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The Effect of the 'Tendency to Report Injuries' on Minor Accident Statistics

James A. Barker
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To the Graduate Council:

I am submitting herewith a thesis written by James A. Barker entitled "The Effect of the 'Tendency to Report Injuries' on Minor Accident Statistics." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Management Science.

Gerald H. Whitlock, Major Professor

We have read this thesis and recommend its acceptance:

ARRAY(0x7f6ffea92188)

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

May 18, 1958

To the Graduate Council:

I am submitting herewith a thesis written by James A. Barker entitled "The Effect of the 'Tendency to Report Injuries' on Minor Accident Statistics." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Industrial Management.

Major Professor

We have read this thesis
and recommend its acceptance:

Accepted for the Council:

Dean of the Graduate School

THE EFFECT OF THE "TENDENCY TO REPORT INJURIES" ON MINOR ACCIDENT STATISTICS

A THESIS

Submitted to
The Graduate Council
of
The University of Tennessee
in
Partial Fulfillment of the Requirements
for the degree of
Master of Science

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by

James A. Barker

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CHAPTER I

INTRODUCTION

General Introduction and Importance of the Study

The problem of accidents and the resulting injuries is one of the more important problems in industry. Accidents are no longer regarded as an inescapable attribute of the machine age which must be accepted in a fatalistic spirit, but rather as occurrences that are largely preventable.

An accident results from a completed sequence of events, the last one of which is the accident itself, and is caused by the unsafe act of a person, or a mechanical or physical factor. Thus, the severity of the injury is a fortuitous matter.

Studies in the field of accident causation have continually reported that the unsafe acts of persons are responsible for the vast majority of injuries.

Heinrich[1] reported that 90.9 per cent of all accidents result in noninjuries; 8.8 per cent of all accidents produce only minor injuries; and that 0.3 per cent of all accidents produce major injuries. Thus, on the average, a person receiving a major injury resulting from an unsafe act has had over three hundred escapes from injury.

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[1]H. W. Heinrich, Industrial Accident Prevention, (3rd ed.; New York: McGraw-Hill Book Company, Inc., 1950), p. 24.

The importance of accidents and their resulting injuries comes into focus when one realizes, in addition to the physical suffering of the individuals involved, the tremendous costs that result. The direct costs involved, i. e., compensation claims, and medical treatment of the individual, represent but 25 per cent of the costs involved in injuries. Items such as cost of wages to the employees involved, loss of production, and damage to plant and equipment represent the great bulk of the cost.[2]

Dr. Alan McLean[3] has reported that in 1954, over ten million industrial accidents were reported and resulted in an average cost of $45 per industrial worker employed per year.

Beginning shortly after World War I, considerable attention and study was paid to the phenomenon of accidents, their causation, and relative proneness to accidents. The early works demonstrated that the obtained distribution of accidents differed significantly from normal chance distribution, and that significant correlations existed between periods of observation.

These studies were directed toward the existence of a difference between injury records and chance expectancy. In this they were successful and the concept of accident proneness was established. The earlier studies pointed out that the correlation between records and

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[2] Ibid., pp. 49-52.

[3] Alan McLean, M. D., "Accidents and the Human Factor," Personnel Journal, 34:342-45, February 1956.

a perfect test of accident proneness need not be high since in a simple chance distribution, individuals are likely to have several times the number of injuries as the average person.

An example of the latter point was illustrated in an article by Dr. W. J. Fulton[4] in which he discussed the problem of the human factor as the underlying cause of most accidents and visitations to the Dispensary. He reported that an analysis of cases at the General Motors Corporation over a period of years revealed that 30 per cent of all employees produced 80 to 85 per cent of the visits to the Dispensary and that within this group is found a preponderance of those with a high ability to injure themselves and others; although the group did not differ from normal population as far as physical ills are concerned, it appeared to be made up primarily of neurotics and indigents.

In one of the classic studies in this field, Mintz and Blum[5] demonstrated that it is not enough to point out that small percentages of people represent a large number of the occurrences (as was done in Dr. Fulton's article), and that fallacious results are obtained unless a comparison is made of the observed distribution with the distribution that would have occurred if all individuals were equally liable. The authors further pointed out that while the difference between the

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[4]W. J. Fulton, M. D., "Industrial Medical Potentials," Industrial Medicine, 18:270-275, July 1949.

[5]Alexander Mintz and Milton L. Blum, "A Re-examination of the Accident Proneness Concept," Journal of Applied Psychology, 33:195-211, March 1949.

observed distribution and a simple chance or Poisson distribution may establish that there is unequal liability, it does not provide one with an indication of the magnitude of difference in the liability and it does not screen out the simultaneous operation of chance factors.

In addition to simple chance factors, other items can appreciably affect the difference between a chance distribution and the observed. The most important of these is the "tendency of an individual to report injuries." In a critique and review of most of the work done in this field, Arbous and Kerrich[6] noted that in none of the studies was this tendency partialled out, and that the entire concept and body of knowledge on the subject of accident proneness is in serious question until the effect of the factor can be determined. The writer knows of no studies published since 1951 in which an attempt is made to partial out the "tendency to report."

Since the very foundation of injury statistics and the concept of unequal accident liability rests upon reported injuries, the effect of the tendency to report injuries becomes of great importance.

It can be assumed that within the spectrum of accidents which result in injuries, the severity of the injury may vary from trivial cases requiring only minor treatment, if any, to the level of fatalities. It is within the lower part of the band of injury severity that this study receives its importance, since it is within this area that an individual has a degree of latitude as to reporting an injury.

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[6]A. G. Arbous and J. E. Kerrich, "Accident Statistics and the Concept of Accident Proneness," Biometrics, 4:341-390, December 1951.

Statement of the Problem

This study is concerned with the effect of the "tendency to report injuries" on minor accident statistics.

Assuming that individuals with the largest number of voluntary visits for nonoccupational illnesses to the Dispensary would be those who most readily report to the Dispensary in the event of minor injuries, the individuals may be defined as those who have a tendency to report injuries.

The hypothesis to be tested in this thesis is:

> The tendency to report injuries has no significant effect on the systematic variance in reported injuries between two successive one-year exposure intervals.

Definitions of Terms

Accident

An accident results from a completed sequence of events resulting from an unsafe act or behavior of an individual, or by a mechanical or physical factor; an accident may or may not result in an injury to a person or persons.

Minor Injury

"An injury which does not result in death, permanent impairment, or temporary total disability, but which requires medical treatment (including first aid)."[7]

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[7] American Standard Method of Recording and Measuring Work Injury Experience (New York: American Standards Association, Inc., 1954), pp. 6-7.

In addition to the preceding definition, minor injuries will be further limited to those injuries not requiring hospitalization or lost time from the job.

Accident Liability

". . . environmental factors plus the personal factor of accident-proneness in the individual determine the accident liability of individuals in any given situation."[8]

Accident Proneness

"Accident proneness is a narrower term than accident liability and means a personal idiosyncrasy predisposing the individual who possesses it in a marked degree to a relatively high accident rate."[9]

Source of Data and Scope of the Study

The data for this study were provided by the Health Division of the Oak Ridge National Laboratory, operated for the Atomic Energy Commission by Union Carbide Nuclear Company and located at Oak Ridge, Tennessee.

