

LAW ENFORCEMENT MANAGEMENT INSTITUTE

**EXPLORING THE CONCEPT OF CUMULATIVE
INJURY FROM STRESS AND AGE**

**A RESEARCH PROJECT
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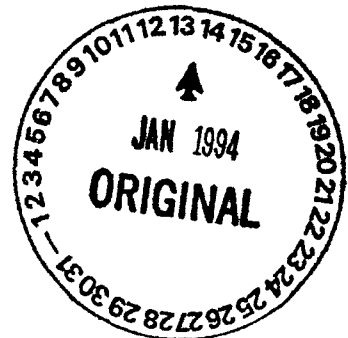
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I INTRODUCTION

The American police officer is getting older. This statement is a logical extension of the fact that the average age of Americans is increasing significantly. The U.S. Bureau of the Census projects that persons age 55 and older will constitute 20 percent of the U.S. population by the year 2000, 26.2 percent by the year 2010, and 32.3 percent by the year 2030. (Bureau of National Affairs 1975, 15) In 1981, the number of persons in the 55-64 age group who are employed grew 55%, (Harris 1981, 40) and one report predicts probable shortages of new labor force entrants. (National Council on the Aging 1981, 116) It follows then, that persons employed in law enforcement should be getting older as a group.

As we age, we all incur physical changes and can offer anecdotal evidence to this. Researchers report that 89% of those in an 18-54 age group reported their health as either excellent or good. In a 55-64 age group, only 65% reported their health to be either excellent or good. (National Council on the Aging 1981, 137)

Biologists and physicians also note specific changes in the body as it ages. The first of these changes noted is that bodily systems decline daily because of cell death which produces a reduction in capacity and function. This reduction

in the functional capacity to do work manifests itself most notably after about age 30. (Smith and Serfass 1981, 12-13) It again follows that police officers, also, incur these physical changes.

The job of law enforcement also exacts its toll on the body. Despite the occasional foot pursuit and wrestling match during an arrest, law enforcement is primarily a sedentary occupation. An axiom of the profession says law enforcement is 90% boredom and 10% panic. That 90% also includes too many cups of coffee, too many fast-food meals, and too much sitting. The results are shown in two studies which found police officers and sheriff's deputies to be below average in physical condition. (Price et al. 1978, 75)

Stress also impacts our lives. Hectic schedules, economic uncertainty, changing culture, and many other stressors adversely affect us all. And, yet,

there is a growing recognition among police administrators that the officers under their command are not superhuman--that they are affected by their daily exposure to human indecency and pain; that dealing with a suspicious and sometimes hostile public does take its toll on them; and that the shift changes, the long periods of boredom and the ever-present danger that are part of police work do cause serious job stress. (Goolkasian, Geddes, DeJong 1985, 1)

The cumulative affects of aging, declining fitness, and stress are producing a population of law enforcement officers who are ill-prepared to meet the requirements of the occupation. Common sense suggests that the patrol officer, the first responder to events requiring law enforcement

intervention, is most in need of adequate physical ability. Responsible law enforcement administrators must explore ways to protect their officers from this cumulative injury.

This paper should offer administrators a rational basis for proposing and selecting courses of protective action. The specific effects of aging on physical systems and states which are particularly relevant to police officers will be detailed. Stressors, as they impact length and quality of life, as well as physical fitness levels and the ability to work, will be identified and discussed. Also presented will be the concept of cumulative injury, in which repeated assaults by stressors against a body being degraded by age finally result in disability. Finally, and perhaps most importantly, this paper will identify two areas which offer to most mitigate the detrimental physical effects of aging and stress on patrol officers.

II PHYSIOLOGICAL ASPECTS OF AGING

Visual Systems

One of the debates in recent years concerning the physical qualifications for entry-level police officers has been vision standards. Both corrected and uncorrected minimum acceptable levels seem to differ from agency to agency. Some agencies allow greater latitude to applicants who correct their vision using contact lenses. However, all law enforcement agencies agree (and common sense dictates) that adequate vision is a necessity for their officers. Visual acuity is not the only aspect of adequate vision.

As we age, the optical structures of the eye change and affect basic visual functions. (Whitbourne 1985, 152) Perhaps one of the most noticeable changes is the power of the eye to accommodate, or to discriminate detail at varying distances. The range of accommodation lessens with age (Corso 1981, 51) and is primarily a result of inelastic lenses (Whitbourne 1985, 158) combined with decreases in the ciliary muscles. (Whitbourne 1985, 154) The inelastic lens resists the weak ciliary muscle's attempt to shape the lens for accommodation. A total loss of accommodation may occur by age 60. (Whitbourne 1985, 158) (Corso 1981, 53) Corrective lenses may be important for reading, driving, shooting, suspect identification, threat assessment, etc.

A related decrement is in dynamic acuity, or the ability to discriminate detail in a moving target.

When visual acuity is measured by the time required to identify the significant detail of a test target, age differences are more pronounced for moving targets than for stationary targets. As the velocity of the moving targets is increased to high levels, the performance of 40-year-olds has a greater relative decline than that of individuals in their twenties. (Corso 1981, 50-51)

Other age-related vision changes with potentially serious consequences for the law enforcement officer are dark adaptation, glare sensitivity, and depth perception.

Dark adaptation is the process of developing "night vision", or becoming able to see in dim light. The time required for this process, and the resulting quality of vision, is negatively affected by age. (Corso 1981, 44) The decrease begins at age 20 and is particularly evident after 60 years. (Whitbourne 1985, 163) An older officer moving from a light environment into a darkened environment (such as from afternoon sun into a darkened warehouse, or from a well-lit building into the dark of night) is at a distinct disadvantage.

