by the LEOs, and that stress clearly posed the greatest threat to health. The narratives of the LEOs regarding stress confirmed the findings based on the data from the self-reported survey, revealing the association of stress with unexpected change, and with anger and frustration related to circumstances perceived as "out of the control" by the officers, resulting in feelings of tension and stress associated with the job. Stress within the profession has been well-documented. It may be a potential contributor to morbidity and mortality from cardiovascular disease (Ekeland, 1988; Ely, 1986; Hill, 1991; Paffenbarger, 1993; Peters, 1983; Rohm, 1993; Stamford, 1978; Williams & Petrallis, 1987).

Sleep patterns, eating habits, and activity levels can be affected by stress and may result in weight loss or gain. Reduced physical activity has been identified as a risk factor for CVD (Lee, 1998; Paffenbarger, 1993; Pate, 1995). The high levels of inactivity in the law enforcement population (Demers, Heyer, & Rosenstock, 1992; Franke, 1994; Peters, 1983; Pollock, 1978; Rohm, 1993; Stamford, 1978; Tuchen, 1996; Williams & Petrallis, 1987) may contribute to their poorer health.

Behavioral and environmental diagnosis

Issues and risk factors “linked” to the main problems were identified in the behavioral and environmental assessment phase. Themes extrapolated from the interviews with the LEOs addressing risk included: (1) nutrition, specifically maintenance of optimal weight; (2) inactivity; and (3) increased stress related to job responsibilities and departmental climate. The following emerging themes developed through analysis of the stories and perceptions shared by the key informants.

Nutrition and maintenance of optimal weight

Some officers suggested that the law enforcement profession involves schedules that lack prioritization of the physiological needs of the officers, such as adequate nutrition. The statement of one officer supports this proposition:

I won't be able to stop or when I stop it gets to a pressure point where I grab a snack here because I won't be able to stop, or when I stop I will eat because that is when I can. There are times when I work nine hours and get nothing to eat or drink. This can happen easily. There are days, especially when the snow flies, that I go all nine hours – might even be eleven hours – without getting anything to eat or drink because we're that busy.

This behavior may lead to eating when it is convenient or feasible, as opposed to hunger-driven eating; such action may lead to excessive weight gain and obesity. Concern about weight gain was a repeated theme among the officers interviewed.

Inactivity

Maintenance of a healthy weight was an issue voiced by all LEOs who were interviewed. The following statement, given in the context of discussion about work and its

effects on physical well-being, is characteristic of the dialogue that ensued about physical activity:

My Dad is 63 and I think he had his first heart attack late in his 40's. But in general, I'm pretty healthy. I can't remember the last time I was ill. I never get sick. I do have slightly elevated blood pressure. It varies at times, but other than that I'm pretty healthy, I guess. I'm little over my ideal weight. I get a little exercise. I don't exercise that much, but mainly I attribute it to our diet, especially on night shift. It is hard to find a healthy meal. We always stop at fast food places, so it's always fast food, and you usually know their variety is pretty slim.

Stress associated with sleep disturbance has been documented in the literature (Ekeland, 1988; Ely, 1986; Paffenbarger, 1993; Peters, 1983; Rohm, 1993; Stamford, 1978; Williams & Petrallis, 1987). An officer shared that when he is on day shift he is "too tired" to do anything when he gets home. This led to a conversation about sleep patterns and the presence or absence of nightmares with shift rotation.

Every now and then I'll have dreams that are associated with something I've been involved with at work, but no lack of sleep or disturbed sleep due to stuff I have experienced at work due to rotation. In fact, my days off are primarily wasted because I sleep so long because I'm "catching up." I just get a few hours of sleep per day on day shift, so it is time to make up for that.

LEOs reported fatigue on their days off and experienced a change in physical activity level with shift rotation. Shift work can contribute to the stress of employees by disrupting their hormone levels, and "diurnal clock." The symptoms expressed by LEOs were consistent with this premise. LEOs noted that their participation in physical activity was less than desired, and identified a number of reasons including shift work, fatigue experienced with shift rotation, and lack of time to exercise. Stressors such as job demands, noise, and disturbance of sleep pattern due to shift work have been demonstrated to contribute to

occupational-related stress (Ekeland, 1988; Ely, 1986; Paffenbarger, 1993; Peters, 1983; Rohm, 1993; Stamford, 1978; Williams & Petrallis, 1987).

