

AN EVALUATION OF THE PERFORMANCE OF WORKERS
WITH IMPAIRMENTS AT THE OKLAHOMA
CITY AIR MATERIEL AREA

by

ELVIN ODELL CAMPBELL
//

Bachelor of Arts
The University of Oklahoma
Norman, Oklahoma
1942

Masters of Business Administration
Oklahoma City University
Oklahoma City, Oklahoma
1966


Master of Science
Oklahoma State University
Stillwater, Oklahoma
1971

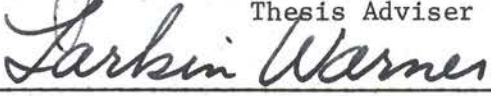
Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
DOCTOR OF PHILOSOPHY
July, 1972

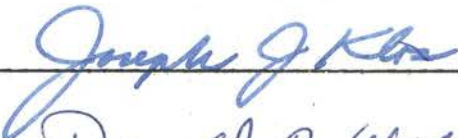
SEP 10 1973


AN EVALUATION OF THE PERFORMANCE OF WORKERS
WITH IMPAIRMENTS AT THE OKLAHOMA
CITY AIR MATERIEL AREA

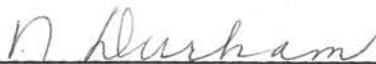
Thesis Approved:



Thesis Adviser








Dean of the Graduate College

PREFACE

This dissertation consists of an evaluation of the performance of workers with impairments at the Oklahoma City Air Materiel Area (OCAMA). An analysis of the performance appraisal standard-score means of 11 groups of impaired workers is made by \$1,000 annual wage ranges. An impaired group having a specific impairment in a particular wage range is compared with a nonimpaired control group of 40 persons in the same wage range. The individual results of such comparisons are aggregated regardless of the occupational group to obtain the overall performance rating for each type of impairment. A similar analysis is made of 18 wage-board occupational groups in each of which there is a sufficient number of impaired persons to permit a statistical treatment of the data.

I wish to express appreciation to Mr. Theodore D. Wheaton, Chief of Civilian Personnel, who has given leadership to OCAMA programs and programs throughout the Air Force for the employment of people with physical and mental disabilities.

Mr. Kenneth E. Lowe, Chief of Employee Relations Branch, Directorate of Personnel of OCAMA, has been of special assistance in making arrangements for this study. Others from OCAMA who have been helpful in regard to research aspects of the study are: Mr. Claude J. Humble, Mr. Danny Roberts, Mr. Clive C. Courtney, Mr. Dan L. Moore, and Mr. Lee Evans.

I wish to express my appreciation for the assistance and guidance given to me by the following members of my committee: Dr. John C. Shearer, Dr. Larkin Warner, Dr. Joseph Klos, and Dr. Donald R. Williams.

TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION.	1
II. THE IMPAIRED AND THEIR REHABILITATION	9
III. ECONOMIC STUDIES OF IMPAIRMENT AND REHABILITATION.	25
IV. PERFORMANCE OF IMPAIRED WORKERS AT THE OKLAHOMA CITY AIR MATERIEL AREA	38
V. SUMMARY AND CONCLUSIONS	76
A SELECTED BIBLIOGRAPHY.	83

LIST OF TABLES

Table	Page
I. Impairments at Oklahoma City Air Materiel Area.	6
II. Work Performance of Workers with Serious Physical Impairments, and of Matched Unimpaired Workers	28
III. Distribution by Annual Wage Ranges of Nonimpaired and Impaired Wage-Board Nonsupervisory Employees	41
IV. Impaired Eliminated Because of Small Cell Size	43
V. Annual Performance Appraisal - Wage-Board Nonsupervisory Rating Elements	45
VI. An Analysis of the Performance Appraisal Standard- Score Means of Impaired and Nonimpaired Groups	50
VII. Numbers of Persons With Performance Appraisal Standard-Score Means Below or Equal to and Above the Means of Nonimpaired Control Groups by Annual Wage Intervals.	51
VIII. Averages of Age, Performance Appraisal Scores, Learning Ability and Years of Education by Impairment Codes and Wage Intervals	59
IX. An Analysis of the Performance Appraisal Standard- Score Means of Impaired and Nonimpaired by Occupational Group	68

CHAPTER I

INTRODUCTION

The Federal-State Program of Vocational Rehabilitation, involving thousands of persons and millions of dollars yearly, seeks to promote a fuller utilization of our human resources by providing a wide variety of services to disabled persons. These services enable rehabilitated persons to participate in gainful activity and use their abilities for the benefit of themselves, their families, and their communities. In addition to medical service, services of training, guidance, education and job placement assistance are provided to impaired persons. A "rehabilitated" person is one who has received one or more of the above services to the extent that he can compete effectively with nonimpaired persons.

Programs of this magnitude should be evaluated periodically to determine whether their contribution to economic welfare is commensurate with the time, money and effort spent in rehabilitating and finding employment for the impaired. An employer should pay only as much as the marginal revenue product of his employee. If the productivity of an impaired individual is not equal to the productivity of a nonimpaired employee, then the employer is not being economically efficient if the impaired worker receives the same remuneration as the nonimpaired worker. If the impaired person performs as well, then the rehabilitation effort has achieved a goal of helping him to become a

productive, contributing, tax-paying member of society. This, however, does not necessarily mean that rehabilitation is economically efficient.

The purpose of this study is to evaluate the work performance of impaired workers in today's job market using specific information concerning individual performances which can be quantified and treated statistically so that precise comparisons can be made with the performances of nonimpaired workers in a single plant, OCAMA, by: (1) \$1,000 wage intervals, and (2) specific occupational groups. Results of these comparisons should assist employers in making decisions concerning the economic desirability of employing various categories of ~~rehabilitated~~ impaired persons. OCAMA offers a unique opportunity for such a study because it has one of the largest concentrations of impaired workers in a single plant in the nation. Of 23,474 workers employed at the time the data were gathered, 4,916 (21 percent) were impaired.

This study analyzes the work performances of various types of impaired workers relative to performances of nonimpaired, but otherwise similar, workers. The analysis, shown in Chapter IV, deals with information regarding the work performance of the various types of impaired persons. Some previous studies were concerned with the intangible benefits to the rehabilitated individual such as independence, heightened self-confidence and an elevated sense of well being. Others studied direct benefits such as increases in earnings over a lifetime because of rehabilitation. One previous study evaluated work performance and quit rates of impaired employees in industry a quarter of a century ago.

In the present study, intangible benefits and increased earnings of the individual are not studied, nor is cost/benefit explored because

of lack of objective, definitive data. The present study makes numerical comparisons which can be reported in terms of standard-scores and analyzed statistically to determine if the marginal revenue products of the groups differ significantly.

Historical Background

Society has made many attempts to solve the problem of human impairment. The most extreme solution of the problem was the ancient custom of extermination, which was indeed the most permanent and least costly solution. Less repugnant, but still unsatisfactory, was the practice of casting the impaired out of the community and forcing them to exist by begging and thievery. Public expenditures mounted when impaired persons were cared for in institutions, and these expenditures increased even more when educational services were added. The most effective and most humane solution is the recent effort to help the individual to support himself, to become integrated into schools and economic communities, and to give him an opportunity to contribute his labor in the job market. The effectiveness of his work is what is explored in this paper.

Public concern over the plight of persons who were unemployed or underemployed because of a handicap first resulted in legislation to provide counseling, vocational training, prostheses, and job placement for physically handicapped persons when the Smith-Fess Act, Public Law 236 (1, U. S. Code Title 29), was signed into law by President Woodrow Wilson in 1920. Vocational rehabilitation services were extended to mentally ill and mentally retarded persons in 1943 and further

broadened by amendments to national legislation in 1968.

During the first 50 years of the rehabilitation program, 2.8 million persons with physical and mental disorders were restored to more productive lives through employment or through enhancement of their capacity to function in the home (2, p. 1). During the fiscal year ending June 30, 1970, 266,975 persons with impairments were rehabilitated. Expenditures of the Federal-State Program during the fiscal year ending June 30, 1969, totaled \$455,865,000 (3, p. 7).

Despite this large effort, there are still millions of persons with limitation of activity because of chronic conditions (4, p. 13). For preschool children, limitation in a major activity means the inability to take part in ordinary play with other children. For school-age children, it means the inability to go to school. For housewives, it means the inability to do any housework. For workers and all other persons, it means the inability to work at a job or in business. Information is not available regarding the number of impaired persons who could be feasibly rehabilitated. In 1968, limitation in a major activity affected 17.9 million persons (9.2 percent of the population) as is shown in the millions of persons below (4, p. 13):

	ALL	MALE	FEMALE
All Ages	17.9	9.1	8.8
Under Age 17	0.8	0.4	0.4
17 - 44	3.7	1.9	1.8
45 - 64	6.2	3.3	2.9
65 and over	7.2	3.5	3.7

Source: National Health Survey of 1968

Definition of Terms

In the present study the writer does not use "limitation in a major activity," but uses the terms "impaired," and "handicapped." An "impaired" person is one who has been classified by a doctor as eligible for selective placement. "Handicapped" has a similar meaning. A nonimpaired worker is one who has not been classified by a doctor as eligible for selective placement.

The impairments used in this study are defined in Table I. These impairments include those caused by: the amputation of one extremity, the impairment of hands or arms, the deformity or impairment of a lower extremity or a back injury, a visual impairment where the corrected vision of the poorer eye is not over 20/200, less severe to profound hearing losses including speech malfunction, inactive pulmonary tuberculosis, compensated heart disease (including valvular problems, arrhythmia, arteriosclerosis and healed coronary lesions), controlled diabetes, adequately controlled epilepsy, and a history of emotional problems requiring selective placement. These impairments are listed as codes and numbered from 1 to 17. Code 17 represents those employees who have no disability such that selective placement is necessary. Codes 8 and 16 are eliminated from the study of performance by \$1,000 annual wage ranges because definitions for them are not as precise as desired and Codes 2, 6 and 15 are eliminated because the small number of impaired persons in them does not meet statistical requirements. Impairment definitions are based upon Civil Service Commission Physical Handicap Code Instructions and delineated in Air Force Regulations (5).

TABLE I
 IMPAIRMENTS AT OKLAHOMA CITY AIR MATERIEL AREA

Impairment	Code	Explanation
Amputation-One	1	Absence or amputation of hand, arm, foot, or leg
Impairment-Upper	3	Deformity or impairment of hand or arm
Impairment-Lower	4	Deformity or impairment of back, foot, or leg
Visual impairment	5	Corrected vision of poorer eye not over 20/200
Hearing-Other	7	Some in 1 ear, none in other ear
Hearing-Mute	9	0/20 in each ear, including speech malfunction
Tuberculosis	10	Inactive pulmonary
Heart disease	11	Compensated-valvular, healed coronary lesions
Diabetes	12	Controlled
Epilepsy	13	Adequately controlled
Behavior disorder	14	Emotional or behavioral problems
Nonimpaired	17	Control group

Source: Air Force Regulation 40-293/OCAMA Supplement 1, Attachment 1
 October 21, 1968 (5)

Note: Impairment Codes 2, 6, and 15 are not shown because of the small number of persons involved. Code 8 (hearing) and Code 16 (miscellaneous impairments) are not listed because they cover impairments that are not precisely defined.

Format of the Study

Chapter II surveys the literature dealing with the history of rehabilitation of impaired persons. From ancient times to the present, attitudes held by the community have affected the economic well-being of people with impairments. The general nature of legislation which deals with rehabilitation, as well as the personal support of that legislation by various Presidents of the United States, is discussed. The chapter concludes with a discussion of the responsibilities of governmental agencies in regard to rehabilitation and an indication of the activities of industry in the rehabilitation and employment of the handicapped.

Chapter III summarizes 4 studies which are relevant to the productivity of impaired persons and relates them to the present work. Only a few economic studies of rehabilitation have been made, and they are somewhat exploratory in nature. Most studies deal in a general way with rehabilitation of the impaired in the aggregate. The studies summarized range from essentially subjective evaluations based upon interviews to one which compared the work performance of impaired employees with that of matched nonimpaired employees in 190 manufacturing plants.

The present study differs from these in the manner in which the impaired and their controls are grouped and compared by wage ranges and by occupational groups using data that are quantifiable and can be treated statistically as described below.

Chapter IV compares the performances of groups of impaired wage-board nonsupervisory workers (blue-collar workers whose wage-rate

schedule is set by a local wage board and who are not technical, supervisory, scientific and engineering, or clerical personnel) at OCAMA with similar control groups of workers by annual wage ranges (\$1,000 intervals) and by eighteen occupation groups. Standard scores for OCAMA blue-collar workers based on performance appraisals by first and second level supervisors are used as surrogates for work performance and the marginal revenue products of impaired and nonimpaired workers. The statistical analyses provide various evidence on how the marginal revenue products of the impaired groups compare with those of the nonimpaired groups.

Chapter V summarizes the findings of the present study and states conclusions which are drawn from the analyses of the data. The labor productivity of groups of impaired workers in most instances is not significantly different from that of groups of nonimpaired workers when comparisons are made by: (1) impairments and annual wage ranges of \$1,000 intervals and (2) impairments and individual occupational groups. Individual results are discussed in Chapter IV.

CHAPTER II

THE IMPAIRED AND THEIR REHABILITATION

Despite the persistence of some old philosophies regarding the disabled, which would exclude many from full participation in society, the United States government, under the leadership of Presidents Woodrow Wilson, Franklin Roosevelt, John Kennedy, and Richard Nixon, has made it national policy to employ people with handicaps. Private agencies such as the March of Dimes, League for the Blind, Insurance Rehabilitation Study Group, American Mutual Insurance Alliance, and the National Safety Council promote rehabilitation in industry and society. Private industry has found that it is profitable to provide suitable employment for people with impairments. A brief summary of attitudes toward impairment and of the treatment of people with disabilities follows in the next section.

Philosophies Regarding the Impaired

The fact that primitive societies frequently linked disability with mysticism, supernaturalism and occultism gave rise to morbid curiosity and often fear. Some people of the ancient world, the Spartans for example, killed their physically imperfect members (6). Some American Indian tribes commonly abandoned their disabled, while ridicule was (and is) common in most cultures (7, p. 19). Although there was a wide diversity in the treatment of people with disabilities,

negative attitudes were preponderant. Probably a universal attitude in all societies was the valuing of the "body-beautiful," although there was no agreement on what was beautiful. No known culture ever valued the absence of legs at birth or considered such a condition to be beautiful (8, p. 255).