Glare sensitivity, or a decrease in visual acuity in bright light, increases rapidly after 40 years of age. (Brookbank 1990, 143) Scotomatic glare, the overstimulation produced by sudden flashes of light (such as oncoming headlights or muzzle flash) is particularly evident after the age of 40. (Whitbourne 1985, 164) Recovery time from glare increases linearly with increasing age. (Corso 1981, 47)

Judging distances and knowing the relationships among objects in space, or depth perception, is a basic requirement for being able to maneuver about successfully in the environment. (Whitbourne 1985, 165) For the law enforcement officer, that maneuvering could involve pursuit driving, chasing suspects on foot, or target acquisition during a gunfight. Up to age 40 only slight changes in depth perception are present; between 40 and 50 years a critical change occurs and depth perception beings to deteriorate rapidly. (Corso 1981, 55)

While suspect identification, threat assessments, target acquisition, and building searches occur with varying degrees of frequency, one activity all law enforcement officers assigned to patrol duty engage in extensively is driving. As Whitbourne has so effectively written:

Another set of practical implications concerns the driving ability of the adult as affected by the aging of the visual system. Reduced retinal illumination with age has the overall effect of placing the older adult driver in a position of having to make decisions in critical situations with incomplete and possibly inaccurate stimulus information. This problem is exacerbated when outside light is minimal, during the evening and nighttime hours. During that time, reading road signs and avoiding pedestrians and obstacles may be less efficiently done. The older adult's greater vulnerability to scotomatic glare reduces the ability to recover from the headlights of oncoming cars on dark roads at night, and to drive during the daytime hours on streets that have alternating shade and bright sunlight. Poorer dark adaptation in the older adult adds to the problem that even younger adults have of changing from cone to rod vision when the light suddenly

fades, as in a tunnel, under bridges, and in going from a well-lighted highway to a small darker street. The lower acuity for moving objects demonstrated in older adults has deleterious effects on the ability to detect and avoid people and other cars approaching the driver at intersections, on or along the road, and coming out of driveways. A loss of sensitivity to movement in the periphery of the visual field means that the older adult will be less prepared to react to oncoming people and cars that appear to emerge suddenly onto the scene because their approach was not observed by the driver.

The loss of accommodation ability in adulthood has the effect of making it more difficult for the adult to read the speedometer and other important dashboard indices after focusing on objects in the distance on the road. (Whitbourne 1985, 166-167)

Whitbourne goes on to write that older adults avoid higher accident rates possibly by reducing their driving, at least under conditions which create visual problems. (Whitbourne 1985, 167) This is obviously written with the much older adult in mind. However, many of these visual changes occur in the forties and fifties; ages of many patrol officers. And, these older patrol officers cannot compensate by reducing their driving or avoiding unfavorable conditions. When the situation does not permit compensation, the older adult's adaptation to the environment is unquestionably reduced. (Whitbourne 1985, 169)

Cardiovascular System

The cardiovascular system is negatively affected by aging in three areas: maximum oxygen consumption, heart rate during

maximum levels of exertion, and coronary heart disease.

Maximum cardiac output is reduced approximately 30% beginning at age 30. (Smith and Serfass 1981, 14) Changes in maximum oxygen consumption and heart rate are most evident during exercise. (Whitbourne 1985, 36) The decrease in maximum oxygen consumption is virtually linear throughout the adult years, (Whitbourne 1985, 36) and occurs both at rest and during exercise. (Brookbank 1990, 173) These two changes signify that throughout the adult years the heart continually loses its efficacy as a pumping device. (Whitbourne 1985, 36) As a result, older persons are less able to adapt to sustained increases of cardiac load and risk cardiac failure. (Smith and Serfass 1981, 24)

The term coronary heart disease is used to describe two processes affecting the arteries. Arteriosclerosis, a narrowing of the arteries, is associated with hypertension and hypertrophy of the left ventricle. Atherosclerosis, or hardening of the arteries, is associated with several risk factors. (Brookbank 1990, 173) These include "high cholesterol and triglycerides, excessive body fat, smoking, elevated blood sugar and uric acid, excessive emotional stress, physical inactivity, and family history." (Price et al. 1978, 67) This condition "occurs so commonly in industrialized populations that it has been mistaken for a natural consequence of aging." (Brookbank 1990, 173)

A study comparing police officers aged 36-52 to the normal sedentary population of similar age, found the officers below average in working capacity, cardiorespiratory fitness, and body composition. (Price et al. 1978, 75) This study agreed with an earlier test which showed deputies to be overweight, tend toward high cholesterol and triglyceride values, smoke excessively, and do not get enough exercise. (Price et al. 1978, xxix)

Another study comparing Texas police officers to standards recommended by the American Heart Association and the Cooper Clinic shows a distinct increase in coronary risk with age. Older officers appear to be at higher than average risk. (Price et al. 1978, 69)

The implications of these negative factors are clear. Officers do not compare favorably even with sedentary populations. And although the majority of patrol officers' duties are sedentary in nature, there are times when they are called to maximum levels of performance. At these times, older officers are at risk due to the condition of their cardiovascular system.

