STATE OF NEW JERSEY
DEPARTMENT OF LAW AND PUBLIC SAFETY
DIVISION OF STATE POLICE

# REPORT ON THE ESTABLISHMENT OF A MANDATORY RETIREMENT AGE AS A BONA FIDE OCCUPATIONAL QUALIFICATION FOR THE NEW JERSEY STATE POLICE



Col. Clinton L. Pagano
Superintendent
New Jersey State Police

December 19, 1984

# REPORT ON THE ESTABLISHMENT OF A MANDATORY RETIREMENT AGE AS A BONA FIDE OCCUPATIONAL QUALIFICATION FOR THE NEW JERSEY STATE POLICE

State of New Jersey
Department of Law and Public Safety
Division of State Police

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APPENDIX ATTACHED

## I. Introduction

The purpose of this report is to evaluate whether a factual basis exists to validly establish a uniform mandatory retirement age for all sworn members of the New Jersey State Police. The Federal Age Discrimination in Employment Act (ADEA), 29 U.S.C. §621 et seq., generally prohibits employment restrictions based upon age unless such a restriction can be shown to constitute a bona fide occupational qualification (BFOQ) which is reasonably necessary to the normal operation of the business involved. 29 U.S.C. §623(f)(1). The New Jersey State Police previously had a mandatory retirement age of 55 for all sworn members of the Division, other than the Superintendent. However, following the decision of the United States Supreme Court in EEOC V. Wyoming, 103 S.Ct. 1054 (1983), which held that the ADEA could be constitutionally applied to the States, the Attorney General concluded that this retirement provision would be invalid in the absence of facts which demonstrated that it constituted a BFOQ under the federal statute. Since no facts had then been established to support the retirement provision as a BFOQ, it was declared unenforceable as of the date of the Supreme Court's decision. Subsequently, the Legislature formally repealed the retirement provision.

In order to determine whether a factual basis exists to support the reestablishment of a mandatory retirement age under BFOQ exception to the ADEA, the Division of State Police, with the legal assistance of the Attorney General, has reviewed the legal principles applicable to the establishment of a BFOQ and has retained the services of cardiologists and physiologists to determine

whether a medical or physiological basis exists to warrant the retirement of all sworn members of the State Police at an age certain. It is the conclusion of this report that a compelling factual basis exists to require the retirement of all sworn members of the State Police at age 55.

## II. The Question Involved

The ADEA permits actions based solely on age "where age is a bona fide occupational qualification reasonably necessary to the normal operation of the particular business, or where the differentiation is based on reasonable factors other than age...." 29 U.S.C. §623(f)(1). The Equal Employment Opportunity Commission, which administers the ADEA, and the courts generally agree as to the criteria to be used in determining whether an age restriction constitutes a BFOQ under this statutory provision. To sustain a BFOQ, it must be shown that, 1) the age restriction is reasonably necessary to the essence of the business involved, and 2) that all or substantially all of the affected age group would be unable to safely and efficiently perform the duties of the job involved, or 3) that it is impossible or impractical to assess the continued fitness of persons over the mandatory retirement age on an individualized basis. 29 C.F.R. §625.6(b); EEOC v. Missouri State Highway Patrol, Docket No. 83-2636 (8th Cir., decided November 12, 1984); Mahoney v. Trabucco, 738 F.2d 35 (1st Cir. 1984), cert. denied 53 U.S.L.W. 3391 (U.S. November 27, 1984); EEOC v. Commonwealth of Pennsylvania, 36 FEP Cases 234 (M.D. Pa. 1984).

In order to evaluate whether a retirement age is reasonably necessary under this three-pronged standard, the Division first identified those responsibilities and job duties of the State Police which are essential to the performance of its public safety function. The Division then consulted experts in cardiology and physiology in an effort to determine whether the aging process would interfere with the performance of those duties and, if so, whether the continued fitness of persons in the affected age group could be determined on an individualized basis.*

(a) Responsibilities and Job Duties of the New Jersey State Police.

The Division of State Police comprises approximately 2,141 sworn officers and its basic mission is to enforce the law throughout New Jersey. Members of the State Police are subject to call by the Governor for duty whenever necessary and have the general power and authority of police officers to apprehend offenders, gather evidence of crimes, execute warrants, and conduct lawful searches and seizures. N.J.S.A. 52:2-1. Pursuant to the Rules and Regulations of the Division, all sworn members of the New Jersey State Police carry firearms while both on- and off-duty and are on call 24 hours a day, 365 days a year, for assignment as needed. They are required to take appropriate action whenever any crime under the jurisdiction of the State Police comes to their attention while both on- and off-duty. In addition, all members of

* Copies of the opinions rendered by these experts are attached as an appendix to this Report.

the State Police are subject to reassignment or transfer within the Division at any time.

These statutory and administrative statements express the clear public policy that all sworn members of the State Police must be able to safely and efficiently accomplish all appropriate law enforcement tasks performed by the Division. The obvious purpose of this policy is to ensure the maximum paramilitary flexibility of the Division in the assignment of sworn personnel, whether in responding to a crisis on an emergent basis, or in addressing an ongoing law enforcement objective. It has been recognized that the ability of a law enforcement organization like the State Police to rely on all of its sworn members to perform these duties is essential to the effective protection of the public. See Massachusetts Board of Retirement v. Murgia, 427 U.S. 307, 310 (1976); Mahoney v. Trabucco, 738 F.2d 35 (1st Cir. 1984), cert. denied 53 U.S.L.W. 3391 (U.S. November 27, 1984). Accordingly, the present inquiry has been approached on the basis that all members of the State Police must be able to safely and efficiently perform all of those duties which are required by the essential operational tasks of the Division.

An accurate assessment of the physical tasks required by State Police was facilitated by an analysis of Division job duties recently conducted by the Training Bureau in the Administration Section of the Division. This survey evaluated and verified all written reports of the Division for a recent two-year period and formulated a comprehensive inventory of all physically or psychologically stressful duties performed by members of the Division. A

summary of the physically demanding activities reported by this survey was used to familiarize the experts retained by the Division with the physical demands presented by State Police work. The documentary information provided to three of the experts was supplemented by site visits to State Police facilities, which enabled them to interview Division personnel and learn first-hand the organizational and functional characteristics of the State Police.

(b) The Medical and Physiological Opinions.

In order to evaluate any age-related factors which might unacceptably interfere with the performance of the essential mission of the State Police, the Division consulted two cardiologists and two physiologists. In addition, the Division consulted an individual with extensive military experience who is both a cardiologist and physiologist.

(1) Albert M. Antlitz, M.D.

Dr. Antlitz is a clinical cardiologist practicing in Baltimore, Maryland. He is certified by the American Board of Internal Medicine, and the Subspeciality Board in Cardiovascular Disease. He is Head of the Division of Cardiology and Department of Electrocardiology at Mercy Hospital in Baltimore and, among other positions, serves as the Director of the Hospital's Coronary Intensive Care Unit. In addition to reviewing the documentary materials regarding the organizational structure, operational policies and personnel characteristics of the New Jersey State Police, Dr. Antlitz made a site visit to Division of State Police facilities on October 11 and 12, 1984.

Dr. Antlitz concluded that by age 50, approximately 70% of men have significant coronary artery disease in the form of obstruction of at least one coronary artery to a degree of at least 50%. According to Dr. Antlitz, there is a gradual increase in the degree of coronary artery obstruction starting in the 20's, which rapidly increases in extent and frequency in the 50's. Although he noted that this degree of obstruction may not be clinically significant to the average person, the reduced blood flow caused by this level of coronary artery obstruction could cause an individual undergoing peak physical exertion to suffer a cardiac event, such as cardiac arrhythmia (very rapid heart beat), ventricular fibrillation (the stoppage of the heart), or myocardial infarction (death of part of the heart muscle). As a result, a significant risk of sudden collapse or death would be presented by requiring such individuals to engage in vigorous physical activity.

In Dr. Antlitz's opinion, there is no practicable means to detect the presence of coronary artery disease of this degree in asymptomatic individuals. In his view, routine electrocardiography is of no value, and analysis of heart activity during treadmill exercise testing, with or without the injection thallium for heart imaging, is not sufficiently precise to detect this degree of coronary artery obstruction. Dr. Antlitz also advised that consideration of conventional coronary artery disease risk factors would not appreciably improve the accuracy of exercise testing in detecting heart disease in asymptomatic individuals. The primary difficulty with such tests is that they will incorrectly suggest the presence of heart disease in a significant portion of the test

group, while also failing to detect heart disease in a large number of individuals who actually suffer from the disease.

Dr. Antlitz advises that the only reliable technique for determining the presence of significant coronary artery disease in asymptomatic individuals is through catheterizing the coronary artery 'tree' with cine-angiography imaging. However, in his opinion this invasive test presents significant risks to the patient and is never routinely used as a method of detecting coronary artery disease in asymptomatic individuals. According to Dr. Antlitz, age is the most significant predictive risk factor for the presence of coronary artery disease at a level of 50% occlusion. In his opinion, the risk of coronary artery disease becoming symptomatic through the occurrence of a cardiac event in officers performing typical State Police tasks would become unreasonably high by age 55.

