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THE EFFECTS OF A
COMPANY HEARING
CONSERVATION PROGRAM
ON EXTRA-AUDITORY DISTURBANCES
IN WORKERS

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The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the National Institute for Occupational Safety and Health.

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ABSTRACT

The present study was an extension to an earlier one which showed that workers in the noisier workplaces (95 dBA or higher) of a boiler fabrication facility to have significantly more numbers of accidents, medical disorders, somatic disturbances and absences than other workers situated in the quieter areas of the same plant complex. These observations were based on entries in the subject worker files as collected over a 5-year period, 1966-1970, which was just prior to the establishment of a hearing conservation program emphasizing the use of personal ear protectors for workers in the noisy plant locations. This follow-on effort addressed the question of whether the same workers, subjected first to the high level noise conditions in their jobs, and subsequently to the reduced levels owing to the use of the ear protectors, would show any decreased incidence of the abovementioned extra-auditory problems during the latter period. For this purpose, comparisons were made of relevant record entries in worker files for 2-year periods just before (1969/1970), and after (1972/1973) the start of the hearing conservation program. These comparisons took account of worker age, length of service, job type, work shift, degree of ear protection use with respect to numbers of accidents, diagnosed medical problems, symptomatic complaints, and absences. The results indicated a preponderance of significant differences in the predicted direction, i.e., frequency of problems being relatively lower for the 1972/1973 time period than during the 1967/1970 period, with the exception of symptomatic complaints which gave equivocal results. Expected relationships between rated usage of ear protectors and incidence of extra-auditory problems were orderly in some cases but not in others. Methodological shortcomings in determining ear protector usage may have been responsible for this result.

In general, the results were seen as adding strong support to the hypothesis that prolonged exposure to high-intensity noise increases the incidence of various medical, accident, and attendance problems, and that a hearing conservation program can be beneficial in reducing these problems as well as hearing loss risk. Recommendations for further study of noise related extra-auditory problems in industry were suggested, emphasizing prospective rather than

retrospective study approaches, in the interest of obtaining more definitive causal data.

Key Descriptors

- Noise
- Extra-auditory Effects
- Medical Disorders in Workers
- Worker Absence
- Job Accidents
- Ear Protectors
- Hearing Conservation Program
- Record Data

FOREWORD

This report was prepared by Raytheon Service Company (RSC), Burlington, Massachusetts under contract to the National Institute for Occupational Safety and Health (NIOSH), U.S. Department of Health, Education, and Welfare (Contract Number CDC-99-74-28, dated 16 April 1974). RSC's Project Manager/Principal Investigator for this research was Mr. Peter Conroy.

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Special acknowledgement is made to: Mr. Robert J. Felbinger, who served as Project Consultant during the initial phase of this study, providing continuity with the previous study; to Mrs. Joanne P. Kilgore, who performed the difficult task of collecting and compiling the raw data; and to Professor Dan Hornbarger, who was responsible for the computer programming.

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1. INTRODUCTION

1.1 General

The present research represents a logical and necessary extension of a recently completed National Institute for Occupational Safety and Health (NIOSH) contract study in which medical, accident, and absenteeism data were compared for over 500 workers assigned to noisy workplaces (at or above 95 dBA) and 500 workers, matched in age and job experience, employed in quieter ones (at or below 80 dBA).^(1,2) The data consisted of relevant entries in the records of the two worker groups which were collated over a period of 5 years (1966-1970) before the advent of hearing conservation programs in two plants that provided the records. The results indicated that workers in the noisy jobs had more frequent symptomatic complaints and actual diagnosed clinical disorders, greater numbers of discrete and total days of absence, and more job-related accidents than those working in quieter areas. Such findings suggested that excessive occupational noise exposure cannot only lead to hearing loss but also pose a risk of added non-auditory problems of the type noted.

Other evidence for extra-auditory disturbances from excessive noise exposure exists in the literature (3-15, 17-23). In many instances, however, these findings have been challenged because of methodological and other shortcomings (reviewed in Refs. 10, 11). So too can the results of the aforementioned record evaluation be challenged. In particular, there was the distinct possibility that the job operations or work conditions having high noise levels could have contained increased hazards of all types relative to those conditions identified with quieter work. That is, the greater prevalence of extra-auditory problems in the noisy versus quieter workplaces might have been due to heightened risk factors connected with the jobs performed in the noisy areas, but not a function of the sound level, per se. On this point, differences in the frequency rates of medical problems, absenteeism and accidents for workers in high noise and low noise groups in the initial NIOSH record study^(1,2) tended to diminish in several comparisons for workers with similar jobs.

A more direct approach in clarifying this issue would be to contrast the incidence of extra-auditory problems in the same noise exposed workers before and after noise reduction measures, especially if these controls did not materially change the nature of their jobs or entail workplace changes that could alter the original extra auditory hazards attendant to the work situation. The present study capitalized on an opportunity to provide for this type of follow-on effort. Specifically, the bulk of the record data used in the original study of extra-auditory problems in workers classified by noisy and quiet workplaces were drawn from the largest and also the noisiest of the two plants involved. This plant instituted a hearing conservation program utilizing primarily ear protection devices which was begun early in 1971, and became operational in January, 1972. The reduction of individual noise exposure through personal ear protectors would be expected to lessen the occurrences of medical, accident and absenteeism problems previously seen in the workers exposed to high in-plant noise levels if excessive noise was, in fact, a contributing factor. The present study sought, therefore, to determine whether there were fewer record entries indicating extra-auditory problems for workers in noisy jobs subsequent to the establishment of the hearing conservation program, as compared with those found previously on the same workers. These determinations could also indicate the extent to which noise control measures designed for hearing conservation can offset other possible health and safety problems connected with occupational noise conditions. The latter holds important implications to current criteria development efforts for controlling industrial noise hazards.

1.2 Study Objectives

The basic objective of the present research was to determine if the elevated frequencies of medical problems, accidents and absences originally observed among the high-noise exposed workers in the previous study would be significantly reduced as a direct result of the implementation of an extensive hearing conservation program. More specifically, the present study sought to answer the question of whether or not the same workers, previously subjected to high workplace noise (95 dBA or more), and subsequently to reduced levels from using ear protectors, would exhibit comparatively fewer medical problems, accidents, and absences during the latter period.

The basic (or gross-level) Null and Test Hypotheses evaluated in this effort are expressed as follows:

GROSS-LEVEL NULL HYPOTHESIS (H_0): The record entries of workers drawn from the high noise workplaces in the original study (noise level of 95 dBA or more) would show no differences in their frequency of diagnosed medical disorders, job accidents, symptomatic complaints and absences, in comparing such data for equivalent time periods before and after the advent of a hearing conservation program emphasizing use of personal ear protectors to attenuate the incident noise.

GROSS-LEVEL TEST HYPOTHESIS (H_1): The record entries of workers drawn from the high noise work areas in the original study (i. e., noise level of 95 dBA or more) would show a lower frequency of diagnosed medical disorders, symptomatic complaints, job accidents and absences during the time period subsequent to the advent of a hearing conservation program in comparison to an equal time period before.

The before-after time periods for collating the record data were each two years in length, the pre-hearing conservation period spanning the years 1969 and 1970, the post-hearing conservation period covering the years 1972 and 1973. The hearing conservation program at the plant complex in question, being instituted in January 1971, took a year to become fully operational. This accounts for the one-year separation between the pre- and post-hearing conservation periods for data collection.

In testing the aforementioned hypotheses, a number of additional comparisons were performed for control purposes and for more in-depth treatment of the data. These included:

- Comparisons of the record entries for workers in the low noise areas of the original study (i. e., noise levels 80 dBA or less) for the same time periods before and after the advent of hearing conservation, that is, 1969/1970 versus 1972/1973. These evaluations were made to

provide an indication of possible plant-wide variations in the incidence of extra-auditory problems between the two time periods in question. If found, such changes would have to be considered in light of those found in the high noise group. Similar changes for each group would suggest factors other than noise level as being responsible.

- Comparisons of the record data for those in the high noise areas before and after the advent of hearing conservation by degree of ear protector usage. Consistent with the test hypothesis, it would be expected that the greatest reduction in frequency of extra-auditory problems would occur for workers who wore ear protectors regularly. Progressively lesser reductions in incidence of such problems would be expected with decreasing use of ear protectors.
- Separate comparisons of record data for workers in the high and low noise areas for the 1969/1970 time period, and for the 1972/1973 time period. These evaluations were intended to define the extent of difference in the prevalence of extra-auditory problems between the two groups prior to and following the establishment of the hearing conservation program. It was expected, consistent with the test hypothesis, that such differences would be smaller in the post-hearing conservation period, reflecting the beneficial effects of the ear protector in offsetting the extra-auditory problems presumed to be of noise-induced origin.

Other details regarding procedures to achieve the study objectives are described in Section 2.0 - Methodology.

1.3 Description of Data Source

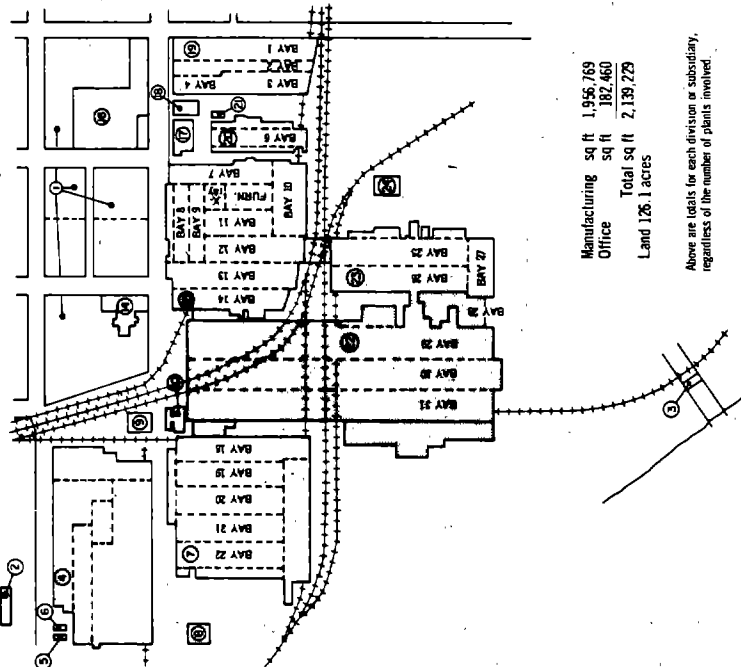
1.3.1 Industrial Complex Description

As already mentioned, the source of record data for this follow-up study (hereafter referred to as "the Plant Complex") was the larger of two plants involved in the original effort. By way of background, the complex is engaged in

the production of large pressure boilers, and is comprised of four manufacturing plants (pooled for analysis purposes): Power Boiler, Nuclear Components, Tube Mill and Superheater. These are further segmented into numerous bays, offices and shop areas. The total employment at the facility is approximately 5200 people, of which 3500 are hourly and 1700 salaried. Generally representative of the high-noise areas within this plant complex are the tube fabrication and linking bays, a power boiler shop, a header mill, general machine shops and a nuclear components building. Equipments located in these facilities include large horizontal boremills and machining centers used for vertical turning, boring and facing of large diameter components. Other high-noise emitting equipments include arc-air flame cutting devices, air compressors, heavy presses ranging from 6,000 tons to 14,000 tons capacity, peg-cutting machines and many large automatic panel welding machines having up to 16 feet ram travel by 36 feet vertical travel. Typical of the high-noise producing operations in this complex are chipping, grinding and welding on large, nuclear reactor vessels and components weighing up to 1,000 tons. A more detailed list of the job operations/areas covered by this study is provided in Appendix A. Facility layouts are shown in Figures 1-1 and 1-2. Figures 1-3 through 1-8 are actual photographs of workers performing several of these jobs. Manufacturing areas for the various plants and bays within the industrial complex encompass approximately 1,956,769 square feet, with another 182,460 square feet allocated to administration and office buildings.

1.3.2 Socio-Economic Factors of the Geographical Area

The industrial complex is situated in a large metropolitan area encompassing 995 square miles which has a population of 305,000. The average annual temperature is 59.2°F., annual rainfall is 44.75 inches, and annual humidity ranges between 58-86 percent. The white to black ratio in the area is 80-10 percent, respectively. There are over 5000 manufacturers in the vicinity, employing approximately 52,000 unskilled and semi-skilled workers and professionals. Principal products of the area include textiles, fabricated metals, chemicals, primary metals, food products, machinery, apparel, paper products, leather goods and many others.



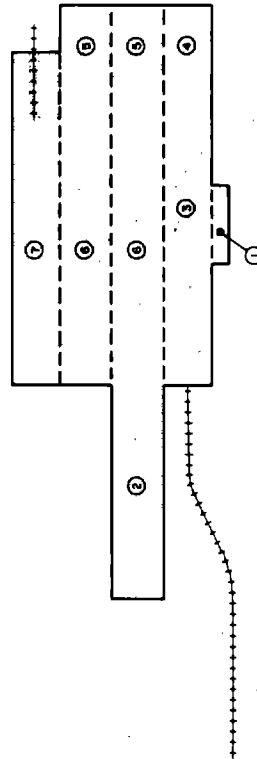
Manufacturing sq ft 1,956,769
Office sq ft 182,460
Total sq ft 2,139,229
Land 128.1 acres

None are details for each division or subsidiary, regardless of the number of plants involved.

PLANTS 1 & 3

PLANT 4 & METALLURGICAL LABORATORY

- 1 Parking Areas
- 2 Garage and Maintenance Storage
- 3 Wharf
- 4 Plate Burning, Warehouse, Weld Rod Room
- 5 Nuclear Assembly Cleanroom
- 6 Paint House
- 7 Storage House
- 8 Tube Fabrication and Link Piping Bays
- 9 Bath House
- 10 Medical Center
- 11 Tube Fabricating Bay
- 12 Shop Offices
- 13 Power Boiler Shop
- 14 Administration Building
- 15 Supplementary Office Building
- 16 Header Mill
- 17 Machine Shop
- 18 Boiler and Storage
- 19 Oil House
- 20 Nuclear Building
- 21 Header Shop
- 22 Locker Room
- 23
- 24



- 1 Office & Lockers
- 2 Fusion welding
- 3 Tube storage
- 4 Tube preparation
- 5 Straight tube welding
- 6 Bending and assembly
- 7 Shipping and pickling
- 8 Met Lab.