Respiratory System

There are a number of changes noticeable in the respiratory system as a result of the aging process. The respiratory capacity of the lungs peaks at 20 to 25 years for men (earlier in women), then steadily decreases throughout

life. (Brookbank 1990, 180-181) (Price et al. 1978, 19) (Smith and Serfass 1981, 34, 98) This reduction in capacity is related to loss of chest wall mobility which restricts the flow of air. (Brookbank 1990, 181) In addition to restricting the total volume of air brought into the lungs, this loss reduces the quantity of air brought in per minute. (Whitbourne 1985, 56) After the age of 50-60, (Smith and Serfass 1981, 94) individuals are less able to maintain a high ventilatory rate at maximum levels of exercise. (Whitbourne 1985, 56)

The older adult's lungs are less effective in transporting oxygen. (Whitbourne 1985, 56-57) After 40 years, the ducts leading to the alveoli increase in volume at the expense of alveolar volume, so the surface area for exchange of respiratory gases decreases. The alveoli lose elasticity, beginning at about 50 years. (Brookbank 1990, 180) As Brookbank concluded, "respiration simply becomes progressively more difficult from the age of 40 on." (Brookbank 1990, 181)

It seems clear that the older officer is less able to engage in strenuous activities. Climbing stairs, chasing fleeing suspects on foot, and physically confronting them all become progressively more difficult with age.

Physical Fitness

One group of researchers define good physical fitness as an efficient cardiovascular-respiratory system, or good aerobic capacity, moderate to low levels of body fat, and adequate muscular strength, endurance, and flexibility. They

believe these characteristics allow an officer to perform daily, both on the job and recreationally without undue fatigue or risk of injury. (Price et al. 1978, xxiii) They go on to write that aerobic fitness is an indicator of the body's ability to adapt and recover from periods of physical stress, resulting in "a more efficient performance of duty, reduced probability of heart disease, and less frequent on or off duty injury due to overexertion." (Price et al. 1978, 68)

However, as noted in the cardiovascular and respiratory system sections, older officers are below average in working capacity, cardiorespiratory fitness, and body composition. (Price et al. 1978, 75) Another study suggests that police agencies lose officers frequently due to inadequate physical fitness. The number of medical or health caused deaths were significant, and the major causes of both early retirement and limited duty assignment were back trouble and heart-related conditions. (Price et al. 1978, 143-147) Six percent of officer attrition was caused by deaths. Twenty-one percent of on-duty deaths were caused by medical/health reasons, as were 60 percent of off-duty deaths. Off-duty deaths generally involved officers over the age of 40. (Price et al. 1978, 143)

Studies of the United States labor force in general have concluded that workers' health is deteriorating. They found "an increase in limitation of activity and restricted-activity days among all men aged 55-64." (Ricardo-Campbell 198, 148) The most limiting condition for men aged 55-61 was heart

disease, and the number of men in this group increased by three percent during the period of the study. (Ricardo-Campbell 1988, 145) Health problems were listed as a primary reason for leaving work, especially for those who stopped working well before age 62. (Ricardo-Campbell 1988, 260-261)

Many lower back problems are attributed to lack of proper exercise of lower back muscles. (Price et al. 1978, 150) The maximal tension developed by a particular muscle declines steadily after 30 years of age with an increased rate of loss after 50. (Brookbank 1990, 163) Muscular endurance, or the ability to continue prolonged heavy work, decreases beginning at age 30. (Smith and Serfass 1981, 39) The source of age differences in muscular strength is the loss of muscle mass due to atrophy of the muscle fibers. (Whitbourne 1985, 21) The atrophy is partially due to disuse, or "hypokinetic disease." (Brookbank 1990, 163)

As the lean body, or muscle, mass falls with age, the at-rest metabolic rate decreases, possibly the result of loss of muscle tissue. (Brookbank 1990, 181) This reduction in muscle mass results in an increase in the percentage of body fat, an indicator of reduced physical fitness.

Also negatively affected by the aging process are the joints. Connective tissues of the tendons and ligaments becomes less resilient and less able to transmit tensile forces. Scar tissue and areas of calcification form within the connective tissue and joint capsule threatening

flexibility. Synovial membranes become less flexible. The structures and substances that are intended to serve as cushions for the forces of movement of and on bones and to ensure that the joint can be maximally flexed or extended all become less efficient throughout adulthood. (Whitbourne 1985, 30) The result is stiffer, more rigid tissues which are less responsive to mechanical stress. (Smith and Serfass 1981, 46)

It appears that all indicators of physical fitness are degraded over time. This degradation is the result of natural changes occurring in systemic structures, and/or lifestyle choices such as diet, smoking, and exercise.

III OFFICER STRESS

There is a growing recognition among police administrators that the officers under their command are not superhuman--that they are affected by their daily exposure to human indecency and pain; that dealing with a suspicious and sometimes hostile public does take its toll on them; and that the shift changes, the long periods of boredom, and the ever-present danger that are part of police work do cause serious job stress. Indeed, police work has been identified as one of the most stressful of all occupations. (Goolkasian, Geddes, and DeJong 1985, 1)

Stress has been defined as everyday wear and tear on the body, or the state of an individual reacting to a problematic event or demand. (Anson and Bloom 1988, 231) "Problematic" events or demands fill a patrol officer's day. Researchers have concluded that police work ranks high among all occupations in the amount and variety of stress it promotes. (Baruth 1986, 306) Officers are more likely to experience certain traumatic incidents in higher proportions than civilian populations, (Nielson 1986, 369) and few occupations encounter the same variety of stressors. (Anson and Bloom 1988, 233)