Dr. Antlitz therefore concluded that these facts made a mandatory retirement age of 55 reasonably necessary for State Police work, since substantially all persons over age 55 would have coronary artery disease at a level of obstruction which would place them at a significant risk of suffering a cardiac event while engaged in routine law enforcement activities, and because there is no reliable or medically practicable way to detect coronary artery disease on an individualized basis.

(2) Alexander R. Lind, D. Phil., D.Sc.

Dr. Lind is a physiologist with degrees of Doctor of Philosophy and Doctor of Science from Oxford University, England. He is Professor and the Chairman of the Department of Physiology at

St. Louis University School of Medicine. In addition to being provided with background documentary materials, Dr. Lind made a site visit to State Police facilities on October 11 and 12, 1984.

Dr. Lind's opinion primarily concerned aerobic capacity, which refers to the amount of oxygen which can be taken in by the body. Since all physical activity requires oxygen to support metabolism, and the oxygen requirements of basic physical tasks can be determined, Dr. Lind advised that aerobic capacity can be used to assess the ability of individuals to perform the physical tasks required by the duties of a job. Dr. Lind therefore evaluated those police functions which require sustained and vigorous physical activity to assess the ability of persons, in terms of their aerobic capacity, to safely and efficiently perform State Police duties.

According to Dr. Lind, it is well-established physiologically that aerobic capacity reaches a peak at 20 years of age of an average of 3.6 liters of oxygen per minute, and that aerobic capacity decreases linearly with age by approximately 30% through age 60. As a result, at age 55, 95% of all individuals have a maximum aerobic capacity of fewer than 3.0 liters per minute. In Dr. Lind's view, regular, vigorous exercise will increase aerobic capacity by no more than 10-15%.

Based on his review of established data regarding the aerobic demands of basic physical tasks, together with his evaluation of the job duties required by essential State Police functions, Dr. Lind concluded that the aerobic requirements of some of those duties are at a level of 3.0 liters per minute, with others reach-

ing a level in excess of 2.2-2.5 liters of oxygen per minute. On the basis of that evaluation, Dr. Lind concluded that an aerobic capacity of 3.0 liters per minute should be required for the safe and effective performance of the duties of a New Jersey State Police officer.

Since 95% of those persons aged 55 and older have an aerobic capacity which is less than this bench-mark of 3.0 liters per minute, Dr. Lind concluded that it would be reasonable to require the retirement of State Police officers at age 55 since substantially all persons over that age would be unable to safely and efficiently perform certain essential police duties.

(3) Edward J. Zambraski, Ph.D.

Dr. Zambraski is a physiologist and an Associate Professor in the Program in Physiology at Cook College of Rutgers University. In addition, he is a Fellow of the American College of Sports Medicine. Dr. Zambraski rendered his opinion on the basis of documentary and narrative materials provided to him regarding State Police operations.

Dr. Zambraski agreed with Dr. Lind concerning the level of average aerobic capacity at various ages and the rate of decline in aerobic capacity with age. However, Dr. Zambraski concluded that most individuals through age 60 would possess the aerobic capacity necessary to perform most State Police functions. Dr. Zambraski based this conclusion on his view that aerobic capacity at all ages can generally be increased by as much as 30% through a program of regular exercise, and his conclusion that particularly demanding activities, such as prolonged foot pursuit

or swimming rescue, would rarely be required as a matter of police strategy.

Dr. Zambraski further concluded that aerobic capacity could be evaluated on an individualized basis for all age groups through tests which would present minimal risk to the subjects involved. It was also his view that more generalized physical performance tests would be more effective means to assess the continued fitness of law enforcement officers to perform their duties. However, Dr. Zambraski declined to express any opinion on the physical or aerobic ability of persons over age 60 to perform the duties required by State Police work, since in his view there are insufficient data available upon which to base such an opinion.

(4) John B. Kostis, M.D.

Dr. Kostis is a cardiologist and a Professor of Medicine at the Rutgers Medical School of the University of Medicine and Dentistry of New Jersey. In addition, he is the Chief of the Division of Cardiovascular Diseases and Hypertension at the Rutgers Medical School and a Fellow of the American College of Cardiology. Dr. Kostis rendered his opinion on the basis of documentary and narrative materials provided to him regarding the operations of the State Police.

Dr. Kostis concluded that the retirement of individuals at any particular age would not provide assurance that cardiac difficulties would not interfere with the performance of police duties. Specifically, Dr. Kostis expressed the view that the presence of coronary artery disease at a level of 50% occlusion in persons 55-65 years of age is lower than 70-75%. According to

Dr. Kostis, the contrary view expressed by Dr. Antlitz is based upon data which may not accurately reflect the incidence or extent of heart disease in the general population. However, Dr. Kostis did not express a specific opinion as to the incidence or extent of heart disease among this age group.

Dr. Kostis stated the further view that age is only one of the risk factors for coronary artery disease, and that conventional risk factors such as smoking, hypertension and abnormal blood lipids, should be included in any evaluation of the probable cardiac risk faced by particular individuals. However, Dr. Kostis stated that none of these evaluative techniques can provide full assurance as to the presence or absence of coronary artery disease of a level which might interfere with the safe and efficient performance of State Police duties. Dr. Kostis also concluded that, even if 50% coronary artery occlusion were present in most members of a particular age group, the performance of State Police duties might not significantly increase the risk of cardiac events among such individuals. Finally, Dr. Kostis expressed the view that the lowering of coronary morbidity and mortality of State Police officers could better be achieved through educational efforts, behavioral modification, early diagnosis and therapy, and regular physical activity.

(5) Earl W. Ferguson, M.D., Ph.D.

Dr. Ferguson is a cardiologist, and is certified by the American Board of Internal Medicine and the Subspeciality Board of Cardiovascular Disease. He is a Fellow of the American College of

Physicians, the American College of Cardiology and the Council on Clinical Cardiology of the American Heart Association. He also has a Ph.D. in physiology. He is a Colonel in the United States Air Force and is presently the Director of Hospital Services and the Deputy Commander of the United States Air Force Medical Center at Scott Air Force Base in Illinois. Dr. Ferguson rendered his opinion on the basis of documentary material provided to him regarding State Police operations and a site visit to State Police facilities which he made on December 7, 1984.

Dr. Ferguson concurred with Dr. Antlitz that by age 55, approximately 75% of men in the general population have coronary artery disease with an occlusion of at least 50% in one artery. It was also Dr. Ferguson's view that the data relied upon by Dr. Antlitz in reaching his conclusion were valid since they had been confirmed in a study recently conducted by the Air Force School of Aerospace Medicine. Dr. Ferguson also agreed with the conclusions of Drs. Antlitz, Lind and Zambraski concerning the aerobic capacity of individuals at various age groups, and the linear decline in aerobic capacity with age. In Dr. Ferguson's view, this decline, together with the incidence of significant heart disease in persons in their 50's, would place these individuals at an unacceptable risk of experiencing a cardiac event if they engaged in the extremely strenuous physical activities required by State Police duties. In Dr. Ferguson's view, this danger was further increased by the fact that, after the fifth decade of life, the amount of blood that the heart pumps with each beat

decreases markedly during exercise, thereby creating greater strain on the cardiovascular system during arduous physical activity.

According to Dr. Ferguson, there is no reliable or practicable method to ascertain the existence of coronary artery disease of this magnitude in asymptomatic individuals. He advised that routine exercise testing of asymptomatic individuals will fail to detect one-third or more of those persons who actually have significant heart disease. Similarly, the vast majority of asymptomatic individuals with exercise tests indicating the probable presence of heart disease will in fact not suffer from the disease. Dr. Ferguson stated that the relatively low predictive value of such exercise testing has been confirmed by a study conducted by the School of Aerospace Medicine, in which Air Force pilots with positive stress tests were taken to cardiac catheterization to determine whether significant coronary artery disease was actually present, in order to determine whether they could continue to safely pilot military aircraft.*

According to Dr. Ferguson, the evaluation of exercise tests in conjunction with a review of conventional risk factors (family history, smoking, high blood pressure, high serum cholesterol) does not significantly increase their predictive value. On the contrary, Dr. Ferguson advised that in the major study using this technique, age greater than 55 years versus less than 55 years

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* Dr. Ferguson emphasized that cardiac catheterization was appropriate in these circumstances only because the unique public safety considerations involved warranted subjecting the pilots to the risks presented by this intrusive procedure. However, he stated that such catheterization would never be warranted as a routine diagnostic procedure in a law enforcement setting.

was the only variable which reliably predicted the probability of suffering a cardiac event within five years of testing.