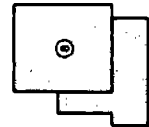


Figure 1-1. Facility Layout

TUBE MILL

- 1 Small parts fabrication & package boilers
- 2 Tube manufacture & storage
- 3 Covered storage area
- 4 Old machine shop
- 5 Stainless Tube Finishing Mill

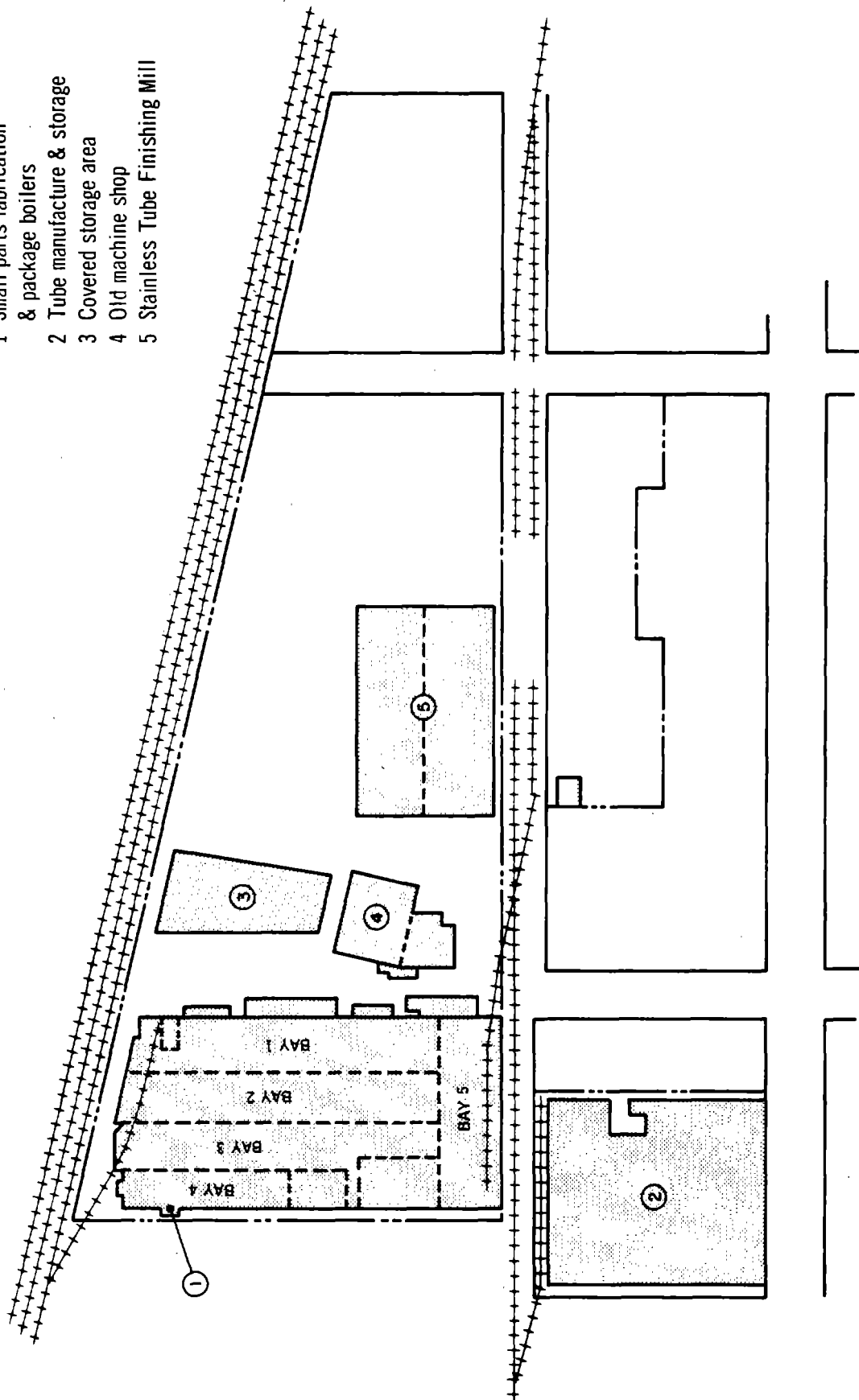


Figure 1-2. Facility Layout

PHOTOGRAPHS OF VARIOUS NOISE LEVEL JOBS



Figure 1-3. Corporate Engineering Department (55 dBA)



Figure 1-4. Nuclear Gauge Room (47 dBA)



Figure 1-5. Employee Operating a PPM Machine, Superheater Plant, Bay 42 (106 dBA)

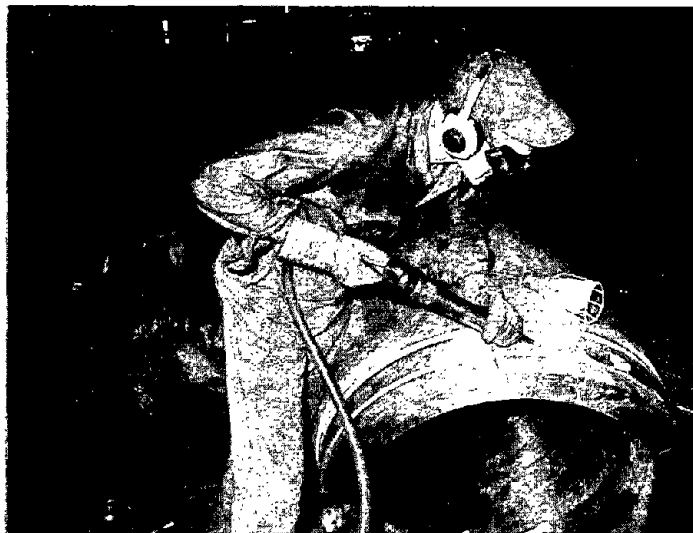


Figure 1-6. Employee Using Chipper Hammer, Boiler Plant, Bay 8 (98 dBA)



Figure 1-7. Employee Grinding on Boiler Drum, Bay 11, Boiler Plant (95 dBA)

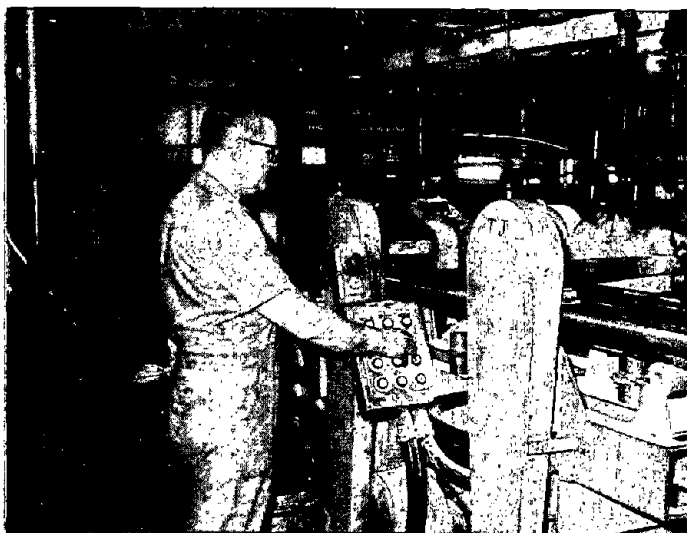


Figure 1-8. Employee Operating an Annealing Furnace, Tube Mill, (98 dBA)

Employees at the industrial complex are grouped into hourly and salaried categories. Salaried personnel are divided into exempt and non-exempt categories. There are 800 non-exempt and 700 exempt workers comprising these categories. Approximately 65-70 percent of the hourly workers have completed high school, and about 20 percent of the salaried workers have undergraduate degrees and another 3-4 percent hold masters degrees or equivalent. Income of hourly personnel ranges for \$3.54 to \$5.46 per hour (40 hour week). Income for salaried personnel ranges between \$5,500 and \$30,000 per year. Approximately 80 percent of the workforce is Caucasian.

1.3.3 Industrial Complex Safety and Medical Facilities

The industrial complex gathers and maintains extensive accident and health records on all employees, through well-qualified Safety and Medical Departments. The Safety Department includes three (3) full-time professional safety engineers, while the Medical Department employs a total of three (3) physicians and eight (8) registered nurses, providing continuous coverage for the three (3) work shifts. In addition, comprehensive insurance claim records are maintained, and were available for supplementary safety and health information.

1.3.4 Hearing Conservation Program

The industrial complex initiated an extensive hearing conservation program in January, 1971, which became fully operational in January 1972. Specifically, this program included required audiometric testing of all workers exposed to noise levels in excess of 90 dBA, in their normal working environments. All employees from these high noise environments are tested annually, and workers with individual audiological problems are tested more frequently. During the 1971 period of program implementation, all employees routinely exposed to noise levels in excess of 90 dBA were individually fitted for insert ear protectors, if these were preferred, or issued ear muffs and instructed in their use and value. The specific type of protector issued (insert or muff) was the choice of the individual worker. Five basic varieties of ear protectors were available for issue, and are currently in use:

- (1) The Willson Company, Models EP100 and EP100SG, (insert type);
- (2) The Welch Division, Textron Company, Models 4551, 4552, 4553, 4554 and 4555 (insert type);
- (3) The Mine Safety Appliance Company, Model MKIV, (muff type);
- (4) The Mine Safety Appliance Company, Model S. M. R. , (insert type);
and
- (5) The Willson Company, Model "Sound Ban", (combination insert/muff type).

Protector types 1 and 2 are the most commonly used, and their specified attenuation characteristics are presented in Table 1-1.

Table 1-1. Specified Attenuation Characteristics of the More Commonly Used Ear Protectors¹

Specified Attenuation In dB*	Protector	Frequency In Hertz					
		500	1000	2000	3000	4000	6000
	• Willson Co., Models EP100, EP100SG	25	27	32	41	44	40
	• Welch Div., Textron Co., Models 4551, 4552, 4553, 4554, 4555	28	33	35	40	37	28

*Tested in accordance with ANSI Z24.22 (1957) (Ref. 27).

¹ Note: Mention of these commercial products does not constitute an endorsement by either the Raytheon Service Company or the National Institute for Occupational Safety and Health.



2. METHODOLOGY

2.1 Definition of Study Variables

Table 2-1 presents a summary of the variables; dependent, independent/control, and independent, applicable to the present study. With the exception of a few minor deletions and modifications, and the addition of the "Ear Protector Use" factor, the variables of the present study were essentially the same as those of the previous investigation. The dependent variables included the various medical, accident and attendance study indicators as specified in Table 2-1 (and further elaborated in Tables 2-3, 2-4, 2-5, 2-6). The so-called "independent/control" variables were the several data sorting categories. These served the dual purpose of allowing comparisons of the various levels within categories (in this sense, they acted as independent variables), and providing the means to sub-divide the total High and Low-Noise Groups into more homogeneous sub-groups, to increase the validity of between-group comparisons. The independent variables in the present study were:

- Level of noise exposure (work-area ambient), either "High Noise" (95 dBA or greater), or "Low Noise" (80 dBA or less), for the High Noise Group, and Low Noise Group Comparisons; and
- Level of noise exposure, either "High Noise" (95 dBA or above), work area ambient (operationally represented by the 1969/1970 time period) or "Reduced Noise" (operationally represented by the 1972/1973 time period), which included the wearing of ear protectors in the High Noise work areas), for the pre- and post-hearing conservation program comparisons.

2.2 Definition of Study Constraints

There were key constraints in the present study which were:

- Validation of the medical, accident and attendance records was not possible; all record entries were accepted as "face-valid". The

Table 2-1. Summary of Study Variables

General	Variable Type	Specific
Accident	Dep.	Six injury-type categories and six body parts affected categories
Medical data	Dep.	Two basic categories (symptomatic and diagnostic), each subsuming the same nine sub-categories (neurological, digestive, cardiovascular, otological, respiratory, glandular, urological, musculo/skeletal).
Attendance data	Dep.	Two Categories: total number of days absent/per year; and number of discrete absences/per year.
Audiometric data	Dep.	Six discrete frequencies for the right ear and the same six frequencies for the left ear.
Age	Indep. / (Control)	Five 10-year groupings.
Amount of experience at present job	Indep. / (Control)	One category (number of years at present job with four subcategory groupings).
Occupation	Indep. / (Control)	Nine groups, subsuming a total of approximately 75 job titles/classifications.
Marital status	Indep. / (Control)	Four categories: married, single, widowed, divorced (separated).
Shift	Indep. / (Control)	Categories: first, second, third, and rotating.
Ear Protector Use (Two Methods)	Indep. / (Control)	• Primary Rating Method: Four ratings of ear protector usage: - "Always" - "Frequently, but not always" - "Infrequently" - "Never", based on composite judgments of the plant Safety Director, individual Line Foreman and the Study Director. • Secondary Rating Method: Two Ratings of Ear Protector Usage: - "Yes" - "No" Referring to the results of on-site observation by the Study Director, only. ("Yes" = Observed Wearing; "No" = Not Observed Wearing)

Table 2-1. Summary of Study Variables (Cont.)

General	Variable Type	Specific
Noise Exposure Level (Primary Study Independent Variable)	Indep.	Two Types: • Either High Noise (95 dBA and above) vs Low Noise (80 dBA and below), measured ambient levels at the work place; or • High Noise (1969/1970 time period) vs "Reduced Noise," (1972/1973 time period), operationally defined by the use of ear protectors.

possibility existed that some entries may not have been accurate, or that some incidents (medical problems and/or accidents) may have been omitted entirely. However, the comprehensive nature of the record system at this plant complex would indicate that such possibilities were minimal.

- The ratings of ear protector use taken in the course of this study could only infer past usage from current impressions or observations. It was not possible to verify these judgments through actual data taken during the time period in question, i. e. , 1972/1973.
- Although nine medical categories were included in analyzing medical problem entries, certain classifications of health indicators were not considered. This was necessary in order to keep the data at a manageable level in terms of the large number of factors to be analyzed. For example, although some researchers have suggested a relationship between noise exposure and other health problems, such as visual dysfunctions (15, 17, 18, 19) reproductive difficulties (cited in 13) infectious diseases (20, 21, 22), these categories were not considered.
- Vacations, holidays, weekends and excused absences for reasons other than reported illness, were deducted from the absenteeism data. Nevertheless, the possibility that a certain number of the reported illnesses, may, in fact, have been for reasons other than bonafide illness, cannot be completely discounted.