The Health Division of this installation provides a high quality in-plant medical service to the employees on both nonoccupational and occupational matters necessitating medical consultation.

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[8]Arbous and Kerrich, p. 351.

[9]Loc. cit.

The study covers the period 1952 through 1953 and was limited to 291 individuals who were employed in nine highly skilled craft occupational categories where the risk of accidents was believed to be relatively homogeneous. Both apprentices and journeymen were included in the study.

For the purposes of this study it was necessary to eliminate from the tabulations all nonoccupational involuntary visitations to the Dispensary for such matters as annual or special examinations or treatment. Therefore, the study will be concerned with voluntary first visitations to the Dispensary for specific nonoccupational matters, and first visitations for minor injuries during two successive one-year periods.

Methods of Procedure

Through statistical techniques, an attempt was made to partial out the effect of "the tendency to report accidents" on the systematic variance in minor accident statistics between two successive one-year periods.

Organization of the Study

This study has been divided into six chapters as follows:

I. Introduction and Statement of the Problem

II. History of the Problem

III. Methodology

IV. Tabulation of Results

V. Analysis of Results

VI. Summary and Conclusions

CHAPTER II

HISTORY OF THE PROBLEM

Introduction

The history of the concept of accident proneness goes back to 1919 when Greenwood and Woods[1] in their classic study of minor accidents concluded as follows:

1. A considerable correlation exists between accidents in successive periods.

2. The individual liability or susceptibility to accidents varies among individuals.

3. The productivity of those who have a large number of accidents is approximately that of an average employee.

4. There is no significance to the matter of age versus accidents.

5. The individual susceptability to accidents includes a great variety of factors which are difficult to measure and separate.

This initial study was later extended and clarified in a study by E. M. Newbolt[2] in 1926 in which the following conclusions were made:

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[1]Major Greenwood and Hilda M. Woods, "The Incidence of Industrial Accidents upon Individuals with Special Reference to Multiple Accidents," Industrial Fatigue Research Board, Report No. 4, pp. 3-28, 1919.

[2]E. M. Newbolt, "A Contribution to the Study of the Human Factor in the Causation of Accidents," Industrial Fatigue Research Board, Report No. 34, pp. 3-61, 1926.

1. Those who have the most accidents are on the average those who visit the medical dispensary more for minor sicknesses.

2. The average number of accidents is significantly influenced by a small number of employees and the accident distributions are far from chance.

3. There appears to be an indication that a part of the individual differences in accident rates is due to personal factors.

4. There appears to be no relationship between output and accidents.

5. The "burnt fingers" hypothesis does not fit.

6. Correlations of between .2 and .3 were found between accidents in different periods, accidents of different types, and accidents in the factory and at home.

The Accident Prone Concept

Although the original investigators in this field pointed out that their hypothesis involved many assumptions and limitations, the concept of accident proneness became rather fully accredited and has been widely reported on in the literature.

The term "accident proneness" was originally used as an identifying phrase for a group of workers who had a recurring series of accidents; however, it has more recently been utilized as a term to describe an individual's repetitive injury experience.

In 1951 Arbous and Kerrich[3] in a review of most of the work in the field stated:

> It is a difficult matter to define what is meant by the term and to evolve a sensible measure of whatever it indicates. Apparently it was meant to define some personal trait as opposed to some characteristic of the environment which predisposed some to have more accidents than others in work conditions where the risk of hazard was equal to all.

The writers pointed out the dangers of drawing conclusions on the basis of a univariate distribution and illustrated the usefullness of the bivariate distribution.

It was not until 1949 that the concept began to be seriously questioned after an analysis of much of the earlier work by Mintz and Blum.[4] They concluded that a great overemphasis had been placed on personal factors as a factor in accident distributions and that not all differences in accident liability are differences in accident-proneness as an individual characteristic.

Mintz and Blum[5] reiterated the point made earlier by Newbolt[6] that the correlation between a perfect test of accident proneness and injury records did not necessarily have to be high since simple chance distribution would yield individuals with several times the injury rates of the average person.

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[3]A. G. Arbous and J. E. Kerrich, "Accident Statistics and the Concept of Accident Proneness," Biometrics, 4:349, December 1951.

[4]Alexander Mintz and Milton L. Blum, "A Re-examination of the Accident Proneness Concept," Journal of Applied Psychology, 33:195-211, March 1949.

[5]Ibid.

[6]E. M. Newbolt, op. cit., p. 27.

In a study of 35,000 injury cases by Schulzinger[7] it was reported that persons who consistently experienced injuries annually over a three-year period accounted for only 0.5 per cent of the injuries studied.

Relationship of Personal Factors to Accident Causation

In addition to mechanical and other environmental factors which may contribute to accident causation, there appears to be rather consistent agreement that many injuries are caused by psycho-physiological factors which may alter the liability of individuals within the same environment.

Among the more important which have been reported are as follows:

Vision

Tiffin[8] reported the results of an experiment in a manufacturing plant which confirmed that low visual performance and injuries are directly associated. The study revealed that different patterns of visual skills may be required for safety in different occupations.

Age

In general, it is difficult to separate the effect of the combination of age, experience, and emotional maturity; however, in an

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[7]Morris S. Schulzinger, M. D., "Accident Proneness," Industrial Medicine and Surgery, 23:151-54, April 1954.

[8]Joseph Tiffin, "Visual Performance and Accident Frequency," Journal of Applied Psychology, 33:499-502, October 1949.

extensive study it was reported that 50 per cent of all injuries occur under the age of twenty-five, and 70 per cent under the age of thirty-five; at the age twenty-one to twenty-two the incidence of injuries reaches its highest level.[9]

It would appear that chronological age, per se, merely reflects the effects of varying degrees of a variety of factors which contribute to an individual's liability to sustain injuries.

Experience

Several contradictory studies have been reported on this factor and they may be due to differences in the training time required and physical demands of the jobs studied.

Experience, per se, is particularly important in the earliest periods of employment, but after a given period it becomes negligible.[10]

Intelligence

The relationship between mental ability and injury experience has been reported in a number of studies with varying results.

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[9]Morris S. Schulzinger, M. D., "The Pre-Accident Patient," Industrial Medicine and Surgery, 25:453, October 1956.

[10]H. L. Humke, "First Month Found Most Dangerous," Personnel Journal, 14:336-7, March 1936.

Farmer and Chambers[11] found no correlation between injury repetition and the level of intelligence, while Hegin[12] reported a relationship between injuries and low scores on intelligence tests.

It would appear that beyond a minimum level of intelligence which would be required to master the complexities of a job, the relationship between injury experience and intelligence would diminish, if not disappear.

Reaction Time

It would appear that reaction time has no significant effect upon accident causation unless drastically differing from the average, either faster or slower. Farmer and Chambers[13] found that the correlation between reaction time and injury frequency was insignificant while in a study of taxi drivers, it was reported that those who had faster and those who had slower reaction times than the average, had more injuries than the average.[14]

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[11]E. Farmer and E. G. Chambers, "A Psychological Study of Individual Differences in Accident Rates," Industrial Fatigue Research Board, Report No. 38, 1926.