Although Dr. Ferguson advised that radionuclide imaging, in conjunction with exercise testing, improves the ability to detect coronary disease, it was his opinion that this approach was impracticable for the evaluation of asymptomatic individuals due to the high cost involved and the intrusive nature of the procedure, which involves the injection of radioactive materials into the subject. In Dr. Ferguson's opinion, the only feasible means to determine the presence of significant coronary artery disease in asymptomatic individuals is through cardiac catheterization. Dr. Ferguson stated that this was not a medically acceptable means to routinely screen for the presence of coronary artery disease in asymptomatic individuals since this intrusive testing procedure presents significant risks to the patient.

With respect to aerobic capacity, Dr. Ferguson advised that such capacity could be inexpensively evaluated on an individualized basis through a simple field test, such as a timed 1.5 mile run. However, in Dr. Ferguson's opinion there would be a significant risk that a cardiac event might be precipitated if persons with asymptomatic coronary artery disease engaged in such testing. Since there is no reliable method to screen for the presence of heart disease, it was therefore his opinion that it is not possible to safely test for aerobic capacity in persons age 55 and older since such testing would present an unacceptable risk of a heart attack or death.

As a result, it is Dr. Ferguson's view that substantially all members of the State Police aged 55 and older cannot safely and efficiently perform State Police work because approximately 75% of them will have coronary artery disease and decreased cardiac output of a magnitude which would present an unacceptable risk of heart attack or death in the performance of routine police functions. In addition, Dr. Ferguson concluded that it would not be practicable to safely test for the presence of the aerobic capacity needed to perform State Police functions since such testing would present an unacceptable risk of inducing a cardiac event. Accordingly, Dr. Ferguson concluded that these medical and physiological considerations warrant the retirement of all sworn State Police officers at age 55.

## III. Discussion

Although there is a measure of disagreement among the experts consulted by the Division, their findings provide an adequate basis for the Division to determine whether a medical and/or physiological basis exists to establish retirement at a particular age as a bona fide occupational qualification.

All of the physiological opinions provided to the Division agree, in general, as to the level of aerobic capacity at various ages, as well as the rate of decline with age in that aerobic capacity. Based on his conclusions as to the aerobic requirements of certain essential State Police functions, Dr. Lind concluded that the performance of these tasks would be beyond the aerobic capacity of 95% of those persons aged 55 and older.

Dr. Zambraski disagreed with this conclusion on the basis of his opinion that some extremely strenuous physical activities would rarely be required, and on the basis of his view that persons through age 60 could increase their aerobic capacity through training by as much as 30% to maintain the aerobic capacity needed to perform other State Police functions. However, both Drs. Lind and Ferguson advised that only in exceptional cases would the increase in aerobic capacity through training average more than 10-15%. Both Dr. Zambraski and Dr. Ferguson advised that the level of aerobic capacity can be easily tested on an individualized basis. However, Dr. Ferguson advised, in his capacity as a cardiologist, that such testing could not be performed on persons in their fifth decade of life without subjecting them to a significant risk of heart attack or death.

On the basis of these opinions, it appears reasonable to conclude that all or substantially all persons aged 55 and older do not have the aerobic capacity needed to perform duties which are essential to the public safety function of the State Police. In addition, it is reasonable to conclude that it is not possible to test for this aerobic capacity among persons older than age 55 on an individualized basis because of the unacceptable health risk such testing would present to the persons involved.

With respect to coronary artery disease, Drs. Antlitz and Ferguson advised that 70-75% of those persons aged 55 and older suffer significant coronary artery disease in the form of occlusion of at least one artery to a degree of 50%. According to these experts, this degree of artery obstruction would place the members

of the State Police at a significant risk of suffering a disabling and potentially fatal cardiac event while performing routine State Police functions. Although Dr. Kostis questioned the relevance of some of the data relied upon by Dr. Antlitz in support of this conclusion, Dr. Ferguson advised that more recent studies performed by the School of Aerospace Medicine have confirmed the reliability of these data.

All the cardiologists agreed that there is no medically acceptable routine diagnostic procedure which can reliably predict the incidence of significant heart disease in asymptomatic individuals. Although all concurred that exercise testing and risk factor analysis are useful in a therapeutic setting, they also agreed that such testing could not conclusively screen for the presence of asymptomatic heart disease.

It is therefore reasonable to conclude on the basis of these opinions that substantially all person aged 55 and older suffer from coronary artery disease to a degree which would prevent them from safely and efficiently performing State Police duties, since to do so would subject them to a significant risk of sudden collapse or death. It is also clear that it is impracticable to screen on an individualized basis for the degree of coronary artery disease which presents this risk.

Although the experts consulted by the Division were by no means unanimous with respect to these conclusions, there was substantial agreement concerning the factors which are critical to this determination. Given the controversy surrounding this issue, both as a matter of public policy and as an issue of physiological

and medical concern, disagreement of the level reflected in the various opinions is not surprising. Moreover, we found persuasive the fact that the testimony of Drs. Antlitz and Lind as to their opinions on these issues (which correspond substantially with those expressed by Dr. Ferguson) was relied upon by the First, Fourth and Eighth United States Circuit Courts of Appeal in three leading cases which recently affirmed the validity of uniformed service retirement provisions. See EEOC v. Missouri State Highway Patrol, Docket No. 83-2636 (8th Cir., decided November 12, 1984); Mahoney v. Trabucco, 738 F.2d 35 (1st Cir. 1984), cert. denied 53 U.S.L.W. 3391 (U.S. November 27, 1984); Johnson v. Mayor and City Council of Baltimore, 731 F.2d 209 (4th Cir. 1984), petition for certiorari filed, 53 U.S.L.W. 3405 (U.S. November 27, 1984).

## IV. Conclusion

The Federal Age Discrimination in Employment Act permits retirement on the basis of age if the retirement provision constitutes a bona fide occupational qualification which is reasonably necessary to the essence of the business involved. On the basis of the medical and physiological opinions provided to the Division, it is apparent that all or substantially all persons aged 55 and older would be unable to safely and efficiently perform duties which are essential to the enforcement of the laws and protection of the public by the State Police. In addition, it has been demonstrated to the Division that it is impracticable to ascertain on an individualized basis the ability of persons over age 55 to perform these essential State Police duties. Accordingly, it is the con-

clusion of this Report that a compelling factual basis exists to support the validity of mandatory retirement at age of 55 of all sworn members of the New Jersey State Police. This Report therefore strongly urges that consideration be given to the immediate enactment of legislation which would reestablish the requirement that all sworn members of the State Police retire at age 55.

STATE OF NEW JERSEY
DEPARTMENT OF LAW AND PUBLIC SAFETY
DIVISION OF STATE POLICE

APPENDIX

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# REPORT ON THE ESTABLISHMENT OF A MANDATORY RETIREMENT AGE AS A BONA FIDE OCCUPATIONAL QUALIFICATION FOR THE NEW JERSEY STATE POLICE

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Col. Clinton L. Pagano
Superintendent
New Jersey State Police

January 7, 1985

# REPORT ON THE ESTABLISHMENT OF A MANDATORY RETIREMENT AGE AS A BONA FIDE OCCUPATIONAL QUALIFICATION FOR THE NEW JERSEY STATE POLICE

STATE OF NEW JERSEY
DEPARTMENT OF LAW AND PUBLIC SAFETY
DIVISION OF STATE POLICE

January 7, 1985

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# Opinion A

ALBERT M. ANTLITZ, M.D.

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October 23, 1984

Colonel Clinton L. Pagano
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RE: Opinion on mandatory retirement age for the New Jersey State Police

Dear Sir:

The basis for my opinion in regards to a mandatory retirement age for the State Police in New Jersey is based on a review of various documents including: "Sixty Second Annual Report of the New Jersey State Police, year ending June 30, 1983", Standard Operating Procedure, New Jersey State Police October 5, 1984, Personnel Roster of the New Jersey State Police, Critical Task Analysis, Summary of Operational Responsibilities of the New Jersey State Police, miscellaneous letters and documents (for example data on assaults on officers), as well as on a site visit to New Jersey from October 10, to October 12, 1984.

This site visit involved individual and group interviews with many officers and troopers of all ranks from colonel to trooper from many sections, bureaus and assignments. The areas covered included Division Headquarters, Troop D at New Brunswick, Troop C at Fort Dix Station, Troop A at Berlin Station and Troop A at Mantua Station. Members of the Helicopter Bureau, Organized Crime and Narcotics as well as members from the Intelligence Services Section, Investigation Section, the Emergency Management Section and others were included in the interview. At least ten to twelve troopers on road duty were also interviewed.

The New Jersey State Police carry fire arms while both on and off duty, are on call twenty-four hours a day, three hundred and sixty-five days a year and are required to take appropriate action whenever any crime under their jurisdiction comes to their attention while both on and off duty. In addition, all members of the State Police are subject to re-assignment or transfer within the Division at any time. All officers will stop and render assistance to other officers as well as to civilians at any time.