During the Renaissance the attitude toward those who were crippled or deformed was one of collective hostility (9, p. 27). Either because of their need for protection or the wish to get them out of sight, the mentally ill, the retarded, the deformed, and other unproductive and burdensome people were confined together in asylums which were supported by public and private funds and by the begging of inmates. For centuries, begging was considered compatible with blindness and deformity.

Cruikshank explains one reason why disability elicits negative attitudes as responses:

The early history of the United States is closely linked with many religious movements. Religion and early political life... were closely related,... Religion was narrowly interpreted.... Man was created in God's own image. God was conceived to be perfect in a physical as well as a theological sense. If God was perfect, man,..to be God-like, must be also perfect.... The physically disabled, being imperfect, were considered to be outside the pale of religion. The religious leaders were also the political leaders (10, pp. 10-11).

On the other hand, the devil was club footed! (Or at least the club-footed, like the poor, had been frowned on by God).

In the absence of scientific fact, attitudes developed in terms of cause-and-effect relationships, as well as "felt appropriateness," so that if a state of being was negative, its cause must be negative also. Therefore, illness was a punishment for wrong doing (Calvinism) because suffering and evil should go together. Such feelings persist (8, pp. 251-273).

In the early history of the country, education was for those with wealth and social position and the vote was limited to the same class of society. People were preoccupied with fighting for the nation's existence and neglected the handicapped as a result. As conditions and attitudes changed, society began to take responsibility for the less fortunate.

Residential care for the disabled seemed logical because the population was small, scattered, and predominantly rural with slow and difficult transportation. It was easier to gather the disabled people in one place than to take services to them. Actually services were largely custodial, but the practice established the precedent for isolation of people with disabilities. When schools were started, they were of the residential type which forced handicapped children to grow up in isolation from society.

The residential school for the handicapped did represent a step forward, for it was recognized that children with disabilities could learn. Once in school, these children could be easily forgotten, and this form of ostracism is still reflected by society's treatment of all deviants whether criminal, mental, or physical.

By the beginning of this century various factors influenced changes in attitudes and practices in dealing with the handicapped. As the population increased and became increasingly concentrated in urban rather than rural areas, there were more handicapped children to be found in a smaller geographical area. It became feasible to provide day school classes for children with different needs. Since 1920, well located day schools for the deaf and blind and hospital-school facilities for crippled children have made it increasingly feasible to keep

children relatively close to home. Correspondingly improved transportation and road networks have made school and home increasingly accessible.

The impact of two world wars did much to change attitudes toward physical impairment and deviation. In these wars, "young men had to go before their draft boards and be judged fit or unfit to serve in the armed services" (10, p. 10). Thousands of young men who had been accepted as a normal part of the community were rejected because of physical impairments. These "4-F's" plus thousands of injured and disabled returning from the wars profoundly modified social attitudes toward physical disability. Friends continued in general to see them "in the perspective of normalcy" (10, pp. 10-16).

Today's philosophy of total rehabilitation stems from the fact that Americans realize that it is in the interest of society to educate and rehabilitate its disabled people. As stated by Simon (9, p. 28), "Rehabilitation of the physically impaired is...strictly an accomplishment of this century."

The expanded manpower needs of World War II resulted in an increased rate of hiring of people with physical disabilities. This practice has since become national policy and, added to this, has come the emphasis upon hiring people with mental and emotional disabilities as well. The evolution of this national policy is discussed next.

A Legislative History of Rehabilitation

Few public efforts at rehabilitation were made before 1920. During World War I Congress attempted to fulfill an obligation to those who had been disabled in the line of duty and to other veterans by

passing, on June 27, 1918, the Smith-Sears Vocational Rehabilitation Act (11). This Act contained an appropriation of \$2,000,000 for medical, convalescent, and restorative services and for rehabilitation. The Federal Board of Vocational Education was made the agent for administration until August, 1921, at which time the newly created Veteran's Bureau took control (7, pp. 226-227). Eventually 46,000 disabled veterans participated in the vocational education program.

As the United States became more industrialized, there were many industrial accidents and fatalities, especially in the steel mills and on the railroads. There developed a demand for legislation to provide rehabilitation services for people other than veterans. Even so there was great opposition when Congress passed the Smith-Fess Act and President Wilson signed it into law in 1920. It provided for those who were injured in industry to have federal funds used for vocational training, counseling and guidance, artificial limbs and other prosthetic appliances and for job placement. Funds amounting to \$150,000 were provided. The bill was widely ignored at first, but within five years thirty-eight states had set up rehabilitation programs (12, p. 3). No provision was made for job placement, for restoration services, for purchase of specialized tools, nor for living expenses while in training. These were provided by the client himself or by charity. Many prospective clients were, therefore, eliminated.

President Franklin Roosevelt, a poliomyelitis victim, dramatized the ability of a person with a disability to make a contribution to society. He actively and aggressively supported much social legislation including that for rehabilitation. In 1935 he signed the Social Security Act which provided income for retired workers under OASI, for

unemployment compensation, and for federal grants-in-aid to states for public assistance programs. It gave the rehabilitation program permanent authority in law and raised the appropriation ceiling to \$2 million per year. Rehabilitation was restoring larger numbers of disabled people to employment - from 523 in 1921, to 9,423 in 1935 (12, pp. 7-9).

The Randolph-Shepherd Act of 1936, also signed into law by President Roosevelt, provided preference for qualified blind persons in setting up vending stands within federal buildings and directed that surveys be made throughout the United States to obtain information that would help blind people find employment (13).

Interest in rehabilitation lagged during the depression, but in 1943, prompted by urgent war-time manpower needs, the 78th Congress passed the first comprehensive vocational rehabilitation bill, the Barden-Lafollette Act (Public Law 113), which included support for the mentally ill and the mentally retarded, and assistance to state agencies for the blind. It greatly expanded services for surgery, hospitalization, subsistence, transportation, occupational tools, equipment and licenses necessary while training and getting a start on the job (14).

Several amendments to the Social Security Act benefited the disabled. Those of 1950 created a new assistance category, "Aid to the Permanently and Totally Disabled." Amendments of 1954 protected by means of a "disability freeze" the insurance benefits of covered workers who became disabled. In 1956 benefits were provided to a disabled worker, aged 50 or over, on essentially the same basis as to a retired worker (except for a longer work requirement for the disabled). In 1960 the age 50 requirement was eliminated so that a disabled worker

of any age became eligible for benefits, provided he had the required number of quarters of coverage. Since 1960 additional amendments have relaxed somewhat the severity of the definition of disability, and the disabled have, of course, shared in the general increase in Social Security benefits periodically enacted by Congress.

One of the first actions taken by President Eisenhower was the creation of the Department of Health, Education and Welfare. Under-Secretary Nelson Rockefeller personally and effectively presented vocational rehabilitation recommendations to Congress, and major amendments to the Vocational Rehabilitation Act were passed in 1954. A multi-program approach to disability and rehabilitation provided grants to states to encourage research for the training of personnel and for demonstration projects designed to check the results of research findings.

The Hill-Burton (Hospital Survey and Construction) Act of 1946, amended in 1954, authorized funds to help build rehabilitation facilities, primarily those of a medical nature. Vocational rehabilitation agencies were designated by most states to carry out rehabilitation. A new era was ushered in in 1954, after which development of rehabilitation facilities was very rapid (15).

The Vocational Rehabilitation Act, amended and expanded in 1965, 1967, and 1968, increased the national effort to provide more effective services to greater numbers of impaired persons. It increased the federal share of cost and provided funds for planning, constructing, and improving facilities and workshops. It broadened rehabilitation services to family members of a disabled person if such were necessary to his successful rehabilitation (16).

Public Law 90-480, signed into law by President Johnson on August 13, 1968, provided for the elimination of architectural barriers from all buildings constructed with federal funds and for funds to modify existing buildings to make them accessible to those with disabilities (17, p. 5).

On April 18, 1969, President Nixon issued an Executive Order affirming his personal commitment to the handicapped citizens of the nation. He stated that they should receive equal consideration in employment, and that he had observed that many benefits are derived from employing people with disabilities (18). A search of the United States Code, annotated, 1964 edition with 1972 Packet Part did not reveal any new legislation concerning the impaired nor amendments to the Vocational Rehabilitation Act of 1954 during the Nixon Administration; however, monies have been appropriated.

Under Title 29, Labor, Section 31, Chapter 4, the Secretary of Labor is authorized to make grants for the "...purpose of assisting States in rehabilitating handicapped individuals so that they may prepare for and engage in gainful employment to the extent of their capabilities, thereby increasing, not only their social and economic well-being, but also the productive capacity of the Nation" (1). Money for the functions of Section 31 was appropriated in Sections 32, 33 and 34 as follows:

Fiscal Year Ending June 30	1969	1970	1971	1972
	Authorized to be appropriated in millions of dollars			
<u>Section</u>				
32	500	600	700	700
33	3.2	6	10	10
34	80	115	140	140

Section 34 provided money for research, demonstrations, traineeships; planning, preparing for, and initiating special programs to expand State Vocational Rehabilitation services; providing jobs to handicapped individuals; and developing new programs to recruit and train individuals for new career opportunities.

Employment in Government and Industry

The Department of Health, Education and Welfare

Many of the services of the Department of Health, Education and Welfare are concerned directly or indirectly with rehabilitation and employment of people with disabilities. The primary responsibility for the rehabilitation and finding of employment for the handicapped rests with this department. It sets minimum standards and allocates funds under certain specified conditions to State Vocational Rehabilitation Agencies which provide impaired persons with evaluation, counseling and guidance, medical services, training, and job placement. Related efforts extend to prevention of injury, treatment and education for the handicapped. The new thrust is toward: (1) removal of architectural

barriers to employment, (2) usable public transportation for people with physical disabilities, and (3) vocational education for young people with special problems (19).

Employment in Government

The Civil Service Commission made a major contribution to the employment of the handicapped by determining the minimum physical requirements of each job and then recommending that each future employee be matched to a specific job.

Joseph G. D'Angelo, M. D., Adjudication Division, Veteran's Administration stated that:

...standards allowed the employment, during World War I, of many who proved to be unjustifiable industrial risks. As a result...physical standards became very high, remained so, and prior to World War II were uniform for all types of jobs and required something that amounted to physical perfection. Physical standards were set without any reasonable relation to the abilities necessary for safe and efficient performance.

With the...shortage of manpower...during World War II the Federal Government was faced with the problem of recruiting thousands of employees with disabilities...and overcoming the prejudice against disabled persons.

...The Commission began a review of its physical standards to make them more realistic by a study of the actual duties involved, the skills, the abilities, and the physical qualities required for safe and efficient performance. On-the-job analyses were made beginning early in 1942 by the Commission's medical officers...For related information they depended upon safety and industrial engineers, industrial medical personnel, supervisors, and foremen...In excess of 15,000 positions...(were) surveyed....

As a result of this initial job study program, physical standards began to contemplate only the minimal physical demands of the job...and the way was opened for employment of persons heretofore...precluded by high physical requirements from...employment (20).

By the end of World War II the Civil Service Commission had

amassed statistics which showed:

1. Handicapped workers perform as well as, or better than, able-bodied workers in both quality and quantity of work produced.
2. They have a lower lost-time rate.
3. They have fewer lost-time accidents, although their accident-frequency is a bit higher.
4. Handicapped workers' absentee records compare favorably with those of the nonhandicapped (21).

On May 16, 1957, President Eisenhower requested the heads of all executive departments and agencies to "...make extra efforts toward accomplishing full utilization of the skills and abilities of all citizens" (9, p. 50). No special preference would be given to those with physical disabilities. They must be qualified for the job and compete with others.

In order to insure that qualified physically handicapped persons receive full consideration in selection, placement and utilization, on March 7, 1957, the Civil Service Commission called upon heads of federal departments to appoint coordinators with authority to: assist in the placement of people with disabilities, keep up-to-date on positions which might be filled by a person with an impairment, work with the supervisor to be assured that physical standards of a job are not too high, work with management and supervision in maintaining an environment favorable to the employment of the impaired, serve as a contact point for applicants, and assure that applicants are given fair consideration for any available job opening for which they are qualified.

From 1942 when records were first kept, until the end of 1968 the Federal Service had hired about a quarter of a million workers with handicaps (22).

Employment in Industry

Private industry also employs people with handicaps, and rehabilitation efforts are made by private agencies. Private agencies, such as the American Federation of Labor and Congress of Industrial Organizations, March of Dimes, and the League for the Blind, have engaged actively in rehabilitation, doing more than merely providing jobs. "It would be a herculean task to properly assess the many far-reaching efforts of the private sector" in helping the handicapped, according to United States Senator Robert Dole of Kansas, who continued:

It is in the American tradition and spirit that parallel to government effort there has developed the vital and growing effort for the handicapped by individuals, business and industry, churches and private, voluntary organizations... (It is here in the private sector -- with its emphasis on the creativity, concern and energies of our people -- that America has become the envy of the world (18, p. 9).

Some information from the Insurance Rehabilitation Study Group of The President's Committee on Employment of the Handicapped, the American Mutual Insurance Alliance in cooperation with The President's Committee on Employment of the Handicapped, and the National Safety Council is presented next.

Insurance Industry Activity in Promoting the Employment of the Handicapped

Insurance companies who write workmen's compensation, health and accident, life, automobile, and general liability coverage consider themselves to be leaders in the rehabilitation and placement of impaired workers (23). They have an economic incentive to promote rehabilitation and placement of handicapped workers. The quicker an insurance company can rehabilitate and place their disabled insured in a

productive job, the quicker they can stop or reduce benefit payments under some policies. The Insurance Rehabilitation Study Group, organized in 1965, is an informal association of executives from more than thirty casualty companies (May, 1968). The Group desires to improve the effectiveness of their companies in promoting the rehabilitation and placement of the impaired.

Many companies now advance to an injured person at least part of what they expect to pay, at a time when it is most needed and will do him the most good. The claimant is not required to sign away his rights, but the company is given credit for the advances against any subsequent settlement. This relieves tension and worry and speeds maximum physical and emotional recovery, not to mention the fact that prompt and appropriate medical attention made possible by such action may allow recovery without complications.

Insurance companies generally try to influence potential employers and present arguments in favor of hiring the handicapped. The American Mutual Insurance Alliance, in cooperation with the President's Committee on the Employment of the Handicapped, assures a potential employer of handicapped workers that:

Your workmen's compensation insurance carrier wholeheartedly encourages you to hire handicapped workers. Properly selected and placed, persons with handicaps make excellent employees. Their safety records are at least as good as those of other employees, often better....