Stressors

Stressors have been categorized as those inherent in police work; those stemming from the policies and practices of the police department; and those stemming from the criminal justice system and society at large. (Goolkasian, Geddes, and DeJong 1985, 4)

Patrol officers are almost always the first called and the first to respond to acts of violence,

intentional or unintentional. They view the pain, the distress, the mutilation, the gore. And concurrently, they must be aware that those they try to help are often antagonistic towards them. There are also those who would, and do, cause harm and death. But despite officers' feelings of anger, fear, disgust, frustration, helplessness, and sorrow, they are expected to project a "professional" image of one in control of their emotions. "The police culture strives to maintain an image of invulnerability and moral superiority. The officer is trained to view self and to be seen by others as physically and emotionally able to handle any crisis without being personally affected." (Stillman 1986, 143)

The need to be constantly aware of potential danger, as well as being always watchful for situations requiring police intervention, creates a state of being hypervigilant or over-reactive to potentially threatening situations. Officer safety and street survival concepts continually emphasize the danger in an officer's daily workplace. Complacency, or being nonreactive in one's environment, is considered potentially lethal in law enforcement. Consequently, each time an officer puts on the uniform, the psychological state is elevated due to this hypervigilant perceptual style. (Gilmartin 1986, 445-446) "Although everyone eventually experiences a sense of his own mortality, police officers tend to come to this realization at a much younger age than most." (McCafferty, Domingo and McCafferty 1989, 24)

Police departments are typically paramilitary organizations, and all provide around-the-clock services. Both situations add to the stress in the occupation. Some researchers have found that working in the bureaucratic organization of a police department is more stressful than facing the dangers on the street. (Kirschman 1986, 457)

Among the stressors found in the organizational environment, lack of participation in decisions which affect the officer's job seems to be most significant. (Smith, Colligan, and Hurrell 1980, 2) (Hurrell 1986, 450) Officers have "the worst of two worlds. ...both powerful and powerless, possessing ultimate authority on the street and minimal authority within the organization." (Kirschman 1986, 457) It is difficult for officers to understand that they have discretion affecting personal freedoms, life and death, but not seemingly trivial matters in the workplace.

Another significant stressor provided through police organizations is shift work. Parr calls this one of the most important problems facing police work today. (Parr 1986, 484) Others correctly point out that shift work appears in all the literature on police stress as a contributor to the job specific stress of law enforcement, and that the preponderance of jobs within a police department are routine patrol functions requiring shift work. (O'Neil 1986, 471)

Career development, or the lack of, is also identified as one cause of stress within police departments. The vast

majority of police officers start and end their careers as patrol officers, and opportunities for promotion to higher ranks, as well as special assignments within patrol, are limited. Rewards for good job performance are lacking or limited. (Goolkasian, Geddes, and DeJong 1985, 5) (Reese and Goldstein 1986, 450) One source correctly states that "it should not be necessary to leave a job you like to get more money or prestige." (Courtney 1986, 238)

A 1972 study of police officers indicated that two stressors more significant and more often emphasized than direct life-threatening situations were adverse court interactions and negative public reactions. (Smith, Colligan and Hurrell 1980, 4) This study was probably referring to what other writers identified as "court decisions curtailing officers' discretion or restricting the role of law enforcement and the perceived leniency of the courts." (Goolkasian, Geddes, and DeJong 1985, 5) Since that time, there seems to have been an increase in both civil and criminal complaints filed against officers. Officers must constantly appraise the consequences of their decisions based on department, community, and media reactions, particularly in officer involved shootings. (Blak 1986, 311) Officers know that many of these reactions are based on emotion, not logic, fact, or experience. Decisions made in the "heat of battle" are leisurely reviewed in the comfort and safety of offices.

Physical Effects of Stress

During periods of excitement, whether produced by positive experiences or negative, the body's Sympathetic Nervous System (SNS) becomes aroused. The body subconsciously and automatically increases heart rate, respiration, blood pressure, the production of hormones, etc. When the body is in a relaxed state the Parasympathetic Nervous System (PSNS) produces results directly opposite to the SNS. When the body is subjected to more frequent and intense excitement than relaxation it develops General Adaptation Syndrome. This syndrome has been associated with physical manifestations such as cardiovascular disease, gastrointestinal disorders, and others which combine to produce shorter, less rewarding lifetimes. These diseases result from the failure of the body to restore itself to equilibrium (to balance periods of excitement with relaxation). This failure may result from the continued perception of stress as unending. (Gentz 1986, 442) (Weber 1980, 43) Earlier in this paper stress was defined as everyday wear and tear on the body, or the state of an individual reacting to a problematic event or demand. (Anson and Bloom 1988, 231) That reaction is the arousal of the SNS. Researchers have concluded that police work ranks high among all occupations in the amount and variety of stress it promotes. (Baruth 1986, 306) Officers are more likely to experience certain traumatic incidents in higher proportions than civilian populations, (Nielsen 1986, 369) and few

occupations encounter the same variety of stressors. (Anson and Bloom 1988, 233) Therefore, it seems to follow that officers are more prone to develop General Adaptation Syndrome. Indeed, research has shown that officers are more prone to develop health problems than the general public. (Ebert 1986, 249)

Many researchers of stress identified by this writer have concluded that stress causes a variety of changes within physical systems (Farmer 1990, 205) leading to "demonstrable organic disease of varying severity." (Goolkasian, Geddes, and DeJong 1985, 7) The disorders range from cardiovascular disease to dermatological problems. (Price et al. 1978,) However, in the context of this paper, discussion will be confined to effects on the cardiovascular and respiratory systems. These systems most directly determine length and quality of life, as well as physical fitness levels and the ability to work.