The Critical Task Analysis of the New Jersey State Police duties provided an accurate picture of the physical tasks required. These duties at times involve heavy and extreme physical exertion and demand an oxygen requirement of at least two to two and a half liters of oxygen per minute and at times up to three liters of oxygen per minute.

There is a total of approximately 2,141 uniformed division personnel of which 1,865 serve in operational assignments. Ninety-nine serve in operational assignments which do not involve public contact, but are still involved in carrying out the duties of a police officer as described above. Ninety-one percent or substantially all members serve in operational units. There is a high likelihood over time that officers will be transferred to an assignment where operational duties are essential to the mission of the outfit. Many move from administrative to operational assignments. High ranking officers are on call at all times, such as emergencies, to perform any task assigned to them. In addition, high ranking officers do render assistance on the road, while in transit, to other officers. This is a routine that has been very well documented by the interviews. Participation of high ranking personnel in operational functions is necessitated by the nature of the law enforcement mission of the various division sections. Higher ranking personnel are required to respond appropriately even when off duty when they witness violations of the law. They are also required to stop and render assistance to civilians in distress and to back up officers on the road.

Based on these findings, it is clear that members of the New Jersey State Police perform routinely, though intermittently, at high physical levels of exertion, that is exertion requiring at least two to two and a half liters of oxygen per minute and at the same time perform at a high level of emotional or psychic stress. Only a few items will be mentioned, for example; partaking in a raid, making an arrest, scuffling with a prisoner or suspect, chasing a suspect on foot, pushing cars in winter or summer on or off the road. These items are only brief listings of examples of high physical strain plus high emotional stress to which all members of the New Jersey State Police are subject to. Working in extremes of heat and cold is also routine.

The incidence of coronary artery disease is the next factor to be considered. After age fifty as many as seventy percent of men have significant, though asymptomatic coronary artery disease. This consists in obstruction of the coronary arteries to at least a fifty percent degree. The presence of such coronary artery occlusion in this age group has been well established. There is a gradual increase in the degree of coronary artery obstruction starting in the twenties and then rapidly increasing in extent and frequency in the fifties. This degree of obstruction may not be clinically significant to the average male, however, in a situation of peak physical exertion at a time of extreme excitement this degree of coronary artery obstruction may well then become significant. A police officer working at peak physical capacity as would happen routinely in a fifty-five year old officer performing the usual and expected duties of a police officer in a situation of high psychic and emotional stress and further driven by the adrenalin response as a result of such a situation may well be driven beyond the capacities of the coronary arteries. The blood flow needed to sustain the heart muscle in such a situation may well not be possible because of the degree of coronary artery obstruction present. Police officers are not able to stop and rest when fatigued, but must continue through to the finish of a situation. A reduced blood flow caused by fifty percent or more obstruction of a coronary artery at times of peak demand may well result in a cardiac event. Such an event could be chest pain, as with angina pectoris, a cardiac arrhythmia, as a very rapid heart beating, or actual stopping of the heart as seen in ventricular fibrillation or possibly a myocardial infarction. Sudden collapse and death would be a possible risk in

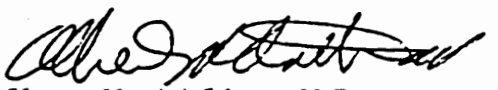
such a situation. Men in their fifties are at particular risk for such an event: first because the duties of a police officer are either at or beyond the physical capacity of this age group and second because the incidence of coronary artery disease becomes very significant in the fifties with as many as seventy percent or more individuals having fifty percent occlusion of a coronary artery. Despite this high incidence of coronary artery disease, there are no tests that can be used in an asymptomatic population as a screen for detecting this degree of coronary artery disease. Routine electrocardiography is of no value and Treadmill exercise testing with or without Thallium is not sufficiently precise or sensitive to detect this degree of coronary artery obstruction. The false positives and false negatives of such testing invalidate the exercise test as a screen or detecting device. This is well accepted by practicing physicians. Adding risk factor analysis to the exercise test has been of no practical value in detection of coronary artery disease in individuals.

Cardiac catheterization with cine-angiography would be able to detect such narrowings of the coronary arteries, however, this is an invasive test with significant risks and has never been used to detect coronary artery disease in asymptomatic people. Age is the most significant predictive risk factor of any risk factors considered. The risk of coronary artery disease becoming symptomatic in officers performing their duty becomes unreasonably high by age fifty-five.

It is my opinion that requiring a member of the New Jersey State Police to be under age fifty-five is reasonably necessary to the essence of the business of the New Jersey State Police. That is, the operation of an efficient law enforcement agency for the protection of the public.

Although there may be some individuals aged fifty-five and older who can safely and efficiently perform the duties of the job of a New Jersey State Police officer, it is my opinion that substantially all persons aged fifty-five and older are not able to perform safely and efficiently the duties of that job because of underlying significant coronary artery disease which is not practically detectable by current medical technique.

Sincerely,



Albert M. Antlitz, M.D.

kaa

Opinion B

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Department of Law and Public Safety
Division of Stae Police
Post Office Box 7068
West Trenton, New Jersey 08625

Dear Colonel Pagano,

In my opinion age can and ought to be used as a BFOQ for the retiral of officers of the New Jersey State Police. That age should not exceed 55 years and the accompanying statement briefly outlines the underlying reasoning for my opinion. We are all aware that aging is accompanied by a progressive decline in our functional capacities and to support this common subjective experience there is an abundance of evidence to document and quantify, objectively, those events.

Please do not hesitate to ask me to elaborate or clarify any part of the enclosed material.

Yours sincerely,

Alexander R. Lind

Alexander R. Lind, D. Phil., D. Sc.
Professor and Chairman

ARL:mak
enclosure

## Age as a Bona-fide Occupational Qualification for State Police Officers in New Jersey

### 1. The occupation of the State Police in New Jersey.

The duties of an officer of the New Jersey State Police are to protect and assist the public and to apprehend those who violate the law. A recent site visit afforded the opportunity of visiting a number of sections of the organization and discussing with a variety of the individuals of all ranks what their duties are and what their various jobs entail both in routine and in exceptional circumstances. Those enquiries elicited that the "front-line" trooper has virtually daily confrontational contact with those who violate the law and/or the need to assist members of the public who are in distress. All officers are required to carry their guns both on- and off-duty, to render assistance to the public and to apprehend violators of the law at all times. In any state of emergency, any or all officers of all ranks are required to be present and to take whatever actions are required to assist the public and to uphold the law; there are no exceptions to that requirement.

Some parts of the routine daily duties are undemanding in terms of physical exertion but they are punctuated by periods of high levels of exertion, some of which are life-threatening. Those high levels of exertion may occur at a moments' notice and from which there is no turning away. Some examples are 1) the physical confrontation, overpowering and arresting violent offenders and mentally disturbed individuals, 2) chasing offenders on foot and grappling with them to arrest them, 3) removing and rescuing individuals from wrecked vehicles, 4) running up stairs and breaking down doors, 5) removing vehicles or dead animals from the highway, etc. These and other jobs involving high levels of energy expenditure must be done in all kinds of weather, winter or summer, in rain, ice or snow. It is these demanding circumstances that become the yardstick for the safe and efficient performance of the officers' duties.

2. Physiological factors of importance for police work.

The question arises whether or not the physiological requirements of police officers can be defined to ensure that they can do their job efficiently and safely to protect the public and to avoid unreasonable risks to their own well-being. Important sensory functions are vision, dark and glare adaptation of vision, hearing and reaction time, while important physical attributes are strength, agility, endurance and aerobic capacity (the ability to generate high levels of energy expenditure). The aerobic capacity is a very important feature in those requirements, and is one that can readily be considered in detail because of the wealth of information available; its importance in any occupation can be judged by the prominent attention it is given in the number and intensity of research investigations in the many and various journals which deal with occupational problems. If any part of an occupation calls for a known energy expenditure or aerobic capacity, only those individuals with that level or a higher aerobic capacity can perform it. In short, the maximum required aerobic capacity in any occupation becomes the minimum need.

3. What is meant by aerobic capacity.

Muscles require oxygen and foodstuffs to maintain their metabolic needs; the cardiovascular system transports those required commodities. At rest, the metabolic needs of the muscles is small and the proportion of the cardiac output (the amount of blood pumped by the heart each minute) sent to resting muscles is only about 15-20%, despite the fact that the muscles represent 40-45% of the total weight of the body. As they become active, the metabolic needs of the muscles increase, calling for more oxygen and foodstuffs and therefore an increase in the amount of blood supplying them. The cardiac output increases

and that increase is almost entirely directed to the active muscles. By various physiological mechanisms the amount of oxygen supplied to active muscles may increase by 40 fold or even more. This process is called aerobic metabolism, which provides the bulk of energy expenditure for most kinds of work. In addition, however, the muscles have an additional source of energy, called anerobic metabolism in which glycogen, stored in the muscles, is broken down to provide glucose as an energy source; this process releases lactic acid which is measurable in the blood to indicate the amount of anerobic metabolism involved. This source of emergency power is limited and is absolute in quantity.