In addition, the Insurance Alliance argues that the following three widely held beliefs are only myths:

That handicapped workers are more likely to have accidents than other employees, that an employer's workmen's compensation insurance rates will rise if he hires handicapped workers, and that his insurance company won't let him hire handicapped persons (24).

Some of the possible disadvantages which the insurance companies mention include: the need for provision of a reserved parking space near the work place of an impaired worker who cannot walk; if the worker is in a wheel chair or blind, the need for a modified schedule in order to avoid pedestrian traffic; ramps and elevators as maybe required; the assistance of a fellow worker in getting the impaired to and from the work place as may be required. Also the employer may not be able to transfer an impaired worker to a different job (if it has different physical requirements) in case of a shift in demand for a product or service.

General Industry Policies and Practices

What are the policies of companies concerning the impaired? An authoritative reply is presented in a June 1963, National Safety News article titled "Why They Hire the Handicapped," by a staff engineer of the National Safety Council's Industrial Department. It is based on that Department's survey of 980 member companies representing all industries from all parts of the United States, which obtained 639 (65.2 percent) usable replies. An analysis of the tabulation of replies showed:

Certain industries tend not to hire physically handicapped persons. There are notable exceptions in each industry -- an indication that education and experience are the controlling factors in accepting the handicapped for employment (25, p. 28).

This analysis also revealed that many companies that do not hire impaired persons do continue to employ anyone who becomes impaired. Replies from 452 of 639 responding companies (70.7 percent) indicated that impaired persons were hired on the same basis as other applicants for specific jobs. The respondents did not find it necessary to make

any great concessions or special provisions for their impaired workers (25, p. 28).

Summary

Whereas impaired people were killed or abandoned by some earlier societies, our philosophy today is that it is in the interest of society to educate and rehabilitate the disabled so that they can lead productive lives.

Federal legislation toward this end includes the Vocational Rehabilitation Act of 1918, the Smith-Fess Act of 1920, which was the real beginning of rehabilitation, the Social Security Act of 1935, the Barden-Lafollette Act of 1943, which was very comprehensive in that it provided for everything needed to rehabilitate a person, the Hill-Burton (Hospital Survey and Construction) Act of 1946, and modifications to these acts.

The Department of Health, Education and Welfare is the focal point of federal activities in regard to the rehabilitation and employment of people with disabilities. The Civil Service Commission has many functions in connection with the federal employment of impaired workers and has determined the minimum physical requirements for most federal jobs.

Workmen's compensation insurance carriers encourage potential employers to hire the handicapped since they make excellent employees who have safety records at least as good as those of other employees. A National Safety Council survey of companies representing all industries from all parts of the United States disclosed that 7 out of each 10 companies replying hired handicapped persons on the same basis as

other applicants for specific jobs.

There were 196 respondents who indicated that no special provisions were necessary for their handicapped employees.

CHAPTER III

ECONOMIC STUDIES OF IMPAIRMENT AND REHABILITATION

Two of the most significant and thorough economic studies of impairment and rehabilitation are summarized in this chapter because they are concerned with the productivity and work performance of impaired employees. Two studies of work performance carried out at OCAMA are also reviewed. Benefit/cost research is not reviewed (even though some recent studies deal with this subject), because the lack of cost and earnings data disaggregated by type of impairment and by type of work activity forced the writer of the current study to abandon attempts to obtain reliable benefit/cost ratios for impaired workers at OCAMA.

No studies reviewed by the writer indicate that rehabilitation or employment of impaired workers is undesirable. On the contrary, the studies indicate that the rehabilitation and employment of impaired workers is desirable from an economic as well as from a humane viewpoint. The most important and far-reaching study of work performance is a Bureau of Labor Statistics study for the Veteran's Administration. It was carried out from 1945 through 1947 (26). A comprehensive survey of literature and analysis of rehabilitation was made by Ronald W. Conley for the Vocational Rehabilitation Administration in 1965. He made particular use of information in the National Health Survey in reporting the findings of the survey and analysis in his book, The Economics of Rehabilitation (27). At OCAMA, Alex J. Simon studied

employment problems of hiring impaired persons and compared efficiency and productivity of impaired workers with that of nonimpaired workers. Dr. Harry J. Parker surveyed the records of impaired workers at OCAMA and of Oklahoma State Employment Service offices to determine the types of jobs being performed successfully by these employees. These represent the outstanding studies of the employment and productivity of impaired persons which are most relevant to the present study; therefore, they are reviewed here.

Bureau of Labor Statistics Study (26)

The Bureau of Labor Statistics carried out a study for the Veteran's Administration of work performance of impaired individuals in terms of absenteeism, injuries, production efficiency and separations, using data gathered from manufacturing industries from 1945 through 1947. This was the period following World War II when many plants were shifting back to normal production routines from wartime status.

Plant managers in sixteen states all across the nation were interviewed in order to find the plants which could fulfill the requirements for being included in the study. A plant was included if it employed as many as twenty workers with handicaps and if it had available records containing the information needed. One hundred and nine plants representing a wide variety of industries and employing 11,028 impaired workers were selected for the study. An attempt was made to match one impaired person with one, two or three nonimpaired persons of "...the same sex, on the same shift, of closely similar age, with about the same length of experience, and working on the same job in the same department of the same plant" (26, p. 123). The matching was done in

order to rule out some extraneous factors so that the existence of a serious physical impairment was the only important difference.

The study pointed out:

Ideally, the comparison of work performance should be made between workers identical in every respect except for the existence of the impairment. In practice, however, this ideal comparison is impossible (26, p. 123).

The definition of an impaired worker was "...so strict as to eliminate all impairments that did not require special placement considerations" (26, p. 120). The largest number of workers in one impairment category was those with a hernia. One group of workers studied had peptic ulcers and another had multiple handicaps. These were different from impairment groups studied in the present paper. Impairments similar to those in the present study were orthopedic, vision, hearing, cardiac, tubercular, diabetic and epileptic. Impaired workers in clerical, administrative, and supervisory jobs were eliminated at the outset. Only workers with physical impairments were included, ruling out workers with mental disorders. They were included in the present study.

Work performance was best expressed by averages and by frequency distributions of five factors: (1) absenteeism, (2) minor work injuries, (3) disabling work injuries, (4) production efficiency, and (5) separations. The production efficiency of 895 of the 11,028 impaired workers for whom such records were available, was based entirely on the quantitative measurement of individual output. Foreman's evaluations and efficiency ratings were not considered. Findings regarding the five factors of work performance are shown in Table II. The percentage relationship of production efficiency of impaired persons to that of matched nonimpaired workers is shown in the next to the last column of

TABLE II

WORK PERFORMANCE OF WORKERS WITH SERIOUS PHYSICAL IMPAIRMENTS,
AND OF MATCHED UNIMPAIRED WORKERS

Group	Absent- tism fre- quency Rate ¹	Nondis- abling Injury frequency Rate ²	Disabling Injury			Average Days of Dis- ability ⁵	Produc- tion Effi- ciency ⁶	Quit ⁷ Rate
			Fre- quency Rate ³	Time Lost ⁴ Rate ⁴				
Average Performance								
Total:								
Impaired	3.8	9.9	8.9	0.10	14.5	101.0	3.6	
Nonimp.	3.4	9.9	9.5	.11	14.9	100.0	2.6	
Male:								
Impaired	3.6	10.1	9.3	.11	14.7	100.3	3.3	
Nonimp.	3.2	10.1	10.0	.12	15.0	100.0	2.3	
Female:								
Impaired	6.4	7.0	2.5	.01	6.0	103.3	6.9	
Nonimp.	6.5	6.9	1.3	.01	6.3	100.0	5.3	
Number of Workers								
Total:								
Impaired	11,028	10,858	10,973	10,973	--	895	5,217	
Nonimp.	18,258	18,001	18,202	18,202	--	1,404	8,783	
Male:								
Impaired	10,253	10,094	10,203	10,203	--	682	4,695	
Nonimp.	16,296	16,692	16,875	16,875	--	1,069	7,909	
Female:								
Impaired	775	764	770	770	--	213	522	
Nonimp.	1,332	1,309	1,327	1,327	--	335	874	

¹Number of days lost per 100 scheduled workdays.

²Number of injuries per 10,000 exposure-hours.

³Number of injuries per 1,000,000 exposure-hours.

⁴Number of days lost for disabling injury per 100 scheduled workdays.

⁵Number of days of disability per disabling injury.

⁶Percentage relationship of production efficiency of impaired to that of matched unimpaired.

⁷Number of voluntary quits per 100 employees in the survey group (during the 6 months period following the end of the survey period).

Source: The Performance of Physically Impaired Workers in Manufacturing Industries (26).

the table. The output of the impaired was slightly better, in all categories, than that of the nonimpaired. Based on the findings shown in Table II, it was concluded that physical impairment did not produce an adverse effect on either the quantity of work produced nor the quality of the work performance.

Individual results of such comparisons, aggregated regardless of job to obtain overall performances for each type of impairment, also showed that a physical impairment did not adversely affect work performance.

The present study differs from the Bureau of Labor Statistics study in several ways. In the first place, the economic and labor conditions at the time that study was carried out, 1945-1947, were very different from those today. The absenteeism frequency rate (not studied in the present paper) favored the nonimpaired workers (3.4 versus 3.8 days lost by the impaired per 100 scheduled workdays) as is shown in Table II. The difference of 0.4 of a day more lost for the impaired, equivalent to 1 day per year, is not great (50 workweeks per year times 5 workdays is 250 workdays per year which is 2.5 times the 100 days during which the impaired lost 0.4 of a day more than the non-impaired. The 2.5 factor times the 0.4 of a day is equal to 1 day per workyear). More significant is the quit rate which favored the non-impaired workers (2.6 versus 3.6 voluntary quits by the impaired per 100 employees in the survey group). The quit rates were determined during a 6 month period following the end of the survey period at a plant. With the end of the war, plants were changing over to normal production and the nonimpaired long-time workers often had better permanent positions due to more seniority than many of the impaired

who were employed for the first time during the war. Some impaired workers, of their own volition, were seeking more secure positions with better chances for advancement. The study attributed to these conditions the fact that the impaired worker was more likely to be separated from his job.

Another difference is that the present study is limited to 1 plant at an air force base having a large concentration of impaired workers, (4,916) compared to the Bureau of Labor Statistics study of quit rates which covers 40 plants having 5,217 impaired workers. The impairments included were somewhat different in that the largest group studied by the Bureau of Labor Statistics was made up of people with hernias. OCAMA includes hernia in impairment Code 16 with other impairments. Only the present study covers those with behavior disorders. The Bureau of Labor Statistics study did not use supervisor ratings as did the present study. Both groups contained uneven cells, and occupational groups were similar.

The Bureau of Labor Statistics study concluded that:

Workers with serious physical impairments, who are placed so as to stress what they can do rather than emphasize what they cannot do, are every bit as desirable as workers without such impairments. It is not implied, of course, that every impaired worker is a desirable employee. But neither is every unimpaired worker a good worker. The important point is that the impairment in itself does not make the impaired person a poor worker (26, p. 31).

The Conley Study (27)

Under a grant from the Vocational Rehabilitation Administration, Ronald W. Conley presented, in 1965, a survey of the literature on The Economics of Rehabilitation (27). Particular use was made of the

information included in the National Health Survey (4) and publications of the Vocational Rehabilitation Administration.

Estimates of the value of rehabilitation in the aggregate were made from published costs of rehabilitation, numbers of persons who were rehabilitated, and annual before and after earnings of those rehabilitated. The performance of persons with specific impairments was not compared to the performance of nonimpaired persons.

Conley's literature survey identified certain hindrances to rehabilitation. They include not only unemployability of a person due to disability, age, and lack of education but also adverse attitudes of the disabled toward work, and beliefs of employers that the disabled would not be able to work competitively and would be costly to employ. Legal restrictions concerning minimum wages and limitations on earnings for those receiving Social Security or welfare benefits are additional hindrances to rehabilitation.

At the time of the literature survey there were more than 100,000 persons rehabilitated annually, and Conley estimated that annual earnings after rehabilitation of those remuneratively employed were 2.5 times to 6 times their previous annual earnings (earnings during a period prior to entering the rehabilitation program - the previous week times 50 or the previous quarter times 4). The great range in the annual estimate depends on whether it is reckoned from earnings during the week prior to entering the rehabilitation program times 50 weeks, the quarter before times 4, or the year before the time rehabilitation was begun (27, p. 93).

Each of these methods of estimating annual earnings has been used by the Rehabilitation Services Administration at various times (18, p.

41). The difference in earnings before and after rehabilitation services was used as a measure of output attributable to rehabilitation. Conley believed that more disabled persons should have been rehabilitated into gainful employment than was the case.

Other benefits accrued to society and to the families of rehabilitated persons. Rehabilitation resulted in a decrease in the tax burden and an increase in taxes paid. The estimated decline in the annual rate of welfare payments to rehabilitants in 1962 was \$10.0 million between the time they began rehabilitation and the time when they were rehabilitated; and those rehabilitated paid an increase of \$13.3 million in federal taxes. The rehabilitation program treated, retrained, and returned to gainful activity thousands of disabled persons. Costs were repaid many times both to society and to the taxpayers who supplied the funds for the rehabilitation program.

The success of rehabilitation depended upon a number of factors including the person's physical and mental ability to work, his attitude toward work, the availability of work and laws that reduced the incentive to work. Married people with more dependents and with a history of substantial employment adjusted better and had higher earnings after rehabilitation than did others (27, pp. 136-138).

The Simon Study (9)

In January, 1961, Alex J. Simon (9) compared the job performance of impaired persons with that of the nonimpaired at OCAMA as part of a Ph.D. thesis in economics from the University of Texas. He identified the problems of the physically handicapped from various sources and also interviewed officials at OCAMA. Questionnaires completed by forty

foremen and seventy-three work leaders of the Accessories Branch of the Shops Division were analyzed. Foremen and work leaders were asked to answer the questions in accordance with their own honest opinions. Those opinions were based on knowledge of those impaired persons known to the leader making the evaluation. The impaired (aggregated) were rated better than, comparable to, or not so good as nonimpaired in the areas of safety, attendance, productivity, attitude, and efficiency. The question most relevant to the present study was number nine of his "Physically Handicapped Questionnaire" which is shown below:

9. With regard to the following six (sic) factors, I believe that the physically impaired worker rates, as indicated below (for each point), when compared to the nonhandicapped:

	<u>Better</u> <u>Than</u>	<u>Comparable</u> <u>to</u>	<u>Not so</u> <u>Good as</u>
a. Safe behavior on the job	_____	_____	_____
b. Attendance	_____	_____	_____
c. Productivity	_____	_____	_____
d. Attitude	_____	_____	_____
e. Efficiency	_____	_____	_____
f. Attitude toward supervision	_____	_____	_____
g. Job adjustment	_____	_____	_____

(9, p. 152)

In the area of productivity, 61.1 percent rated the impaired comparable to or better than the nonimpaired.