2.3 Procedure

The basic procedure employed in the present research can be generally summarized by the following major steps:

- The validation of the study worker population and the particular work environments in view, of study requirements;

- The compilation of 1972/1973 health, accident and attendance data, for those workers from the original study (ref. 50), who were still employed in their particular jobs;
- The interpretation and classification of the raw data;
- The quantitative and qualitative analysis and interpretation of these data.

A pictorial representation of the logical relationships of the major study tasks is presented in Figure 2-1, Study Task-Flow/Process Chart. The following paragraphs discuss each of these major tasks in detail. (The numerical designation of tasks is referenced directly to that of the Study Task-Flow/Process Chart.)

2.4 Task 1.0: Validate Study Worker Population and Work Environments, In View of Study Requirements

Employee personnel records were screened to identify those employees who were included in the original study (1969/1970 time period only), and who were employed at the same job for the 1972/1973 time period. Employees not meeting these criteria were dropped from the study population. In addition, all hygienic and other changes to the work environment made between 1970 and 1973 which could have effected employee health and safety, and thereby confounded any observed differences in the study indicators (with the exception of the introduction of hearing protection), were carefully reviewed with the Safety Engineering Department of the industrial complex. It was found that an oil-mist filter had been installed in a particular work station, resulting in several employees, though part of the original study, to be deleted from this follow-up evaluation. Finally, the ambient noise levels at the various High and Low-Noise work stations from the original study were measured to insure that there had been no significant changes since 1970. The results of this noise survey are contained in Table 2-2, Noise Survey Data. Noise levels that had changed since 1970, are shown in parentheses, all other levels remained essentially the same. Only a few sound level variations were noted among those originally recorded in the High and Low

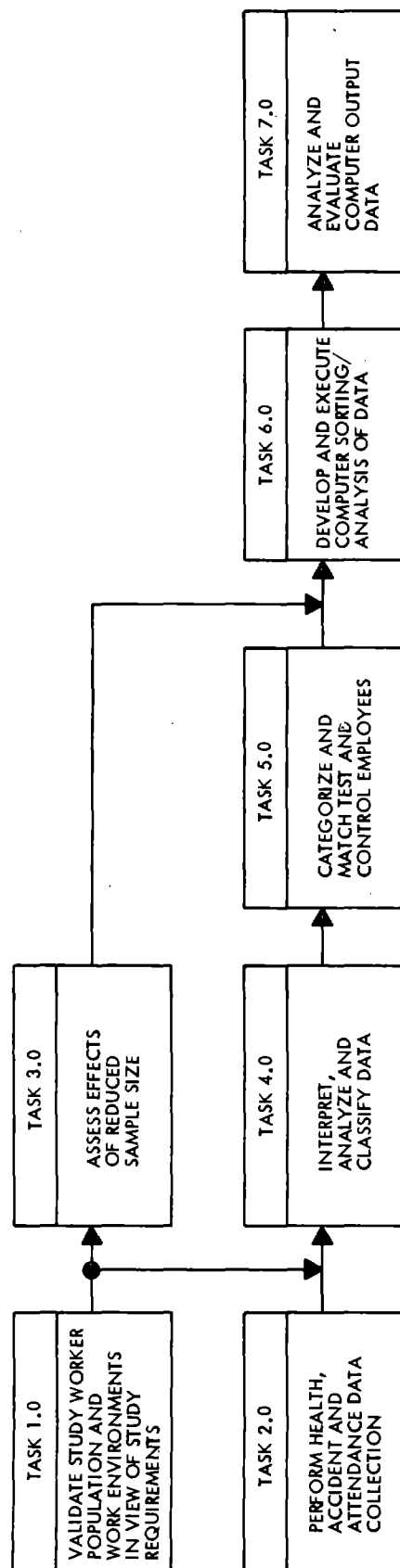


Figure 2-1. Study Task - Flow/Process Chart

Table 2-2. Noise Survey Data

<u>Location/Equipment</u>	<u>A Scale Reading (dB)</u>	<u>Remarks</u>
Machine Shop		
Bay 1, South	86	
Bay 2, South (L)	76 (84)	
Bay 3, North (L)	78	
Bay 3, South (L)	80 (81)	
Bay 4, Middle (L)	79	
Maintenance		
Bay 6, North (L)	79 (72)	
Bay 6, Middle (L)	70 (72)	
Bay 6, South (L)	76 (73)	
Boiler Shop		
Bay 7, North (H)	100	Chipping on thick shell
Bay 14, North (H)	95 (90)	Grinding on header
Bay 14, Middle (H)	98	Chipping hammer operating
Header Shop		
Bay 26, North (H)	108	Chipping on header
Bay 26, Middle (H)	101	Chipping on header
Nuclear		
Bay 29, South (L)	80	
Bay 30, South (L)	79	
Bay 31, South (L)	80	
At Compressor (H)	108 (91)	
Bay 31, North (L)	80 (81)	
Tube Plant		
Bay 22, South	92	
Bay 22, Middle (H)	118	Air blowing on operator
Material Service		
Range Boiler Bldg.		
Fin Cutter		
Rod Cutter (H)	98	Equipment operating
Warehouse (L)	73	No apparent noise
Plant 4		
Maintenance (H)	111	Compressor operating
Bay 4, North	87	
U. T. Mach. (operator) (H)	97+	
U. T. Machine Tube prep. (H)	96	Air exhausting
Bay 2, Mig Welder (H)	100	
Bay 2, by furnace (south) (H)	95 (87)	Air arc welding

Table 2-2. Noise Survey Data (Cont.)

<u>Location/Equipment</u>	<u>A Scale Reading (dB)</u>	<u>Remarks</u>
Old Tube Mill		
Rear of Molding Mach. (H)	96	Mach. operating
Oper. Sta., Mach. 2 (H)	106	Mach. operating
Front of Molding mach. (H)	103	Mach. operating
At furnace operator (H)	98	
New Tube Mill		
Compressor Enclosure (H)	109	Compressor on
	107	Compressor off
Dye Check Table (H)	105	
Grinding Table (H)	95	Opposite grinding operator
	106	At grinding operator station
Sidney Street		
Bay 54, East (L)	80	
Bay 55, South (L)	80	No operation
Bay 55, North (H)	106	Saw operating
Bay 7, North end (H)	100	Chipping on thin shell
Bay 7, South end (H)	113	Doodling
Bay 9, West end (H)	111	Grinding inside drum (old type)
Bay 9, West end (H)	95	Grinding on drum (outside)
Bay 10, Middle (H)	124	Chipping inside drum
Bay 13, South (H)	115	Chipping on header
Bay 14, North end (H)	95	Grinding on header
Bay 14, Middle (H)	98	Chipping on header tube
Bay 14, South end (H)	102	Internal grinding on header
Bay 14, South end (H)	115	Blowing chips of weld
Bay 14, North end (H)	95	Union-melt machine
Bay 14, North end (H)	112	Grinding header with disc
Bay 22, Middle (H)	118	Air hose cooling weld
Bay 26, Middle (H)	108	Chipping on thin shell
Bay 26, Middle (H)	101	Chipping on thin shell
Bay 30, North end (H)	113	Chipping on thin shell
Bay 30, North end (H)	105	Grinding inside shell
Yard Crane (shed) (H)	125	Sawing 6" channel
Bay 41, North end (H)	102	
Bay 41, North end (H)	96	
Bay 41, North end (H)	116	
Bay 42, North end (H)	109	
Bay 42, North end (H)	106	
Bay 42, South end (H)	95	
Range Boiler Bldg. (H)	103	Peg fin operator's station
Range Boiler Bldg. (H)	111 (106)	6' from tumbler
Bay 54, West end (H)	97	At shears
Lean-to, Tube Plant (H)	98	Stone saw #1282

Table 2-2. Noise Survey Data (Cont.)

<u>Location/Equipment</u>	<u>A Scale Reading (dB)</u>	<u>Remarks</u>
Range Boiler Bldg. (H)	96 (93)	Rod room, wire cutter #2766
Rivoryard (H)	118	Metal saw #247
New Tube Mill (H)	106	Grinding
Administrative Offices (L)	60	Average ambient with all type- writers operating
Engineering Bull (L)	55	Average ambient noise level
Guard Area (L)	45	Average ambient noise level
Reproduction Area (L)	52	Average ambient noise level
Accounting Area (L)	63-70	

Noise areas. In the High Noise areas, five (5) noise levels indicated a decrease, but four (4) of the five (5) did not go below 90 dBA. In the Low Noise area, six (6) noise levels indicated a change; some slightly increased, and others slightly decreased relative to the first reported values. None of these noise level changes were the result of engineering changes in the environment. Rather, they were seen as reflecting random changes in the noise levels generated by the work processes at the time of measurement. Consequently, no workers in either the High or Low Noise areas were dropped from the study because of noise level variation. The notation "H" or "L", shown in parentheses beside the specified work area or equipment site in Table 2-2 indicates locations where one or more workers were drawn to form the High and Low Noise exposure groups, respectively.

2.5 Task 2.0: Perform Health, Accident and Attendance Data Collection

Concurrently with Task 1.0, all medical, accident and absence data for the High and Low Noise Exposed Worker Groups of the original study were collected and compiled, on-site at the industrial complex for the 1972/1973 time period. This was done by a trained research assistant. In the performance of the data collection task, the research assistant had been instructed to maintain the confidentiality of all data. Also, in order to preclude the possibility of any bias in the collection and recording of the raw data, the research assistant was not given any specific information regarding the purpose of the investigation. In addition, all employees were identified merely by clock number, and the research assistant did not know which workers were from the High or Low Noise work stations. In recording the health data, the number of discrete instances of dispensary visits for independent problems (as opposed to repeated visits for the same problem) were tabulated. For accident data, the frequency, type of accident, and body part effected were recorded. In addition, the results of each worker's most recent audiometric examination (if available) were included. In the compilation of attendance data, both the number of days absent and the number of discrete absences were recorded, while times lost for holidays, vacations, weekends and other non-health related reasons, were discounted.

Appendix B presents an example of the data form used to record the health, accident, attendance and other pertinent data, from each employee record. These data were subsequently interpreted, categorized, and translated to a data processing key-punch format. An example of the form used for key-punching is also included in Appendix B.

2.6 Task 3.0: Assess Effects of Reduced Sample Size

A total of 44 workers whose record data were used in the original study could not be included in this follow-on evaluation for various reasons. Forty such workers had either terminated employment with the boiler complex, retired or died during the period 1971 through 1973. Four other workers, though still employed at their same jobs, had to be dropped because of the installation of an hygienic control device (oil mist filter) at their work station. These exclusions necessitated recalculation of the original pre-hearing conservation data, and provisions were made for comparing the results of the reduced vs. total samples to insure that the deletions caused no significant changes in the original distributions of data on the various dependent measures.

2.7 Task 4.0: Interpret, Analyze and Classify Data

All of the raw data were compiled directly from the safety, medical and personnel files of the industrial complex studied. The dependent factor categories used were the same as those of the previous study, and initially derived from a detailed inspection of the record entries and a comprehensive review of the categorization techniques used in similar research. The accident categories included both the injury type and the body part effected.⁽²⁴⁾ In the case of the health categories, the raw data were classified into disorders actually diagnosed by an attending physician, or symptomatic (un-diagnosed) complaints reported directly by the worker. In the process of interpreting, analyzing and classifying the health data, assistance was provided by both the industrial complex medical staff and RSC's medical advisory staff, as required, to insure the accuracy and validity of this process. The specific accident and medical categories are presented in Table 2-3. Examples of diagnostic and symptomatic health data categorizations are shown in Table 2-4.

Table 2-3. Accident and Medical Categories

Accident Categories	
<u>Injury Type</u>	<u>Body Part</u>
Abrasion and Puncture	Head/Neck
Wound/Laceration	Limb*
Cut/Contusion	Trunk
Break/Fracture	Hand
Burn	Foot
Sprain/Strain	Unspecified
Foreign Body	
Other	
*Included both Arm and Leg Injuries	
Medical Categories	
(The Medical Categories listed were the same for both the Diagnostic and Symptomatic Illness Types.)	
Category	
• Neurological • Digestive • Cardiovascular* • Otological/Audiological • Allergenic/Dermatological • Respiratory • Glandular • Urological • Muscular/Skeletal	
*Included circulatory problems	

Table 2-4. Examples of Medical Data Categorization

Prime Indicator Category	Examples	
	<u>Diagnostic</u> (Physician's Diagnosis)	<u>Symptomatic</u> (Subjective Complaints)
1. Neurological	Manic Depressive Radiculoneuritis Acute Anxiety Neurosis Hemiplegia Sciatica	Headache Dizziness
2. Digestive	Ulcer (Duodenal & Peptic, etc.) Gastritis Diverticulosis Duodenitis Appendicitis Acute Gastroenteritis	Stomach Cramps Heartburn Upset Stomach Nausea Diarrhea
3. Cardiovascular/ Circulatory	Tachycardia Angina Pectoris Hypercholesterolemia Hemotrypsia Coronary Sclerosis Hypertension Hypotension	Pain in Chest and Arm (with History of Heart Disease)
4. Otological/ Audiological	Stapedectomy Blocked Eustachian Tube Ear Infections Fenestration Suppurative Ear Otosclerosis	Ear Bleeding Ear Hurting Can't Hear Ear Ringing
5. Allergenic/ Dermatological	Skin Growths, Lesions, Blisters, Boils, Pimples, Moles, Warts, Fungus, Rashes, Skin Infections/Irritations, Psoriasis, Allergenic Dermatitis, Urticaria, Asthma, Allergenic Rhinitis	Skin Itching Skin Burning

Table 2-4. Examples of Medical Data Categorization (Cont.)