[12]M. S. Hegin, "Intelligence and Safety," Journal of Educational Research, 16:81-7, September 1927.

[13]E. Farmer and E. G. Chambers, "A Study of Personal Qualities in Accident Proneness and Proficiency," Industrial Health Research Board, Report No. 55, 1929.

[14]D. Wechsler, "Tests for Taxicab Drivers," Journal of Personnel Research, 5:24-30, May 1926.

Fatigue

Arbous and Kerrich[15] stated that "It is doubtful whether fatigue in industry ever consists of some degree of pure physical exhaustion, unaccompanied by the psychological factors of ennui, boredom, discontent, irritability, bad morale, etc."

Alcohol Consumption

Studies have been shown that the consumption of alcohol greatly increases an individual's susceptibility to injuries.

> The effects of alcohol vary with individual tolerance and length of usage. In an individual of average weight, two ounces of whiskey are enough to produce a blood alcohol level of 0.05 per cent - an amount sufficient to produce an average impairment of 25 per cent. Alcohol is eliminated from the blood at the rate of about one-third of an ounce per hour. Physiological impairments thus are likely to last for hours, depending on the amount consumed.[16]

Emotional Instability

Several clinical studies are available on the relationship between the frequency of injuries and emotional factors. In a study of four hundred minor injury cases, it was reported that over half occurred when the individual was worried or in generally low emotional state of mind.[17] It was further estimated that the average person is in a low emotional state approximately 20 per cent of the time.[18]

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[15]Arbous and Kerrich, op. cit., p. 345.

[16]Morris S. Shulzinger, M. D., "The Pre-Accident Patient," Industrial Medicine and Surgery, 25:453, October 1956.

[17]R. B. Hersey, "Emotional Factors in Accidents," Personnel Journal, 15:59-65, June 1936.

[18]Loc. cit.

In a clinical study of each motorman with a high injury record in the Cleveland Railway Company, Viteles[19] reported that in no two cases were the causes exactly alike, and that in many cases a combination of psycho-physiological factors existed.

Hearing Loss

Of the physical factors considered in a study by Harvey and Luongo,[20] hearing loss appeared to have a greater positive relationship with injury experience than any other physical impairment.

Areas of Reported Accident Proneness Investigations

The studies of a nonpsycho-physiological nature which have been based upon the statistical approach in determining group tendencies may be separated into the following areas:

Injuries Within Different Environments and the Relationship Between Different Types of Injuries

In general, the results of several investigations would indicate that an individual's propensity to incur injuries in different environments varies considerably and little relationship exists.

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[19] M. S. Viteles, Industrial Psychology (1st ed.; New York: W. W. Norton and Co., Inc., 1932), pp. 382-84.

[20] V. K. Harvey and E. P. Luongo, "Physical Impairment on Job Performance," Journal of American Medical Association, 127:963, April 1945.

The highest degree of relationship was reported by Newbolt[21] who found correlation coefficients of between .2 to .3 in accidents occurring in the work place and in the home. In studies correlating one type of accident with another in a homogeneous environment, the results have been lower. Brown and Ghiselli,[22] reported intercorrelations of from -.11 to .22 in their study of trolley car motormen. They state that, ". . .if there is any tendency to retain liability to have accidents under many different circumstances, the facts would indicate that such a tendency is of minor importance as a factor in the determination of accidents."[23]

Minor Injuries in Two Successive Periods

In general, the studies in this area have reported coefficients of from .2 to .4 with occasional results as high as .84 for relatively short periods of time. The results would indicate that there is a definite tendency for individuals to repeat their minor injury records.

Wong and Hobbs[24] reported a coefficient of .56 in their study of 290 brewery workers over two four-week periods. Newbolt[25] found

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[21]E. M. Newbolt, op. cit., p. 57.

[22]Clarence W. Brown and Edwin E. Ghiselli, "Accident Proneness Among Street Car Motormen and Motor Coach Operators," Journal of Applied Psychology, 32:20-23, February 1949.

[23]Ibid., p. 23

[24]W. A. Wong and G. E. Hobbs, "Personal Factors in Industrial Accidents; A Study of Accident Proneness in an Industrial Group," Journal of Industrial Medicine and Surgery, 18:241-49, July 1949.

[25]E. M. Newbolt, op. cit., p. 57.

correlations of from -.01 to .62, and Greenwood and Woods[26] found coefficients of from .37 to .72 for various groups studied.

Arbous and Kerrich[27] in commenting on the positive tendency of individuals to report their minor injury records, stated:

> The fact still remains, however, that it is impossible to say whether this reflects the different liability of individuals to sustain accidents, or merely an artifact of a tendency of some to report their occurrences, while others do not.

Major Injuries in Two Successive Periods

> . . . if our basic assumptions are valid and our observed frequency distributions are to be explained in terms of unequal initial liability, the stability of the phenomenon of accident proneness is only in the order of .2, or .3 at the most, in cases of major accidents. This coefficient increases somewhat when minor accidents are considered, or when minor and major are taken together, but this rarely rises above .6 . . .[28]

Relationship Between Minor Injuries and Major Injuries

Arbous and Kerrich[29] pointed out in three reported studies of the correlation of minor injuries with major injuries within a given period, small coefficients in the order of .1 were obtained, which illustrated that minor accidents cannot be successfully utilized as a predictor of major injuries which must be regarded as a chance occurrence.

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[26]Greenwood and Woods, op. cit., pp. 12-25.

[27]Arbous and Kerrich, op. cit., p. 368.

[28]Loc. cit.

[29]Ibid., pp. 369-70.

Other Approaches in Accident Proneness Research

Clinical Method

> The aim of the clinical method is to examine the whole individual and from an examination of the whole to arrive at a knowledge of the significance of the various aspects of his personality - the relative importance of each sector of his personality in a given situation. The application of the clinical approach in the analysis of accident causes involves a complete study of the individual involved in accidents - it makes the individual the point of departure, and provides for a thorough examination of every factor - physical, mental, social, and economic, and of those extraneous to the individual - which may have played a part in the accident in which he has been involved.[30]

As a result of the application of the clinical method and treatment of motor drivers in the Cleveland Railway Company, it was reported that the rate of accidents of those included in the study decreased 42.7 per cent in the following year.[31]

Arbous and Kerrich[32] pointed out that although the results of the application of the clinical method were significantly high, the methodology utilized does not lend itself to general industrial application, and that the possibility exists that the group studied were responding in a manner in which they thought they should, as was found in the Hawthorne Experiment of the Western Electric Company.

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[30] M. S. Viteles, op. cit., p. 382.

[31] Ibid., p. 384.

[32] Arbous and Kerrich, op. cit., p. 390.

Identification of Accident Proneness Through an Intermediate Criteria

In a radical departure from the more sterile approaches to the identification of accident proneness, Whitlock[33] developed a methodology utilizing the intermediate criteria of accident behavior in order to test the validity of the concept of accident proneness.