As the severity of exercise increases, so does the amount of oxygen (and foodstuffs) used by the muscles. It is well established that the level of work is linearly related to the intake of oxygen through the lungs, to the blood and so to the muscles. Each individual has a specific upper level of aerobic capacity that is called the maximal aerobic capacity, or in the short-hand of the physiologist, $VO_2$ max where V=volume, $O_2$=oxygen and max=maximumal. This is commonly expressed in liters of oxygen per minute($L.O_2.min^{-1}$), or in milliliters of oxygen per kg of body weight per minute ($ml.O^2.kg^{-1}.min^{-1}$); the first expression refers to total aerobic capacity, such as is required to perform a specific task whereas the second expression is commonly used to assess "physical fitness".

When an individual has to expend the maximal $VO_2$ ($VO_2$ max)to perform a task, that level of exercise can be continued for only 3 or 4 minutes before fatigue intervenes. At all levels of exercise that exceed about 50% $VO_2$ max, anerobic metabolism occurs and fatigue will eventually occur if that work is

continued; as the level of work becomes progressively more severe, the greater is the need for anerobic metabolism and the shorter is the period of work before fatigue intervenes. For example, at 80% $VO_2$ max, work can commonly be continued for only about 10-20 min before exhaustion occurs. In industry, the level of work averages only some 25-40% $VO_2$ max and those components of work in heavy industry where the energy cost exceeds 2.0 $L.O_2.min^{-1}$ are labelled "extremely heavy work".

4. The energy expenditure of arduous police duties.

The energy expenditure or aerobic requirement of the arduous duties of police officers can be assessed from the many reports in the literature. The aerobic requirements of several of those duties reach a level of 3.0 $L.O_2.min^{-1}$ or more, and others reach levels in excess of 2.2-2.5 $L.O_2.min^{-1}$.

Given those circumstances it is eminently reasonable to accept that a limit of 3.0 $L.O_2.min^{-1}$ should be required for the safe and effective performance of the duties of the police officer.

5. The influence of age on aerobic capacity.

The greatest $VO_2$ max of any individual reaches its peak at about the age of 20 years. If a group of 100 men from the general population at age 20 years are examined, the average $VO_2$ max is about 3.6 $L.O_2.min^{-1}$ and 2 to 3 of those men will have a $VO_2$ max over about 4.5 $L.O_2.min^{-1}$. As with all other physiological functions, both sensory and motor, aerobic capacity declines with age. The $VO_2$ max falls linearly with age by some 30% from the age of 20 to the age of 60 years. Thus, at age 60 years, the average $VO_2$ max is about 2.2 $L.O_2.min^{-1}$ and 2 to 3 individuals of that age group have a $VO_2$ max of 2.8 $L.O_2.min^{-1}$ or above.

The values given above refer to that part of the population referred to by physiologists as "sedentary", which is defined as those who do not take regular vigorous exercise. In the several studies published on police officers, involving

about five hundred officers, they fit the definition of "sedentary".

Training by regular, vigorous exercise can increase the $VO_2$ max. Physiologists refer to such members of the population as "active", the definition being that the individuals exercise for a minimum of 20-30 minutes 3 times per week at 60% $VO_2$ max or higher. That level of regular, vigorous exercise will increase the $VO_2$ max by 10-15%. The reduction in aerobic capacity of the "active" population with age is parallel to that of the "sedentary" population. At age 55 years, some 5 of every 100 individuals of an "active population", as defined, have a $VO_2$ max of over 3.0 $L.O_2.min^{-1}$. It must be kept in mind that the benefits of training in increasing the $VO_2$ max are quickly lost (weeks) if the training regimen is discontinued.

The data summarized above come from many experiments on several thousands of subjects in many countries and include data from several hundreds of police officers in the U.S.A. It is clear that such data are generic in nature and follow a pattern that is applicable to all groups or occupations.

6. Conclusion.

Given those observations, it is clear that age can be used as the basis of a Bona Fide Occupational Qualification if police officers are to perform their duties safely and effectively. In statistical evaluations, the level of one chance in twenty of some event occurring is commonly accepted as significant; that level is put forward here. If the notion is accepted that only 5 of every 100 officers fit the requirements of a BFOQ that all, or nearly all officers cannot perform the required duties the age limit should be between 50 and 55 years and it is reasonable to accept an age of 55 years for the sworn police officer for retirement from those particular duties.

# Opinion C

EDWARD J. ZAMBRASKI, Ph.D.

THE STATE UNIVERSITY OF NEW JERSEY
RUTGERS

Cook College · Program in Physiology
Bartlett Hall · New Brunswick · New Jersey 08903 · 201/932-9428

November 16, 1984

Michael R. Clancy
Deputy Attorney General
State of New Jersey
Richard J. Hughes Justice Complex
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Trenton, New Jersey 08625

Dear Mr. Clancy:

The question I have been asked to address is whether or not there is an age dependent decline in aerobic or physical work capacity, which at some point in time would limit the ability of a State Policeman to effectively and safely perform the duties required, and if so, at what age would this point occur. If this were the case then this would constitute a valid exception to the Age Discrimination in Employment Act.

In treating this specific question there are several inherent assumptions being made. The first is that a relatively high aerobic and physical work capacity is required to carry out the responsibilities of a State Policeman. Secondly, that the lack of aerobic and physical work capacity would limit the ability of an officer to perform and/or would place him or someone else in jeopardy. The third assumption is that the higher a State Policeman's aerobic and physical work capacity the greater that individual's effectiveness will be, or conversely, a low aerobic and physical work capacity will limit job effectiveness.

Concerning these assumptions, studies of State Trooper, Highway Patrolmen, and local police indicate that aerobic and physical work capacity are <u>not</u> a pre-requisite for these positions. Numerous studies have shown that these professionals, as a group, possess either normal sedentary levels of aerobic capacity and fitness or lower than normal levels of fitness (2,3, 7,8,15,17). In addition, the aerobic and physical capacity of law enforcement personnel have been shown to be lower than that of prisoner inmates (9). Although the several month long academy training of Troopers or State Police increases their work and aerobic capacity (15), the amount of physical activity they do in the course of their job responsibilities is lower than what is needed to maintain aerobic fitness and physical work capacity (15).

One study of 140 California Highway Patrol Officers had these individuals rated by their superiors using a previously validated 16 critical job task analysis (17). The group was divided into the 70 officers who were rated the highest on job performance and 70 rated the lowest. In a double blind study, laboratory tests which evaluated strength, flexibility, body composition, and cardiorespiratory condition failed to identify low versus high rated officers. Therefore, there was no correlation between an objective measure of job performance and either cardio-respiratory or physical work capacity. The same study attempted to correlate performance scores on two field simulated tests with aerobic capacity. One of the field simulated tests involved a running, climbing, and restraining of an arrest resistor and the other a rescue involving a 165 lb dummy dragged from an automobile. Maximal oxygen consumption or aerobic capacity was not significantly correlated with performance of these two tests ($r=.13-.14$).

I have evaluated the "Summary of Physical Job Duties of New Jersey State Police". Unfortunately many of the activities are inappropriately described in terms of their nature or what is implied concerning the physiological requirements of a given task. Specifically, the word endurance is used throughout the listing. If one defines endurance as the ability to do continued work over prolonged periods of time, which is dependent upon cardio-respiratory function or aerobic capacity, very few of the activities cited actually demand endurance. The only activities which would require true aerobic capacity would be the pursuit of a subject over a long distance, swimming long distances for a rescue, and perhaps rappeling. If an activity, requiring large amounts of dynamic muscular contraction is not maintained continuously for periods of at least 10 minutes or more, performance of that activity will not be limited by cardio-respiratory function or aerobic capacity. In this situation other metabolic sources of energy (stored muscle high energy phosphates, anaerobic metabolism) will be utilized. Most of the activities described only require muscle strength over relatively short periods of time which would place demands and be limited by factors other than aerobic capacity. As indicated, the exceptions would be a prolonged pursuit or swimming rescue, although I doubt if in terms of strategy whether a State Policeman would engage in activity at a high intensity for a prolonged period of time which would separate him from his vehicle or other support/personnel and possibly increase vulnerability.

Consequently, none of the activities would place a physical demand upon an individual that would combine the necessary intensity and duration to require these individuals to utilize their maximal aerobic capacity or what is measured as maximal oxygen consumption. This conclusion is supported by the previously cited studies which demonstrated that State Police have only low to average levels of aerobic capacity. It would be erroneous to numerically compare estimated energy expenditure associated with a given task with an individual's aerobic capacity because very rarely, if ever, would a State Policeman do the type of work that would evoke a steady state at his maximal aerobic capacity.