Simon stated:

Analysis of the information...leads to one general conclusion: physically handicapped job applicants, if intelligently selected, trained, and properly placed will produce as efficiently as the nonimpaired and generally will maintain better attendance and safety records than the nonhandicapped...the handicapped; (1) have a lower labor turnover rate, (2) adjust as readily to different jobs, (3) have a better attitude, and (4) observe rules...as readily if not better than the nonhandicapped (9, p. 139).

The main problem was with the small percent of the impaired workers who had poor attitudes such as that the "world owed them a living"

(9, p. 136).

Records were not disaggregated by type of impairment; therefore, it is possible that groups having specific impairments may have performed better than or worse than nonimpaired groups. It may be that a group with a specific impairment consistently performs better or worse at certain jobs than the nonimpaired workers; however, this was not studied.

The Parker Study (28)

In 1965, Dr. Harry J. Parker surveyed records of unrehabilitated impaired employees at OCAMA and of such individuals placed by the Oklahoma State Employment Service in other establishments (28). The subject of the survey was "Employability of Impaired Individuals who have Transferable Skills and no Specific Training". Since part of the survey covers the same plant as the present study, it is summarized here. Dr. Harry J. Parker presented:

...validated information about the presence of specific impairment categories and compatibility with identified occupations in the economy...these data...provide evidence of employability of impaired categories based upon transferability of experience and no additional or specific training (28, p. 93).

Cases were selected where it was known that no training program was involved and that only transferable skills were considered relevant for employment. Factors of age, sex, work experience, current job performance, and specific impairment were tabulated for all samples. Occupational job titles were listed under each of the following impairments: (1) amputation one extremity, (2) upper extremity, (3) lower extremity and back, and (4) heart disease.

A significantly higher percentage of unrehabilitated impaired were in highly skilled jobs at OCAMA than was true of other placements:

<u>Level of Job</u>	<u>OCAMA</u>			<u>State Employment Service Office</u>	
	<u>Cases</u>	<u>Percent</u>		<u>Cases</u>	<u>Percent</u>
Journeyman	47	59.5	Skilled	21	45.6
Trainee-Junior	15	10.0			
Semi-skilled- unskilled	12	15.2		9 10	19.6 21.7
(Other)		(15.3)			(13.1)

Dr. Parker hoped the date would bring a professional sensitivity to the impaired workers' potential in our economy.

Summary

Studies summarized in this chapter indicate that rehabilitation is desirable from an economic as well as a humane viewpoint and that impaired persons, when properly placed, perform as well as the non-impaired workers. Not all impaired workers are good workers, nor are all nonimpaired workers good workers.

The present paper uses an annual performance appraisal score as a proxy for labor productivity and compares the standard-score means of 11 types of impaired groups with those of appropriate nonimpaired control groups. The comparability of the groups being studied was achieved by: (1) studying employees at only one plant, (2) studying only wage-board nonsupervisory workers (the four categories of

personnel not studied are listed in the following chapter), (3) studying impaired and nonimpaired groups by annual wage ranges of \$1,000 intervals, and (4) studying impaired and nonimpaired groups by occupational groups.

The Bureau of Labor Statistics study covered the work performance of impaired persons by analyzing: (1) absenteeism, (2) injury rates, (3) quit rates, and (4) production efficiency based on the actual production of 895 impaired workers. The first three items above are not directly considered in the present paper. The fourth item is approached in a different manner in the present study as indicated above. The BLS study did not disaggregate work performance by wage ranges or by occupational groups, which are distinctive features of the present study.

The Conley study reported that the success or failure of rehabilitation depended upon a person's physical and mental ability to work, his attitude toward work, the availability of work, and laws that reduce the incentive to work. The study contained information regarding the types of research that had been undertaken prior to 1965, and Conley summarized publications in the area of rehabilitation. The present study concerns one specific installation and deals with specific impairments by wage ranges and by occupational groups. The Conley study, on the other hand, used information for the nation as a whole and it was not analyzed by impairment, by wage range, or by occupational group.

The Simon study provided only limited background information for the present study. It was subjective in nature, based on management interviews and a questionnaire survey of 40 foremen and 73 work leaders

of the Accessories Branch of the Shops Division, one of dozens of branches covered in the present study. In addition to its much broader, plant-wide coverage, the present study was based on quantifiable performance scores from systematic annual performance reviews which were analyzed statistically.

The Parker survey at OCAMA was not directly related to the present study, because it dealt only with unrehabilitated workers; however, it did reveal that impaired persons were employed in high skill-level jobs without having received specific training since the onset of an impairment. In contrast to the present study, his study has no information regarding the performance of the impaired.

Filmed as received

without page(s) 38.

UNIVERSITY MICROFILMS.

Selection of Samples

The Oklahoma City Air Materiel Area employs 5 categories of personnel: technical, supervisory, scientific and engineering, clerical, and wage-board nonsupervisory workers.

The wage-board nonsupervisory employees, the largest group of workers at OCAMA, were selected for study for several reasons, including a desire for comparability between impaired and nonimpaired groups. These are blue-collar workers whose wages are set by a local wage board, and since all of the workers are at a single establishment policies, practices, and working conditions are more uniform than would otherwise be the case. Actual physical production records of wage-board nonsupervisory workers are more likely to be available to the supervisors making the performance appraisals than is the case for other types of employees. Comparability between groups of impaired and nonimpaired workers was achieved to a further extent by sorting the personnel records into six annual wage ranges (\$1,000 intervals). Occupational groups were next used in place of wage ranges to achieve comparability between groups of impaired and nonimpaired workers. Of the possible 48 occupational groups, 18 contained at least 3 persons having a specific impairment, and some groups contained as many as 7 types of impairments.

In addition to 12,235 wage-board nonsupervisory employees, there were 10,025 general schedule, 1,021 foremen, and 193 leaders for a total employment of 23,474, previously mentioned. After a computer edit which eliminated persons in training, those with errors in their records, and those with information missing in their records, there

were 10,597 complete wage-board nonsupervisory records. Table III shows the distribution of these workers by impairments and annual wage ranges.

On January 4, 1971, there were 12,235 wage-board nonsupervisory workers employed at OCAMA. Those workers hired since the last annual performance appraisal were eliminated from consideration as no performance scores existed. There were 10,597 employee records which, by means of computer edit, were shown to be complete.

Employed January 4, 1971	12,235
Eliminated by computer edit	<u>- 1,638</u>
	10,597

The composition of these 10,597 was:

Nonimpaired	8,070
Impaired	<u>+ 2,527</u>
	10,597

Fourteen nonimpaired were eliminated because there were no impaired in the \$11,000-11,999 annual wage range after Code 16 was eliminated, as shown below. This left 8,056:

Nonimpaired	8,070
Nonimpaired in \$11,000-11,999 annual wage range	<u>- 14</u>
	8,056

The 8,056 nonimpaired records were segregated into 6 annual wage ranges of \$1,000 intervals: \$5,000 to 5,999; \$6,000 to 6,999; \$7,000 to 7,999; \$8,000 to 8,999; \$9,000 to 9,999; and \$10,000 to 10,999. A random selection of 40 nonimpaired workers (the reason for the choice of 40 is discussed later) was made by means of a random number table, from nonimpaired persons in each of the 6 annual wage ranges. Forty people from each of 6 annual wage ranges gave a total of 240 nonimpaired in the control groups.

There were 2,527 records of impaired persons available for

TABLE III
DISTRIBUTION BY ANNUAL WAGE RANGES OF NONIMPAIRED AND
IMPAIRED WAGE-BOARD NONSUPERVISORY EMPLOYEES

Nonimpaired N = 8,070		75	744	2,419	2,025	2,373	420	14
Group N = (1)		40	40	40	40	40	40	14
Annual Wage Intervals		\$5,000- 5,999	\$6,000- 6,999	\$7,000- 7,999	\$8,000- 8,999	\$9,000- 9,999	\$10,000- 10,999	\$11,000- 11,999
Impaired Code N (2) (3)		Numbers of Impaired Persons						
16	1,604	21	106	470	433	489	84	1
15	1		1					
14	74	1	3	22	21	25	2	
13	10			3	2	4	1	
12	29		3	6	11	8	1	
11	85	1	3	19	24	32	6	
10	20			4	9	6	1	
9	6				3	2	1	
8	20			7	7	5	1	
7	13			3	2	7	1	
6	3		1	2				
5	97	3	3	24	27	34	6	
4	456	6	26	112	121	167	24	
3	99		7	19	28	40	5	
2	1			1				
1	9	1	2		3	2	1	
	2,527	33	155	692	691	821	134	1

- (1) The forty persons were randomly selected from the group of the non-impaired shown in the first horizontal line of the table except in annual wage range, \$11,000-11,999.
- (2) The impairment codes are explained in Table I.
- (3) Number in impaired groups. The impaired persons shown in Codes 2, 6, 8, 15, and 16 total 1,629 not in wage range study. The 2,527 impaired less this 1,629 leaves 898 persons who are studied by group means only. The study by wage ranges does not include cells containing less than 3 persons. The 898 impaired less 21 persons eliminated (cell size) equals 877.

study after the computer edit as is shown above, but only a minority of these records were usable in this study. Impairment Codes 16 and 8 were eliminated from the study by wage ranges because of imprecise definitions (1,604 and 20 persons respectively). Impairment Codes 2, 6, and 15 were also eliminated from the study by wage ranges because of the small numbers of persons in the groups (1, 3, and 1 persons respectively, or a total of 5 persons) as shown in Table IV. These 1,629 persons (1,604, 20 and 5) eliminated from the 2,527 persons left 898 persons studied by wage ranges and by the numbers of impaired persons with scores above and below the means of their nonimpaired groups. For statistical reasons, it was decided to use a minimum cell size of 3 persons when the t-test was used to determine if the null hypothesis should or should not be rejected. In addition to the 1,629 persons eliminated above, 21 additional persons were eliminated because of the small cell size resulting from a grouping by wage ranges and by impairments. The 1,629 plus the 21 results in a total of 1,650 impaired persons eliminated from the 2,527 impaired remaining after the computer edit or 877 impaired persons.

Annual Performance Appraisal

In previous studies the performance of impaired workers has been compared to that of nonimpaired workers in the areas of quit rates, supervisor's opinions, physical outputs, and safety records. Simon (9), for example, permitted the evaluating supervisor only three choices per element rated. The writer of the present study desired a surrogate (proxy) for labor productivity (performance) that was more quantitative and discriminating than proxies used in previous studies. The Air

TABLE IV

IMPAIRED ELIMINATED BECAUSE OF SMALL CELL SIZE

Annual Wage Interval		\$5,000- 5,999	\$6,000- 6,999	\$7,000- 7,999	\$8,000- 8,999	\$9,000- 9,999	\$10,000- 10,999
<u>Impairment</u>	<u>Code</u>						
Mental Retardation	15	0	1	0	0	0	0
Behavior Disorder	14	1	0	0	0	0	2
Epilepsy	13	0	0	0	2	0	1
Diabetes	12	0	0	0	0	0	1
Heart Disease	11	1	0	0	0	0	0
Tuberculosis	10	0	0	0	0	0	1
Hearing-Mute	9	0	0	0	0	2	1
Hearing-Other	7	0	0	0	2	0	1
Visual Imp. (blind)	6	0	1	2	0	0	0
Visual Impairment	5	0	0	0	0	0	0
Impairment (lower)	4	0	0	0	0	0	0
Impairment (upper)	3	0	0	0	0	0	0
Amputation (2)	2	0	0	1	0	0	0
Amputation (1)	1	1	2	0	0	2	1
Totals = 26		3	4	3	4	4	8

Details of the impairments are shown in Table I.

Definitions for Codes 16 and 8 were not as precise as desired so they were omitted from the study. Codes 2, 6, and 15 totaled 5 persons that were dropped from the wage range and group means studies. These were below the minimum number of persons (3) set for statistical reasons. The total of 26 persons shown above less the 5 persons just mentioned leaves 21 more impaired persons who are included in the study by means of groups (898 total) compared to the wage range study involving 877 persons.

Force Logistics Command "Performance Appraisal - Wage-Board Nonsupervisory" Form 679 A dated February 1970 met the need for a quantitative and discriminating method in that the first-level supervisor is required to consider 15 rating elements (shown in Table V) versus Simon's three choices. For each rating element the supervisor must circle one of the following: 5 (high point), 4, 3, 2, 1, 0 (low point), or N (non-ratable). The ratings must be discussed with the second-level supervisor who may make changes. The total score is the sum of the circled numbers and would be 75 if 5 were circled for each of the 15 elements. A converted score is obtained next in order to get a base with 100 as a perfect score. The converted score is:

$$\frac{\text{Total Score}}{(15 \text{ elements} - \text{Number of N's circled}) (5)} 100$$

If an employee receives a 5 rating on each of the 15 elements, his converted score would be: $75/15(5) \times 100$ or 100.

Each worker should receive a score that reflects his true performance in comparison with other workers under other supervisors. Some supervisors tend to rate all workers low or high in comparison to other supervisors. In order to eliminate as much of this supervisor bias as possible, a standard score is determined based on the final rating by an employee's second-level supervisor. A standard score is:

$$100 + 10 \left[\frac{\text{Converted Score Minus Second-level Supervisor's Mean}}{\text{Second-level Supervisor's Standard Deviation}} \right]$$

A second-level supervisor's mean and standard deviation are based on the standard scores of his wage-board nonsupervisory employees if he has 10 or more. If he does not have 10 wage-board nonsupervisory employees, his mean and standard deviation are based on the scores of

TABLE V

ANNUAL PERFORMANCE APPRAISAL - WAGE-BOARD
NONSUPERVISORY RATING ELEMENTS

The following elements are rated by the employee's first level supervisor by circling 5 (high point), 4, 3, 2, 1, 0 (low point), or N (non-ratable). The final rating is given by the employee's second-level supervisor.

1. Requires minimum supervision, works independently to extent required by the job.
2. Meets time schedules and maintains production.
3. Operates effectively under pressure of deadlines.
4. Cooperates well with others and is a good team worker.
5. Adjusts effectively to new and changing situations; shows a willingness to try out new ideas or operations.
6. Actively tries to improve performance by gaining new knowledge pertaining to the job.
7. Work products and work performance meet quality standards.
8. Attempts to minimize error and reduce waste.
9. Stays abreast of new developments in job related subject knowledge areas.
10. Willingly accepts full responsibility for any task assigned.
11. Minimizes risks with good safety practices.
12. Dependable in attendance, reports absences promptly.
13. Solves problems encountered in assignments and, when needed, can independently trouble shoot.
14. Takes good care of all tools, material and equipment.
15. Follows policies, procedures and supervisory instructions.