The study involved the use of a methodology similar to Flanagan's critical incident approach to criterion development. In a sample group of approximately four hundred workers performing similar and rather routine work, the accident behaviors were observed and recorded by foremen for a period of eight months. It was reported that the correlation between the number of unsafe behaviors reported and the number of injuries sustained was .27, which corrected for attenuation was .43, illustrating a positive relationship.

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[33]Gerald H. Whitlock, "Accident Proneness Research," (Unpublished Paper Delivered at the Annual Meeting of the Southern Society of Philosophy and Psychology, New Orleans, La., March 1955), pp. 1-4.

CHAPTER III

METHODOLOGY

Selection and Composition of Sample

In discussions with members of the Health Division of the Oak Ridge National Laboratory, it was decided that the investigation should be limited to skilled craft occupational groups where the environmental risk exposure was believed to be relatively homogeneous. It was also decided that the study should be limited to two successive one-year intervals during a relatively stable period of employment and for this purpose the period 1952-53 was selected.

Homogeneity of Sample

In order to obtain a relatively homogeneous sample, it was decided to include only those workers who were continuously employed in the craft group for the two-year period of the study and for one or more years prior to the investigation which would minimize the possibility of unfamiliarity with the work environment, and would also provide for group stability. Further screening of the sample was done in order to remove any workers who were rated by the Health Division to have a physical limitation, even though minor, which could bias the individual's susceptibility to injuries; those who had a major injury resulting in either loss time from the job or a general limitation of work assignment during the two-year period of the investigation were removed from the sample.

Composition of Sample

It was realized during the initial discussions concerning the investigation that the nature and composition of the craft workforce of the Oak Ridge National Laboratory, being an extensive research and development installation, would impose limitations as to obtaining a suitable size sample for any single skilled craft group; therefore, the alternative was chosen of including all of the highly skilled craft groups used at the installation. In reviewing these groups it appeared that only minor environmental differences would be present. As an additional check on the above premise, it was decided that a statistical test of association among the occupational groups included based upon the reported injury experience would be made. Those groups whose total injury experience differed significantly from an expected total injury frequency would be treated separately.

The crafts groups selected were those of a highly skilled nature which required either an extensive apprenticeship or other types of on-the-job and classroom training to master. Since apprentices in each of the craft groups performed the same work as that of the journeymen and were subjected to the same environmental factors, it was decided to include them, although the relative number of apprentices in the total sample was small.

The final sample which was selected and carefully screened was comprised of nine basic skilled craft groups consisting of a total of 291 workers and is shown as Table I.

TABLE I

COMPOSITION OF SAMPLE

Occupational Group	Number in Sample				Mean Age of Group[a] (Years)	Mean Months of Service With Company[a]
	Journeyman	Apprentice	Total	Per Cent of Total Sample		
Carpenter	24	1	25	8.6	47.0	111
Electrician	28	8	36	12.4	40.9	54
Instrument Mechanic	26	8	34	11.7	30.8	41
Machinist, Tool and Model Maker, Mechanical Instrument Maker	80	7	87	29.9	41.2	55
Millwright	41	2	43	14.8	46.0	57
Pipefitter	22	7	29	10.0	41.1	34
Rigger and Iron Worker	12	0	12	4.1	42.7	66
Sheetmetal Worker	13	0	13	4.5	42.3	54
Welder	12	0	12	4.1	37.2	34
Total	258	33	291	100.1	41.1	56

[a]At the beginning of the two-year study.

The employment and medical standards of hiring at the installation are at a very high level since the quality of work is generally of critical importance in the fabrication or development of experimental apparatus and components. The general population of the sample can be considered as possessing a higher degree of occupational skills and fewer physical impairments than workers in similar occupations throughout industry.

Nature of Data

Since the Health Division of the Oak Ridge National Laboratory provides a high quality medical service both for annual medical inventories, special examinations, the treatment of occupational injuries, and for the treatment or diagnosis of illness or other nonoccupational cases, rigid criteria were established for the inclusion of data for this investigation.

The data for minor injuries included only the first visitation to the Dispensary for each injury so as to eliminate bias which would result from the severity of the injury and the resulting required revisits for treatment. The vast majority of the minor injuries consisted of small cuts, lacerations, burns, bruises, etc., and was so defined as to eliminate from the study those individuals who sustained injuries requiring either hospitalization or time away from the work place except for treatment at the Dispensary; therefore, the minor injury data ranged in severity of cases from those requiring medical attention of some degree but not requiring time away from the job or impairment in the

worker's ability to perform his duties, to the level of trivial cases which did not absolutely require medical treatment. It should be noted, however, that the general standards of safety at this installation are very high and many national safety awards have been given to this concern for its record in maintaining long periods of major injury-free exposure. The Management philosophy is that all individuals who receive injuries must report to the Dispensary where the injury is treated and a report of the accident is prepared.

The criteria for nonoccupational visits to the Dispensary were defined to include only the first visit for any specific condition. These cases would generally consist of either diagnosis or treatment of a case, or both. Second or repeat visitations for the same condition were not included, thereby eliminating bias arising from the severity of the case.

The Health Division operates a central, well-equipped dispensary staffed by physicians, nurses, and technicians, and two outlying dispensaries staffed by nurses so that their services are readily accessable to all employees of the installation. The general philosophy of the Health Division is one of preventative medicine and all employees are encouraged to utilize their services when needed.

Collection of Data

The data for this study were collected and recorded by the Health Division operating within the framework of the criteria as previously set forth.

These data were recorded on cards which included the worker's name, occupational classification, date of hire, and the date of birth. Separate tabulations were listed on each card for the period 1952 and 1953. The number of nonoccupational first visits and the total number of minor occupational injuries with a brief description of each were listed for each of the two years.

CHAPTER IV

TABULATION OF RESULTS

Distribution of Sample

In order to test the hypothesis that the nine occupational groups were homogeneous a chi-square test of association was made as shown in Table II. Since a chi-square of 59.2 was obtained with a probability of occurrence through chance of $<.001$, the hypothesis of homogeneity was rejected at the 5 per cent level of significance.

In comparing the reported injuries of the nine occupational groups to the expected frequencies, it was obvious that two of the groups differed substantially, i.e., Instrument Mechanics had a frequency of less than 50 per cent of the expected, while the Welders had an observed frequency of over 70 per cent more than expected.

When a chi-square test of the other seven groups was made as shown in Table III, a P of $>.05$ was obtained and was considered insignificant since this was slightly above the 5 per cent level of confidence. Therefore, the total sample of nine occupational groups was divided into three groups consisting of the Seven Occupational Categories, and Instrument Mechanics and Welders considered separately.

The total frequency of injury and nonoccupational visits by years for each of the three groups is shown in Table IV.