Job stress

The theme of stress inherent within the job emerged in all interviews, and the LEOs recognized that their job caused stress. Stress contributes to the development of disease both physiologically and mentally. A large body of research supports this proposition. Stress, related to increased anxiety and anger, has been reported in the law enforcement population (Boltwood, 1993; Ekeland, 1988; Ely, 1986; Franke, 1994; Kawachi, 1994; Russek, 1990).

LEOs are expected to “be in control” at all times to maintain control over citizens and to keep others safe. Yet, officers perceive lack of control, or “voice,” in the professional environment:

It's really frustrating when you know you are low man on the totem pole so you just basically give up your say and it causes a lot of tension.

This clearly adds to frustration and tension as described by the LEOs. It is apparent that the expectation to make decisions *on-the-job*, but not *about* the job causes dissonance and leads to frustration.

When asked if they receive stress management education, none of the LEOs could recall specific training; however, one remembered being apprised (at the academy) that they would encounter stressful situations. When asked about stress management, this LEO replied:

I can't recall. They might be teaching it now in the academy, but I don't recall--maybe when I was I cadet. They did explain to us [in classes] these are the things you are going to experience ... emotions and feelings. I don't recall specifics about how to handle stress or to cope.

LEOs perceive little opportunity for input about job policies and procedure. Their comments might be interpreted as experiencing “no voice.” Through the personal interviews, review of the planned changes within the organization, and the indications for change listed in the literature, it became apparent that transformational leadership (which is based on building relationships and shared governance), is not common within the organization. Without participative leadership, feelings of frustration and disempowerment seem to ensue. The younger officers saw the veterans as isolated and hardened by the years of “survival.” One officer shared his perception of conversations between LEOs who have been on the force a long time:

I guess I don't like to see some things about them. I guess negative in ways or in ways not caring or not really caring about the job; just trying to get enough years in to retire. That's kind of depressing knowing there are so many of them like that now, most likely I'll be that way, too so that's kind of disappointing.

Educational and organizational diagnosis

In the educational and organizational assessment phase, the entire organization was reviewed in an attempt to categorize risk as one of the following factors: (1) predisposing, (2) reinforcing, or (3) enabling. LEOs were predisposed to stress via inadequate knowledge of coping skills, which was apparently frustrating to them. They perceived they were not empowered to have a voice in organizational policy or make decisions autonomously about the job. This idea was reinforced by comments expressed, such as being “low on the totem pole” and by the frustration voiced by older officers (as perceived by the younger LEOs).

Organizational policies, such as provision for automatic disability with full benefits for development of CVD, reinforced and rewarded poor self-care. Policies such as this may

enable LEOs to become complacent about their health. Lack of a fitness program within the organization may reinforce the perception that fitness is not a priority. Many LEOs were unaware of the benefits of exercise, other than apparent improvement in physical appearance. Dissonance occurs when LEOs are “expected to be fit,” but are not provided with the time, skills or resources to maintain their condition.

In this study it was clear that dysfunctional communication within the organization contributed to the LEOs’ stress. LEOs perceived they had infrequent opportunities to offer suggestions about policies, and viewed the organization as “hierarchical.” Lack of coping skills to deal with organizational stressors further accentuated the LEOs’ perception of “no voice.” The next phase of Precede-Proceed further defined how this represented risk to LEOs.

Administrative and policy diagnosis

Organizational capabilities were assessed from an administrative perspective to ascertain what feasibly could change the level of risk to the employees within the organization. Administrative and policy assessment revealed that there had been resources available within the DPS for fitness and health promotion, but the program was discontinued recently for fiscal reasons. The DPS seemed to be unaware of the relevant cost of an exercise program compared to the cost of chronic disease, such as CVD with ensuing myocardial infarction. Policies existed that prohibited officers from eating or smoking in the patrol vehicles. It is encouraging that transformational leadership is currently being explored within the DPS as an alternative to the present leadership style, which recognizes that

improved communication within the organization is imperative. Review of these policies illuminated opportunities for content revision resulting in the promotion of health.