The majority of the items in the summary of job duties require muscle strength and short-term (less than 10 minutes) anaerobic power. These parameters, which do show an age related decline, are totally different from aerobic capacity.

Having demonstrated that as a group State Police have average sedentary or lower than average levels of aerobic and physical work capacity, the next issue is how do the aging effects influence their absolute values. Several studies have evaluated how age effects aerobic capacity or maximal oxygen consumption. Kasch and Wallace (4,5) reported that between the age of 45-55 there is a 9-15% decline in physical work capacity. Other studies have shown that a 4-5 ml/min/kg per decade decline in maximal oxygen consumption may occur over 25-65 years of age (14). Maximal oxygen consumption for a sedentary group would be approximately 40, 35, 30 ml/min/kg at ages 40, 50 and 60 years, respectively. Based upon all data available this decline appears to be linear through age 65-70; i.e. There is no sudden decrease at a given age (16). On a percentage basis this would mean that the aerobic capacity would decreased by 11, 13, and 14% over 40-60 years of age.

It is important to note that this age related decline in aerobic capacity can be attenuated or totally prevented by involvement in a program of regular physical activity (5,11,14). In addition Seals, et al (10) recently reported that in a group of 61-67 years old men, exercise training increased their maximal aerobic capacity by 30%. These studies demonstrate that the age related decreases in maximal aerobic capacity that occur from 40-60 years are preventable. In addition, at age 60, a State Police Officer who is involved in a regular exercise program will probably have an aerobic capacity which is not significantly different than that of an average 40 year old State Police Officer.

From age 45 to 65 their is an approximate 15% decrease in strength (1). Again this decrease can be attenuated or totally eliminated by a strength training program (11,13). In comparing absolute values for strength, an officer at age 60 who has maintained his strength through an exercise program may have measures of strength performance similar to that of the average untrained State Policeman at age 40.

The lack of aerobic and physical work capacity has been identified as a risk factor for cardiovascular disease. Consequently, it might be argued that due to an age related decline in these parameters there would be an increased risk of cardiovascular disease. However, studies on police and State Troopers have shown that, as a group, a large percentage of these individuals have a significant number of other risk factors. Specifically, at age 40-50 years 88% of 213 individuals had one risk factor, 65% had two, 48% had three and 31% had a total of four risk factors for cardiovascular disease (8). These factors include serum cholesterol and triglycerides, body fat, blood pressure, and cigarette smoking. Therefore, as far as cardiovascular disease, the contribution that a decline in fitness with age might have to the overall probability of morbidity or mortality is probably minor

compared to other existent risk factors. The statement that the age factor is secondary to other factors, as far as disability, is supported by the fact that the mean age for retirement disability of California Highway Patrolmen is 40 years (17).

As previously indicated, although it has not been proven that a high level of aerobic capacity is a pre-requisite for a trooper to meet his responsibilities, there are numerous tests which could be used to evaluate aerobic capacity, muscular strength/flexibility, and muscular power. Tests have been designed and proven to present minimal risks to subjects over all age ranges. Specific tests which have been designed to mimic duties of a State Trooper (i.e. pursuit and arrest; rescue simulation) are available (17). These tests could be used to evaluate fitness levels and to ascertain if officers are maintaining their physiological capacities.

In summary, although it is contrary to what one might presuppose, aerobic and physical work capacity have not been shown to be a pre-requisite for State Troopers to effectively carry out their current responsibilities. Job performance appears to be related to factors other than these physiological capacities. It should be added that a State Trooper's decline in aerobic capacity, decrease in physical work performance, and increased risk of pre-mature cardiovascular disease is quantitatively more attributable to behavioral action (i.e. smoking, lack of regular physical activity, increased body weight) than to a normal age dependent change in physiological function.

There is no justification for the statement that based on aerobic capacity and physical work performance that individuals should be discriminated against based on age. Data are available indicating that a person's physiological capacities could be maintained through age 60 at a level comparable to what State Police, Highway Patrolmen and local police officers currently maintain at the ages of 40-50.

Signed,

Edward J. Zambraski

Edward J. Zambraski, Ph.D
Associate Professor of Physiology
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Enclosures

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# Opinion D

JOHN B. KOSTIS, M.D.

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December 5, 1984

Mr. Michael R. Clancy
Deputy Attorney General
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CN112
Trenton, NJ 08625

RE: Consultation with the New Jersey State Police

Dear Mr. Clancy:

Thank you very much for your letters of October 30, 1984 and November 26, 1984 concerning a uniform specific age of retirement of the members of the New Jersey State Police. I have reviewed the "corrected file copy," dated October 10, 1984 of a memorandum by you to Michael R. Cole, first assistant Attorney General and Col. Clinton R. Pagano, Superintendent, as well as five professional articles sent to you by Dr. Antlitz and have received permission from the President of the University to proceed with this.

I understand that retirement at age 55 has been advised by cardiologists for two reasons:

1. That approximately 70 to 75% of persons over the age 50 suffer from significant coronary artery disease in the form of 50% occlusion of the coronary arteries.
2. That it is impractical to test for the presence of asymptomatic heart disease with accuracy greater than 65 to 75%.

Although it may be necessary to set a specific age for retirement of members of the New Jersey State Police, I do not think that this should be done solely on the basis of the effect of age on the development of heart disease. Age is only one of the many factors that are associated with the presence of coronary artery disease. There is great variability in the severity of this disease and wide differences exist in physiology and pathology among human beings of the same chronological age.

My opinion is based on the following:

1. The probability of presence of significant coronary artery disease in persons 55 - 65 is lower than 70 to 75%.

a. The paper submitted by Dr. Antlitz (White NK, Edwards JE, Guy TJ. The Relationship of the Degree of Coronary Atherosclerosis with Age in Man. Circ. I 645-55, 1950) pertains to 600 hearts that had been saved at the time of necropsy as a routine procedure (not war casualties) without regard as to

whether or not cardiac disease was present. Since cardiovascular disease is the most frequent cause of death in the older age groups these data bias the results to falsely increase the prevalence of coronary atherosclerosis in older age groups and not reflect the true prevalence of the disease in persons who are alive.

b. A more appropriate cohort would include autopsies performed on subjects who did not die from heart disease. Data from the International Atherosclerosis Project, a large study comprising 13,000 autopsies from 14 countries, sheds light on this question. (Tejada C, Strong JD, Montenegro MR, Restrepo C, Solberg LA. Distribution of Coronary and Aortic Atherosclerosis by Geographic Location, Race and Sex. Laboratory Investigation Vol. 19 No. 5 pages 509-525, 1968.) In this study among hearts of persons aged 55 to 64 who died of accidents, cancer, infections, and miscellaneous causes, coronary stenosis defined as a reduction of the cross sectional area by 50% or more at one or more points in any of the coronary arteries was present in 32% of white men in New Orleans, 21% of black men in New Orleans, 24% of men in Oslo and 8% of men in Puerto Rico.

c. I suspect that the prevalence of the disease in the 1980s is even lower since there has been a significant decrease in mortality from coronary artery disease by approximately 30% in the last 20 years.

d. Age is only one of the risk factors for coronary artery disease. If retirement criteria are to be set according to the probability of presence of coronary artery or future development of coronary morbid or mortal events then smoking, hypertension and abnormal blood lipids should be included in the formula since in certain instances they outweigh the risk imposed by age. For example, a person in the age group between 55 and 64 who stops smoking has an average annual incidence of coronary attacks of 5.7 per thousand per year which is lower than the 11.9 annual incidence per thousand of a person who is 10 years younger (age group 45 to 54) but continues to smoke one pack of cigarettes a day. These data are present in Figure 9 of the paper on optimal resources for primary prevention of atherosclerotic diseases by the Atherosclerosis Study Group (Kannel WB, Doyle JT, Ostfeld AM, Jenkins CD, Kuller L, Podell RN, Stamler J. Circulation Vol. 70, page 157a, 1984). Similarly in the paper by Goldman L, et al (Incremental Value of the Exercise Test for the Diagnosis in the Presence or Absence of Coronary Artery Disease) a 10 mg/% increase in cholesterol level, for example, from 230 to 240 mg/dl was a stronger predictor of coronary artery disease than increase in age by one year. In the same paper, smoking had an effect in increasing the risk of coronary artery disease similar to a 10 year increase in age. If age is to be set as the criterion for retirement, the age of retirement for women should be 10 years higher than that of men, since women lag behind men in the incidence of coronary heart disease by 10 years.