Prime Indicator Category	Examples	
	<u>Diagnostic</u> (Physician's Diagnosis)	<u>Symptomatic</u> (Subjective Complaints)
6. Respiratory	Pneumonia Pleurisy Bronchitis Bronchopneumonia Pharyngitis Laryngitis Cold & Sore Throat	Coughing Congestion in Chest and Head Stuffy Nose Shortness of Breath Hoarseness
7. Glandular	Hyperthyroidism Hypothyroidism Diabetes Prostatitis	Overweight and Underweight Conditions
8. Urological	Kidney Stones Nephritis Renal Colitis Cystitis Nephrectomy	Can't Urinate Regularly Pain in Bladder Area Blood in Urine
9. Muscular/Skeletal	Fibrositis Arthritis Hernia Bursitis Rheumatism Tendonitis Myositis	Backaches and Neckaches Soreness in Muscles Swelling & Other Pressure on Body Numbness of Body Cramps

2.8 Task 5.0: Categorize and Match Test and Control Employees

In all cases, individual workers in both the Test (High-Noise Exposed) and Control (Low-Noise Exposed) groups were appropriately divided into a number of categories in order to form more homogeneous sub-groups for data comparison purposes, and to allow any observed between-category differences to be factored out and evaluated. This was accomplished by the computer software. The individual categories and sub-groups within categories are shown in Table 2-6, as are the cell sizes for the High and Low Noise Groups.

2.8.1 Types of Comparisons

The present study consisted of two basic types of comparisons:

- Comparisons of worker record data for the 2-year periods before and after the advent of hearing conservation performed separately for the High Noise Group and the Low Noise Group.
- Comparisons of worker record data for the High Noise Group versus the Low Noise Group performed separately for the 2-year period before hearing conservation and the 2-year period after the establishment of the program.

In the first set of comparisons, employees in the High and Low Noise Groups served as their own controls and thus were perfectly matched. In the second set of comparisons, employees in the High and Low Noise Groups were matched to the maximum extent possible in accordance with selection procedures described in the report of the original study which attempted to take account of age, sex, length of service, work shift, and job type factors. Table 2-5 describes the distributions of worker ages and lengths of service in the High and Low Noise Group whose record data was used in this follow-up evaluation. The match-ups in age and job service are nominally close. Greater disparities are seen between the members of the High and Low Noise Groups in considering other factors such as job type, workshift, etc. (see Table 2-6).

Table 2-5. Number of Workers in High and Low Noise Groups
by Age and Length of Job Service

Years at Present Job	Number of Workers		Age	Number of Workers	
	High Noise Group	Low Noise Group		High Noise Group	Low Noise Group
5-10	333	256	Below 26	60	9
11-15	42	97	26 - 35	152	98
16-20	39	41	36 - 45	88	133
Over 20	20	34	46 - 55	83	137
			56 - 65	51	55

Table 2-6. Categories and Subcategories (or Levels) Making up the Total Employee Population, Including Numbers of Workers in Each Subcategory (or Level)

Category (Independent Factor)	Subcategory (or Level)		Number of Workers (High-Noise Group/Low- Noise Group)
● Age	Five (5) Subcategories, as follows:		
	Below 26		60/9
	26 - 35		152/98
	36 - 45		88/133
	46 - 55		83/137
	56 - 65		51/55
● Occupation (Specific Job Descriptions for Each Job Title are In- cluded in Appendix A)	Seven (7) Subcategories, as follows:		
	Major Subcategory	Job Titles Subsumed	
	● Production Worker	Chipper, Floor Worker, Fit-Up Worker, Grinder, Unit Assembler, Rod-Handler, Laborer, NDT Assistant, Welder, Utility Man	257/2
	● Administra- tor	Production Planner Contract Analyst, Systems Analyst, Analyst Estimator, Accountant, Administrative Specialist, Buyer	10/43
	● Plant Support	Guard, Building Supervisor, Clerk, Graphics, Coordinator, Laboratory Technician, Production Worker, Electrician, Mechanical Specialist	2/10
	● Machine Operator	Truck Operator, Equipment Operator, U-Melt Operator, Spin Machine Operator, Coating Machine Operator, Blast Operator, Crane Operator, Press Operator, Magnaflux Operator, Lathe Operator, Machine Tender, Electric Truck Operator, X-Ray Operator, Specialist, Machine Bender, Burner	86/1

Table 2-6. Categories and Subcategories (or Levels) Making up the Total Employee Population, Including Numbers of Workers in Each Subcategory (or Level) (Cont.)

Category (Independent Factor)	Subcategory (or Level)		Number of Workers (High-Noise Group/Low- Noise Group)
	Major Subcategory	Job Titles Subsumed	0/205
	• Engineer / Draftsman	Engineer, Draftsman	
	• Foreman	Production Foreman, Foreman, Supervisor	
	• Test and Inspector	Inspector	
• Marital Status	Four (4) Subcategories, as follows:		
	Married		370/387
	Divorced		6/5
	Single		57/39
• Amount of Experience at Present Job	Four (4) Subcategories, as follows:		
	5 - 10 years		333/256
	11 - 15 years		42/97
	16 - 20 years		39/41
• Shift	Four (4) Subcategories, as follows:		
	1st Shift		210/333
	2nd Shift		125/46
	3rd Shift		96/37
• Total Group Size	Rotating		3/16
	High-Noise Group		434
	Low-Noise Group		432

Table 2-6. Categories and Subcategories (or Levels) Making up the Total Employee Population, Including Numbers of Workers in Each Subcategory (or Level) (Cont.)

Category (Independent Factor)	Subcategory (or Level)	Number of Workers (High-Noise Group/Low- Noise Group)
Use of Ear Protectors (Applied only to employees from the high-noise environment)	<u>Primary Rating Method:</u> Four (4) ratings of ear protector usage, as follows (included in Primary Method of rating use of ear protectors, along with the singular observations of the study director):	
	(Levels refer to how often ear protectors were worn in the high-noise environment.)	
	"Always"	128
	"Frequently" (but not always)	40
	"Infrequently"	16
	"Never"	15
	Total	199
	<u>Secondary Rating Method:</u> Two Ratings as follows (represents singular observations of study director as sole source of ear protector usage ratings):	
	(("Yes" and "No" refer to whether or not particular workers were observed to be wearing ear protectors during the on-site inspections by the study director.)	
	"Yes"	179
	"No"	39
	Total	218

2.8.2 Categorization of Employees with Respect to Use of Ear Protectors

In addition to processing record data from worker files, special procedures attempted to classify workers in the High Noise Group with respect to the extent they wore ear protectors during the 1972/1973 time period. It was anticipated, consistent with the test hypothesis, that the degree of ear protection use would be directly related with the amount of reduction in frequency of medical problems, somatic complaints, job accidents and absences. As worker judgments about ear protection use were expected to be biased, it was decided to use the judgments of their superiors for this purpose augmented by observations of the study director. Specifically, ear protection use represented the composite of three judgments:

- (1) The impressions of members of the plant Safety Engineering Department who routinely inspected the high as well as low noise areas over the 1972/1973 time period in question;
- (2) The impressions of each worker's individual line foreman; and
- (3) The results of individual, unannounced visits to the worksites of the workers in the High Noise Group by the study director. In actuality, these latter observations were merely a check on the reliability of the other two judgments.

In this composite evaluation procedure, referred to as the "Primary Method," a 4-point rating scale was used with the descriptors; "Always," "Frequently," "Infrequently," and "Never," referring to the degree of ear protector use believed characteristic of the individual workers being rated. About one-half of the total workers in the High Noise Group could be classified by this primary means of rating ear protection use. For the remainder, the singular observations of the study director in the course of unannounced visits to their stations served as the basis for a rating. In this latter procedure, termed the "Secondary Method," workers were merely classified as either wearing the ear protectors ("Yes") or not wearing the ear protectors ("No"). These two methods for rating the use of

ear protection were treated independently in the analysis of the record data collected on the workers in the High Noise Group.

One hastens to mention that both of the aforementioned methods for defining ear protection use suffer from the fact that current impressions and/or observations are being used to describe a state of affairs that existed 2-3 years before. Because of its crucial role in this study, even these admittedly imperfect measures of ear protection use were believed deserving of evaluation.

2.9 Task 6.0: Develop and Execute Computer Sorting/Analysis of Data

As previously stated, the sorting and quantitative (statistical) analysis of the data were accomplished by the computer software. There were four (4) major sortings, executed in a similar fashion, but with variations among several of the independent factors. Figure 2-2 presents a pictorial summary of the hierarchy and rationale for these computer sortings. (It should be noted that the progression from the first through the third sort levels was geometric rather than arithmetic in nature in that the sort categories from one level were maintained for each subsequent sort level). For each resultant sort grouping, frequency data were tallied with respect to each of the dependent factors described in Table 2-1, and median values calculated. Hearing level data also available on a number of workers in the High Noise and Low Noise Groups, as measured during both time periods, were also averaged in this data collection process.

All comparable sort groupings were subsequently tested statistically with respect to each of the study dependent factors (as indicated in Figure 2-2), except hearing levels. Because of the essential frequency nature of the data, non-parametric techniques were used throughout in these analyses. Specifically, in the case of Sort-Types 1 and 2, the Wilcoxon Matched-Pairs Signed-Ranks Test was applied.⁽¹⁶⁾ The Wilcoxon Test is a relatively powerful test for evaluating the magnitude and direction of differences within matched pairs. (In Sort-Types 1 and 2, employees were "perfectly" matched in that, each employee served as

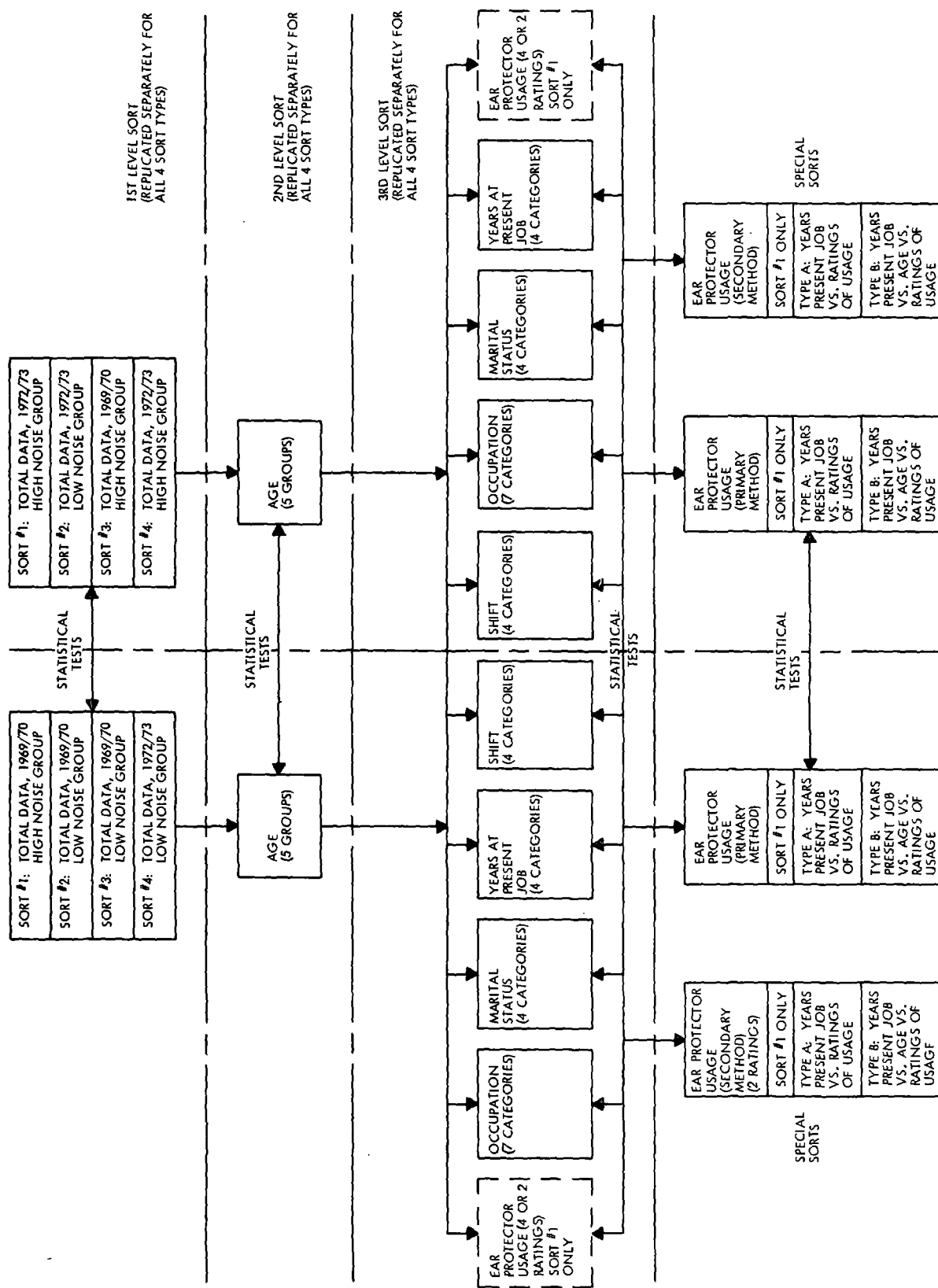


Figure 2-2. Pictorial Summary of Computer Sorting Hierarchy

his own control). For Sort-Types 3 and 4, the Median Test was applied to test the significance of observed differences.⁽¹⁶⁾ The Median Test is a technique for testing whether two (2) independent samples differ in measure of central tendency (median).

Both statistical tests (Wilcoxon Test and Median Test) were applied as one-tailed tests, except in the case of 1969/1970 data vs. 1972/1973 data for the Low Noise Group, which were two-tailed tests. One-tailed tests were employed for evaluating differences in directions conforming with the test hypothesis. Two-tailed tests were used where no directional change was predicted. For the Wilcoxon Test, observed differences were tested against the parametric Z distribution. Results of the Median Tests were evaluated against either the Fischer or Chi-Square distributions, depending on sample size. Levels of significance or exact probabilities were printed out directly as output data.

2.10 Task 7.0: Analyze and Evaluate Computer Output Data

All test results were translated from the computer output format to tables and graphs to allow for more direct interpretation, and to present the data in the most clear and meaningful manner possible. These results were evaluated with regard to the basic study objectives.