TABLE II

CHI-SQUARE TEST OF TOTAL INJURY FREQUENCY OF NINE OCCUPATIONAL GROUPS

Occupational Group	Number in Sample	Observed Frequency (2 Years)	Theoretical Frequency (2 Years)	Chi-Square
Instrument Mechanic	34	50	102.1	26.59
Carpenter	25	96	75.1	5.82
Machinist	87	262	261.3	0.00
Electrician	36	87	108.1	4.12
Millwright	43	142	129.2	1.27
Sheetmetal Worker	13	49	39.1	2.51
Welder	12	62	36.0	18.78
Rigger & Iron Worker	12	36	36.0	0.00
Pipefitter	29	90	87.1	0.10
Total	291	874	874.0	59.19 $=\chi^2$
	d.f. = 8 P = <.001			

TABLE III

CHI-SQUARE TEST OF TOTAL INJURY FREQUENCY OF SEVEN OCCUPATIONAL GROUPS

Occupational Group	Number In Sample	Observed Frequency (2 Years)	Theoretical Frequency (2 Years)	Chi-Square
Carpenter	25	96	77.8	4.26
Machinist	87	262	270.6	0.27
Electrician	36	87	112.0	5.58
Millwright	43	142	133.7	0.52
Sheetmetal Worker	13	49	40.4	1.83
Rigger & Iron Worker	12	36	37.3	0.05
Pipefitter	29	90	90.2	0.00
Total	245	762	762.0	12.51 $=\chi^2$
	d.f. = 6			
	P = > .05			

TABLE IV

TOTAL INJURY AND NONOCCUPATIONAL VISIT FREQUENCY
FOR THREE GROUPS BY YEARS

Group	Number In Sample	Injury Visits				Nonoccupational Visits			
		Year One	Year Two	Total	Mean Two Years	Year One	Year Two	Total	Mean Two Years
Seven Occupational Categories	245	400	362	762	3.1	922	961	1883	7.7
Instrument Mechanic	34	33	17	50	1.5	94	102	196	5.8
Welder	12	29	33	62	5.2	58	66	124	10.3
Total	291	462	412	874	3.0	1074	1129	2203	7.6

Association of Minor Injuries in Two Successive Years

Using the product-moment method of correlation, the coefficients of correlation between the two successive one-year periods for each of the three groups were computed and are shown in Table V.

In order to test the hypothesis that the true correlation coefficient was zero, Student's t Test was computed for each of the coefficients and the probability of the results occurring through chance was found to be $< .001$ for the Seven Occupational Group, $< .04$ for the Welder Group, and $\sim .45$ for the Instrument Mechanics. Therefore, while the hypothesis of zero correlation cannot be rejected for Instrument Mechanics, it can be rejected at the 5 per cent level of significance in the case of the other two groups. In view of the unreliability of the injury data for the Instrument Mechanics Group, no further analyses were made on those data.

When the coefficients of correlation were raised by Spearman-Brown, they became .55 and .72 for the Seven Occupational Group, and the Welder Group, respectively. These latter coefficients are the reliability coefficients of the injury data for the two-year period.

Association of Nonoccupational Visits in Two Successive Years

Coefficients of correlation for the two successive one-year periods were found to be .67 for the Seven Occupational Group, and .46 for the Welder Group.

TABLE V

CORRELATION OF REPORTED MINOR INJURIES IN TWO SUCCESSIVE ONE-YEAR PERIODS FOR THREE GROUPS

Group	Number in Sample	Observed Correlation, r
Seven Occupational Group	245	.38
Instrument Mechanic	34	-.14
Welder	12	.64

Student's t Test was computed and P was found to be $< .001$ for the Seven Occupational Group, and $< .02$ for the Welder Group. Therefore, the hypothesis of zero correlation was rejected at the 5 per cent level of significance for both groups.

When the coefficients were raised by Spearman-Brown to obtain the reliability coefficients for the two-year period, they became .81 for the Seven Occupational Group, and .63 for the Welder Group.

Association of Nonoccupational Visits and Injury Visits

Association of Mean Injury Visits with a Quartile Distribution of Nonoccupational Visits

To determine the relationship between injury visits and nonoccupational visits, the Seven Occupational Group sample was divided into a quartile distribution based upon frequencies of nonoccupational visits. From this distribution the mean injury visit and standard deviation was computed. These data are shown in Table VI, and are shown graphically in Figure 1.

Correlation of Nonoccupational Visits and Injury Visits

To obtain the correlation between nonoccupational visits and injury visits, the coefficients of correlation were computed and are shown in Table VII.

The hypothesis of zero correlation was tested through Student's t Test and rejected for each of the coefficients at the .001 level of significance with the exception of r_{ac} for the Welder Group which was found not to be significant at the 5 per cent level.

TABLE VI

MEAN INJURY VISITS AND STANDARD DEVIATIONS OF A QUARTILE DISTRIBUTION OF TWO-YEAR NONOCCUPATIONAL VISITS IN THE SEVEN OCCUPATIONAL GROUP

Distribution of Two-year Nonoccupational Visits	Frequency of Nonoccupational Visits Within Quartile	Mean Injury Visits			Standard Deviation of Two-year Injury Visits, σ
		Year One	Year Two	Total	
Quartile 1	0-3	0.86	0.78	1.64	1.64
Quartile 2	4-6	1.37	1.23	2.60	1.89
Quartile 3	7-10	1.51	1.33	2.84	2.20
Quartile 4	11 & Over	2.80	2.57	5.37	3.53