2. The presence of 50% coronary narrowing increases the risk of future morbid or mortal events as does a positive exercise stress test but the risk is not great and there is no proof that it is markedly increased by the duties of a policeman.

a. Since the probability of presence of coronary artery disease is affected by risk factors is a continuous faction, no retirement age or diagnostic criteria will give 100% assurance that mortal or morbid events will

not happen during the performance of the duties of a policeman. Therefore, a decision has to be made taking into consideration the loss of the expertise of older officers, the probability of them sustaining a fatal or non-fatal coronary event, the probability of that event will occur on durty or during off-duty hours, and the probability, very small in my opinion, that this will happen during strenuous activity.

b. Sudden death and myocardial infarction usually occur while the patient is at rest or asleep. Although the risk of occurrence of sudden death (per minute) increases during performance of strenuous physical activity, habitual physical activity has an overall beneficial effect in lowering incidence of sudden death.

c. Although 50% stenosis as verified by coronary arteriography is usually associated with decreased flow to the heart during stress (increased heart rate or increased blood pressure as occurs in exercise or emotional upset) the prognosis of individuals with 50% stenosis is rather benign.

d. Although a negative stress test does not guarantee the absence of 50% coronary arterial stenosis, it is used clinically to study the functional significance of the stenosis. Fifty percent stenoses that do not result in abnormal exercise stress test with thallium are considered not functionally significant from the point of view of treatment.

3. If the objective is to lower coronary morbidity and mortality of officers of the New Jersey State Police a better approach would be to give the officers the education and opportunity to pursue healthy lifestyles and to have early diagnostic and therapeutic interventions rather than to set the retirement age at 55. I hope that this is helpful to you.

Sincerely,

John B. Kostis, M.D.
Professor of Medicine and
Chief, Division of Cardiovascular Diseases
and Hypertension

JBK/j

cc: Ms. Norma Davenport, Esq.

# Opinion E

EARL W. FERGUSON, M.D., Ph.D.

23 December 1984

Col. Clinton L. Pagano
Superintendent
New Jersey State Police
Division of State Police
West Trenton, NJ 08625

Dear Col. Pagano:

Since my site visit on 7 December, I have completed a more comprehensive review of the recent literature pertinent to the problem of asymptomatic (silent) coronary artery disease in occupations, such as policemen, where sudden incapacitation from coronary disease might have a significant impact on the public safety. This letter will discuss the incidence of coronary artery disease events (heart attacks, sudden death from coronary disease, etc.) in this country with special reference to recent trends and the problem of determining the true prevalence of coronary artery disease (how many people in the population have coronary disease) because of the large number of individuals with asymptomatic disease. It will also discuss the importance of extent of disease and degree of coronary artery blockage in terms of long term effects and risk of cardiac events; the inadequacies of exercise testing for the detection of coronary disease in asymptomatic individuals; the importance of age as the major risk factor for coronary artery disease and as a major factor in the ability of individuals to perform strenuous, particularly aerobic, exercise; and the medical and physiological bases for BFOQ with special reference to the requirements of the New Jersey State Police. The cost-effectiveness of various options will be discussed.

It is clear that there are no clear-cut, simple answers to the problem we are addressing. My goal is to present the pertinent facts in the problem to show just how complex it is. References to articles will be cited in the text by author(s) and year and the complete references listed in Attachment 1.

Incidence of coronary artery disease events:

Levy (1984) and Feinleib (1984) have reviewed the recent trends in morbidity and mortality from coronary artery disease in this country. Although there has been a 40% decline in the age-adjusted cardiovascular mortality rate since 1950, with the greatest decrease occurring in the last 16 years, cardiovascular disease is still the leading cause of death in the United States. Coronary heart disease is responsible for more than 550,000 deaths and as many as 1.5 million heart attacks each year. More than 5.4 million Americans have symptomatic coronary artery disease and many more (at least 10 million and perhaps 20 million

or more) have undiagnosed coronary disease. The number of individuals with undiagnosed coronary artery disease makes it impossible to determine the true prevalence of coronary disease (how many people in the population have coronary disease), but it is clear that it is much higher than the incidence of coronary events alone would lead us to believe.

White, Edwards and Dry (1950), in a classic autopsy study of the degree of coronary artery disease in men in each decade from 30 to 89 years, found that 18% of men aged 30 to 39, 40% of men aged 40 to 49, and 75% of men aged 50 to 59 had at least one 50% blockage in their coronary arteries. It should be noted that this study was done in a university hospital on specimens obtained from routine consecutive autopsies on men dying from a wide variety of causes. Patients with cardiac disease or significant risks of heart disease were not excluded from the study. Spain and Bradess (1960), on the other hand, did a postmortem study on the degree of coronary artery disease in "normal" men dying suddenly from accidents, homicides and suicides. They excluded from consideration those cases that at autopsy had findings consistent with diabetes mellitus, chronic renal disease, cirrhosis of the liver, hypothyroidism, and advanced coronary artery disease, as well as those cases that had had a previous clinical history of hypertension or diabetes mellitus. Even with this highly select group, 31% had coronary blockages of 40% or greater and the average degree of coronary blockage was approximately 40% in men aged 46 to 50, with further increases in the degree of coronary blockage in men aged 51 to 60. The Spain and Bradess (1960) study and others that have included only persons not known to have coronary artery disease before death have been used by Diamond and Forrester (1979) to suggest that the true prevalence of coronary artery disease in asymptomatic patients is about 4.5%. There is much data to suggest that the true prevalence of asymptomatic and undiagnosed coronary disease is higher. Myerburg and Davis (1964) noted that of 1348 cases of sudden death due to coronary artery disease only 26% were known premortem. Undiagnosed symptoms of coronary disease were present in another 33%, but in 41% the first and only manifestation of coronary disease was sudden death. More recently, Hopkirk et al. (1984) studied 225 asymptomatic aircrewmen (aged 35 to 57) at the USAF School of Aerospace Medicine. Of these highly selected, clinically "healthy" men, 65 or 29% (mean age 43) had significant coronary artery disease (at least one 50% blockage).

One major difficulty that hampers the determination of the prevalence of coronary artery disease (especially asymptomatic coronary disease) in the population is the wide individual difference in the clinical responses of different patients to coronary disease. Cohn et al. (1983) have recently demonstrated that patients with symptomatic and asymptomatic coronary disease do not differ in extent or type of coronary blockages, age, sex or response to exercise. Droste and Roskamm (1983) found identical results and demonstrated that patients with asymptomatic coronary disease had higher pain tolerances to

electrical, cold and tourniquet induced pain. It is not surprising, then, that Burggraf and Parker (1975) demonstrated that mortality from coronary artery disease correlates better with the degree of obstruction and number of vessels involved than with symptoms or history of previous heart attack.

Another difficulty is that determining what degree of coronary artery blockage is significant is difficult, especially in the asymptomatic individual. Gould et al. (1974) have shown experimentally in dogs that while an 80% occlusion was necessary to decrease flow at rest, a 40 to 60% occlusion significantly decreased maximum hyperemic flow (as would occur with a stimulus such as exercise). Logan (1975) found similar results in human coronaries studied postmortem using perfusion under controlled hydrostatic pressures. Even coronary blockages less than 50% may progress rapidly and be clinically significant (McGranahan et al., 1983). Bruschke et al. (1973) have shown that the five year mortality for patients with blockages of less than 30% is three times that for patients with normal coronaries and that for patients with 30 to 50% blockages it is seven times that for patients with normal coronaries. Lim et al. (1974) found that blockages 50% or less (including intimal roughening, minimal disease) increased mortality five fold.

Detection of asymptomatic coronary disease:

Uhl and Froelicher (1983) have recently reviewed the problem of detecting coronary disease in asymptomatic individuals. As they point out, numerous studies have now shown exercise electrocardiography to have a sensitivity (ability to detect disease) of approximately 50% and a specificity (ability to demonstrate that normals are normal) of 90%. When attempting to detect coronary disease in asymptomatic individuals, the test, therefore, misses half of the individuals that have disease. Furthermore, almost 80% of the asymptomatic individuals that have positive tests will be normal. The problem of sensitivity and specificity and the predictive value (percent of persons with a positive test that actually have disease) for exercise electrocardiography in populations with different prevalences of disease is well discussed by Froelicher (1977). Even if the prevalence of disease in asymptomatic men is only 5%, exercise testing is inadequate. If exercise testing has a sensitivity of 60% and a specificity of 90%, then its predictive value in that population would be 24% (24% of men with a positive test would have disease, 40% of men with disease would be missed and 76% of men with positive tests would be normal). If the prevalence of disease is 10%, exercise tests would have a predictive value of 40% (40% of men with a positive test would have disease, 40% of men with disease would be missed and 60% of men with positive tests would be normal). In summary, when the prevalence of disease in a population is relatively low, the predictive value of a test such as exercise electrocardiography is poor.