3. RESULTS

3.1 Effects of Reduced Sample Size

In order to insure that the exclusion of the record data of 44 workers had no material effect in the originally reported frequency distributions of each of the study indicators (dependent factors), individual medians for the reduced sample data were calculated and compared with those of the full (original) sample. Tables 3-1 and 3-2, present a summary of these comparisons for the High- and Low-Noise exposed groups for a number of sort combinations. Differences between the medians of the total versus reduced sample data were found to be quite small, and for many comparisons they did not differ at all (signified by a "O"). The direction of the apparent differences was also quite varied, revealing no systematic trend. Indeed, there were nearly as many differences favoring the total sample data (noted as a "+") as there were favoring the reduced sample results (noted as a "-") for the different dependent measures. In effect then, it could be concluded that the reduced sample data were compatible with that of the full sample.

3.2 Accident Data

- Overall Results

Figure 3-1 presents the cumulative percent frequency distribution of workers in the High-Noise Group having had a specified number of accidents during the 1969/1970 and 1972/1973 time periods. As shown in these curves, accident rates were uniformly lower during the 1972/1973 time period, as compared to the 1969/1970 time period for the same group of workers. For example, approximately 10% of the workers had as many as 14 accidents or more during the 1972/1973 time period; whereas in the 1969/1970 time period, approximately 16% of the workers had 15 accidents or more. Again, during the 1972/1973 period, approximately 50% of the workers had 2 or more accidents; while for the 1969/1970 period, approximately 60% of the workers had 2 or more accidents.

Table 3-1. Summary Table of Sort-Groupings with Variations in Sample Sizes, Including Median Values and Direction of Differences (High Noise Group, 1966-1970 Data, Full Sample and Reduced Samples)

Group/Sub-Group Combination	MEDIAN VALUES																	
	Accidents						Diag. Med.						Sympt. Med.					
	Full Samp.	Red. Samp.	Dir. Diff.	Full Samp.	Red. Samp.	Dir. Diff.	Full Samp.	Red. Samp.	Dir. Diff.	Full Samp.	Red. Samp.	Dir. Diff.	Full Samp.	Red. Samp.	Dir. Diff.	Full Samp.	Red. Samp.	Dir. Diff.
Total Sample	9.0	9.2	+	3.9	3.8	-	1.7	1.8	+	3.0	3.1	+	30.3	30.1	-	49.8	49.5	-
Age: 26-35	11.8	11.5	-	5.0	4.8	-	3.0	2.9	-	3.1	3.0	-	34.0	32.8	-	54.8	52.5	-
Yrs. Prs. Job: 5-10	11.0	10.5	-	4.9	4.8	-	3.1	3.0	-	3.1	3.0	-	34.0	32.8	-	54.8	52.5	-
Shift:	9.5	9.0	-	4.5	4.5	0	2.8	2.8	0	2.8	2.8	0	36.5	35.0	-	55.0	54.5	-
Second	11.5	11.5	0	3.8	3.5	-	2.7	2.5	-	2.7	2.5	-	33.5	33.0	-	57.5	56.5	-
Marital Stat: Single	17.5	18.5	+	4.0	4.0	0	2.2	2.3	-	2.2	2.3	-	51.5	50.5	-	73.5	69.0	-
Married	10.3	10.3	0	5.1	5.0	-	3.2	3.1	-	3.2	3.1	-	30.0	29.2	-	49.5	48.0	-
Occupation: Prod. Wkr.	18.5	19.0	+	5.5	5.6	+	3.7	3.8	+	3.7	3.8	+	40.5	38.5	-	59.5	57.0	-
Age: 36-45	10.5	10.5	0	3.3	3.1	-	2.1	2.0	-	2.1	2.0	-	25.2	25.2	0	39.5	39.5	0
Yrs. Prs. Job: 5-10	10.0	10.0	0	3.4	3.2	-	2.5	2.4	-	2.5	2.4	-	23.0	23.0	0	35.5	34.5	-
Shift:	9.0	6.2	-	3.8	3.5	-	1.3	1.1	-	1.3	1.1	-	27.0	27.0	0	44.0	44.0	0
Second	10.5	10.5	0	3.1	3.1	0	2.1	2.1	0	2.1	2.1	0	24.8	25.2	-	39.0	39.5	+
Marital Stat: Married	14.5	14.3	-	5.8	5.3	-	3.0	2.8	-	3.0	2.8	-	37.5	37.5	0	53.0	53.0	0
Occupation: Prod. Wkr.	7.5	8.5	+	3.4	3.4	0	1.0	1.2	+	1.0	1.2	+	27.0	27.5	+	42.5	46.5	+
Age: 46-55	10.3	10.5	+	3.7	3.8	+	1.2	1.3	+	1.2	1.3	+	40.5	43.5	+	60.5	62.0	+
Yrs. Prs. Job: 5-10	4.0	4.5	+	3.5	3.5	0	1.8	2.2	+	1.8	2.2	+	19.5	19.5	0	33.0	28.5	-
11-15	3.5	3.5	0	3.2	3.2	0	0.5	0.7	+	0.5	0.7	+	13.0	16.0	+	30.5	31.5	+
16-20	8.0	8.0	0	3.3	3.3	0	0.9	0.9	0	0.9	0.9	0	36.5	35.5	-	51.5	51.0	-
Shift:	7.0	11.0	+	3.8	3.5	-	0.7	1.1	+	0.7	1.1	+	24.5	25.0	+	37.5	38.0	+
Second	8.5	10.0	+	3.0	3.5	+	2.5	3.5	+	2.5	3.5	+	15.0	23.0	+	26.0	45.0	+
Third	8.0	9.0	+	3.5	3.5	0	1.1	1.2	+	1.1	1.2	+	27.0	27.5	+	42.5	46.5	+
Marital Stat: Married	2.0	3.5	+	4.0	3.5	-	2.0	2.5	+	2.0	2.5	+	2.5	1.5	-	7.0	3.5	-
Occupation: Foreman	2.8	2.8	-	1.8	2.8	+	0.4	0.5	+	0.4	0.5	+	5.0	5.5	+	6.5	15.5	+
Test/Inspect	10.5	12.0	+	3.3	3.5	+	1.0	1.1	+	1.0	1.1	+	51.0	51.5	+	33.0	34.0	+
Prod. Wkr.	4.0	3.7	-	3.1	2.7	-	0.5	0.5	0	0.5	0.5	0	28.5	28.5	0	47.5	44.5	-
Age: 56-65	5.5	5.0	-	4.0	3.2	-	0.2	0.2	0	0.2	0.2	0	29.5	37.5	+	44.0	29.5	-
Yrs. Prs. Job: 5-10	4.5	3.0	-	2.5	2.0	-	1.3	1.0	-	1.3	1.0	-	16.5	16.5	0	36.5	36.5	0
11-15	4.0	7.5	+	3.0	3.5	+	0.8	1.0	+	0.8	1.0	+	29.5	29.5	0	63.0	63.0	0
16-20	3.1	2.9	-	3.1	2.7	-	0.5	0.4	-	0.5	0.4	-	29.5	29.5	0	56.5	55.0	0
Shift:	4.3	4.5	+	3.5	3.5	0	0.5	0.8	+	0.5	0.8	+	16.5	18.0	+	33.5	33.5	0
Second	8.0	5.5	-	3.5	2.5	-	0.5	0.3	-	0.5	0.3	-	26.5	23.5	-	52.0	50.5	-
Third	4.0	3.5	-	3.0	2.5	-	0.6	0.5	-	0.6	0.5	-	28.5	28.5	0	47.5	44.5	-
Marital Stat: Married	4.0	3.5	-	8.5	8.5	0	1.3	1.3	0	1.3	1.3	0	20.5	19.5	-	54.0	44.5	-
Occupation: Foreman	3.2	6.5	+	2.5	2.5	0	0.8	0.8	0	0.8	0.8	0	30.0	30.0	0	60.5	60.5	0
Mach. Op.	7.5	4.0	-	3.5	2.5	-	0.3	0.2	-	0.3	0.2	-	31.5	30.5	-	54.5	54.5	0
Prod. Wkr.																		
Total Number of -			13			18			13						13			18
Total Number of +			14			6			15						11			9
Total Number of 0			8			11			7						11			8

Table 3-2. Summary Table of Sort-Groupings with Variations in Sample Sizes, Including Median Values and Direction of Differences (Low Noise Group, 1966-1970 Data, Full and Reduced Samples)

Group/Sub-Group Combination	MEDIAN VALUES																	
	Accidents			Diag. Med.			Sympt. Med.			Disc. Abs.			Days Abs.					
	Full Samp.	Red. Samp.	Dir. Diff.	Full Samp.	Red. Samp.	Dir. Diff.	Full Samp.	Red. Samp.	Dir. Diff.	Full Samp.	Red. Samp.	Dir. Diff.	Full Samp.	Red. Samp.	Dir. Diff.	Full Samp.	Red. Samp.	Dir. Diff.
Total Sample	0.4	0.4	0	0.6	0.6	0	0.3	0.3	0	4.2	4.2	0	8.8	8.8	0	13.5	13.5	0
Age: 26-35	0.4	0.4	0	0.5	0.5	0	0.3	0.3	0	5.8	5.3	0	13.5	12.5	0	10.5	9.5	0
Yrs. Prs. Job: 5-10	0.4	0.4	0	0.5	0.5	0	0.3	0.3	0	4.5	4.5	0	10.5	9.5	0	16.5	17.0	0
Shift: First	0.3	0.3	0	0.3	0.3	0	0.2	0.2	0	6.8	7.0	0	16.5	17.0	0	13.5	14.0	0
Marital Stat: Single	0.3	0.3	0	0.6	0.7	+	0.3	0.4	+	4.5	6.0	+	13.5	14.0	+	23.5	24.0	+
Married	0.5	0.4	-	0.4	0.4	0	0.3	0.3	0	6.0	6.2	+	13.5	12.5	-	8.9	9.1	+
Occupation: Eng./Draft.	0.3	0.2	-	0.3	0.3	0	0.2	0.2	0	8.9	9.1	+	23.5	24.0	+	0.4	0.4	0
Admin.	0.1	0.2	+	0.2	0.3	+	0.1	0.2	+	0.4	0.1	-	0.4	1.5	+	3.8	3.8	0
Age: 36-45	0.5	0.5	0	0.7	0.6	-	0.3	0.3	0	3.8	3.8	0	8.2	8.2	0	8.5	8.5	0
Yrs. Prs. Job: 5-10	1.2	1.3	+	0.8	0.7	-	0.4	0.4	0	3.8	3.8	0	8.5	8.5	0	3.0	3.0	0
11-15	0.2	0.1	-	1.5	1.2	-	0.4	0.3	-	4.3	4.3	0	7.5	7.5	0	4.3	4.3	0
Shift: First	0.3	0.3	0	0.5	0.5	0	0.2	0.2	0	3.5	3.5	0	7.0	7.0	0	3.5	3.5	0
Third	3.5	3.5	0	2.5	2.5	0	2.5	3.5	+	3.8	3.8	0	8.5	8.5	0	3.0	3.0	0
Marital Stat: Married	0.5	0.5	0	0.6	0.5	-	0.3	0.3	0	3.3	3.3	0	8.7	8.7	0	4.5	4.8	+
Occupation: Foreman	3.5	3.5	0	3.5	3.5	0	3.0	3.5	+	4.5	4.8	+	7.5	7.8	+	0.2	0.2	0
Test/Inspect	1.5	0.5	-	1.8	1.5	-	0.5	0.4	-	4.1	4.0	-	8.0	7.8	-	0.2	0.2	0
Eng./Draft.	0.2	0.2	0	0.3	0.2	-	0.1	0.1	0	3.9	3.9	0	8.0	7.8	-	0.2	0.2	0
Age: 46-55	0.4	0.4	0	0.4	0.4	0	0.2	0.2	0	3.5	3.5	0	7.0	7.0	0	4.0	4.0	0
Yrs. Prs. Job: 5-10	0.6	0.6	0	0.4	0.4	0	0.2	0.2	0	3.8	3.5	-	8.0	7.2	-	4.0	4.0	0
11-15	0.4	0.4	0	0.6	0.5	-	0.2	0.2	0	4.1	4.0	-	8.0	7.8	-	4.0	4.0	0
Shift: First	0.3	0.3	0	0.3	0.3	0	0.2	0.2	0	1.0	1.0	0	1.5	1.5	0	2.5	2.5	0
Third	4.8	5.2	+	1.5	2.5	+	1.0	2.0	+	4.0	3.9	-	8.3	8.0	-	4.0	4.0	0
Marital Stat: Married	0.4	0.4	0	0.5	0.4	-	0.2	0.2	0	14.0	14.0	0	67.0	66.5	-	4.2	4.2	0
Divorced	6.5	6.0	-	4.5	4.0	-	2.5	2.5	0	2.8	2.5	-	3.5	3.0	-	2.5	2.5	0
Occupation: Foreman	3.0	3.3	+	1.2	1.3	+	0.5	0.6	+	4.2	4.2	0	9.0	9.0	0	4.2	4.2	0
Eng./Draft.	0.1	0.2	+	0.3	0.3	0	0.1	0.1	0	4.2	4.2	0	8.5	8.5	0	4.2	4.2	0
Age: 56-65	0.5	0.5	0	1.2	1.2	0	0.2	0.2	0	4.2	4.5	+	8.5	8.5	0	4.2	4.2	0
Yrs. Prs. Job: 5-10	0.5	0.4	-	1.4	1.5	+	0.1	0.2	+	2.8	2.5	-	3.5	3.0	-	4.2	4.2	0
11-15	0.4	0.4	0	0.8	0.8	0	0.2	0.2	0	4.0	4.0	0	9.0	9.0	0	4.0	4.0	0
Shift: First	0.3	0.3	0	1.0	1.0	0	0.1	0.1	0	4.8	5.0	+	8.2	8.2	0	4.2	4.2	0
Marital Stat: Married	0.5	0.5	0	1.1	1.2	+	0.3	0.3	0	4.2	4.5	+	8.2	8.2	0	4.2	4.2	0
Occupation: Foreman	2.7	2.8	+	2.1	2.3	+	0.7	0.8	+	3.3	3.3	0	8.0	8.0	0	4.5	4.5	+
Eng./Draft.	0.1	0.1	0	0.9	0.9	0	0.0	0.1	+	4.5	5.0	+	8.5	9.5	+	1.5	1.5	0
Admin.	0.3	0.5	+	0.5	1.0	+	0.0	0.0	0	1.5	4.5	+	1.5	7.0	+	2	2	0
Total Number of -			6			9			2			6			12			7
Total Number of +			7			8			9			10			15			15
Total Number of 0			21			17			23			18			15			15