Improvement of the overall climate and health of the DPS requires successful communication and integration of the knowledge and perspectives from scientific and professional disciplines, including exercise science, health promotion, nursing and DPS administrators. The risk for CVD could also be reduced, directly by diminishing organizational stress and indirectly through education about factors such as coping skills and the benefits of physical activity. This change might lead to decreased health and disability costs for the Iowa State Patrol and, equally important, improvement in the overall health and well-being of all LEOs.

Discussion

The Precede-Proceed model was used to identify environmental and behavioral risk factors associated with CVD in the target population. The main findings from the interviews with LEOs included: (1) the belief that certain aspects of the profession perpetuate poor eating habits and contribute to weight gain; (2) the belief that participation in physical activity is impeded by shift work, availability of time, and fatigue; and (3) the perception that several sources inherent within the organizational environment contribute to stress. Sub-themes associated with stress related to job responsibilities included anger and frustration, diminished control in the job environment, and shift work. These themes are consistent with those that have been documented in the published research related to the profession of law enforcement and the inherent risk for LEOs to develop CVD.

According to the administrative and policy assessment phase of the Precede-Proceed model, policy can help to initiate and maintain behavior change. It was suggested to the DPS that a policy allowing food in patrol cars should be reconsidered. This reconsideration might facilitate and encourage healthier food choices by allowing LEOs to bring food with them to work. Policy advocacy and development addressing physical fitness might encourage LEOs to increase their participation in physical activity and stay fit. Creation of a policy addressing a mechanism for feedback on the laboratory work performed at ISU would empower LEOs to take more responsibility for their own well-being through education and increased awareness. Collectively, these measures could result in decreased incidence of CVD in the LEO group.

There seems to be a disassociation between the message that police should be healthy and physically fit, and the situation that is imposed by the job's incompatibility with health and fitness. When the functional and logistical modes of action were analyzed, it was apparent that dissonance exists between the officers' perception of healthy behaviors and their personal value system on one hand, and the reality of their behavior on the job on the other hand (Jacobson, 1991). Routine medical exams are required annually; however, according to the LEOs, dissemination of health promotion information is minimal. LEOs are expected to stay fit and healthy, even when their duties might preclude them from eating or drinking for up to 8-10 hours at a time. While participation in many activities is mandatory, participation in a fitness program is not.

While officers' perception of their own physical well-being differs greatly from the public's view of their physical status, the officers' personal awareness of health is questionable. It is unclear whether the officers are unaware of their risk for disease, or choose not to accept the reality of risk or the risks associated with certain behaviors.

Conclusion

The following conclusions were made based on the outcomes of the study. The use of the Precede-Proceed planning model enhanced identification of appropriate behavioral and environmental objectives toward which the intervention strategies were directed. A list of various behavioral and environmental strategies (Table 1) was recommended to the DPS to improve the overall health of the LEOs and to decrease the incidence of chronic disease. Eighteen intervention strategies were drafted jointly by a representative of the Iowa State Patrol and personnel from ISU, one-half addressing behavioral changes within the organization and the other half addressing environmental changes of the LEOs.

Prevention-focused implications of this study, based on the review of the literature, included reduction of occupational stress within the workplace, increased health promotion and education, and promotion of healthier life styles for LEOs employed in law enforcement.

Stress related to the job of law enforcement was a prominent issue within the Iowa State Patrol. Clearly, there exists a disassociation between the message sent to officers to “be fit” and the actual achievement of fitness by the Patrol members in their work environment. Because stress can contribute to the development of CVD, perceived stress levels present in the work environment should be examined further.

In view of the costs to the DPS incurred from the risk for and development of CVD, it would behoove the department to employ primary and secondary intervention options to prevent disease or, minimally, to intervene to retard the progress of the disease when it occurs. Monitoring of the risk factor incidence would be a way proactively to utilize fiscal resources within the DPS to decrease the incidence of disease.