High rates of death from coronary heart disease have been found in law enforcement officers compared to other occupations. One study found 15 percent of the officers with cholesterol levels that doubled their risk of coronary heart disease, and elevated triglyceride levels in 27 percent. Many were overweight, and a total of 27 percent were at medium-high or high risk for coronary heart disease. Another study found that almost two-thirds of police officers admitted to hospitals were for digestive or circulatory problems, compared

to only half of all occupations combined. (Goolkasian, Geddes, and DeJong 1985, 7) A third study showed that the rate of premature death among police officers, particularly due to circulatory diseases, was significantly high. (Farmer 1990, 206) Other findings suggest that coronary risk is higher for those with high levels of stress. (Parr 1986, 485) (Farmer 1990, 207)

Although most research has focused on the links between police work and cardiovascular disease, at least one also attributes respiratory ailments such as asthma and hyperventilation to the stress in law enforcement. Others, while not directly emphasizing respiratory effects, note that more officers smoke, and smoke more, than the general population. (Goolkasian, Geddes, and DeJong 1985, 7-8) Still other researchers found that officers suffering from advanced stages of stress reaction smoked even more than those less affected. (Farmer 1990, 207) This empirical evidence can be confirmed anecdotally by anyone who has watched a smoker increase consumption during periods of stress.

The connection between smoking and lung disease such as emphysema and cancer is well known. When the rate and quantity of smoking increases for a particular population, lung disease attributable to smoking should increase also. So while stress in law enforcement may or may not directly produce respiratory illness, it seems to increase smoking, which in turn results in lung diseases.

Smoking has also been identified as a contributing factor in coronary heart disease. (Price et al. 1978, 67) Heavy metals such as lead, mercury, and cadmium have been found in cigarette smoke, as have nicotine and carbon monoxide. These substances have been connected with atherosclerosis and hypertension. (Rosenbluh 1986, 508) Again, stress may or may not directly produce coronary heart disease, but if it increases smoking, it increases the probability of heart disease.

There appears to be a two-edged sword connected with the physical effects of stress on law enforcement officers. The body's natural reaction to the stressors results in adverse health consequences. If the officer smokes, and apparently many do, the stress causes an increase in consumption which increases the exposure to the toxic substances in cigarette smoke. This increased exposure results in more adverse health consequences which would seem to multiply those already produced by stress.

One stressor heavily identified with health problems is shift work. Although it may be generally difficult to distinguish between specific stressors in law enforcement which affect the body, that is not the case with shift work. Research has been conducted in occupations other than law enforcement which specifically identifies shift work as a stressor affecting large numbers of workers. (Smith, Colligan, and Harrell 1980, 5-6) One researcher believes that all shift

workers are at risk. (O'Neill and Cushing 1991, 18) Another writes that the ailments of shift workers are due to chronic sleep disturbances, not the type of work. (O'Neill 1986, 473)

The primary risk factor is the major disruption of sleep patterns which prevent the body from recovering from periods of activity. Deep stages of sleep are required to physically recuperate, and the deepest stage to mentally recuperate. Recuperation is the body's natural attempt to restore itself to the balance between excitement and relaxation, or equilibrium, cited earlier. (Gentz 1986, 442) Because the body's natural rhythm, circadian rhythm, is to wake during daylight and sleep during darkness, (O'Neill and Cushing 1991, 20) some researchers believe it is impossible to adjust to night work. (Gentz 1986, 472) (O'Neill and Cushing 1991, 18)

Day and evening sleep averages two hours less in duration than night sleep, and is more fragmented. This chronic sleep deprivation produces physiological fatigue (O'Neill 1986, 472-473) which manifests itself in ailments from colds and foot cramps to digestive disorders and coronary problems. (Smith, Colligan and Hurrell 1980, 6)

One study involving shift rotation of police officers found triglyceride and glucose levels lower in a rotation more closely following the sleep-wake cycle. (Hurrell 1986, 449) Elevated triglyceride and glucose levels have been identified as risk factors of coronary heart disease. (Price et al. 1978, 67) Other researchers write that shift work is directly

related to risk for coronary heart disease, and that the danger of shift work should be recognized as more serious than previously thought. (O'Neill and Cushing 1991, 25)

It seems clear that besides the obvious dangers involved in law enforcement, there is also the definite risk of becoming seriously ill as a result of the job.

IV CUMULATIVE EFFECTS

This paper has noted the negative effects of aging and stress on the human body, concentrating particularly on police officers. It has been shown that the capacities and functions of the body decline daily due to cell death. (Smith and Serfass 1981, 12) The heart loses its effectiveness as a pumping device, (Whitbourne 1985, 36) and its arteries become hard and narrow. (Brookbank 1990, 173) The older respiratory system is restricted in both the volume of air brought in and the rate at which air is brought in. (Whitbourne 1985, 56) The oxygen transport system in aging lungs is less effective. (Whitbourne 1985, 56) (Brookbank 1990, 180)

The primary indicators of fitness; aerobic capacity, body fat, muscle strength, endurance, and flexibility, are all degraded by time. Aerobic capacity, measured by cardiorespiratory efficiency, is reduced due to physiological changes in the organs of the cardiovascular and respiratory systems. (Whitbourne 1985, 56) (Brookbank 1990, 172-173, 180) Loss of muscle mass with age reduces muscular strength (Whitbourne 1985, 21) and contributes to an increase in body fat. (Brookbank 1990, 181) Changes in joint tissues inhibit the range of motion, or flexibility. (Whitbourne 1985, 30) (Smith and Serfass 1981, 46)