Source: Air Force Logistics Command Form 679 A, dated February, 1970.

all his employees if he has 10 or more employees of all types. If he does not have 10 employees of all types, his mean and standard deviation are those calculated for all wage-board nonsupervisory employees at OCAMA. A standard score is the measure of performance used in the present study (surrogate or proxy for labor productivity).

There were over 2,000 nonimpaired persons in each of 3 annual wage ranges as is shown in Table III. This large number made sampling desirable. Some feel that a sample of less than 100 is a small sample, whereas others feel that a sample of less than 20 is a small sample. The needs for small sample considerations increase as N decreases and they may become critical somewhere below an N of 30. Although an N of 30 is of sufficient size, it was decided to use a nonimpaired sample of 40. The larger the sample size, the smaller will be the variance of the sample, and the greater the likelihood that the mean of the sample will be near the mean of the population sampled.

Many of the small-sample statistical tests are based on the statistic known as "Student's t ." A t -test (Student's t) is used in the present study to express in statistical terms the results of a comparison of performance appraisal score means for impaired and nonimpaired groups. This test assumes that the individual scores are normally distributed.

The t -statistic is the ratio of the difference of the standard-score means of the nonimpaired group M_1 and impaired group M_2 divided by the standard error of the difference between the two means:

$$t = \frac{M_1 - M_2}{\sqrt{\frac{\sum x_1^2 + \sum x_2^2}{N_1 + N_2 - 2} \left[\frac{N_1 + N_2}{N_1 N_2} \right]}}$$

where x represents the deviation from the mean of the sample, M_1 and M_2 are the means of the two samples, $\sum x_1^2$ and $\sum x_2^2$ are the sum of squares in the two samples, and N_1 and N_2 are the number of persons in the two groups. The denominator as a whole is the standard error of the difference between two means. The degrees of freedom are two less than the sum of N_1 and N_2 . The statistic thus computed is the "calculated-t" of the t-test used below. The next step is to prepare the hypothesis to be tested. It does not appear reasonable to expect an impaired worker to perform better than he would have, had he never been impaired. If anything, one might expect an impaired worker's performance to be poorer than that of a nonimpaired worker. This constitutes the alternative hypothesis. The corresponding null hypothesis is that the impaired worker will perform as well as the nonimpaired worker. In formal terms:

$$H_0: \text{Mean}_{\text{Nonimpaired}} = \text{Mean}_{\text{Impaired}}$$

$$H_1: \text{Mean}_{\text{Nonimpaired}} > \text{Mean}_{\text{Impaired}}$$

The inequality in the alternative hypothesis indicates a one-tailed test, with the region of rejection on the right-hand side of the corresponding t-distribution.

To complete the hypothesis test, one compares the calculated t-value with the appropriate critical t-value. If the calculated t exceeds the critical t, one has sufficient evidence to reject the

null hypothesis H_0 . This act would imply that the impaired-worker sample is significantly inferior to the nonimpaired-worker sample.

A t-table indicates that for two degrees of freedom the critical value for the calculated Student's t distribution is 2.920 for a significance level of 5 percent for a one-tailed test (10 percent level of significance for a two-tailed test). As the sample size decreases, one has to go out a greater distance in order to find the points which set off the regions of significance at 5 percent or other standard levels. As the sample size becomes infinite the sampling distribution of t becomes normal.

At the 5 percent level of significance the critical value of t with 30 degrees of freedom is 1.697, for 40 it is 1.684, and for 60 it is 1.671, all for a one-tailed test. From this it is seen that additional degrees of freedom lower the critical value of t very little. The critical values of t are selected in such a manner that with a sample size of 5 ($N_1 = 2$ and $N_2 = 3$) the degrees of freedom would be 3 and the critical value of t would be 2.353. The critical value of t drops all the way down to 1.658 with 120 degrees of freedom, for instance. If three persons, instead of 40, had been randomly selected from the nonimpaired group, the t-test would have been less biased for an impaired group of 3. On the other hand, one would be less confident in saying that the sample of 3 nonimpaired persons represented the entire group of nonimpaired employees in an annual wage interval. The actual size of the impaired groups varied from 1 to 167 in number; therefore, it was impossible to obtain 30 or 40 impaired persons in each group. One gains some advantage from one standpoint, but loses some from another standpoint as sample size is reduced for one of the

samples.

Performance Comparisons by Annual Wage Range

In each of 6 annual wage ranges (\$1,000 intervals) the performance (standard scores) of a nonimpaired group of 40 workers is compared to that of from 2 to 9 groups of nonimpaired workers. Each impaired group within a specific annual wage range has a specific impairment.

The hypothesis (H_0) to be tested follows from the previous discussion.

$$H_0: \text{Mean}_{\text{Nonimpaired}} = \text{Mean}_{\text{Impaired}}$$

$$H_1: \text{Mean}_{\text{Nonimpaired}} > \text{Mean}_{\text{Impaired}}$$

H_0 : The annual performance appraisal standard-score mean of an impaired group is equal to that of the nonimpaired group.

H_1 : The annual performance appraisal standard-score mean of an impaired group is less than that of the nonimpaired control group.

A major finding of this study is that in 8 of 39 groups (20.5 percent of the groups in Table VI) H_0 was rejected. The 8 impaired groups in Table VIII for which the H_0 was rejected represented 302 impaired persons (33.6 percent of the 898 impaired persons. Two hundred and three of these (22.6 percent of 898) had standard-scores below their control group's mean and 99 had standard-scores equal to or above their group's mean. Table VI contains the results of these 39 comparisons out of 66 which were theoretically possible. Table VII lists each of the 66 possible groups and shows the numbers of impaired who had scores below the nonimpaired control group means (494 persons over all or 55.0 percent of the 898 impaired persons) and those (404 or 45.0 percent)

TABLE VI
AN ANALYSIS OF THE PERFORMANCE APPRAISAL STANDARD SCORE
MEANS OF IMPAIRED AND NONIMPAIRED GROUPS

Group Identification		Annual Wage Ranges																										
		\$5,000-5,999			\$6,000-6,999			\$7,000-7,999			\$8,000-8,999			\$9,000-9,999			\$10,000-10,999											
Code	N	N	Mean	t	N	Mean	t	N	Mean	t	N	Mean	t	N	Mean	t	N	Mean	t									
Nonimpaired (control)	17	240																										
Impaired			40	97.1		40	95.5		40	100.6		40	100.0		40	104.8		40	103.9									
Amputation-One Impair.-Upper	1 3	3 99			7	87.3	1.9*	19	102.3	-1.0	3	99.3	1.0	28	101.3	-0.1	40	98.8	3.1**	5	106.0	-0.5						
Impair.-Lower Visual Impair.	4 5	456 97	6	99.7	-0.5	26	97.9	-0.9	112	98.9	1.0	121	99.7	0.7	167	99.6	3.2**	24	101.9	-0.8	34	101.1	1.9*	6	99.2	1.1		
Hearing-Other Hearing-Mute	7 9	10 3						3	97.3	0.7				7	102.4	0.7												
Tuberculosis Heart Disease	10 11	19 84			3	85.3	1.6	4	105.8	-1.5	19	98.6	0.8	9	105.4	-1.3	24	99.1	0.8	6	102.5	0.7	32	101.7	1.6	6	102.2	0.4
Diabetes Epilepsy	12 13	28 7			3	96.0	-0.1	6	95.7	1.6	3	101.7	-0.3	11	99.1	0.6	8	103.8	0.3	4	95.3	2.1*						
Behavior Dis.	14	71			3	80.0	2.4*	22	95.8	2.5**	21	97.8	1.2	25	101.1	1.8*												
Total Impaired		877																										

Group identification details are shown in Table I. The N represents the number of persons. The t represents the Student's t-statistic. A single * indicates that there is a difference in the standard-score means of the two groups at the 5 percent level of significance. A double asterisk indicates that there is a difference in the standard-score means of the two groups at the 1 percent level of significance.

Those impaired workers in cells smaller than 3 are shown by impairment and by annual wage range in Table III. This accounts for the blanks in the above table (21 persons were in small cells above).

TABLE VII

NUMBERS OF PERSONS WITH PERFORMANCE APPRAISAL STANDARD-SCORE
MEANS BELOW OR EQUAL TO AND ABOVE THE MEANS OF NONIMPAIRED
CONTROL GROUPS BY ANNUAL WAGE INTERVALS

\$5,000-5,999 Annual Wage Interval

Nonimpaired (Control Group of 40) Performance Appraisal
Standard-Score Mean - 97.05

<u>Impairment</u>	<u>Code</u>	<u>Number of Impaired Persons with a Performance Appraisal Standard-Score Mean:</u>	
		<u>Below 97.05</u>	<u>Equal or Above 97.05</u>
Nonimpaired	17	19	21
Amputation-One Imp.-Upper	1 3	1 0	0 0
Imp.-Lower Visual Imp.	4 5	2 1	4 2
Hearing-Other Hearing-Mute	7 9	0 0	0 0
Tuberculosis Heart Disease	10 11	0 0	0 1
Diabetes Epilepsy	12 13	0 0	0 0
Behavior Dis. Total Impaired	14	<u>1</u> 5	<u>0</u> 7

\$6,000-6,999 Annual Wage Interval

Nonimpaired (Control Group of 40) Performance Appraisal
Standard-Score Mean - 95.50

<u>Impairment</u>	<u>Code</u>	<u>Number of Impaired Persons with a Performance Appraisal Standard-Score Mean:</u>	
		<u>Below 95.50</u>	<u>Equal or Above 95.50</u>
Nonimpaired	17	17	23
Amputation-One Imp.-Upper	1 3*	2 5	0 2
Imp.-Lower Visual Imp.	4 5	7 1	19 2
Hearing-Other Hearing-Mute	7 9	0 0	0 0
Tuberculosis Heart Disease	10 11	0 3	0 0

TABLE VII Continued

Diabetes	12	1	2
Epilepsy	13	0	0
Behavior Dis.	14*	<u>3</u>	<u>0</u>
Total Impaired		22	25

\$7,000-7,999 Annual Wage Interval

Nonimpaired (Control Group of 40) Performance Appraisal
Standard-Score Mean - 100.55

<u>Impairment</u>	<u>Code</u>	Number of Impaired Persons with a <u>Performance Appraisal Standard-Score Mean:</u>	
		<u>Below 100.55</u>	<u>Equal or Above 100.55</u>
Nonimpaired	17	20	20
Amputation-One Imp.-Upper	1 3	0 8	0 11
Imp.-Lower	4	60	52
Visual Imp.	5	11	13
Hearing-Other	7	1	2
Hearing-Mute	9	0	0
Tuberculosis	10	1	3
Heart Disease	11	9	10
Diabetes	12	4	2
Epilepsy	13	1	2
Behavior Dis.	14**	<u>15</u>	<u>7</u>
Total Impaired		110	102

\$8,000-8,999 Annual Wage Interval

Nonimpaired (Control Group of 40) Performance Appraisal
Standard-Score Mean - 101.02

<u>Impairment</u>	<u>Code</u>	Number of Impaired Persons with a <u>Performance Appraisal Standard-Score Mean:</u>	
		<u>Below 101.02</u>	<u>Equal or Above 101.02</u>
Nonimpaired	17	13	27
Amputation-One Imp.-Upper	1 3	3 10	0 18
Imp.-Lower	4	60	61
Visual Imp.	5	11	16
Hearing-Other	7	1	1
Hearing-Mute	9	2	1

TABLE VII Continued

Tuberculosis	10	1	8
Heart Disease	11	11	13
Diabetes	12	6	5
Epilepsy	13	1	1
Behavior Dis.	14	<u>13</u>	<u>8</u>
Total Impaired		119	132

\$9,000-9,999 Annual Wage Interval

Nonimpaired (Control Group of 40) Performance Appraisal
Standard-Score Mean - 104.75

<u>Impairment</u>	<u>Code</u>	<u>Number of Impaired Persons with a Performance Appraisal Standard-Score Mean:</u>	
		<u>Below 104.75</u>	<u>Equal or Above 104.75</u>
Nonimpaired	17	18	22

Amputation-One Imp.-Upper	1 3**	2 25	0 15
Imp.-Lower	4**	116	51
Visual Imp.	5*	19	15
Hearing-Other	7	5	2
Hearing-Mute	9	1	1
Tuberculosis	10	4	2
Heart Disease	11	20	12
Diabetes	12	5	3
Epilepsy	13*	2	2
Behavior Dis.	14*	<u>18</u>	<u>7</u>
Total Impaired		217	110

\$10,000-10,999 Annual Wage Interval

Nonimpaired (Control Group of 40) Performance Appraisal
Standard-Score Mean - 103.87

<u>Impairment</u>	<u>Code</u>	<u>Number of Impaired Persons with a Performance Appraisal Standard-Score Mean:</u>	
		<u>Below 103.87</u>	<u>Equal or Above 103.87</u>
Nonimpaired	17	18	22

Amputation-One Imp.-Upper	1 3	0 1	1 4
Imp.-Lower	4	11	13
Visual Imp.	5	3	3

TABLE VII Continued

Hearing-Other	7	0	1
Hearing-Mute	9	1	0
Tuberculosis	10	0	1
Heart Disease	11	2	4
Diabetes	12	1	0
Epilepsy	13	1	0
Behavior Dis.	14	<u>1</u>	<u>1</u>
Total Impaired		21	28

Total Impaired 898 or 494 + 404
55 percent 45 percent

This table covers 66 impaired groups (898 persons).

*Significant at the five percent level.

**Significant at the one percent level.

Codes 2, 6, 8, 15, and 16 are not included above (total of impaired is 898 consisting of 877 from Table VI and 21 from small cells).

The mean of the 240 persons in the control groups is 100.46.

Nonimpaired Mean 100.46	Impaired		Nonimpaired	
	Number	Percent	Number	Percent
"Above"	454	50.56	131	54.58
"Below"	<u>444</u>	<u>49.44</u>	<u>109</u>	<u>45.42</u>
	898	100.00	240	100.00

There are 54.58 percent of the nonimpaired persons (240 in six control groups) with scores above their mean (100.46) compared to 50.56 percent of impaired persons with scores above the 100.46.

who had scores above the means of the nonimpaired groups.