Table 1. Behavioral and environmental intervention strategies drafted for the Iowa State Patrol

No.	Intervention
<i>Behavioral</i>	
1.	Apprise officers of the findings of the cardiovascular risk survey completed in the spring of 2001.
2.	Calculate the 10-year risk for heart disease from existing data.
3.	Address repeating patterns of health issues identified at ISU, such as increased blood pressure, increased cholesterol levels, weight, and diabetes.
4.	Enhance the relationship with ISU and coordinate communication with the Professional Development Bureau within the DPS
5.	Establish a physical fitness program within the department, including educational information on the benefits of exercise, necessary frequency, etc.
6.	Disseminate health information at meeting/in-services addressing priority issues such as nutrition and stress.
7.	Provide forums for officers to voice thoughts and concerns about health issues perceived to be associated with the work environment.
8.	Dialogue annually about any issues rising from the annual health screening performed at ISU.
9.	Incorporate and follow the NCEP guidelines for detection and evaluation of increased cholesterol and perform the risk assessment for each individual officer, predicting the 10-year outcome (Grundy, 2001).
<i>Environmental</i>	
10.	Revisit the definition of health and examine its congruence with the department mission statement.
11.	Shift focus from fitness to health within the Iowa State Patrol believing that fitness occurs when health is valued.
12.	Examine historical fitness data over the past twenty years to identify trends regarding risk factors.
13.	Track the number of medical disability cases occurring annually and the associated morbidity, to evaluate the incidence of cardiovascular disease and the efficacy of health promotion endeavors.
14.	Consider providing access to health promotion and education websites for diabetes awareness and health promotion information.
15.	Teach stress management at the academy with periodic refresher sessions; include relaxation techniques as a part of organizational meetings.
16.	Offer transformational leadership training for LEOs and DPS administration.
17.	Examine the efficacy of longer periods of time for shift rotation, considering the physiologic effects of shift work.
18.	Administer the perceived stress scale questions (abridged version, consisting of 4 questions) monthly for 6-12 months.

When considered by the health profession, the strategies outlined in the intervention strategies in Table 1 directed at risk reduction and disease prevention are not new; however, these suggestions enlightened the representatives of the Iowa State Patrol about ways to improve the overall health of the LEOs in a cost-effective manner.

The Precede-Proceed framework provided a comprehensive approach to health promotion and education by focusing on outcomes at the initiation of program development, recognizing that the factors relevant to an outcome must be assessed before health promotion interventions can be drafted. The authors attribute much of the success and practicality of the program planning (drafted for the Iowa State Patrol) to the use of this framework, and perceive that the Precede-Proceed model was integral to successful identification of the recommendations presented to the DPS in Iowa.

More research and application studies are needed that address the impact of workplace determinants on the health of employees. Interdisciplinary approaches to workplace health promotion should be explored to comprehensively assess not only occupational safety be equally as important occupational health promotion.

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CHAPTER 6. SUMMARY AND RECOMMENDATIONS

More than ninety-five percent of the officers surveyed in this research considered their general health to be from good to excellent. However, for many of these officers, this opinion contrasted with the information they provided on the questionnaire. There was a clear disassociation between the expectation for officers to be "fit" and the realistic picture of the overall health of this cohort of LEOs. This disassociation was typified by their increased cholesterol levels and excess body weight. Exacerbation of risk factors, perpetuated by stress (which clearly is associated with duration of time in the profession), puts officers at risk for the development of disease. If these factors are truly related to increased stress, it would follow that empowering officers with an improved ability to cope might decrease the incidence of risk factors and CVD.

The consequences of perceived stress include development and exacerbation of cardiac risk factors. Recognizing the unique aspects of law enforcement, including environmental and organizational stressors, may help organizations to identify ways to improve the coping skills of LEOs. A resultant improvement in the overall health of the officers would occur which would help to reduce risk factors and morbidity as well as mortality from CVD.

Improved communication and education within the departments of Public Safety about cardiac risk factors would empower LEOs to take personal responsibility for improvement of their health. Coping strategies, such as problem solving, are utilized for stressors within the control of the individual, while coping strategies, such as relaxation breathing may be employed for those stressors perceived to be outside the realm of control

by the LEO. Organizational facilitation of acquisition of these skills would empower LEOs to cope more effectively with a resultant decrease in perceived stress.