Stress, earlier defined as the state of an individual reacting to a problematic event or demand, (Anson and Bloom 1988, 231) has been connected with changes in physical systems

and specific organic diseases, (Goolkasian, Geddes, and DeJong 1985, 7) (Farmer 1990, 205) These diseases, ranging from cardiovascular to dermatological, (Price et al. 1978, 151) result from the body's failure to balance periods of excitement with relaxation, thereby restoring itself to equilibrium, (Weber 1980, 43) (Gentz 1986, 442)

Law enforcement has been identified as an occupation ranking high in the amount and variety of stress it promotes. (Anson and Bloom 1988, 233) (Baruth 1986, 306) Research has shown that officers are more prone to develop health problems than the general public. (Ebert 1986, 249)

Bodily capacities and functions decline with age due to physiological changes, (Whitbourne 1985, 56) (Brookbank 1990, 172-173, 180) Stress has also been connected with physiological changes, (Goolkasian, Geddes, and DeJong 1985, 7) (Farmer 1990, 205) and law enforcement produces a large amount and variety of stress. (Baruth 1986, 306) (Anson and Bloom 1988, 233) Therefore, it should follow that older officers with more years of service would be even more subject to those changes. Common sense tells us that since age results in decline, increasing age should result in further decline. (We often witness this in the death of elderly persons who die without any pathological conditions; their bodies simply decline to the point where they can no longer support life.) Simply put, age reduces the body's ability to respond to the demands placed on it. Common sense also tells

us that since exposure to stress adversely affects the body, increased exposure should mean increased adverse effects. (Research empirically confirms that long term exposure to stressors increases the probability of physical impairments.) (Ebert 1986, 249) Stress also reduces the body's ability to respond to the demands placed on it. The cumulative effects of age and the exposure to stress during lengthy service in law enforcement should logically produce an even greater probability of physical distress.

Cumulative injury is the term used in workers' compensation law to describe the disability resulting from exposure to stress over time. (Tebb 1980, 30) Stress-related disability is not assumed to be an event, but a slowly unfolding process (Kirschman 1986, 453) in which minor incidents known as micro-traumas repeatedly assault the body over time. (Tebb 1980, 30) (Stratton 1986, 528) It is another description for the repeated stimulation of the Sympathetic Nervous System without corresponding stimulation of the Parasympathetic Nervous System, (Gentz 1986, 442) or the failure of the body to restore itself to equilibrium, (Weber 1980, 43) resulting in changes in physical systems and specific organic diseases. (Goolkasian, Geddes, and DeJong 1985, 7) (Farmer 1990, 205)

Another danger accompanying this process of accumulating micro-traumas is that, over time, an officer becomes more vulnerable to each additional stressor. (Blak 1986, 312)

Although some single events are intense enough to cause trauma alone, an officer may accumulate such an amount of "minor" incidents that just one additional incident, no matter how minor, may be the "straw that breaks the camel's back." (Blak 1986, 312) (Gilmartin 1986, 446) A logical extension of this thinking is that if the precipitating event is not just another micro-trauma but is sudden and gross, the officer may experience major physical trauma. One researcher quoted verses by Oliver Wendell Holmes Sr.:

Have you heard of the wonderful one-hoss-shay
That was built in such a logical way
It ran a hundred years to a day
And then ...
.....
[I]t went to pieces all at once--
All at once, and nothing first,
Just as bubbles do when they burst.
(Levine 1988, 19)

Still other threats to officers' physical well-being arise after serving in law enforcement for an extended period. The Federal Bureau of Investigation concluded that "the probability of a law enforcement officer being assaulted with injury increases cumulatively with length of service. After 20 years of service, the chances of sustaining injury rise to 72% (Federal Bureau of Investigation 1991, 1-2) A related finding is that older officers are less likely to wear protective body armor while working on the street. (John Jay College of Criminal Justice 1991, 2) If we accept the premise that the physiological changes of age are exacerbated by those physiological changes produced by stress, and that older

officers are more likely to be injured, at what age and/or length of service is the officer most at risk?

In Texas, the minimum age for being licensed as a peace officer is generally 21. [Tex. Gov't Code Ann. § 415.059 (West 1987)] In departments operating under Municipal Civil Service regulations, a person older than 35 is not generally eligible for a beginning position. [Tex. Local Gov't Code Ann. § 143.023 (West 1987)] So, the 20-year veteran at risk of sustaining an injury from assault could be an officer between the ages of 41 and 55.

This 41-55 age group seems especially vulnerable. Off-duty deaths due to medical or health factors generally involve officers over the age of 40. (Price et al. 1978, 143) "Night work is more deleterious for individuals over the age of 40," and "sleep disturbances increase in proportion to the longevity of night work." (O'Neill 1986, 473) Over 62% of California workers filing compensation claims for cumulative injuries were 37 to 60 years old. (Tebb 1980, 32) Reports of excellent or good health drop 24% after the age of 55. (National Council on the Aging 1981, 137) Aspects of vision such as dynamic acuity, (Corso 1981, 50-51) glare sensitivity, (Brookbank 1990, 143) scotomatic glare reaction, (Whitbourne 1985, 164) and depth perception (Corso 1981, 55) change dramatically after age 40. Officers aged 36-52 were found below average in working capacity, cardiorespiratory fitness, and body composition that the normal sedentary population.