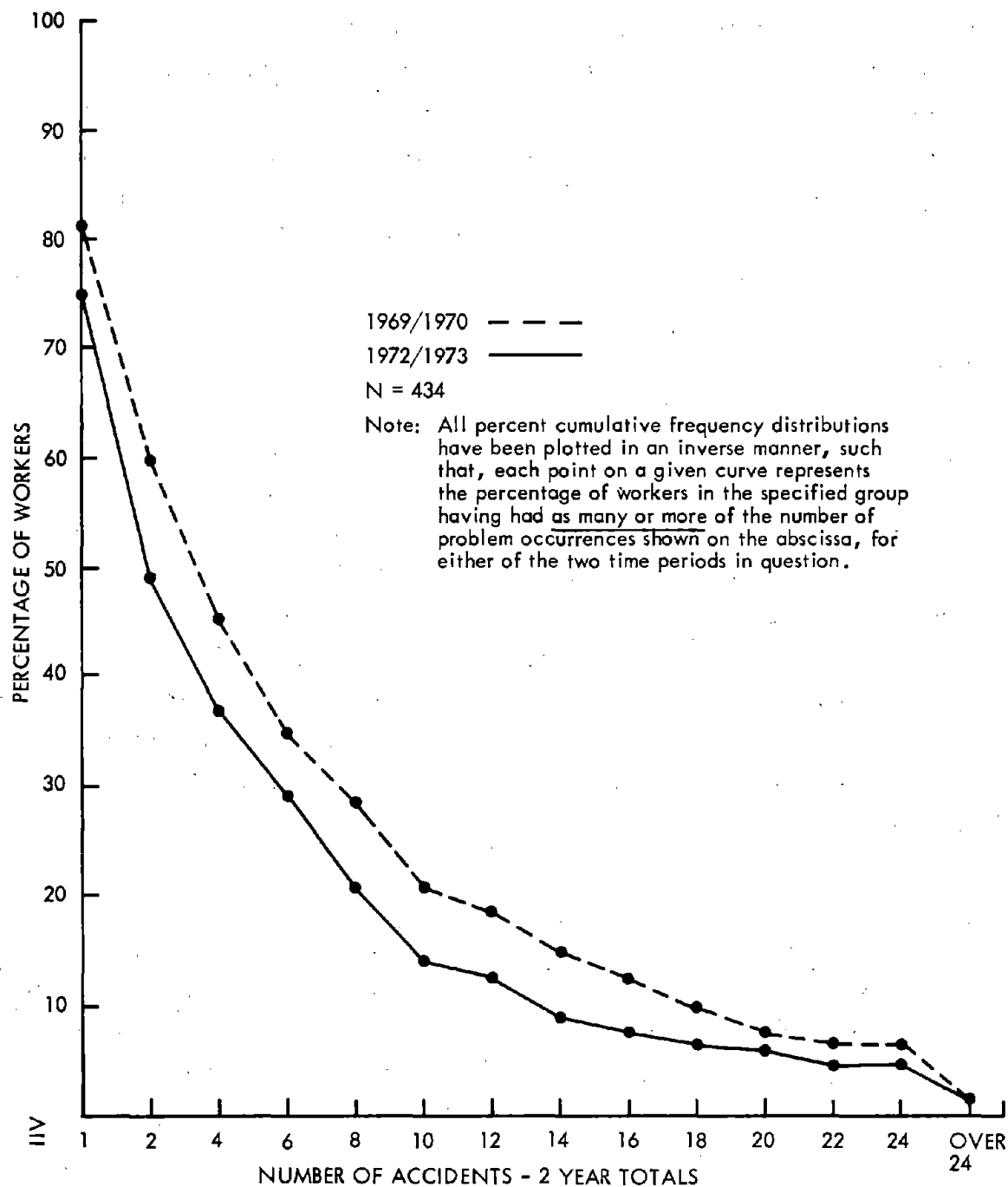


Figure 3-1. Cumulative Percent Frequency Distribution of Workers from the High Noise Group with a Specifiable Number of Accidents in the 2-Year Periods Before (1969/1970) and After (1972/1973) the Advent of a Company Hearing Conservation Program

A comparison of the median frequency of accidents for the two time periods is presented in Figure 3-2. Accident frequencies between the two time periods were tested statistically (Wilcoxon Matched-Pairs Signed-Ranks Test) and yielded a significant difference at the .01 level of confidence (see Table 3-6). The indicated difference in median accident frequency between the two time periods was in the predicted direction (i.e., fewer accidents subsequent to the advent of the hearing conservation program (1972/1973)).

- Results by Age

Figure 3-3 illustrates the comparisons of the median frequencies of accidents for the two time periods for different worker age groups. Median frequencies of accidents were lower for the 1972/1973 time period as compared with the 1969/1970 period for all age groups. However, there was a trend for the median values to decrease with increasing age in both time periods with the relative difference between the two periods also becoming smaller with increasing age. The results of statistical comparisons by age groups are included in Table 3-6. Significant differences were observed (at the .01 level) for all but the oldest (56-65 yr.) age group.

- Results by Experience (Years at Present Job)

Figure 3-4 provides a graphic comparison of average frequencies of accidents for the two time periods, by experience. For the four (4) experience levels shown, average frequencies of accidents were lower for the 1972/1973 period than for the 1969/1970 period. Similar to the age variations above, accident frequencies generally showed a decrease with increasing experience, for both time periods. Although statistical comparisons were not performed on these data, the magnitude and uniform direction of the differences is noteworthy.

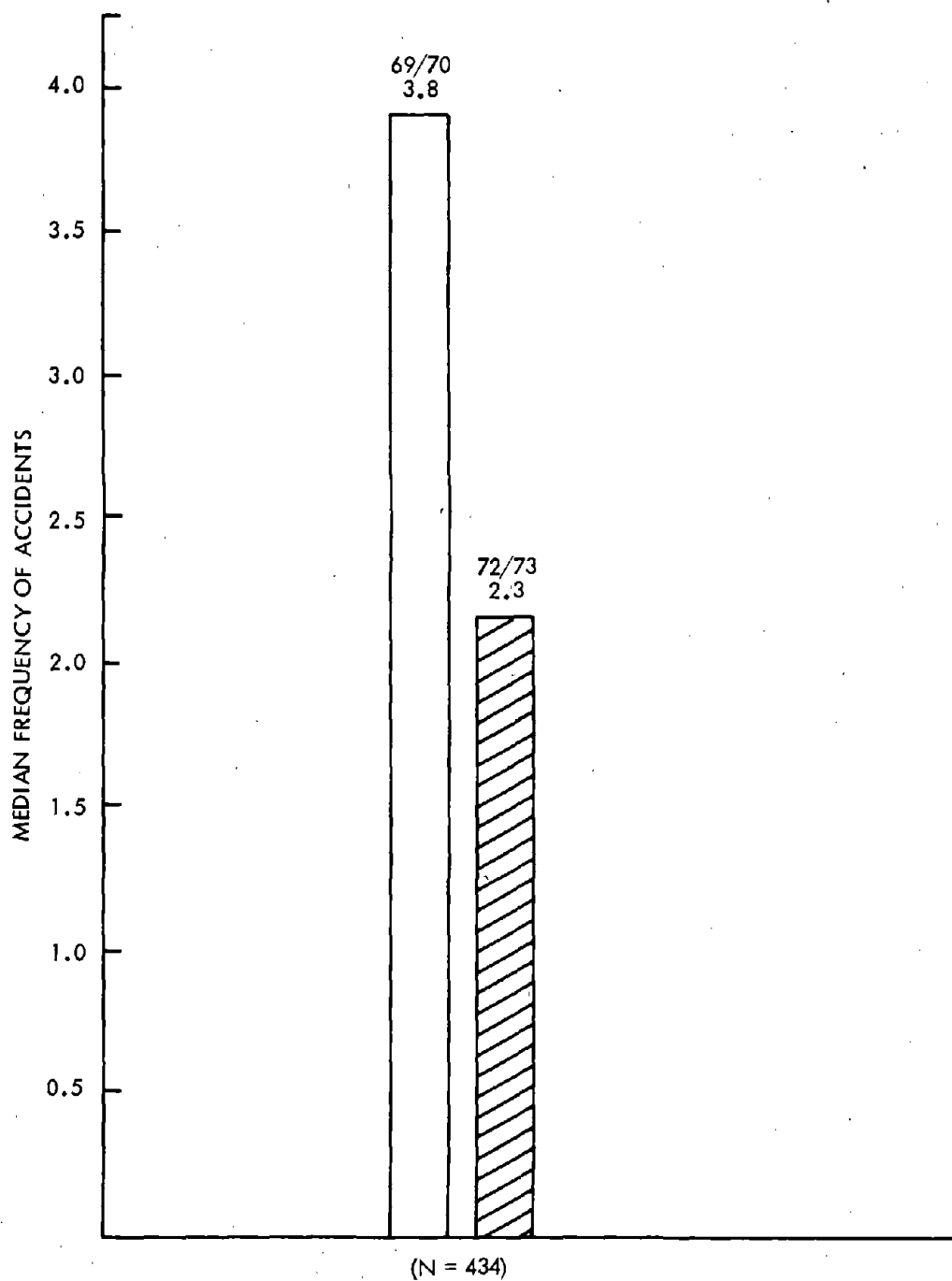


Figure 3-2. Median Frequencies of Accidents for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

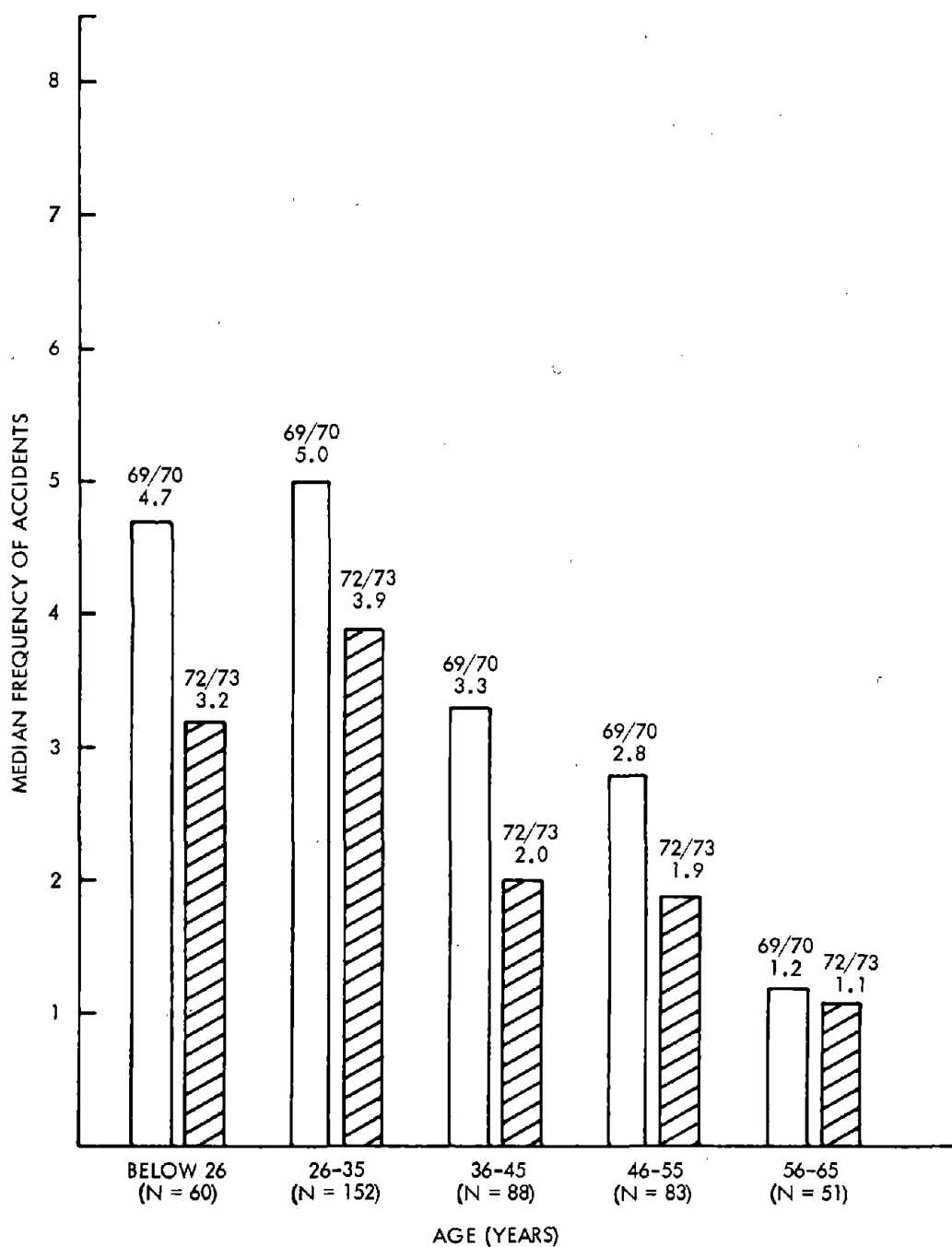


Figure 3-3. Median Frequencies of Accidents, by Age, for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