Despite the exposure to unique stressors (including the ever-present risk for death), in the words of one officer from one Midwestern state surveyed, "We still love our jobs."

Because these officers have made a commitment to protect and serve the members of the general public, it is for both ethical and health reasons that one should continue to examine the issues of stress and health among the law enforcement cohort. Recommendations for law enforcement agencies should be actualized while considering the LEOs' perception of health, with the intended outcome of participant satisfaction as a key determinant.

The LEOs in eight states were surveyed in this study. Future research should include surveying the retirees of the respective DPS within the same states. That cohort might contain officers who self-selected out of this study group as well as those who were forced to leave the LEO ranks for reasons including health. Therefore, in combination with the present LEO sample, this cohort might provide a more complete picture of the relationships between LEO traits and morbidity.

APPENDIX A: COVER LETTER AND HUMAN SUBJECTS APPROVAL**Cover Letter****Law Enforcement Officers:**

According to the American Heart Association (AHA), since the 1900's, cardiovascular disease (CVD) has been and remains the number one killer of adults in America. The prevalence of the disease is staggering. In America, 59,700,000 residents have one or more types of cardiovascular disease according to the estimates by the AHA. Certain occupations may be at increased risk for the development of cardiovascular disease. Among these is law enforcement. For the past nine years, Warren Franke, Ph.D. at Iowa State University, has conducted research to identify the risk of CVD in sworn officers of the Iowa Department of Public Safety. The research has been supported and endorsed by the Departments' Division Directors, including Colonel Robert O. Garrison of the Iowa State Highway Patrol.

While this research indicates that law enforcement officers might be at increased risk for development of CVD, it is uncertain *why* they are at increased risk. To determine this we need to study a larger cohort of officers from several states. Therefore, we would like to invite you to participate in the present study. Participation in the study consists of completion of a brief survey that requires approximately 15 minutes to complete. Completion of the survey is completely voluntary and confidential. You may refuse to answer any question and you may discontinue participation in the study at any time. Your identity will not be accessible by the DPS or Iowa State University in any reports compiled from this data. Consent to participate in the study will be indicated by returning the completed survey in the envelope provided. Thank you for your time.

Sincerely,

Warren Franke Ph.D.
Associate Professor
Department of Health and Human Performance
Iowa State University
515-294-8257

Sandra L. Ramey R.N, M.S.N.
Assistant Professor
Division of Nursing
Grand View College
515-263-2849

Human Subjects Approval

OFFICE USE ONLY	
Project ID# <u>01-216</u>	IRB Approval Date: <u>8-27-01</u>
Oracle ID# _____	IRB Expiration Date: <u>8-26-02</u>

Iowa State University
Continuing Review and/or Modification of Research Involving Human Subjects

(Please type the information on this form)
 This and other forms are on the Human Subjects Research Office web site at
<http://grants-svr.admin.iastate.edu/VPR/humansubjects.html>

IRB

AUG 13 2001

SECTION I: PI/Project Information
--

- I agree to provide the proper surveillance of this project to insure that the rights and welfare of the human subjects are protected. I will report any adverse reactions to the committee. Additions to or changes in research procedures after the project has been approved will be submitted to the committee for review. I agree that all key personnel involved in conducting human subjects research will receive training in the protection of human subjects. I agree to request renewal of approval for any project continuing more than one year.
- Type of Submission: Continuing Review (fill in sections I & II) Modification (fill in sections I & III)
 Continuing Review & Modification (fill in sections I, II, & III)
- Date of Last IRB Approval: Feb 01
- Title of Project: Relationship between CVD morbidity, risk factors, and stress in LEO
- Originally approved under the title Examination of CVD in Law Enforcement
 Funding Source: NIH
- Have key personnel been added since last approval? No Yes If yes, please list. (see part III for signature requirements) _____

Sandra L. Ramey R.N., M.S.N.
 Typed name of principal investigator

8/9/01 Sandra L. Ramey
 Date Signature of principal investigator

ELPS
 Department

4420 101st St Dvm 50322
 Address for correspondence

515-278-1310 or 263-2849 (wk)
 Phone number and email

If student project:

Typed name of major professor or supervisor
Warren Franke HHP

8/27/01 Warren Franke
 Date Signature

IRB Approval:

Rick Sharp
 IRB Chair

Rick Sharp
 Signature of IRB Chair

8/27/01
 IRB Approval Date

OFFICE USE ONLY Project ID# <u>01-216</u> Oracle ID# _____	IRB Approval Date: <u>2/16/01</u> IRB Expiration Date: <u>2/16/02</u>
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Iowa State University
Continuing Review and/or Modification of Research Involving Human Subjects

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IRB
FEB 16 2001

SECTION I: PI/Project Information

I agree to provide the proper surveillance of this project to insure that the rights and welfare of the human subjects are protected. I will report any adverse reactions to the committee. Additions to or changes in research procedures after the project has been approved will be submitted to the committee for review.

- Type of Submission: Continuing Review (fill in sections I & II) Modification (fill in sections I & III)
 Continuing Review & Modification (fill in sections I, II, & III)
- Date of last Continuing Review: See 1st form.
- Title of Project: CVD in law enforcement officers
- Funding Source: HHP and my personal funds.

Typed name of principal investigator

Date

Signature of principal investigator

Co-principal investigator: Sandy Ramey, R.N., M.S.N.

Warren Franke, Ph.D.
Campus Address

Department

ELPS
HHP
Phone number and email

4420 101st Street
Urbandale, IA 50322

IRB Chair

Signature of IRB Chair

Approval Date

SECTION II: Continuing Review

- Have there been any serious and/or unexpected adverse experiences since the last review?
 Yes, please explain. No
- Previously approved procedures and measure will remain the same.
 Yes If no, please fill out section III.

APPENDIX B. SURVEY QUESTIONNAIRE

Risk Questionnaire for the Project: Cardiovascular Risk in Law Enforcement Officers

In what division and state are you employed (check one of each) ?

- | | | | | | | | |
|---------------------------|-------|----|-------|----|-------|----|-------|
| A. Criminal Investigation | _____ | IA | _____ | NE | _____ | ND | _____ |
| B. Fire Marshall's Office | _____ | MI | _____ | OK | _____ | | |
| C. Narcotics Enforcement | _____ | MN | _____ | OH | _____ | | |
| D. Highway Patrol | _____ | MO | _____ | SD | _____ | | |
| E. Other | _____ | | | | | | |

PLEASE CIRCLE THE LETTER OF THE ANSWER WHICH MOST APPLIES TO YOU.

- *1. Would you say that in general your health is:
A. Excellent B. Very Good C. Good D. Fair E. Poor F. Don't Know/Not Sure
- *2. Was there a time during the last 12 months when you needed to see a doctor, but could not because of the cost?
A. Yes B. No C. Don't Know/Not Sure
- *3. About how long has it been since you last visited a doctor for a routine checkup?
A. Within the past year (1 to 12 months ago) D. 5 or more year ago
B. Within the past 2 years (1 to 2 years ago) E. Never
C. Within the past 5 years (2 to 5 years ago) F. Don't know/not sure
- *4. About how long has it been since you last had your blood pressure taken by a doctor, nurse, or other health professional?
A. Within the past 6 months (1 to 6 months ago) E. 5 or more years ago
B. Within the past year (6 to 12 months ago) F. Never
C. Within the past 2 years (1 to 2 years ago) G. Don't know/not sure
D. Within the past 5 years (2 to 5 years ago)
- *5. Have you ever been told by a doctor, nurse, or other health professional that you have high blood pressure?
A. Yes B. No C. Don't Know/Not Sure
- *6. Have you been told on more than one occasion that your blood pressure was high, or have you been told this only once?
A. More than once B. Only once C. Don't Know/Not Sure
- *7. About how long has it been since you last had your blood cholesterol checked:
A. Within the past year (1 to 12 months ago) E. 5 or more years ago
B. Within the past 2 years (1 to 2 years ago) F. Never
C. Within the past 5 years (2 to 5 years ago) G. Don't know/not sure