(Price et al. 1978, 75) Respiration "becomes progressively more difficult from the age of 40 on." (Brookbank 1990, 181) Approximately half of surveyed officers over 50 years old seldom, if ever, wear body armor when working on the street. (John Jay College of Criminal Justice 1991, 2) The likelihood of being the victim of a heart attack sharply increases at age 55, especially for police officers. (U.S. Congress, House 1986, 77) Heart disease is four times more likely to be discovered in persons aged 50 as in those aged 39. (U.S. Congress, House 1986, 101) Drivers over age 55 begin to experience an above average accident rate when compared to middle-aged drivers. (Corso 1981, 203)

Even when researchers do not identify a specific age as the demarcation for physical decline, they indicate an increase in difficulties with advancing age. Officers with greater tenure may show the results of stress more than those with less tenure. (Stotland, Pendleton, and Schwartz 1989, 57) "Death and disability from degenerative disease processes increase with increasing age," and "risk increases, at an accelerating rate, with each additional year of chronological age." (U.S. Congress, House 1985, 153)

It seems apparent that officers with at least 20 years of service who are 40 years old are entering the "danger zone" for the cumulative injury effects of stress and age. At approximately 50 years of age, the danger seems to increase even more. Similar conclusions, based on similar research

findings, most likely prompted a number of law enforcement agencies, including federal, to mandate retirement well before the "customary" age of 65.

V ADMINISTRATIVE ALTERNATIVES

If older officers with more years of service are most at risk for cumulative injury, law enforcement administrators must be concerned enough about the well-being of their officers to explore methods to reduce that risk. Officers literally give the best years of their lives to the profession and are often used up in the process; living only eight years after retirement. (U.S. Congress, House 1986, 77) Aside from the moral and ethical responsibilities to ensure the protection of officers, it is simply good business to protect those in whom a department has invested so much; especially considering that there may be fewer labor force entrants to replace them. (National Council on the Aging 1981, 116) (Rix 1990, 121) Also of concern should be the increase in stress-related workers' compensation claims. (Stratton 1986, 527)

Common sense suggests that the patrol officer, the first responder to events requiring law enforcement intervention, is most in need of adequate physical ability. Patrol officers most often require adequate vision to identify suspects, assess threats, engage in vehicular pursuits, and respond with gunfire. Patrol officers are most in need of adequate aerobic capacity, muscular strength, and endurance to climb, run, and physically control combative suspects.

Patrol officers may also be subjected to more and different stressors than officers in other assignments. Patrol officers must be constantly vigilant for potential

danger and situations requiring police intervention.

(Gilmartin 1986, 445) Patrol officers are the first to view the results of violence, but yet feel they must maintain an image of invulnerability and moral superiority. The majority of police officers spend their careers in patrol functions requiring shift work. (Stillman 1986, 143) (O'Neil 1986, 471)

If the preceding paragraphs are correct, the most important point on which to focus cumulative injury prevention is the patrol officer. Attention to shift work and physical fitness offers to most mitigate the detrimental physical effects of aging and stress on patrol officers.

Shift Work

O'Neil calls shift work one of the most important problems facing police work today, and points out that "shift work appears in all the literature on police stress as a contributor to the job specific stress of law enforcement." (O'Neil 1986, 471) Yet, it is the most readily addressed problem.

Nonrotating shifts can be staffed to more accurately reflect the number of calls for service by time of day, and is preferable to rotating shifts. (Smith, Colligan, and Hurrell 1978, 6) (McCaffety et al. 1989, 31) (Parr 1986, 485) (Hurrell 1986, 449) (O'Neill 1986, 475) However, this presents a major problem for officers assigned to the midnight shift. Long-term night work is physically and psychologically damaging, as

noted earlier in this paper. A combination of fixed and rotating shift assignments could be a potential solution.

Traditional shifts, either fixed or rotating, vary little from a 7:00 A.M. to 3:00 P.M., 3:00 P.M. to 11:00 P.M., and 11:00 P.M. to 7:00 A.M. format. Consider substituting a 7:00 P.M. to 3:00 A.M. fixed shift for the 11:00 P.M. to 7:00 A.M. shift. This would provide additional manpower during the peak call-for-service period, and would be less physically detrimental to the officers assigned. (It more closely matches natural sleep-wake cycles than the 11:00 P.M. to 7:00 A.M. shift.) (Smith, Colligan, and Hurrell 1978, 6) The period between 3:00 A.M. and 7:00 A.M. could be covered by a limited number of younger, less senior, officers assigned to shifts rotating through the traditional time periods at intervals determined by the department. Clockwise rotation (days, evenings, midnights) is preferable, (Hurrell 1986, 449) (O'Neill and Cushing 1991, 63) as is rapid rotation intervals where no more than two consecutive nights are worked without 48 hours off. (Hurrell 1986, 449) (O'Neill 1986, 475)

Shift assignment should be allocated by bid systems according to seniority. Senior officers could bid out of the late night and rotating shifts, and officers whose natural sleep-wake cycle is more tuned to night work could bid into them. Less senior officers who are less at risk physically, would be working the more physically demanding shifts.