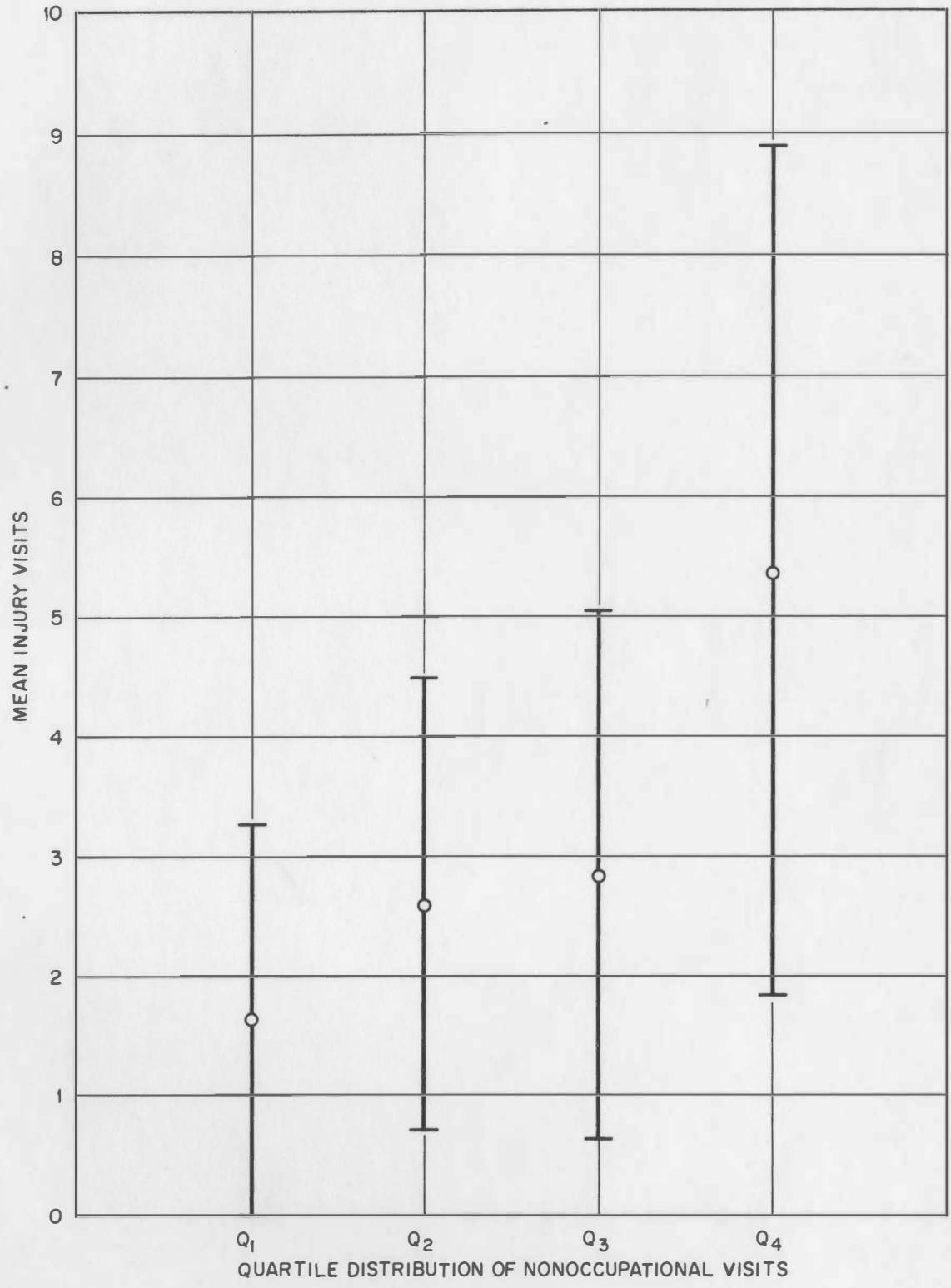

Figure 1. Trend in the Two-Year Mean Injury Visits and Plus and Minus One Standard Deviation of a Quartile Distribution of Two-Year Nonoccupational Visits for the Seven Occupational Groups.

TABLE VII

CORRELATION OF NONOCCUPATIONAL VISITS AND INJURY VISITS FOR THE SEVEN OCCUPATIONAL GROUP AND THE WELDER GROUP

Group	Number in Sample	Observed Correlation		
		r_{ac}	r_{bc}	$r_{(a+b)(c)}$
Seven Occupational Group	245	.42	.46	.51
Welder Group	12	-.02	.43	.25

where, r_{ac} = Injury visits, year one, vs. non-occupational visits, for two-year period.

r_{bc} = Injury visits, year two, vs. non-occupational visits for two-year period.

$r_{(a+b)(c)}$ = Injury visits for two-year period vs. non-occupational visits for two-year period.

The Effect of Nonoccupational Visits on Injury Visits

The basic hypothesis of the investigation is that the tendency to report injuries has no significant effect on the systematic variance in reported injuries between two successive one-year exposure intervals. In order to test this hypothesis, a partial correlation of injury visits in the two successive periods was made holding constant or nullifying the effects of nonoccupational visits during the two-year period. Using this technique, the coefficient of correlation was reduced from .38 to .23 and although both coefficients are within the 95 per cent confidence limit, the probability of chance occurrence was increased from $<.001$ to $<.01$.

In an attempt to determine the statistical significance of the additional variance contributed by nonoccupational visit variance, the method of multiple correlation was employed. Letting year one injury visits be the dependent variable, the multiple correlation was computed between year one and year two injury visits plus the nonoccupational visits. Using the standard formula for multiple correlation utilizing betas, the following results were obtained:

$$\beta_{ab.c} = .2529$$
$$\beta_{ac.b} = .3110$$
$$\beta_{ab.c}\, r_{ab} = .0950$$
$$\beta_{ac.b}\, r_{ac} = .1302$$
$$R^2_{a.bc} = .2252$$
$$R_{a.bc} = .47$$

Where, a = Injury visits, year one
b = Injury visits, year two
c = Nonoccupational visits for two-year period

Both beta coefficients were significant at better than the .001 level.

Correlation of Annual Injury Visits by Quartile Distribution of Nonoccupational Visits

The Seven Occupational Group was divided into a quartile distribution based upon the two-year frequency of nonoccupational visits, and the coefficients of correlation of injury visits between the two exposure intervals of one year were computed and are shown in Table VIII.

The coefficients of correlation for quartiles one and two were within the 95 per cent confidence level; however, those of quartiles three and four were found to be outside this limit of confidence.

In order to test the hypothesis that the relationship was nonlinear, the correlation ratio was computed and was found to be .51, which was identical with the correlation coefficient of .51 which was computed on the basis of a linear relationship. Therefore, the hypothesis was rejected.

The significance of these findings will be discussed in Chapter V.

TABLE VIII

CORRELATION OF ANNUAL INJURY VISITS BY QUARTILE DISTRIBUTION OF NONOCCUPATIONAL VISITS FOR THE SEVEN OCCUPATIONAL GROUP

Distribution of Two-year Nonoccupational Visits	Frequency of Nonoccupational Visits Within Quartile	Observed Correlation, r
Quartile 1	0-3	.36
Quartile 2	4-6	.43
Quartile 3	7-10	.14
Quartile 4	11 & Over	.21

CHAPTER V

ANALYSIS OF RESULTS

Association of Minor Injuries in Two Successive Years

The correlation between reported injuries for the two successive one-year periods was computed and found to be .38, -.14, and .64, for the Seven Occupational Group, Instrument Mechanics, and Welders, respectively. The coefficients obtained for the Seven Occupational Group and the Welder Group were significant at the 5 per cent level, whereas the coefficient obtained for the Instrument Mechanic Group was not significant at that level.

The negligible relationship of minor injuries for the Instrument Mechanic Group as indicated by the coefficient of -.14 appears to have been caused by the substantial decrease in the total injury frequency for the second one-year exposure period as shown in Table IV. Since the mean two-year injury frequency of this group was only 1.5, which was approximately 50 per cent of that of the Seven Occupational Group, and approximately 29 per cent of the mean for the Welder Group, it would appear that minor fluctuations in the year-to-year injury frequency of members of the group would produce insignificant correlations.

The reliability coefficients for the total two-year period were found to be .55 and .72 for the Seven Occupational Group, and the Welder Group, respectively, when the coefficients were raised by the Spearman-Brown Prophecy Formula. The magnitude of these coefficients indicated that the injury data were sufficiently reliable for further analysis.

The coefficients of .38 and .64 obtained for the correlation of minor injuries for the two successive one-year periods are somewhat higher than the results reported in the literature which generally have ranged from .2 to .4.

The coefficients of .38 and .64 indicate that the percentage of variance in one period, which is accounted for by the variance in the other period, was 14.44 and 40.96 respectively, for the Seven Occupational Group and the Welder Group. Although these percentages indicate a rather substantial positive relationship, the fact remains, however, as was pointed out by Arbous and Kerrich[1], that it is impossible to determine whether these relationships indicate different individual liabilities to sustain injuries or reflect the varying degrees of tendencies of some individuals to report their injuries. As will be seen later, the apparent amount of variance in common between the two periods is reduced when the tendency to report is taken into account.