- *8. Have you ever been told by a doctor or other health professional that your blood cholesterol is high?
A. Yes B. No C. Don't Know/Not Sure
- *9. Have you ever been treated for high cholesterol?
A. Yes B. No C. Don't Know/Not Sure
- *10. Have you ever been told by a doctor that you have diabetes?
A. Yes B. No C. Don't Know/Not Sure
- *11. Have you smoked at least 100 cigarettes in your entire life? (5 packs = 100 cigarettes; If "no," skip 12 and 13)
A. Yes B. No C. Don't Know/Not Sure
- *12. On the average, about how many cigarettes a day do you now smoke? (1 pack = 20 cigarettes)
Number of cigarettes (_____) Don't Know/Not Sure
- *13. About how long has it been since you last smoked cigarettes regularly, that is, daily?
A. Within the past month (0 to 1 month ago) E. Within the past 5 years (1 to 5 years ago)
B. Within the past 3 months (1 to 3 months ago) F. Within the past 15 years (5 to 15 years ago)
C. Within the past 6 months (3 to 6 months ago) G. 15 or more years ago
D. Within the past year (6 to 12 months ago) H. Don't know/not sure
- *14. During the past month, how many days per week or per month did you drink any alcohol?
A. Days per week _____ B. Days per month _____ C. Don't know/not sure
- *15. To lower your risk of developing heart disease or stroke, has a doctor advised you to . . .
A. Eat fewer high fat or high cholesterol foods C. Neither
B. Exercise more D. Both
- *16. To lower your risk of developing heart disease or stroke, are you
A. Eating fewer high fat or high cholesterol foods? C. Neither
B. Exercising more? D. Both
- *17. Has a doctor ever told you that you had any of the following?
A. Heart attack or myocardial infarction C. Stroke
B. Angina or coronary heart disease D. None of the above
- *18. During the past month, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?
A. Yes B. No C. Don't Know/Not Sure
- *19. What type of physical activity or exercise did you spend the most time doing during the past month?
A. Walking B. Jogging C. Weight Lifting D. Other _____

- *20. How many times per week or per month did you take part in this activity during the past month?
 A. Times per week ____ B. Times per month ____ C. Don't know/Not sure
- *21. And when you took part in this activity, for how many minutes or hours did you usually keep at it?
 Hours and minutes ____ hrs. ____ min.
 Don't know/Not sure
- *22. Are you now trying to lose weight?
 A. Yes B. No C. Don't Know/Not Sure
- *23. Are you using physical activity or exercise to lose weight? Keep from gaining weight?
 A. Yes B. No C. Don't Know/Not Sure
- *24. In the past 12 months, has a doctor, nurse, or other health professional given you advice about your weight?
 A. Yes, lose weight
 B. Yes, gain weight
 C. Yes, maintain current weigh
 D. No
 E. Don't know/Not sure
 C. Yes, maintain current weight
- *25. Have you ever used or tried any smokeless tobacco products such as chewing tobacco or snuff?
 A. Yes, chewing tobacco
 B. Yes, snuff
 C. No, neither
 D. Don't Know/Not sure
- *26. Do you currently use any smokeless tobacco products such as chewing tobacco or snuff?
 A. Yes chewing tobacco
 B. Yes, snuff
 C. Yes, both
 D. No neither
 E. Don't know/Not sure
- *27. Have you ever been told that you have a kidney stone?
 A. Yes B. No C. Don't Know/Not Sure
- *28. Have you ever been treated for a kidney stone?
 A. Yes B. No C. Don't Know/Not Sure
29. If yes, how many kidney stones have you had? _____
30. When did you last receive treatment for a kidney stone? _____
31. In the last month, how often have you been upset because of something that happened unexpectedly?
 A. Never B. Almost Never C. Sometimes D. Fairly Often E. Very Often
32. In the last month, how often have you felt that you were unable to control the important things in your life?
 A. Never B. Almost Never C. Sometimes D. Fairly Often E. Very Often