Aside from avoiding the detrimental effects of disrupted sleep patterns, bidding shifts by seniority offers older officers the following benefits:

1. Allowing a choice reduces the stress of non-participation, (Smith, Colligan, and Hurrell 1980, 2) (Hurrell 1986, 450) and could be considered a reward for service. (Goolkasian, Geddes, and DeJong 1985, 5)
2. Calls generating the most stress and most often requiring physical intervention may not be as prevalent. (Price et al. 1978, 118-119)
3. Working during daylight hours avoids the exacerbating effects of reduced illumination on aging visual processes. (Corso 1981, 44-55) (Whitbourne 1985, 157-167) (Rix 1990, 107)
4. Nonrotating shifts, especially day shifts, do not produce stress by disrupting family and social activities. (O'Neill and Cushing 1991, 36-37) (Reese and Goldstein 1986, 475)

Physical Fitness

Good physical fitness (defined as good aerobic capacity, moderate to low levels of body fat, adequate muscular strength, endurance, and flexibility), (Price et al. 1978, xxiii) is recognized as a requirement for adequate performance of law enforcement duties, (Price et al. 1978, 68) and as a method of protecting against the effects of stress. (Gentz 1986, 443)

The physical system most important to fitness and more effected by stress in police work is the cardiovascular-respiratory system. Fortunately, this system responds well to fitness training, regardless of age. (Whitbourne 1985, 42) In fact, "values of aerobic power for the physically active are

higher than values for sedentary persons at all ages," (Smith and Serfass 1981, 102, 141) and "continued exercise throughout the middle adult years ... makes it possible to avoid age losses in aerobic power and perhaps even reverse them." (Whitbourne 1985, 41)

Aerobic training also reduces the concentrations of blood lipids (cholesterol and triglycerides) which "reverses the normal effect of aging" by diminishing "the chances for lipid accumulation in the arteries." (Whitbourne 1985, 45) Elevated cholesterol and triglyceride levels have been associated with coronary heart disease. (Price et al. 1978, 67) Vigorous exercise has also been found to protect against sudden fatal heart attacks. (Price et al. 1978, xxiii)

Older officers can also improve muscular strength and endurance through training. Smith and Serfass report that physiological losses in muscle function attributed to age may be partially due to disuse, and is easily reversed. (Smith and Serfass 1981, 153-154) One report calls the adage "use it or lose it" a "biological principle" applying to people of any age. (Bureau of National Affairs, Inc. 1987, 154) Another author states that exercise training is the most readily accessible compensation for adult muscular deterioration due to disuse. (Whitbourne 1985, 22)

In light of the positive physiological changes reducing the negative impacts of age and stress available through physical fitness training, law enforcement administrators

should actively proceed to implement physical fitness programs. "Employers should be held responsible for the establishment of health...policies and the monitoring of programs to ensure minimal risk in work environments."

(National Council on the Aging, Inc. 1981, 118) One survey of police officers found 90% of the respondents in favor of department-sponsored physical fitness programs, (Price et al. 1978, 156)

One group of researchers (Price et al. 1978, xxxxiv) identified three basic administrative approaches to physical fitness programs:

1. The Voluntary approach in which the department provides exercise equipment and encouragement. It is the most widely used, but least effective. Others believe exercise must be voluntary and self-determined, and officers must be rewarded for accepting responsibility for their health. (Connolly and Band 1986, 233)
2. The Revolutionary approach in which officers are given specific time frames to meet certain fitness criteria or face negative disciplinary action. No assistance or programs are offered. Care must be taken that selected criteria are reasonable and defensible as nondiscriminatory. "Lack of physical competence is generally grounds for discharge, demotion, or retirement." (Price et al. 1978, 231) However, this approach is contrary to the philosophy that administrators should be concerned about their officers' well-being and about extending careers. It could also be counter-productive by becoming a source of stress itself. (Goolkasian, Geddes, and DeJong 1985, 5)
3. The Evolutionary approach provides training concerning the program, testing current fitness levels, and assistance in meeting the criteria. When officers have had adequate opportunity to meet the criteria, compliance becomes mandatory. This approach is the most effective, and most accepted by officers.

VI CONCLUSION

American police officers are in danger; not only because of increasingly violent offenders, but also because they are part of an aging population, and are employed in a profession which exposes them to inordinate types and amounts of stress. As the human body grows older, it changes for the worst; its systems are degraded daily by cell death and disuse, and become less capable of responding to demands placed on them. Exposure to stress places further demands on the body; systemic functions are aroused in response, and continued arousal over-loads the body. When a body already degraded by the aging process is continually subjected to overloading from stress, the effects of both processes compound to produce cumulative injury.

Patrol officers are most at risk from this cumulative injury. They are subjected to more and different stressors than officers in other assignments; particularly shift work, constant vigilance, first-hand contact with the results of violence, and physical combat. Older patrol officers should be the focus point for cumulative injury prevention.

Law enforcement administrators have two highly effective measures available to combat cumulative injury. The stress of shift work can be reduced by configuring shifts to more closely follow natural sleep-wake patterns, and by allowing senior officers preference in selecting shift assignments. Evolutionary physical fitness programs which slowly bring

officers into compliance with fitness standards provide "decontamination" from stress, strengthen bodily systems to be more capable of responding to stress and physical combat, and slow or reverse the process of aging.

Law enforcement administrators have moral and financial incentives to protect older patrol officers from cumulative injury. Protecting them protects the investments the department has made in them, may prevent costly workers' compensation claims, and keeps officers in the work force during a time that replacing them may prove difficult. More importantly, protecting them shows appreciation for the service they have given, and for being the most valuable members of the profession.

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