Association of Nonoccupational Visits in Two Successive Years

The correlation of nonoccupational visits for the two successive one-year periods was found to be .67 for the Seven Occupational Group, and .46 for the Welder Group. Both coefficients were significant at the 5 per cent level.

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[1]A. G. Arbous and J. E. Kerrich, "Accident Statistics and the Concept of Accident Proneness," Biometrics, 4: 368, December 1951.

The reliability coefficients for the total two-year period were found to be .81 for the Seven Occupational Group, and .63 for the Welder Group when the coefficients were raised by the Spearman-Brown Prophecy Formula.

The correlation coefficients for nonoccupational visits are generally higher than those found for injury visits, indicating that there is a greater tendency for individuals to repeat their nonoccupational visit record than their respective injury record.

Since similar studies have not been reported in the literature, it is not possible to make comparisons.

Association of Nonoccupational Visits and Injury Visits

Having established the degree of stability of the variables minor injury visits and nonoccupational visits, an examination was made of their inter-relationship.

The Seven Occupational Group was divided into a quartile distribution based upon the individuals' total two-year frequency of nonoccupational visits, and for each of these four groups the mean injury visits were computed for each of the one-year periods and for the total two-year period. The results are shown in Table VI and indicate a marked positive relationship which was consistent in both of the one-year periods. In both of the two exposure periods of one year for minor injuries, the mean injury visits increased systematically by a magnitude of ~ 3.3 from quartile one to four for the nonoccupational data. Thus, as the frequency of nonoccupational visits increased, the mean injury visits increased rather systematically.

In order to assess the degree of variability of injury visits from the quartile means, plus and minus one standard deviation was computed and revealed substantial deviations. This relationship is illustrated graphically in Figure 1.

In order to obtain the degree of association between nonoccupational visits and injury visits, the correlation was computed and shown in Table VII. All of the coefficients were found to be significant at the 5 per cent level with the exception of the correlation between injury visits for the first year and nonoccupational visits for the two-year period in the Welder Group.

Due to the low coefficient obtained for the Welder Group, additional analyses for this group were not conducted. The small sample size of twelve undoubtedly was a factor in the unreliability of the coefficient.

The correlation coefficients between nonoccupational visits for the two-year period and minor injuries for each of the two separate one-year exposure intervals and the total two-year period were .42, .46, and .51, respectively, for the Seven Occupational Group. The magnitude of each of these coefficients indicates a substantial positive relationship between nonoccupational visits and injury visits.

Although there are no similar studies available in the literature for comparison, Newbolt[2] indicated that the individuals who had

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[2]E. M. Newbolt, "A Contribution of the Study of the Human Factor in the Causation of Accidents," Industrial Fatigue Research Board, Report No. 34, pp. 3-61, 1926.

the most injuries were on the average those who visited the medical dispensary more for minor sicknesses, which has been verified by this study.

Testing of Primary Hypothesis

The primary hypothesis is that the tendency to report injuries has no significant effect on the systematic variance in reported injuries between two successive one-year exposure intervals. This hypothesis was tested through a partial correlation of injury visits in the two successive one-year periods, holding constant the effects of nonoccupational visits during the two-year period. Utilizing this method, the coefficient of correlation was reduced from .38 to .23, and the probability of chance occurrence was increased from $<.001$ to $<.01$. The reduction in the magnitude of the coefficient from .38 to .23 indicates that the percentage of variance in one of the variables, which was attributable to the variance in the other variable, was reduced from 14.44 to 5.29 when the common variance contributed by nonoccupational visit variance was partialled out. Thus, the coefficient of correlation between the two successive one-year injury exposure intervals is not a pure measure of the systematic variance in injuries actually sustained but includes to a substantial degree a measurement of a tendency to report injuries. Therefore, the primary hypothesis was rejected on the basis of a significant reduction in the percentage of variance accounted for when the effects of nonoccupational visits were nullified. The method of determining the significance of this effect is indicated on the following page.

In an attempt to determine the statistical significance of the additional variance contributed by nonoccupational visit variance, the method of multiple correlation was employed. Utilizing year one injury visits as the dependent variable and then computing the multiple correlation between year one and year two injury visits plus the nonoccupational visits for the two-year period, it becomes possible, using beta coefficients, to accurately determine the unique variance which is separately accounted for by the second-year injury visits and nonoccupational visits for the total period. Thus, the square of the coefficient of multiple correlation ($R^2_{a.bc} = \beta_{ab.c}\, r_{ab} + \beta_{ac.b}\, r_{ac}$) is equal to .0950 plus .1302.

It therefore appears that second-year injuries account for only 9.5 per cent of the variance in first-year injuries when the variance it has in common with nonoccupational visit variance is ignored. On the other hand, nonoccupational visit variance appears to account for 13 per cent of the variance in the first-year injuries when its common variance with second-year injuries is ignored. Finally, it is apparent that both second-year injury variance and nonoccupational visit variance account for only 22.5 per cent of the first-year injury visit variance.

Since there was a discrepancy between the percentage of variance accounted for between the 5.29 per cent and 9.0 per cent when the methods of partial correlation, and multiple correlation were used, it was apparent that there was some variance that had not been accounted for in the 9.0 per cent estimate.

Utilizing an alternate formula for multiple correlation, it was possible to separate the unique variance in the dependent variable which

could be said to be accounted for by the two independent variables. Thus, the formula used included an expression for the variance contributed to the dependent variable by the combined effects of the two independent variables acting in concert.

$$R^2_{a.bc} = \beta^2_{ab.c} + \beta^2_{ac.b} + 2r_{bc}\,\beta_{ab.c}\,\beta_{ac.b}$$
$$= .0561 + .0967 + .0678$$

Thus, it is seen that second-year injuries account for 5.6 per cent of the variance in first-year injuries and that the effect of the tendency to report accounts for 9.7 per cent of the variance in first-year injuries, or nearly twice the variance contributed by second-year injuries. Additionally, it is seen that the interaction of the independent variables accounts for approximately 6.8 per cent of the variance in first-year injuries.

Using the forementioned approach, it is possible to compute the significance of the beta coefficients, and thus, determine whether or not the variables in question have a significant effect on the total variance predicted. Since both betas were significant at better than the .001 level, it is apparent that nonoccupational visit variance contributed significantly to the variance in reported injury visits.

Based on the results of this study, the data seem to warrant the following conclusions:

1. Reported minor injuries include to a substantial degree the artifact of a tendency to report injuries and therefore, do not result in a reliable index of injuries actually sustained. Thus, we have nc "real" injury data in this study.

2. The results of studies in the area of accident proneness may include a marked positive bias such that the significance of the findings are greatly reduced.

Correlation of Annual Injury Visits by Quartile Distribution of Nonoccupational Visits

By way of further analysis to examine the relationship of nonoccupational visits and injury visits, the Seven Occupational Group was divided into a quartile distribution based upon the individuals' two-year frequency of nonoccupational visits, and for each of the four groups the correlation coefficients of minor injuries between the two exposure periods of one year were computed and found to be .36, .43, .14 and .21 for quartiles one through four, respectively. The coefficients for quartiles one and two were significant at the 5 per cent level, whereas those of quartiles three and four were not.