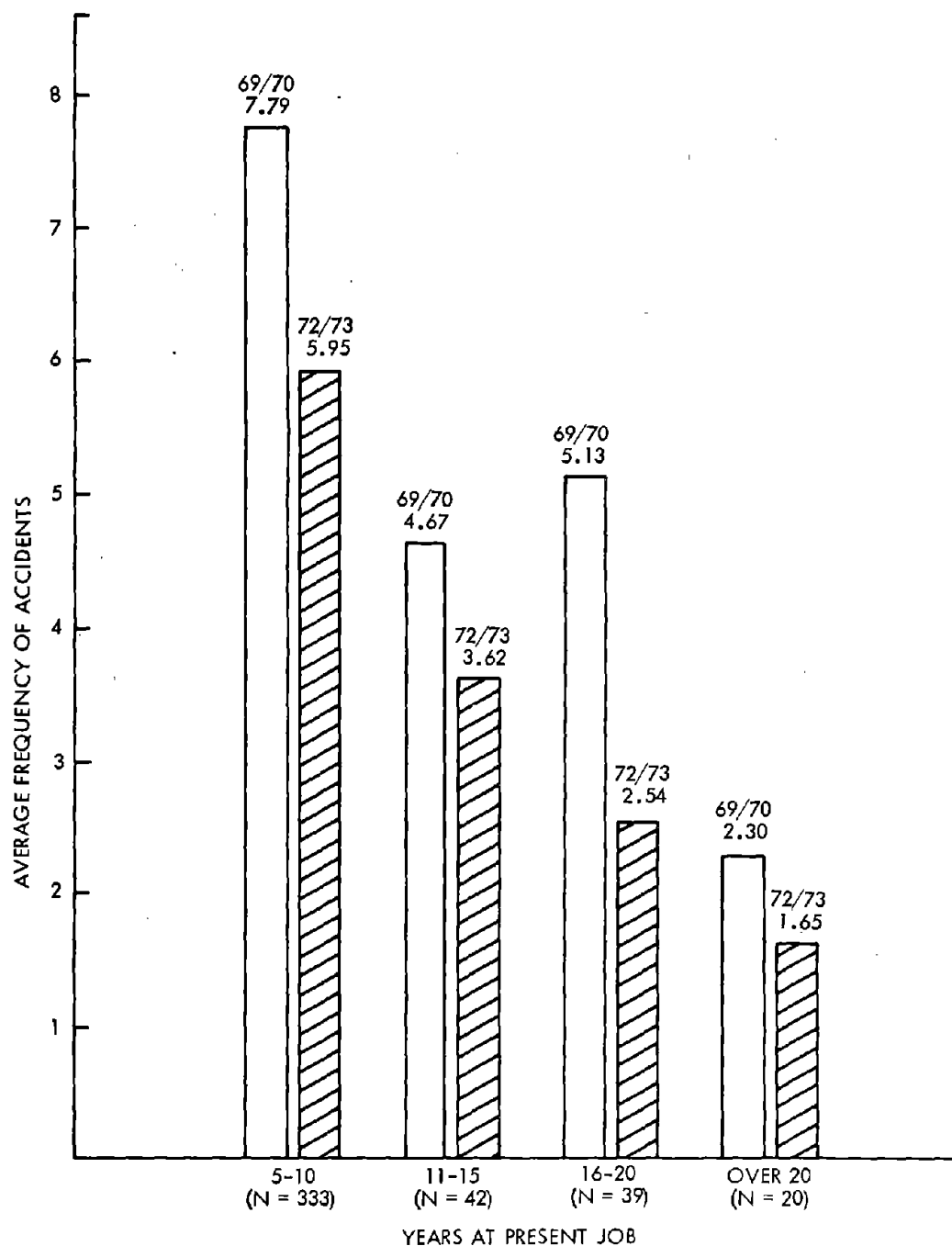


Figure 3-4. Average Frequencies of Accidents, by Years at Present Job, for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

- Results by Age - Experience Combinations

Median frequencies of accidents for specified age-experience combinations are presented in Table 3-3. In eleven out of fifteen comparisons, the differences between the two time periods indicated fewer accidents in the 1972/1973 period versus the 1969/1970 period as hypothesized. Less than half of these differences attained statistical significance, most of these occurring in the shortest service groups of variable age (see Table 3-6).

- Results by Shift

Table 3-4 presents a comparison of average frequencies of accidents for the 1969/1970 vs. 1972/1973 time periods, by work shift. For all four (4) work shifts, the average frequency of accidents was lower during the 1972/1973 time period than during the 1969/1970 time period. Statistical tests were not performed on these comparisons. However, Wilcoxon Test results for shift-by-age are included in Table 3-6, and indicate significant differences in the predicted direction (1972/1973 frequencies lower than 1969/1970 frequencies) in the First, Second and Third Shifts, for several of the various age categories. In all, 7 of the 15 age/shift comparisons proved to be statistically significant.

- Results by Job Type

Comparisons of average frequencies of accidents by job type (shown in Table 3-5) for the two time periods showed mixed results. The Test and Inspector, Machine Operator, Administrator, and Production Worker job categories showed differences in the predicted direction, while the Foreman and Plant Support job categories showed a difference in the opposite direction; and no difference, respectively. Again, these comparisons were not tested. However, job type-by-age statistical comparisons are included in Table 3-6. These results indicated significant differences in the predicted direction in the Machine Operator

Table 3-3. Age-Experience Comparisons of Median Frequencies of Accidents for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

	Age (Years)									
	Below 26		26-35		35-45		46-55		56-65	
	1969/ 1970	1972/ 1973	1969/ 1970	1972/ 1973	1969/ 1970	1972/ 1973	1969/ 1970	1972/ 1973	1969/ 1970	1972/ 1973
Years at Present Job										
5-10	(Sig. < .05) 4.8 (59)	(Sig. < .01) 3.3 (59)	(Sig. < .01) 5.0 (146)	(Sig. < .01) 3.9 (146)	(Sig. < .05) 3.0 (66)	(Sig. < .05) 2.0 (66)	(Sig. < .01) 4.6 (41)	(Sig. < .01) 2.2 (41)	2.0 (21)	1.5 (21)
11-15	4.0 (1)	0.0 (1)	(Sig. < .05) 7.5 (6)	(Sig. < .05) 3.0 (6)	4.5 (10)	4.0 (10)	1.5 (15)	2.5 (15)	0.5 (10)	1.2 (10)
16-20	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	(Sig. < .05) 3.5 (12)	(Sig. < .05) 0.4 (12)	(Sig. < .05) 1.1 (20)	(Sig. < .05) 1.2 (20)	(Sig. < .05) 3.5 (7)	(Sig. < .05) 0.5 (7)
Over 20	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	3.0 (7)	2.0 (7)	0.8 (13)	1.2 (13)

Notes: 1 Numbers In Parentheses Refer to Sample Sizes

2 Parenthetic expressions (Sig. < .01 or < .05) indicate statistically significant differences in comparing the data collected over the two time periods, based upon Wilcoxon Matched-Pair Signed-Ranks Tests.

Table 3-4. Comparison of Average Frequencies of Accidents,
for High Noise Group, by Shift, During the 1969/1970
vs 1972/1973 Time Periods

	Shift 1	Shift 2	Shift 3	Rotating Shift
1969/ 1970	5.81 (210)	7.74 (125)	8.69 (96)	4.33 (3)
1972/ 1973	4.78 (210)	5.34 (125)	6.13 (96)	2.33 (3)

Note: Numbers in Parentheses Refer to Sample Sizes

Table 3-5. Comparison of Average Frequencies of Accidents, by Job Type, for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

	Job Type					
	Foreman	Test and Inspect	Machine Operator	Plant Support	Administrator	Production Worker
1969/1970	1.03 (32)	1.64 (47)	6.44 (86)	0.50 (2)	2.60 (10)	14.04 (167)
1972/1973	1.47 (32)	1.47 (47)	4.81 (86)	0.50 (2)	2.10 (10)	8.63 (167)

Note: Numbers in Parentheses Refer to Sample Sizes

Table 3-6. Results of Wilcoxon Matched-Pairs Signed-Ranks Tests, Comparing 1969/1970 Data With 1972/1973 Data, With Respect to Frequency of Accidents in High Noise Group

Null Hypothesis - 1969/70 Data is Equivalent to 1972/1973 Data
 Test Hypothesis - 1972/73 Data is Less Than 1969/70 Data

Sort Factors		Z	Significance
Total Sample-	434		
	Freq. of Accidents	-5.6299	0.0 **
Age Group-	Below 26		
Sample-	60		
	Freq. of Accidents	-2.1491	0.0158**
Age Group-	26 - 35		
Sample-	152		
	Freq. of Accidents	-3.9532	0.0 **
Age Group-	36 - 45		
Sample-	88		
	Freq. of Accidents	-2.3701	0.0089**
Age Group-	46 - 55		
Sample-	83		
	Freq. of Accidents	-2.5701	0.0051**
Age Group-	56 - 65		
Sample-	51		
	Freq. of Accidents	-0.4996	0.3087
Age Group-	26 - 35		
Occup. Title-	Foreman		
Sample-	8		
	Freq. of Accidents	-1.0954	0.1367

Notes: (1) A negative (-) 'Z' value indicates a difference in the predicted (test hypothesis) direction, while a positive (+) 'Z' value indicates a difference in a direction opposite to the test hypothesis.
 (2) Statistical significance indicated by: * = .05 level; and ** = .01 level.

Table 3-6. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests:
 Accidents

Sort Factors		Z	Significance
Age Group- 36 - 45 Occup. Title-Foreman			
Sample- 5	Freq. of Accidents	-1.0954	0.1367
Age Group- 46 - 55 Occup. Title-Foreman			
Sample- 9	Freq. of Accidents	2.0284	0.9787
Age Group- 56 - 65 Occup. Title-Foreman			
Sample- 10	Freq. of Accidents	1.1832	0.8816
Age Group- Below 26 Occup. Title-Test & I			
Sample- 6	Freq. of Accidents	-1.2136	0.1125
Age Group- 26 - 35 Occup. Title-Test & I			
Sample- 8	Freq. of Accidents	0.8090	0.7908
Age Group- 36 - 45 Occup. Title-Test & I			
Sample- 18	Freq. of Accidents	0.6989	0.7577
Age Group- 46 - 55 Occup. Title-Test & I			
Sample- 11	Freq. of Accidents	-0.0700	0.4721

Table 3-6. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests:
 Accidents

Sort Factors		Z	Significance
Age Group- 56 - 65 Occup. Title-Test & I			
Sample- 4	Freq. of Accidents	0.2673	0.6054
Age Group- Below 26 Occup. Title-Mach. Op.			
Sample- 18	Freq. of Accidents	-2.2493	0.0122**
Age Group- 26 - 35 Occup. Title-Mach. Op.			
Sample- 28	Freq. of Accidents	-1.2470	0.1062
Age Group- 36 - 45 Occup. Title-Mach. Op.			
Sample- 17	Freq. of Accidents	0.0942	0.5375
Age Group- 46 - 55 Occup. Title- Mach. Op.			
Sample- 13	Freq. of Accidents	-1.2944	0.0978
Age Group- 56 - 65 Occup. Title-Mach. Op.			
Sample- 10	Freq. of Accidents	-1.0142	0.1552
Age Group- 56 - 65 Occup. Title-Admin.			
Sample- 4	Freq. of Accidents	0.0	0.5000

Table 3-6. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests:
Accidents

Sort Factors		Z	Significance
Age Group- Below 26 Occup. Title-Prod. Wk.			
Sample- 35	Freq. of Accidents	-0.4702	0.3191
Age Group- 26 - 35 Occup. Title-Prod. Wk.			
Sample- 105	Freq. of Accidents	3.9689	0.0000**
Age Group- 36 - 45 Occup. Title-Prod. Wk.			
Sample- 48	Freq. of Accidents	-2.8747	0.0020**
Age Group- 46 - 55 Occup. Title-Prod. Wk.			
Sample- 47	Freq. of Accidents	-2.9221	0.0017**
Age Group- 56 - 65 Occup. Title-Prod. Wk.			
Sample- 22	Freq. of Accidents	-0.4544	0.3248
Age Group- Below 26 Shift- First			
Sample- 23	Freq. of Accidents	-0.1786	0.4291
Age Group- 26 - 35 Shift- First			
Sample- 57	Freq. of Accidents	-2.0690	0.0193

Table 3-6. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests:
Accidents

	Sort Factors	Z	Significance
Age Group- 36 - 45 Shift- First			
Sample- 53	Freq. of Accidents	-2.2037	0.0138**
Age Group- 46 - 55 Shift- First			
Sample- 46	Freq. of Accidents	-1.8211	0.0343
Age Group- 56 - 65 Shift- First			
Sample- 31	Freq. of Accidents	0.1811	0.5719
Age Group- Below 26 Shift- Second			
Sample- 13	Freq. of Accidents	-1.2448	0.1066
Age Group- 26 - 35 Shift- Second			
Sample- 50	Freq. of Accidents	-2.9571	0.0016**
Age Group- 36 - 45 Shift- Second			
Sample- 24	Freq. of Accidents	-0.5207	0.3013
Age Group- 46 - 55 Shift- Second			
Sample- 25	Freq. of Accidents	-1.6424	0.0503*

Table 3-6. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests:
 Accidents

	Sort Factors	Z	Significance
Age Group- 56 - 65 Shift- Second			
Sample- 13	Freq. of Accidents	1.0703	0.1423
Age Group- Below 26 Shift- Third			
Sample- 24	Freq. of Accidents	-2.0453	0.0204
Age Group- 26 - 35 Shift- Third			
Sample- 45	Freq. of Accidents	-1.8077	0.0353
Age Group- 36 - 45 Shift- Third			
Sample- 10	Freq. of Accidents	-0.1185	0.5472
Age Group- 46 - 55 Shift- Third			
Sample- 11	Freq. of Accidents	-0.5606	0.2875
Age Group- 56 - 65 Shift- Third			
Sample- 6	Freq. of Accidents	-0.4045	0.3429
Age Group- Below 26 Yrs. Pres. Job- 5-10			
Sample- 59	Freq. of Accidents	-2.0320	0.0211*

Table 3-6. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests:
Accidents

Sort Factors		Z	Significance
Age Group- 26 - 35 Yrs. Pres. Job- 5-10			
Sample- 146	Freq. of Accidents	-3.6009	0.0002**
Age Group- 36 - 45 Yrs. Pres. Job- 5-10			
Sample- 66	Freq. of Accidents	-1.5983	0.0550*
Age Group- 46 - 55 Yrs. Pres. Job- 5-10			
Sample- 41	Freq. of Accidents	-2.4282	0.0076**
Age Group- 56 - 65 Yrs. Pres. Job- 5-10			
Sample- 21	Freq. of Accidents	0.2197	0.5870
Age Group- 26 - 35 Yrs. Pres. Job- 11-15			
Sample- 6	Freq. of Accidents	-2.0226	0.0216*
Age Group- 36 - 45 Yrs. Pres. Job- 11-15			
Sample- 10	Freq. of Accidents	-1.1255	0.1302
Age Group- 46 - 55 Yrs. Pres. Job- 11-15			
Sample- 15	Freq. of Accidents	1.4125	0.9211

Table 3-6. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests:
 Accidents

Sort Factors		Z	Significance
Age Group- 56 - 65 Yrs. Pres. Job- 11-15			
Sample- 10	Freq. of Accidents	0.1690	0.5671
Age Group- 36 - 45 Yrs. Pres. Job- 16-20			
Sample- 12	Freq. of Accidents	-1.5993	0.0549*
Age Group- 46 - 55 Yrs. Pres. Job- 16-20			
Sample- 20	Freq. of Accidents	-1.7042	0.0442
Age Group- 56 - 65 Yrs. Pres. Job- 16-20			
Sample- 7	Freq. of Accidents	-1.8257	0.0339
Age Group- 46 - 55 Yrs. Pres. Job- Over 20			
Sample- 7	Freq. of Accidents	-1.0690	0.1425
Age Group- 56 - 65 Yrs. Pres. Job- Over 20			
Sample- 13	Freq. of Accidents	0.7135	0.7622

and Production Worker job categories in a few instances. In actuality, these jobs due to their nature might be more risky than the others so that benefits from the noise reduction might be more apparent here. On the other hand, the Machine Operator and Production Worker categories had a larger number of workers than the other categories which could explain these differential results.