33. In the last month, how often have you felt nervous and "stressed"?
- A. Never B. Almost Never C. Sometimes D. Fairly Often E. Very Often
34. In the last month, how often have you dealt successfully with irritating life hassles?
- A. Never B. Almost Never C. Sometimes D. Fairly Often E. Very Often
35. In the last month, how often have you felt that you were effectively coping with important changes that were occurring in your life?
- A. Never B. Almost Never C. Sometimes D. Fairly Often E. Very Often
36. In the last month, how often have you felt confident about your ability to handle your personal problems?
- A. Never B. Almost Never C. Sometimes D. Fairly Often E. Very Often
37. In the last month, how often have you felt that things were going your way?
- A. Never B. Almost Never C. Sometimes D. Fairly Often E. Very Often
38. In the last month, how often have you found you could not cope with all the things that you had to do?
- A. Never B. Almost Never C. Sometimes D. Fairly Often E. Very Often
39. In the last month, how often have you been able to control irritations in your life?
- A. Never B. Almost Never C. Sometimes D. Fairly Often E. Very Often
40. In the last month, how often have you felt that you were on top of things?
- A. Never B. Almost Never C. Sometimes D. Fairly Often E. Very Often
41. In the last month, how often have you been angered because of things that happened that were outside of your control?
- A. Never B. Almost Never C. Sometimes D. Fairly Often E. Very Often
42. In the last month, how often have you found yourself thinking about the things that you have to accomplish?
- A. Never B. Almost Never C. Sometimes D. Fairly Often E. Very Often
43. In the last month, how often have you been able to control the way you spend your time?
- A. Never B. Almost Never C. Sometimes D. Fairly Often E. Very Often
44. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?
- A. Never B. Almost Never C. Sometimes D. Fairly Often E. Very Often
- *45. What is your age? Code age in years _____

***46. What is your race?**

- A. White
B. Black
C. Asian, Pacific Islander
D. American Indian, Alaska Native
Other (specify)

***47. What is the highest grade or year of school you completed?**

- A. Never attended school or only attended kindergarten
B. Grades 1 through 8 (Elementary)
C. Grades 9 through 11 (Some high school)
D. Grade 12 or GED (High school graduate)
E. College 1 year to 3 years (Some college or technical school)
F. College 4 years or more (College graduate)

**48. About how much do you weigh without shoes? Weight _____ pounds
Don't Know/Not Sure**

**49. About how tall are you without shoes? Weight _____ pounds
Don't Know/Not Sure**

50. How many years have you been employed as an officer? _____ ? _____

***These questions (1-28, 45 & 46, 47A-D) were taken directly from the 1999 BRFSS, which relate directly to the survey used to obtain information from the officers. A copy of the 1999 BRFSS questionnaire is available from the CDC at: Department of Health and Human Services, Public Health Service, CDC, Atlanta, GA 30333.**

APPENDIX C: RELATED DATA

Table C1. Perception of stress by Iowa LEOs

No. Question	Fairly to very often	Sometimes	Almost never to never
42. In the last month, how often have you found yourself thinking about the things that you have to accomplish?	54.7	38.7	4.8
33. In the last month, how often have you felt nervous and "stressed"?	13.2	51.2	34.3
41. In the last month, how often have you been angered because of things that happened that were outside of your control?	10.9	37.5	50.2
34. In the last month, how often have you dealt successfully with irritating life hassles?	53.7	31.0	13.7
31. In the last month, how often have you been upset because of something that happened unexpectedly?	7.3	36.3	51.1
32. In the last month, how often have you felt that you were unable to control the important things in your life?	6.2	24.3	68.0
43. In the last month, how often have your been able to control the way you spend your time?	70.1	25.0	3.2
38. In the last month, how often have you found you could not cope with all the things that you had to do?	9.9	17.6	70.6
44. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	7.0	19.0	72.5
35. In the last month, how often have you felt that you were effectively coping with important changes that were occurring in your life?	74.0	20.6	3.7
39. In the last month, how often have you been able to control irritations in your life?	74.6	16.7	7.0
37. In the last month, how often have you felt that things were going your way?	77.3	17.6	3.2
40. In the last month, how often have you felt that you were on top of things?	82.1	14.6	1.6
36. In the last month, how often have you felt confident about your ability to handle your personal problems?	88.7	8.3	1.6

Table C2. Number of LEO cases and responses by state

State	Cases	Responses
Iowa	450	432
North Dakota	132	110
Nebraska	480	379
Ohio	1,400	975
Missouri	200	128
Minnesota	565	294
South Dakota	160	81
Oklahoma	740	274
Michigan	500	154
Total	4,627	2,818

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