The forementioned coefficients indicated the possibilities of a nonlinear relationship between nonoccupational visits and injury visits. When a correlation ratio was computed and found to be identical with the coefficient computed on the basis of a linear relationship, the hypothesis of a nonlinear relationship was rejected.

Based upon the quartile distribution of two-year nonoccupational visits and the positive association obtained between nonoccupational visits and injury visits, the individuals in the two lower quartiles may be considered as having a low tendency to report whereas those individuals in the two upper quartiles may be considered as having a high tendency to report. For this quartile distribution the observed

correlation coefficients between minor injuries in the two successive one-year periods indicate that the individuals in the two lower quartiles who have a low tendency to report and have the lowest mean injury visits for each of the two periods of one year also have a substantial positive tendency to repeat their injury records as illustrated by the correlation coefficients of .36 and .43. Those individuals in the upper two quartiles and who have a high tendency to report and also the highest mean injury visits for each of the two exposure periods of one year have a negligible tendency to repeat their injury records from one period to the next as illustrated by the correlation coefficients of .14 and .21, neither of which is significantly different from zero. Thus, an interesting and as yet, unexplained phenomena is observed.

However, these results would appear to warrant the following conclusions:

1. Individuals with a low tendency to report demonstrated a significant tendency to repeat their injury records as evidenced by the correlation coefficients of .36 and .43. Thus, the injury data for these individuals exhibits substantial reliability and therefore satisfies the basic assumption underlying the concept of accident proneness.

2. Individuals with a high tendency to report demonstrated an insignificant tendency to repeat their injury records as evidenced by the correlation coefficients of .14 and .21. Thus, accident proneness as a group tendency was not demonstrated by the individuals with a high tendency to report. However, these individuals may have sustained

injuries from one exposure period to another which had systematic causes but were completely obscured by the heavy reporting of pseudo-injuries, or other idiosyncratic items; the heavy reporting of injuries and other spurious items apparently tended to fluctuate in a chance fashion. These periods of heavy reporting appeared to be distributed by chance since the mean injury visits were maintained at a consistently high level while the correlation of injuries between the two periods was negligible.

However, when one examines the reliability of the injury data for those individuals with above average tendency to report (third and fourth quartiles of nonoccupational visit distribution), one is lead to a conclusion which is at direct variance with all existing supposition with respect to the concept of accident proneness! That is to say, these data appear to indicate that the greater the injuries the less the proneness, since the evidence for proneness definitely exists for individuals with lower mean injury experiences and disappears for individuals with higher mean injury experiences.

It is believed that the data provide an alternate explanation if one examines the reliability of the nonoccupational visits. Here it is seen that these data have a reliability coefficient of .81 which is unusually high. Thus, one must conclude that the unreliability of the injury data for the individuals reporting most injuries does not result from a drop in the reliability of the variance in injuries due to the tendency to report. One must conclude, rather, that the tendency to report is consistent. Therefore, it follows that

the items reported do not occur in a predictable fashion. The question then arises as how can this be reconciled with the substantial reliability of the injury data for the individuals with lower mean injury experience. This may be explained by noting that these individuals, by definition, have less of the tendency to report, and therefore report only those injuries which are in fact real injuries, the distribution of which contains systematic variance. This would suggest that the greater the tendency to report, the less the systematic variance in the distribution of items reported.

3. It was previously demonstrated that a partial correlation of injury visits in the two exposure periods while holding constant the effects of nonoccupational visits significantly reduced the correlation between injuries in the two periods. Therefore, it appears that the effect of the tendency to report is greatest in the lower two quartile groups consisting of individuals with a low tendency to report since the only significant correlation of injuries existed in these groups. Thus, it appears that the lack of a tendency to report is consistent and operates to "purify" the injury data.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Summary

It was the purpose of this investigation to determine if there exists the artifact of a tendency to report minor injuries, and if so to determine the effect on the systematic variance in reported minor injuries between two successive one-year exposure intervals.

The data for this study were provided by the Health Division of the Oak Ridge National Laboratory, operated for the Atomic Energy Commission by Union Carbide Nuclear Company and located at Oak Ridge, Tennessee. The study covered the period 1952 through 1953 and was limited to nine highly skilled craft occupations consisting of a total of 291 journeymen and apprentices who were continuously employed from 1951 through 1953.

The procedure was to screen from the sample those individuals who either were rated by the Health Division to have a physical limitation or who had a major injury resulting in lost time from the job or general limitation of work assignment.

In order to test the premise that only minor environmental differences existed between the nine occupational groups, a chi-square test of association was computed based upon the total injury frequency of the groups. The results indicated that two of the groups deviated substantially from the theoretical frequency; therefore, the total sample of nine occupational groups was divided into three separate

relatively homogeneous groups. For each of the individuals in the sample, the number of nonoccupational first visits and injury first visits to the Dispensary were recorded.

For the three basic groups in the study, the correlation between injury visits for the two successive one-year periods were found to be .38, -.14, and .64; the reliability coefficients of the injury data for the two-year period was found to be .55 and .72 for the two groups whose correlation coefficients were within the desired level of significance when raised by the Spearman-Brown Prophecy Formula.

Coefficients of correlation for nonoccupational visits between the two exposure periods were found to be .67 and .46 and when raised by Spearman-Brown to obtain the reliability coefficients for the two-year period, became .81 and .63.

The association of nonoccupational visits and injury visits was found to be .51 and .25 for the two groups for the total two-year period. The effect of the tendency to report injuries was determined by a partial correlation of injury visits in two successive one-year periods holding constant the effects of nonoccupational visits during the two-year period. Using this technique, the coefficient of correlation was significantly reduced from .38 to .23. Utilizing multiple correlation analysis, this relationship was further examined and it was found that the variance contributed by the tendency to report contributed significantly to the variance in reported injuries between the two periods.

By way of further analysis in examining the relationship of nonoccupational visits and injury visits, a quartile distribution of

nonoccupational visits for the two-year period was made, and for each of the quartile groups the correlation of injury visits for the two successive one-year periods was determined.

Conclusions

In summary, the following conclusions may be made from the results of this study:

1. While a significant positive relationship was found between injury visits in the two successive one-year periods, the reliability of nonoccupational visits were generally higher, indicating that there is a greater tendency for individuals to repeat their nonoccupational visit record than their respective injury record.

2. A marked relationship was obtained between nonoccupational visits and injury visits in each of the two exposure periods. This correlation was found to be .51.

3. Reported minor injuries include to a substantial degree the artifact of a tendency to report injuries and therefore are not a reliable index of injuries actually sustained. Thus, "real" injury statistics do not exist for this data.

4. A significant decrease in the systematic variance between reported injuries in the two successive one-year periods is evidenced when the effect of the tendency to report injuries is partialled out. The correlation coefficient was reduced from .38 to .23 when nonoccupational visits were held constant. Thus, a correction factor is needed in order to ascertain the true variance in reported injuries in one period which is accounted for by the variance in another period.

5. Individuals with a below average number of nonoccupational visits demonstrated a significant tendency to repeat their injury records while these individuals with an above average number of non-occupational visits demonstrated an insignificant tendency to repeat their injury records.

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