An analysis of the data in Table VII by annual wage range is followed in a later section by an analysis of the 8 impaired groups having low performance and the 31 impaired groups from Table VI for which the null hypothesis was accepted. In the \$5,000-5,999 annual wage range 5 impaired persons (42 percent versus 47 percent for the nonimpaired) had scores below the mean (97.05) of the nonimpaired control compared to 7 (58 percent versus 53 percent for the nonimpaired) with scores above 97.05. The impaired performed a little better than the nonimpaired on this basis.

In the \$6,000-6,999 annual wage range 22 impaired persons (47 percent versus 42 percent for the nonimpaired) have scores below the mean (95.50) of the nonimpaired control compared to 25 (53 percent versus 58 percent with scores above 95.50). It is interesting to note that the percentages reversed between the two wage ranges just considered. The two groups (Codes 3 and 14) that were lower at a 5 percent level of significance account for the poor performance of the impaired in this salary range. Those with behavior disorders (Code 14) are all below the nonimpaired mean. The Code 4 impaired on the other hand offset to some extent the poor performance of the other two impaired groups. In the first wage range the impaired were better and in the second wage range they were worse than the nonimpaired.

In the \$7,000-7,999 annual wage range 110 impaired persons (52 percent versus 50 percent for the nonimpaired) have scores below the mean (100.55) of the nonimpaired control compared to 102 (48 percent versus 50 percent of the nonimpaired) with scores above 100.55. Those persons with lower impairments or back injuries (Code 4) and behavior

disorders (Code 14) contributed greatly to the poor performance of the impaired.

In the \$8,000-8,999 annual wage range 119 impaired persons (47 percent versus 35 percent for the nonimpaired) have scores below the mean (101.02) of the nonimpaired control compared to 132 (53 percent versus 65 percent for the nonimpaired) with scores above 101.02. Those with behavior disorders (Code 14) hurt the performance of the impaired but the fact that 65 percent of the nonimpaired have scores above their mean is the main reason the impaired were poorer in comparison to the nonimpaired.

In the \$9,000-9,999 annual wage range 217 impaired persons (66 percent versus 45 percent of the nonimpaired) have scores below the mean (104.75) of the nonimpaired control compared to 110 (34 percent versus 55 percent for the nonimpaired) with scores above 104.75. Five of the 8 impaired groups having poor performance as shown in Table VI are in this annual wage range. Those with lower impairments or back problems in Code 4 are the major contributors to the poor performance of the impaired in this wage range. It may be that those who wish to get out of heavy work fake a back injury since it is hard to detect. A person inclined to do this probably would be a poor performer. The 5 groups mentioned specifically will be examined in more detail in a later section.

In the \$10,000-10,999 annual wage range 21 impaired persons (45 percent versus 45 percent for the nonimpaired) have scores below the mean (103.87) of the nonimpaired control compared to 28 (55 percent versus 55 percent of the nonimpaired) with scores above 103.87. The performance of the nonimpaired and impaired appear to be approximately

the same.

Another method of looking at the data in Table VII is to total the number of impaired persons in each wage range who have scores below the mean of the nonimpaired group (494 or 55.0 percent of 898 impaired persons) and the number who have scores above the mean (404 impaired persons or 45.0 percent of the 898).

As shown at the bottom of Table VII, the standard-score mean of the 240 impaired workers in the 6 control groups is 100.46. The 50.56 percent of impaired persons having scores above the nonimpaired mean (100.46) is not significantly different (at the 5 percent level) from the 54.58 percent of nonimpaired workers having scores above the mean (100.46) of the nonimpaired as is shown at the end of Table VII.

An Analysis of Impaired Groups Having Low Performance

It would be of value to employers and to rehabilitation administrators if the reason could be found as to why some impaired groups studied did not perform as well as the nonimpaired control groups. H_0 was rejected in the 8 of 39 group comparisons.

The nonimpaired control groups and the impaired groups were matched by selecting only blue-collar workers with similar conditions of employment in a single establishment by \$1,000 annual wage intervals which possibly indicate socioeconomic levels. The groups were not matched in regard to certain other variables which possibly affect ability to perform on a job such as chronological age, learning ability, and education. These characteristics were in the personnel files of each worker and were examined for possible clues. A future study might well further explore differences using personality and attitude

tests and background case history studies.

Table VIII includes averages of age, performance appraisal scores, learning ability scores, and years of education by impairment codes and annual wage interval. The only item that requires some explanation is the learning score. Details of the test cannot be revealed but it is a modified intelligence (I.Q.) test developed by United States Air Force psychologists specifically for selection and promotion purposes. It is known as the Air Force Learning Ability Test.

Information in Table VIII is used in an effort to determine if something other than the existence of an impairment may have caused the poorer performance of 8 groups of impaired workers (when compared to nonimpaired workers) indicated by 1 asterick or 2 astericks in Table VII.

The initial exception analyzed is at the \$6,000-6,999 wage interval where 7 persons with impairment-upper (Code 3) are an average of 9 years older, have an average learning score 4 points below, and have a year less of education on the average compared to the nonimpaired control group; therefore, the groups are not comparable. This lack of comparability rather than the existence of the impairment may explain the poorer performance.

The second group in this wage interval to be analyzed consists of 3 persons with behavior disorders (Code 14) who have about the same years of education as the nonimpaired. The learning score of 52.00 compared to the 43.60 for the nonimpaired group leads one to wonder if the impaired are too bright for the type of work they are doing and are dissatisfied. The fact that they are 7.61 years younger on the average may indicate that they are not as settled as the nonimpaired.

TABLE VIII

AVERAGES OF AGE, PERFORMANCE APPRAISAL SCORES, LEARNING
ABILITY AND YEARS OF EDUCATION BY IMPAIRMENT
CODES AND WAGE INTERVALS

Wage Interval and Impairments	Impair- ment Code	N	Average Age	Score		Years (Average) Education
				(Average) Performance	(Average) Learning	
<u>\$5,000-5,999</u>						
Nonimpaired (Control)	17	40	42.40	97.05	31.42	9.57
Impairment-Lower	4	6	53.16	99.66	25.-0	9.00
Visual Impairment	5	3	50.66	99.00	16.33	6.00
<u>\$6,000-6,999</u>						
Nonimpaired (Control)	17	40	35.95	95.50	43.60	11.40
Impairment-Upper	3	7	44.71	87.28*	39.28	10.42
Impairment-Lower	4	26	46.53	97.88	38.34	9.84
Visual Impairment	5	3	44.66	99.00	44.00	11.33
Heart Disease	11	3	41.66	85.33	45.00	10.00
Diabetes	12	3	40.33	96.00	56.00	11.00
Behavior Disorder	14	3	28.33	80.00*	52.00	12.33
<u>\$7,000-7,999</u>						
Nonimpaired (Control)	17	40	40.22	100.55	44.32	10.77
Impairment-Upper	3	19	51.00	102.31	35.52	10.26
Impairment-Lower	4	112	50.61	98.89	38.47	10.13
Visual Impairment	5	24	45.79	98.91	37.00	10.08
Hearing-Other	7	3	56.33	97.33	39.66	10.33
Tuberculosis	10	4	50.75	105.75	41.75	9.75
Heart Disease	11	19	53.47	98.57	36.26	9.73
Diabetes	12	7	48.00	95.66	46.00	11.16
Epilepsy	13	3	39.00	101.66	53.33	12.00
Behavior Disorder	14	22	46.95	95.77*	43.59	11.13
<u>\$8,000-8,999</u>						
Nonimpaired (Control)	17	40	44.17	101.02	43.30	10.60

TABLE VIII Continued

Wage Interval and Impairments	Impair- ment Code	N	Average Age	Score		Years (Average) Education
				(Average) Performance	(Average) Learning	
Amputation-One	1	3	52.66	95.33	45.00	10.66
Impairment-Upper	3	28	47.07	101.25	42.32	11.03
Impairment-Lower	4	121	49.28	99.71	42.56	10.07
Visual Impairment	5	27	48.88	99.74	43.37	10.25
Hearing-Mute	9	3	51.66	99.66	35.66	9.00
Tuberculosis	10	9	47.22	105.44	56.88	12.11
Heart Disease	11	24	48.79	99.08	44.91	10.08
Diabetes	12	11	44.00	99.09	45.81	10.18
Behavior Disorder	14	21	43.00	97.80	43.61	10.33
<u>\$9,000-9,999</u>						
Nonimpaired (Control)	17	40	45.40	104.75	45.50	10.77
Impairment-Upper	3	40	47.82	98.75**	46.10	10.67
Impairment-Lower	4	167	50.04	99.60**	44.59	10.69
Visual Impairment	5	34	47.55	101.05*	48.08	10.91
Hearing-Other	7	7	51.00	102.42	39.71	11.57
Tuberculosis	10	6	48.50	102.50	43.16	10.83
Heart Disease	11	32	54.09	101.65	45.00	11.18
Diabetes	12	8	46.62	103.75	50.75	11.50
Epilepsy	13	4	43.75	95.25*	39.-0	9.00
Behavior Disorder	14	25	46.60	101.08*	45.04	10.92
<u>\$10,000-10,999</u>						
Nonimpaired (Control)	17	40	48.60	103.87	51.90	11.62
Impairment-Upper	3	5	56.00	106.00	49.40	11.20
Impairment-Lower	4	24	50.87	101.87	53.33	11.33
Visual Impairment	5	6	51.16	99.16	61.66	10.66
Heart Disease	11	6	52.00	102.16	50.66	11.33

TABLE VIII Continued

*Appraisal score mean is significantly lower at the 5 percent level.

**Appraisal score mean is lower at the 1 percent level of significance.

The impaired group's performance rating score of 80.00 is an average of scores 70, 80, and 90, all of which are below the 95.50 mean of the nonimpaired control group.

The next exception is at the \$7,000 wage interval and also concerns persons with behavior disorders. The average years of education and learning scores are similar, but the impaired are an average of 6.73 years older than the nonimpaired control group and 18.62 years older on the average than the impaired at the \$6,000 wage interval discussed above. Only 7 of 22 impaired persons had scores above the control group mean, as shown in Table VII.

Behavior disorder groups (Code 14) were in 4 of 6 wage ranges, and for groups in 3 of the 4 wage ranges H_0 was rejected, thereby warranting particular attention. There were 50 persons in the three groups where H_0 was rejected (70.4 percent of the total of 71 persons in the 4 wage ranges) and 21 impaired persons (29.6 percent) in the 1 group where H_0 was accepted. Average ages of the groups varied from 28.33 to 46.95 years, but there was not a pattern which would explain why H_0 was rejected for 3 of the 4 groups. The average age shown in Table VIII, nor learning ability, nor the average years of education explain the poor performance of those with behavior disorders.

For some reason, the \$9,000 wage interval contained 5 groups (of the 8 groups) of impaired in which H_0 was rejected. They may have reached their level of incompetence. Two of the 5 groups of impaired in this wage range did not perform as well as the nonimpaired control group at the 1 percent level of significance. Many of the master craftsmen, full journeymen, general machinists, and patternmakers fall into this annual wage range and would be expected to have more varied

duties than others. It is possible that the type of work in this salary range demands more physical activity and greater mobility. The impairment-upper and impairment-lower groups, the 2 largest groups, may have had mobility problems and did not perform as well as the non-impaired control groups at the 1 percent level of significance.

The group of 4 persons with epilepsy in the \$9,000 wage interval had scores of 70, 99, 106, and 106; was younger than the nonimpaired group (43.75 versus 45.40 years); had a lower average learning score (39.00 versus 45.50) and fewer years (average) of education (9.00 versus 10.77). An individual having this impairment may be quite different from another with the same impairment since a different part of the brain may be involved.

The 34 persons with visual impairments (Code 5) in the \$9,000 wage interval were similar to the nonimpaired control group (based on Table VIII) even though 15 had performance scores below the mean of the nonimpaired control group as shown in Table VII. These items do not offer a clue to the poor performance.

The 167 persons in the \$9,000 wage range (Table VIII) having an "Impairment-lower" classification (Code 4) were older (50.04 versus 45.40) and years (average) of education (10.69 versus 10.77) were about the same as those of the nonimpaired group. Again, the higher age may explain a lack of aggressiveness or ambition.

The 40 persons classified as having an "Impairment-upper" (Code 3) in the \$9,000 wage interval had a standard-score mean 6 points lower (98.75 versus 104.75) than the nonimpaired group. The average learning score of the impaired group was slightly better than the nonimpaired group (46.10 versus 45.50) and the years (average) of

education were similar (10.67 versus 10.77). No clues as to why the impaired performed poorer than the control group were evident.

Performance comparisons by annual wage range for 11 types of impaired groups show that in 8 of 39 groups (20.5 percent of the groups) H_0 was rejected. The 8 impaired groups for which the H_0 was rejected represented 302 impaired persons (33.6 percent of the 898 impaired persons). Two hundred and three of these (22.6 percent of 898) had standard-scores below their control group's mean and 99 had standard-scores equal to or above their control group's mean.

An Analysis of Impaired Groups Not Having Low Performance

The 31 groups of impaired persons in Table VI for which the null hypothesis is accepted were critically analyzed to determine if the age, learning ability, or education (shown by impaired group in Table VIII) differed significantly from that of the nonimpaired control group. The analysis determined if the null hypothesis could have been accepted because an impaired group was not comparable to its nonimpaired control group in regard to age, learning ability, or education. For instance, an impaired group might have had more years of education than its nonimpaired control group, the additional education thereby offsetting the existence of the impairment. For wage-board nonsupervisory employee groups, an average age greater than 35 years would not be expected to cause an improvement in work performance. In general, one would expect a higher average learning ability or more years of education to result in improved work performance.

At the \$5,000-5,999 wage range (Table VIII) those groups with lower impairments (Code 4) and visual impairments (Code 5), when

compared to their nonimpaired control group, were older, had poorer learning ability, and fewer years of education. There were no apparent factors offsetting the existence of the impairments.

At the \$6,000-6,999 wage range (Table VIII), those groups with lower impairments (Code 4), visual impairments (Code 5), and heart disease (Code 11), when compared to their nonimpaired control group, were older and had similar learning ability and education. There were no apparent factors offsetting the existence of the impairments. The group with diabetes (Code 12), when compared to the nonimpaired control group, was slightly older, had a learning ability score 12.40 points greater, and had slightly less education. The greater learning ability may have offset the existence of this impairment.