It is clear that exercise electrocardiography alone as a

screening tool for coronary disease in asymptomatic men is inadequate. Recent examples of the futility of such testing include the studies by Piepgrass et al. (1982). In this study, reported from the USAF School of Aerospace Medicine, routine exercise tests (not all treadmill tests) were performed on 771 asymptomatic male flyers (aged 35 to 54). Of the 21 men that eventually had clearly positive treadmill tests (ST segment depression on electrocardiogram), 17 were taken to cardiac catheterization and one individual with a single 30% lesion and another with a 50% lesion were found. The other 15 individuals subjected to cardiac catheterization were normal. The five individuals that declined cardiac catheterization were removed from flying duties. This study demonstrates the poor yield from routine exercise testing, the unnecessary, expensive, invasive testing that it can cause, and the negative impact it can have on individuals' careers. It is clearly not cost-effective to expend major financial resources in search of poor data that cannot be adequately dealt with.

To improve the effectiveness of exercise testing for the detection of asymptomatic coronary disease, numerous investigators have evaluated the usefulness of screening for various cardiac risk factors and addition of exercise variables other than electrocardiography to improve the predictive value of testing. Bruce et al. (1980) studied 2365 clinically healthy men as part of the Seattle Heart Watch. With risk factor screening and the use of four exercise predictors they were able to identify a group of individuals with a 33% likelihood of having a coronary event within 5.6 years. However, this group was only one percent of the total population, and 80% of the cardiac events that occurred in the 5.6 year follow-up period occurred in the groups that were judged to be at low or mild risk. Hopkirk et al. (1984), who did cardiac catheterizations on their 225 asymptomatic aircrewmen, found that while the combination of risk factors they used were highly predictive (89% who had the risk factors had disease), they were relatively insensitive (only 37% of aircrewmen with disease were detected by the combination of risk factors alone). Thus, if they had not catheterized all their subjects, they would have missed 63% of the individuals with disease.

Even when combined with risk factor screening, it is clear that mass screening of asymptomatic men for coronary artery disease by exercise testing fails to detect most men with significant coronary disease and most coronary events which will occur, while proving to be an expensive way of detecting coronary disease in the few men that are detected. For example, using the data from the study of Bruce et al. (1980) and assuming a cost of $300 per person for risk factor screening (medical history, physical examination, determination of cholesterol and high density lipoprotein and other laboratory work, resting electrocardiogram) and a treadmill exercise test (much less than the probable cost), the cost for screening 1000 men would be $300,000. For this screening we would find 10 men with a 33% probability of having a coronary event within 5.6 years (at a cost of $30,000 each or

$90,000 per coronary event). During the same time period we would expect the vast majority of cardiac events (approximately 80%) to occur in the individuals that were considered to be at low or mild risk on the basis of our screening program. Such a program is clearly cost-ineffective as a means of screening for coronary events. The article by Patterson et al. (1984) on "Bayesian comparison of cost-effectiveness of different clinical approaches to coronary disease" further expounds on this problem. Even the use of radioisotopes in combination with exercise testing (a more expensive procedure) does not solve the problem, as highlighted in the article "The declining specificity of exercise radionucleide ventriculography" by Rozanski et al. (1983).

Effects of age on coronary disease and exercise capacity:

Major risk factors for the development of coronary artery disease are age, male sex, smoking, hypercholesterolemia (high blood cholesterol), and hypertension (high blood pressure). Other risk factors include family history, diabetes mellitus, and an abnormal resting electrocardiogram. Smoking, hypercholesterolemia, and hypertension are the risk factors that are stressed in education and prevention programs, because these are the major modifiable risk factors. However, age alone is the single most important risk factor for the development of coronary disease. For example, in the Seattle Heart Watch Study data of Bruce et al. (1980), age greater than 55 years versus less than 55 years was the only risk factor that alone predicted an increased 5 year probability of a cardiac event. No other individual risk factor (positive family history, hypertension, smoking, hypercholesterolemia) was predictive. The USAF School of Aerospace Medicine is currently using a risk factor index that correlates fairly well with the presence of angiographic evidence of coronary disease. This index is based on age, cholesterol, and high density lipoprotein cholesterol (HDL). The USAFSAM risk index = age squared ((cholesterol - HDL)/HDL). Thus, while cholesterol and HDL cholesterol are linearly related to cardiac risk, age is a much stronger risk factor since risk increases as the square of age.

Port et al. (1980) examined 77 active healthy adult volunteers between the ages of 20 and 95 years using radionuclide angiography to evaluate the effects of age on heart function during exercise. They found that 21 of 29 subjects above the age of 60 years had a decrease in the ability of the heart to function with exercise, whereas only 4 of 48 subjects below the age of 60 had such changes with exercise. They concluded that the changes were not related to coronary artery disease, since there was no evidence for it in their population. However, Hakki et al. (1983) evaluated the same parameters in patients above the age of 60 who had their coronary anatomy defined by cardiac catheterization. They concluded that coronary disease, not age alone, decreased the ability of the heart to function with exercise. Therefore, the decrease in cardiac function with age

in the study by Port et al. may well have been due to undetected and asymptomatic coronary artery disease, and, short of cardiac catheterization to precisely define coronary artery anatomy, the best predictor for coronary artery disease and decreased cardiac function appears to be age.

It is well known and well documented in the literature that the ability to do aerobic exercise, the aerobic capacity, decreases progressively with age (Hodgson and Buskirk, 1977; Raven and Mitchell, 1980). Hodgson and Buskirk reported a decrease in the maximum aerobic capacity (VO2max) of 0.45 ml of oxygen per min per year of age between the ages of 20 and 60 years, regardless of the level of physical activity. If we set the acceptable level of VO2max at 42 to 46 ml/kg/min (the "good" level for men aged 21 to 29 set by the West Virginia State Police based on data by K. H. Cooper, R. A. Bruce and others), then individuals at acceptable levels at age 25 can be expected to be at 28.5 to 33.5 ml/kg/min at age 55, a 29 to 32% decrease in VO2max and clearly out of the acceptable range. To remain in the acceptable range at age 55, individuals would have to start with a VO2max at age 25 of at least 55.5 ml/kg/min. This is an exceptionally high VO2max, generally characteristic only of well trained athletes.

Training is, however, not the answer to the aging problem. The VO2max can be increased by 15 to 20% by vigorous aerobic conditioning. Increases of more than 20% in healthy, nonobese individuals are unusual. Saltin et al. (1968) found that three weeks of strict bedrest decreased the VO2max 20 to 25% in healthy subjects and that it took 10 to 40 days of training for subjects to regain their pre-bedrest level of VO2max. Normal, healthy, nonobese sedentary individuals are much more aerobically fit than similar individuals subjected to three weeks of bedrest, and their ability to increase their VO2max is much less.

Medical and physiological bases for BFOQ:

The prevalence of coronary artery disease in the population, and, thus, the incidence of cardiac events (heart attacks, sudden death, etc.), increases markedly with age. Age is, in fact, the strongest risk factor for coronary disease. Coronary disease can not be adequately detected in the majority of individuals, especially those with no symptoms or with chest pains not thought to be related to the heart. Review of Tables 2 and 3 in the article by Diamond and Forrester (1979) shows that the risk of coronary artery disease increases from 1.9% at age 30-39, to 5.5% at age 40-49, to 9.7% at age 50-59, to 12.3% at age 60-69 in asymptomatic men; and from 5.2% at age 30-39, to 14.1% at age 40-49, to 21.5% at age 50-59, to 28.1% at age 60-69 in men with nonanginal chest pain--pain thought not to be from the heart. Such increases with age are dramatic and are consistent with the dramatic increases in coronary artery disease seen with age in pathologic/autopsy studies. By age 50-60 years, the risk of sudden death or incapacitation from undiagnosed coronary artery disease is highly significant. In individuals involved in

occupations where the public safety could be jeopardized by sudden incapacitation from coronary disease (such as airline pilots, military pilots, firefighters, policemen), unless there is an adequate, cost-effective means of detecting and removing those individuals at risk from their duties, then retirement on the basis of the major risk factor, age, may be justified. It is clear that current screening programs fail to detect up to 80% of individuals that will have cardiac events. Whether or not this is acceptable is a policy decision.

It is also clear that the ability to perform aerobic exercise decreases progressively with age and that most men aged 50 to 60 years are unable to maintain a VO2max of 42 ml/kg/min. This level of VO2max is the level that would be required for tasks such as swimming for five minutes to rescue someone, lifting and carrying someone for five minutes, running for five minutes, etc.--all tasks described to me as required of the New Jersey State Police in written material and in discussions during my site visit. Five minutes was picked as an arbitrary time. It is certain that a significant number of tasks would take longer and require higher levels of fitness.

The ability to perform work at a VO2max of 42 ml/kg/min can be tested. However, such testing procedures require medical screening, evaluation, and supervision. Furthermore, a significant number of deaths and cardiac events from asymptomatic or undiagnosed coronary artery disease can be expected to occur during such an exercise testing program.

Once you have reviewed this letter, please feel free to contact me if you have any further questions or require clarification on any area. This is really only a summary. A wealth of additional supporting data is availible.

Sincerely yours,

Earl W. Ferguson, M.D., Ph.D.

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