At the \$7,000-7,999 wage range (Table VIII) those groups with upper impairments (Code 3), lower impairments (Code 4), visual impairments (Code 5), hearing impairments (Code 7), tuberculosis (Code 10), and heart disease (Code 11), when compared to their nonimpaired control group, were older, had poorer learning ability, and had less education. There were no apparent factors offsetting the existence of the impairments. As in the previous wage range, the group with diabetes (Code 12), when compared to their nonimpaired control group, were older, had a better learning ability (1.68 points) and had equivalent education. The group with epilepsy (Code 13), when compared to their nonimpaired control group was 1.22 years younger (39.00 versus 40.22), had a better learning ability (9.01 points), and had 1.23 years more education. The younger age (1.22 years), the better learning ability, and better education may have offset the existence of the impairment.

At the \$8,000-8,999 wage range (Table VIII) those groups with

lower impairments (Code 4) and hearing impairments (Code 9), when compared to their nonimpaired control group, were older, had poorer learning ability, and had less education. Those groups with one amputation (Code 1), upper impairments (Code 3), visual impairments (Code 5), heart disease (Code 11), diabetes (Code 12), and behavior disorders (Code 14), when compared to their nonimpaired control group, were about the same age or older, had similar learning abilities, and had about the same years of education. Those with a history of tuberculosis (Code 10), when compared to their nonimpaired control group, were older, had a higher learning ability score (13.58 points), and had more education (1.51 years). The greater learning ability and additional education of this group (Code 10) may have offset the existence of the impairment.

At the \$9,000-9,999 wage range (Table VIII) the group with a hearing impairment (Code 7), when compared to the nonimpaired control group, was older (5.60 years), had less learning ability (5.79 points), and had slightly more education (0.80 years). Those with a history of tuberculosis (Code 10) and heart disease (Code 11), when compared to their nonimpaired control group, were older and had about the same learning ability and education. Those with diabetes (Code 12) when compared to their nonimpaired control group, were older, had better learning abilities (5.25 points), and had more education (0.73 years). The greater learning ability of the impaired may have offset the existence of the impairment.

At the \$10,000-10,999 wage range those with upper impairments (Code 3) and lower impairments (Code 4), when compared to their nonimpaired control groups, were older but they had about the same

learning ability and education. Those with visual impairments (Code 5), when compared to their nonimpaired control group, were older, had better learning ability (9.76 points), and had slightly less education. The better learning ability could have offset the existence of the impairment (Code 5).

Therefore, in 5 groups out of the 31 groups for which the null hypothesis was accepted (16.1 percent of the 31 groups), greater learning ability may have offset the existence of the impairment. The 5 groups contained 29 impaired persons (5.0 percent of the 575 impaired in the 31 groups in Table VI).

Performance Comparisons by Occupational Groups

The performances of groups of persons who have specific impairments and who work in specific occupational groups were compared to the performances of nonimpaired persons in the same occupational groups (48 occupational groups are listed for OCAMA use). The Rehabilitation Services Administration, which provides on-the-job training and institutional training to disabled persons, is interested in knowing those occupational groups in which a rehabilitated person can compete effectively. Employers need to know the jobs in which rehabilitated persons can compete effectively with the nonimpaired. A disabled person needs information on the performance of the impaired by occupational group so that he can decide the type of training he should seek.

There were one or more impaired groups of at least 3 persons in 18 occupational groups. In 5 of 62 group comparisons (8.1 percent of the groups), H_0 was rejected. The 5 groups represented 32 impaired persons (4.2 percent) out of 760 impaired in the study by occupational

TABLE IX
AN ANALYSIS OF THE PERFORMANCE APPRAISAL
STANDARD-SCORE MEANS OF IMPAIRED
AND NONIMPAIRED BY OCCUPATIONAL
GROUP

Occupational Group and Impairment	Impair- ment Code	Group N	Mean	t- Statistic
Electronic Equipment Installation and Maintenance (Radar, radio, television, but not teletype or telephone)				
Nonimpaired Control Group	17	24	104.875	
Impairment-Upper	3	12	103.166	0.591
Impairment-Lower	4	34	101.617	1.360
Visual Impairment	5	10	98.200	2.290*
Heart Disease	11	6	105.166	-0.087
Diabetes	12	6	105.500	-0.175
Behavior Disorder	14	4	93.750	2.687**
Electrical Installation and Maintenance (Motors, lines, electro-mechanical accessories, aircraft systems)				
Nonimpaired Control Group	17	7	96.428	
Impairment-Lower	4	25	94.960	0.305
Visual Impairment	5	7	102.857	-0.986
Heart Disease	11	5	104.400	-1.186
Behavior Disorder	14	4	96.250	0.020
Instrument Overhaul (Computer, aircraft instruments, optical, photographic, time)				
Nonimpaired Control Group	17	13	98.692	
Impairment-Upper	3	12	98.083	0.140
Impairment-Lower	4	40	99.675	-0.332
Heart Disease	11	8	103.875	-1.270
Diabetes	12	3	102.333	-0.608
Machine Tool Work (Engine cylinder, parts rework, toolmaking, measuring)				
Nonimpaired Control Group	17	12	100.916	
Impairment-Upper	3	7	103.714	-0.600
Impairment-Lower	4	31	99.709	0.320
Visual Impairment	5	6	98.666	0.475
Heart Disease	11	8	96.500	0.899
Diabetes	12	3	98.333	0.430
Behavior Disorder	14	3	102.666	-0.280

Details of OCAMA impairments and codes are given in Table I. N indicates the number of persons. A single * indicates that there is a difference in the standard-score means of the two groups at the 5 percent level of significance. A double asterisk indicates that there is a difference in the standard-score means of the two groups at the

TABLE IX Continued

1 percent level of significance. There are 760 impaired persons in this tabulation and 224 nonimpaired persons in control groups.

Occupational Group and Impairment	Impair- ment Code	Group N	Mean	t- Statistic
Manual Labor				
(Janitorial, pest control, disposal work, aircraft loadmaster)				
Nonimpaired Control Group	17	31	98.000	
Impairment-Lower	4	4	104.250	-1.028
Visual Impairment	5	3	99.000	-0.139
Metal Processing				
(Welding, metalizing, electroplating, heat treating)				
Nonimpaired Control Group	17	6	100.00	
Impairment-Upper	3	6	101.16-	-0.183
Impairment-Lower	4	10	103.000	-0.742
Metal Work				
(Sheet metal, structural iron, containers, tube manufacturing)				
Nonimpaired Control Group	17	15	103.800	
Impairment-Upper	3	4	97.250	1.230
Impairment-Lower	4	32	99.468	1.480
Heart Disease	11	10	100.300	1.084
Behavior Disorder	14	8	96.250	1.748*
Lithographing, Printing, and Reproduction				
(Lithographing, printing, and reproduction equipment)				
Nonimpaired Control Group	17	3	95.666	
Impairment-Lower	4	7	105.714	-1.365
Woodworking				
(Carpentry, woodworking, crating)				
Nonimpaired Control Group	17	9	101.888	
Impairment-Lower	4	10	97.200	1.077
Visual Impairment	5	6	96.833	0.876
Fixed and/or Industrial Equipment Maintenance				
(Air conditioning, millwright, power plant)				
Nonimpaired Control Group	17	4	102.000	
Impairment-Lower	4	13	99.769	0.503
Fixed and/or Industrial Equipment Operation				
(Water plant, parts, equipment)				
Nonimpaired Control Group	17	3	103.333	
Impairment-Lower	4	11	99.363	0.724
Visual Impairment	5	4	103.000	0.044

TABLE IX Continued

Occupational Group and Impairment	Impair- ment Code	Group N	Mean	t- Statistic
Mobile Equipment Operation (Fork lift, vehicle, trash truck, crane, earth moving)				
Nonimpaired Control Group	17	5	104.200	
Impairment-Upper	3	5	98.000	1.358
Impairment-Lower	4	17	99.000	1.116
Warehouse Work (Parts routing, identification and condition verifying)				
Nonimpaired Control Group	17	21	100.857	
Impairment-Upper	3	11	101.818	-0.317
Impairment-Lower	4	57	98.526	1.038
Visual Impairment	5	13	102.769	-0.648
Hearing-12/20 Plus	8	5	99.000	0.469
Heart Disease	11	12	95.083	1.647
Diabetes	12	6	98.166	0.643
Behavior Disorder	14	14	98.785	0.713
Packaging and Processing (Preservation packaging, household goods shipping)				
Nonimpaired Control Group	17	7	93.428	
Impairment-Lower	4	9	96.666	-0.622
Fluid Systems (Components repairing, hydraulic systems mechanic, gaseous)				
Nonimpaired Control Group	17	19	101.315	
Impairment-Upper	3	15	99.133	0.641
Impairment-Lower	4	64	100.890	0.172
Visual Impairment	5	13	100.923	0.130
Heart Disease	11	5	100.000	0.342
Diabetes	12	3	91.000	2.065*
Behavior Disorder	14	7	100.571	0.208
Mechanical Parts and Components Work (Bearing reclaiming, components repair, parts reworking)				
Nonimpaired Control Group	17	12	98.000	
Impairment-Lower	4	16	102.687	-1.152
Visual Impairment	5	3	105.666	-1.422
Aircraft Engine Overhaul (Power units, engine assembly, turbine starter, testing)				
Nonimpaired Control Group	17	17	101.941	
Impairment-Upper	3	7	97.571	1.104
Impairment-Lower	4	36	97.750	1.403
Visual Impairment	5	11	100.272	0.440
Heart Disease	11	7	94.142	1.-53
Behavior Disorder	14	7	94.285	1.773*

TABLE IX Continued

Occupational Group and Impairment	Impair- ment Code	Group N	Mean	t- Statistic
Aircraft Overhaul (Integral tank sealing, storage conditioning, mechanic)				
Nonimpaired Control Group	17	16	98.125	
Impairment-Upper	3	7	94.571	0.642
Impairment-Lower	4	22	100.045	-0.637
Visual Impairment	5	9	98.555	-0.086
Heart Disease	11	7	102.285	-0.801
Behavior Disorder	14	10	102.800	-1.058

groups. Table IX is used in analyzing the occupational groups.

Two groups of impaired workers with performance score means lower than the means of the nonimpaired groups were in the same occupational group (Electronic Equipment Installation and Maintenance-the first group). The group of four persons with behavior disorders (Code 14) had a standard-score mean (93.750) lower than a group of 10 persons with visual impairments (Code 5 mean is 98.200) compared to a standard-score mean of 104.875 for the nonimpaired (Code 17) in the same occupational group. Only 24 (10 percent) of the 240 nonimpaired randomly selected wage-board nonsupervisory workers fell into this occupational group.

Fifty-three persons with behavior disorders (Code 14) were in 7 different occupational groups which performed as well as the nonimpaired groups at a significance level of 5 percent compared to the above group of 4 persons with behavior disorders which did not perform as well as the nonimpaired group at a 1 percent level of significance.

Ten other occupational groups contained 75 persons with visual impairments. These visually impaired groups performed as well as the groups of nonimpaired workers at a significance level of 5 percent compared to the group (10 persons with visual impairments) which did not perform as well (Electronic Equipment Installation and Maintenance).

The group of 4 persons with behavior disorders (Code 14) which did not perform well was older (44.00 versus 41.83 years for the non-impaired), had more years (average) of education (14.00 versus 12.08), and had a lower learning score (43.25 versus 56.46).

The group of 10 persons with a vision impairment (Code 5) which had a lower standard-score mean, was older (48.30 versus 41.83),

had fewer years (average) of education (11.00 versus 12.08), and had a lower learning score (53.60 versus 56.46). The fact that the impaired were older than the nonimpaired may be a clue to their poorer performance.

The following tabulation summarizes the information in Table IX regarding the impaired groups that did not perform as well as the non-impaired control groups by occupational groups.

<u>Impairment and Code</u>		<u>Number of Impaired Groups</u>		<u>Number of Impaired Persons</u>	
Visual	5	H _o Accepted	10		75
		H _o Not Accepted		1	10
Diabetes	12	H _o Accepted	4		18
		H _o Not Accepted		1	3
Behavior	14	H _o Accepted	5		38
		H _o Not Accepted		3	19
Totals			19	5	131
Percent			79	21	80
					20

An examination of age, education, and learning ability scores did not explain why the 5 impaired groups performed poorly. A future study could be directed toward case histories and the giving and evaluating of personality and attitude tests.

Summary

The performance appraisal used at the Oklahoma City Air Materiel Area has been discussed and comparisons made between groups having different types of impairments and groups of nonimpaired workers. Comparisons were made by annual wage ranges (\$1,000 intervals) and also by occupational groups (18 contained 3 or more persons with a specific impairment). In most cases the performance of the impaired groups did not differ from that of the nonimpaired control group at a 5 percent level of significance.

Major findings were: (1) In 8 of 39 comparisons (20.5 percent of the groups) H_0 was rejected as shown in Table VI by wage ranges (\$1,000 intervals). H_0 is that the mean performance score of the impaired is equal to that of the nonimpaired. The 302 persons in the 8 groups (33.6 percent of 898 impaired persons) included 203 (22.6 percent of 898 impaired persons) who had performance scores below the means of the impaired groups versus 99 impaired whose scores were equal to or greater than the means of the matching nonimpaired groups, (2) In 5 of 62 comparisons by occupational groups (8.1 percent) in Table IX H_0 was rejected. The five groups represented 32 impaired persons (4.2 percent) out of 760 impaired in the study by occupational groups.

The hiring of impaired workers is national policy. Supervisors, though they must comply, are required to meet production standards regarding quality and quantity of work produced and they may resist hiring impaired persons without assurances that the impaired will perform well on the job. In rating an individual a supervisor may be biased in favor of him and may sympathize with him. He may be

irritated at problems caused by selective placement or he may be biased against the disabled person and feel revulsion. One supervisor (when compared to another) may tend to give high or low appraisal ratings to all of the persons under him. Any rating system is subject to the bias of the person making the rating. At OCAMA a performance appraisal by a first-level supervisor is reviewed by a worker's second-level supervisor who may adjust the appraisal of the first-level supervisor, thereby reducing some of the bias of first-level supervisors. The supervisors are required to consider 15 rating elements and to pick one of 6 possible scores for each of the elements that he rates. The assignment of numerical values to the essentially subjective rating elements results in a precise number which can be treated statistically, and is an improvement over just asking a supervisor if the impaired workers in general perform better in certain areas than the nonimpaired workers in general as was done in the Simon study (9). The calculation of a standard-score as discussed in this chapter further reduces the problem of bias.

As previously mentioned, a specific type of impairment such as epilepsy covers a considerable range of possible severity of impairment. More precise impairment categories would, in most instances, be helpful, but there is a disadvantage in that it would be more difficult to secure an impairment group of sufficient size (a minimum of 3 persons) to give results having statistical significance.

CHAPTER V

SUMMARY AND CONCLUSIONS

Introduction

Society has made many attempts to solve the problem of disability. The most extreme solution was the ancient custom of extermination, which was indeed the most permanent and least costly solution. The most effective and most humane solution is the recent effort to help the individual to support himself, thereby integrating him into the social and economic community. The manpower needs of World War II accelerated the employment of people with impairments, and their work records have helped to improve employer and public attitudes toward the impaired.

From the creation of the Federal-State Program of Vocational Rehabilitation in 1920 until the end of fiscal year, 1970, approximately 2.8 million persons had been rehabilitated. Unfortunately, the number of newly disabled continues to exceed the number of rehabilitated. There were 767,319 new cases referred (processed) to the State Vocational Rehabilitation Agencies, but only 266,975 were rehabilitated in the fiscal year, 1970. How well do impaired persons perform in actual work situations? Findings regarding this question are summarized in the following sections, and conclusions are drawn.

Performances of Impaired Workers at OCAMA

The Oklahoma City Air Materiel Area has a large concentration of workers with impairments of various types and provides the setting for the study of the performance of impaired workers based on standard scores derived from performance appraisals. In employing physically impaired, mentally retarded and emotionally disturbed workers, OCAMA carries out national policy as set forth in federal legislation and in Presidential directives.

Thirty-nine comparisons (based on standard scores derived from performance appraisals) between impaired groups and nonimpaired control groups by wage ranges of \$1,000 intervals are made. H_0 states that the impaired worker's performance appraisal standard-score mean is equal to that of the nonimpaired control group. In 3 cases (Table VI) H_0 is rejected at the 1 percent level of significance. In 5 other cases H_0 is rejected at the 5 percent level of significance. Thus in 8 of 39 comparisons, (20.5 percent of the groups) H_0 is rejected at a 5 percent level of significance. The 8 impaired groups (Table VII) consisting of 302 (33.6 percent) individuals contain 203 (22.6 percent) of the total of 898 impaired persons who have individual performance scores below the means of the control groups versus 99 persons in the 8 impaired groups who have individual performance scores above the means of the control groups.

As is shown at the end of Table VII, there were 494 impaired persons (55.0 percent of the 898 impaired) with standard scores below the standard-score means of the nonimpaired control groups in each wage range, and 404 impaired persons (45.0 percent of the 898 impaired)

with standard scores above the standard-score means of the nonimpaired control groups in each wage range.

When all of the control groups (240 nonimpaired persons) were combined, their standard-score mean was 100.46 and 54.58 percent of the nonimpaired had standard scores above this mean compared to only 50.56 percent of the impaired with standard scores above 100.46.

Sixty-two comparisons (Table IX) are made (by occupational group and by impairment) between the standard-score mean of impaired groups and the standard-score mean of their nonimpaired control groups. H_0 is rejected in 5 group comparisons (32 persons or 4.2 percent of the 760 impaired), one of which is at the 1 percent level of significance. The 4 persons in the latter group have a history of behavior disorders, and they perform electrical equipment installation and maintenance functions.

Conclusions

Rehabilitation benefits the person with the impairment; his family benefits from his status as a wage earner or from his improved earning power; and society benefits from his labor in that it increases net national product. Economic benefits are complemented by considerable psychological and social benefits. The results of this study of the work performance of impaired person show that when properly placed, impaired persons did compete effectively with the nonimpaired workers in 66.4 percent (596 impaired persons out of the 898 shown in Table VII) of the individual comparisons by wage ranges. H_0 is accepted for 31 of 39 group comparisons by wage ranges (79.5 percent of the groups shown in Table VI) at a 5 percent level of significance.

As is shown at the end of Table VII, there were 494 impaired persons (55.0 percent of the 898 impaired) with standard scores below the standard-score means of the nonimpaired control groups in each wage range, and 404 impaired persons (45.0 percent of the 898 impaired) with standard scores above the standard-score means of the nonimpaired control groups in each wage range.

When all of the control groups (240 nonimpaired persons) were combined, their standard-score mean was 100.46 and 54.58 percent of the nonimpaired had standard scores above this mean compared to only 50.56 percent of the impaired with standard scores above 100.46.

The study further indicates that the impaired persons did compete effectively with the nonimpaired workers in 95.8 percent (728 impaired persons out of the 760 shown in Table IX) of the individual comparisons by occupational groups. H_0 is accepted for 57 of the 62 group comparisons (91.9 percent of the groups shown in Table IX) at the 5 percent level of significance.

A unique contribution of this study results from its disaggregated features. This one installation (OCAMA) had sufficient numbers of impaired workers so that individual types of impaired groups could be analyzed statistically by annual wage ranges and also by occupational groups. An annual performance appraisal standard-score was used as a surrogate for the labor productivity of individual impaired and non-impaired workers. The highly skilled occupational groups are in the higher annual wage ranges, and the skill level decreases as one moves to the lower annual wage ranges.

At the \$10,000-10,999 wage range (the highest skill level), all 5 impaired groups performed sufficiently well so that the null hypothesis

was accepted. The groups were composed of 5 persons with upper impairments, 24 persons with lower impairments, 6 persons with visual impairments, and 6 persons with heart disease. The fact that persons with these particular impairments performed well in highly skilled occupational groups should be of value to employers seeking this level of worker. The above indicates that the marginal revenue product of the indicated types of impaired workers is equivalent to that of the non-impaired workers.

If an employer is confronted with a situation in which he must make a decision regarding the hiring of a particular impaired person, information in this study will enable him to: (1) check how well that impaired group performed by skill level (wage range) and (2) determine how well the specific impaired group performed in the occupational group of interest to the employer. Therefore, the employer, by making use of the data presented in this study, should be in a better position to avoid some of the risk of paying a subsidy to an impaired worker for whom the study indicates a statistically significant possibility that the worker will have a low labor productivity. This same procedure should prove helpful to other decision makers in the areas of rehabilitation and training.

An example of how the information in this study may be used is next presented. The person considered has a lower impairment (Code 4--deformity or impairment of the back, foot, or leg) and has been employed in the past as a master craftsman. The skill indicates that he would be somewhere in the \$9,000-9,999 wage range. The information by wage range shows that for the group of 167 persons with this impairment H_0 was rejected. Also, this impaired group did not perform

as well as the nonimpaired at a 1 percent level of significance. Within the framework of this example, thus, there is a statistically significant possibility that the employer would be paying a subsidy to this employee if he hired him. The information by occupational groups indicates many types of work in which those with this impairment can compete effectively. Those persons counseling impaired workers regarding training programs should also find this type of information beneficial.

A major finding of this study is that persons with behavior disorders (Code 14) have lower productivity (at a statistically significant level) when compared to nonimpaired workers. Behavior disorder groups were in 4 wage ranges, and for groups in 3 of the 4 wage ranges H_0 was rejected, thereby warranting particular attention. There were 50 persons in the 3 groups where H_0 was rejected (70.4 percent of the total of 71 persons in the 4 wage ranges) and 21 impaired persons (29.6 percent) in the 1 group where H_0 was accepted. In the study by occupational groups 3 of the 5 comparisons (19 persons or 59.4 percent of the 32 persons) in which H_0 was rejected were groups with behavior problems.

The employment of persons with upper and lower impairments at some of the higher skill levels (\$9,000-9,999 wage range) involves a statistically significant possibility that a subsidy to the worker will result. There were 40 persons with upper impairments and 167 persons with lower impairments who did not perform as well as the nonimpaired at a 1 percent level of significance. Many of the master craftsmen, full journeymen, and general machinists fall in this wage range, and they would be expected to have varied duties requiring appreciable physical activity.

As is shown above, statistically significant differences were found when comparing the impaired and nonimpaired groups by wage ranges and occupational groups. There is not a significant difference (at the 5 percent level), however, when comparing the impaired and nonimpaired groups on an overall basis. Given the standard-score mean of 100.46 for the 240 nonimpaired persons in the control groups, 50.56 percent of the 898 impaired persons had standard-scores above this mean compared to 54.58 percent of the nonimpaired persons.

A SELECTED BIBLIOGRAPHY

- (1) Smith-Fess Act, Public Law 236, U. S. Code Title 29, June 2, 1920.
- (2) Caseload Statistics, State Vocational Rehabilitation Agencies, United States Department of Health, Education and Welfare, Social and Rehabilitation Service, Rehabilitation Services Administration, Division of Statistics and Studies, Washington, D. C.: 1970.
- (3) State Data Book, Federal-State Program of Vocational Rehabilitation United States Department of Health, Education and Welfare, Social and Rehabilitation Service, Rehabilitation Services Administration, Division of Statistics and Studies, Washington, D. C.: 1969.
- (4) National Health Survey, National Center for Health Statistics, Series 10, Number 60, United States Department of Health, Education and Welfare, Public Health Service, Rockville, Maryland: June, 1970.
- (5) Air Force Regulation 40-293, Oklahoma City Air Materiel Area, Supplement, Attachment 1, October 21, 1968.
- (6) History of the Treatment of the Physically Handicapped, President's Committee on Employment of the Physically Handicapped, Washington, D. C.: 1954.
- (7) Kessler, Henry H. Rehabilitation of the Physically Handicapped, Columbia University Press, New York: 1953.
- (8) Wright, Beatrice. Physical Disability, a Psychological Approach, Harper and Row Publishers, New York: 1960.
- (9) Simon, Alex Joseph. "A Study of the Employment Problems and Work Experiences of the Physically Handicapped in Government and Industry." (Unpub. Ph.D. thesis, University of Texas, 1962).
- (10) Cruickshank, Wm. M., and G. Orville Johnson, Editors, Education of Exceptional Children and Youth, Second Edition: Prentice Hall Inc., Englewood Cliffs, N. J.: 1967.
- (11) Smith-Sears Act, U. S. Code Title 40, Statute 617, Chapter 107, June 27, 1918.

- (12) 50 Years of Vocational Rehabilitation History in the U.S.A., 1920-1970, United States Department of Health, Education and Welfare, Washington, D. C.: 1970.
- (13) Risley, Burt L. and C. W. Hoehne. "The Vocational Rehabilitation Act Related to the Blind, the Hope, the Promise, and the Reality," Journal of Rehabilitation, September-October, 1970, pp. 26-31.
- (14) Pathways to Action-Jobs for the Handicapped, Program Guide President's Committee on Employment of the Handicapped, Washington, D. C.: 1963-1964, p. 40.
- (15) Switzer, Mary E. Vocational Rehabilitation in the United States, Office of Vocational Rehabilitation, United States Department of Health, Education and Welfare, Washington, D. C.: 1969, pp. 4-6.
- (16) Statistical History, Federal-State Program of Vocational Rehabilitation 1920-1969 50 Years, United States Department of Health, Education and Welfare, Social and Rehabilitation Service, Rehabilitation Services Administration, Division of Statistics and Studies, Washington, D. C.: 1970, pp. 2-3.
- (17) The Handicapped Speak, U. S. Civil Service Commission, Washington, D. C., the 1968 Conference on Federal Employment of the Handicapped, Conference Highlights, June 11, 1968.
- (18) Minutes, Annual Meeting, The President's Committee on the Employment of the Handicapped, Washington, D. C.: May 1 and 2, 1969.
- (19) How Federal Agencies Have Served the Handicapped, President's Committee on the Employment of the Handicapped, Washington, D. C.: 1969.
- (20) D'Angelo, Dr. Joseph G. "How the Government Views Physical Standards in Public Service," Discussion Session of the Public Personnel Association, New York City: October 24, 1960, pp. 7-9.
- (21) Selective Placement, Hiring the Handicapped According to Their Abilities, Personnel Methods Series No. 9, U. S. Civil Service Commission, Washington, D. C.: August, 1963, p. 8.
- (22) McCahill, William P. "Remarks before Tinker Management Club," The President's Committee on Employment of the Handicapped, Washington, D. C.: October 17, 1968, p. 4.
- (23) Johnson, Clarence, Summarizer, "Insurance Industry Working With and Employing the Handicapped," Panel Presentation by Insurance Rehabilitation Study Group, Washington, D. C.: May 2, 1968.

- (24) "Hiring the Handicapped: Facts and Myths," Published by the American Mutual Insurance Alliance in Cooperation with The President's Committee on the Employment of the Handicapped, Chicago, 20 North Wacker Drive, undated.
- (25) "Why They Hire the Handicapped," National Safety News, Vol. 87, Number 6, June 1963.
- (26) The Performance of Physically Impaired Workers in Manufacturing Industries. United States Department of Labor, Bulletin 923: Washington United States Government Printing Office, 1948.
- (27) Conley, Ronald W. The Economics of Rehabilitation, Baltimore: John Hopkins University Press, 1965.
- (28) Parker, Harry J. "Employability of Impaired Individuals who have Transferable Skills and no Specific Training," in Feingold, S. Norman, Editor, The Vocational Expert in the Social Security Disability Program, Springfield: Charles C. Thomas, 1969.

VITA

Elvin Odell Campbell

Candidate for the Degree of

Doctor of Philosophy

Thesis: AN EVALUATION OF THE PERFORMANCE OF WORKERS WITH IMPAIRMENTS
AT THE OKLAHOMA CITY AIR MATERIEL AREA

Major Field: Economics

Biographical:

Personal Data: Born in Elgin, Oklahoma, October 24, 1918, married to the former Lois Franklin, number of children: two.

Education: Attended The University of Oklahoma from 1939 to 1942; received the Bachelor of Arts degree from The University of Oklahoma in 1942, majoring in Mathematics and Sciences; attended Oklahoma City University from 1964 to 1966; received the Master of Business Administration degree in 1966, with major area of concentration in Industrial Management; attended Oklahoma State University from 1967 to 1971; received the Master of Science degree from Oklahoma State University 1-18-71 in Economics; completed requirements for the Doctor of Philosophy degree at Oklahoma State University in 1972.

Professional Experience: Industrial Specialist (Petroleum), Department of Defense, Washington, D. C., December, 1945, to July, 1951; Regional Laboratory Manager, Petroleum Chemicals Division, E. I. dePont de Nemours, Tulsa, Oklahoma, August, 1951, to October, 1956; Manager, Kerr-McGee Corporation, Oklahoma City, Oklahoma, October, 1956, through July, 1961; Administrative Manager of Research and Development, Kerr-McGee Corporation, Oklahoma City, Oklahoma, August, 1961, to August, 1966; Assistant Professor, Oklahoma City University, Oklahoma City, Oklahoma, June, 1966, to January, 1967; Department Head, Economics and Finance, Nicholls State University, June 1, 1971, to the present.