- Results by Ratings of Ear Protector Usage (Primary Method)

Figure 3-5 presents a comparison of median frequencies of accidents for each of the four (4) ratings of ear protector usage (Primary Method). The differences observed between the 1969/1970 time period and the 1972/1973 time period were all in the predicted direction, independent of protector usage rating. The magnitude of the differences appeared to systematically decrease with decreasing protector usage, as expected, except for the "Never" rating, which showed a relatively large difference. Significant differences in the accident frequencies between the two time periods were noted only for the "Always" and "Never" ratings of ear protector use (see Table 3-7).

- Results by Ratings of Ear Protector Usage (Primary Method), by Age

Before-after comparisons of accident frequency by ear protector use did not yield consistent results in the expected direction when classified by age, as shown in Figures 3-6, 3-7, 3-8, 3-9, and 3-10. No age group displayed a progressive reduction in the numbers of accidents in the 1972/1973 period relative to the 1969/1970 with decreasing use of ear protection as was expected. While only those differences favoring the test hypothesis, i.e., 1972/1973 accident frequencies less than 1969/1970, attained significance, they were scattered among the various ear protector use by age comparisons and revealed no clear trend (see Table 3-7).

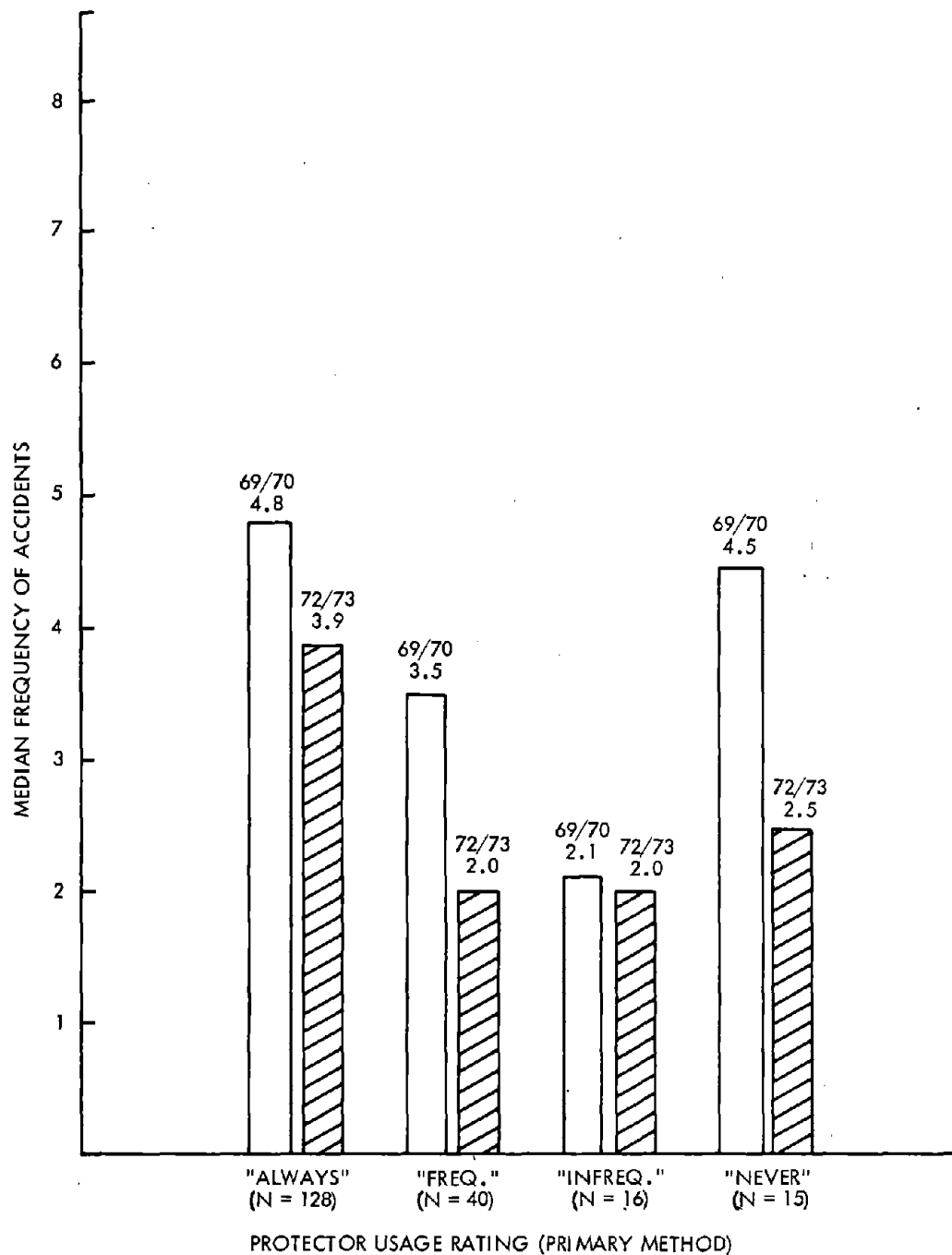


Figure 3-5. Median Frequencies of Accidents for High Noise Group, by Protector Usage Rating (Primary Method), During the 1969/1970 vs 1972/1973 Time Periods

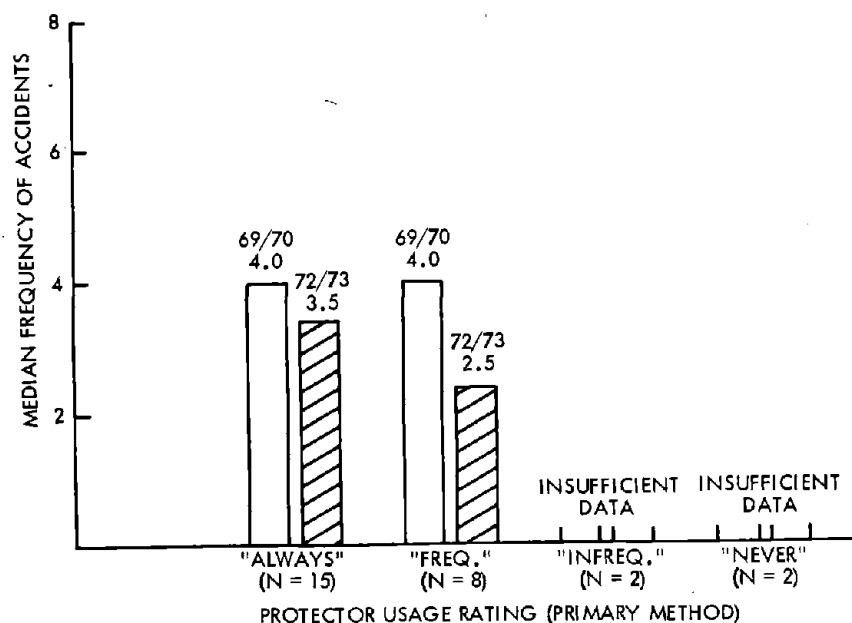


Figure 3-6. Median Frequencies of Accidents for High Noise Group, by Protector Usage Rating (Primary Method), for the "Below 26" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

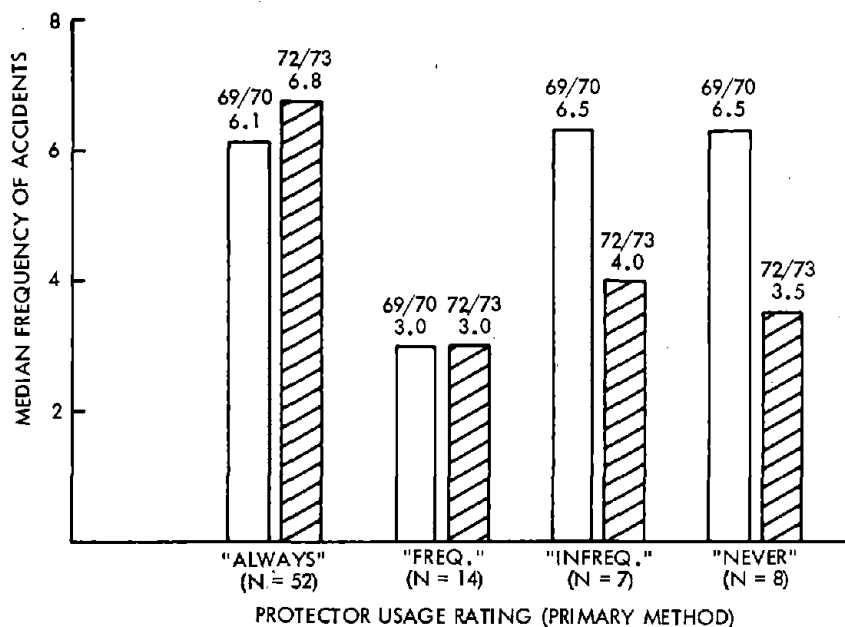


Figure 3-7. Median Frequencies of Accidents for High Noise Group, by Protector Usage Rating (Primary Method), for the "26-35" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

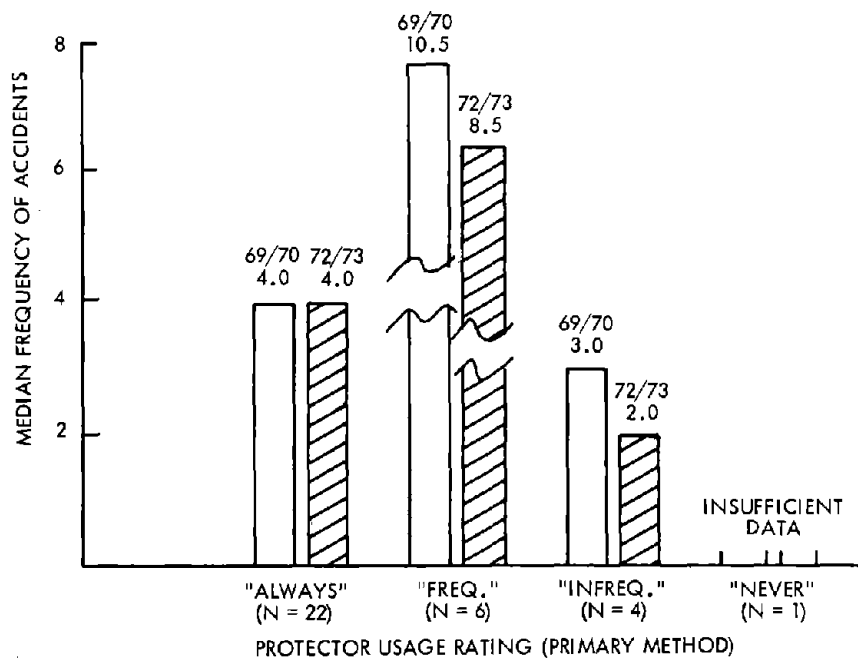


Figure 3-8. Median Frequencies of Accidents for High Noise Group, by Protector Usage Rating (Primary Method), for the "36-45" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

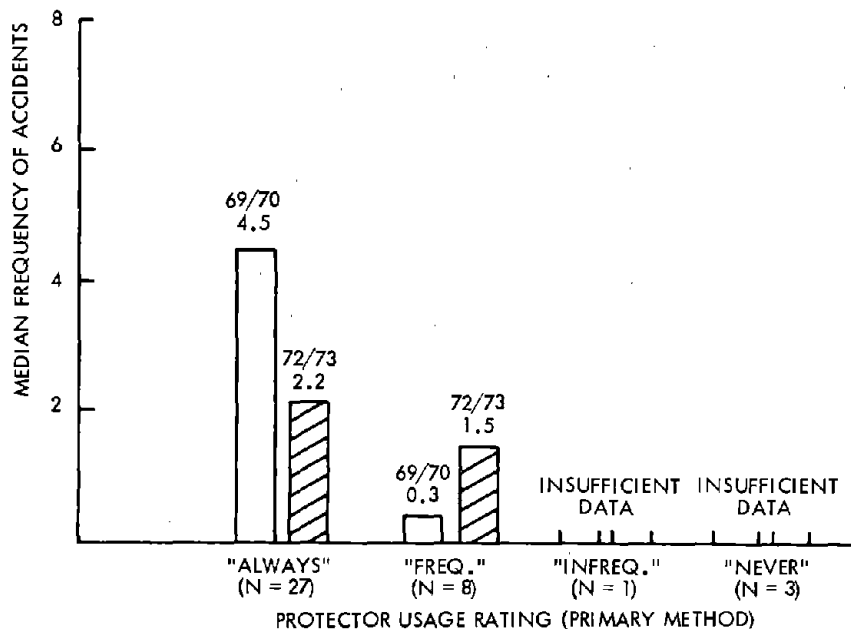


Figure 3-9. Median Frequencies of Accidents for High Noise Group, by Protector Usage Rating (Primary Method), for the "46-55" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

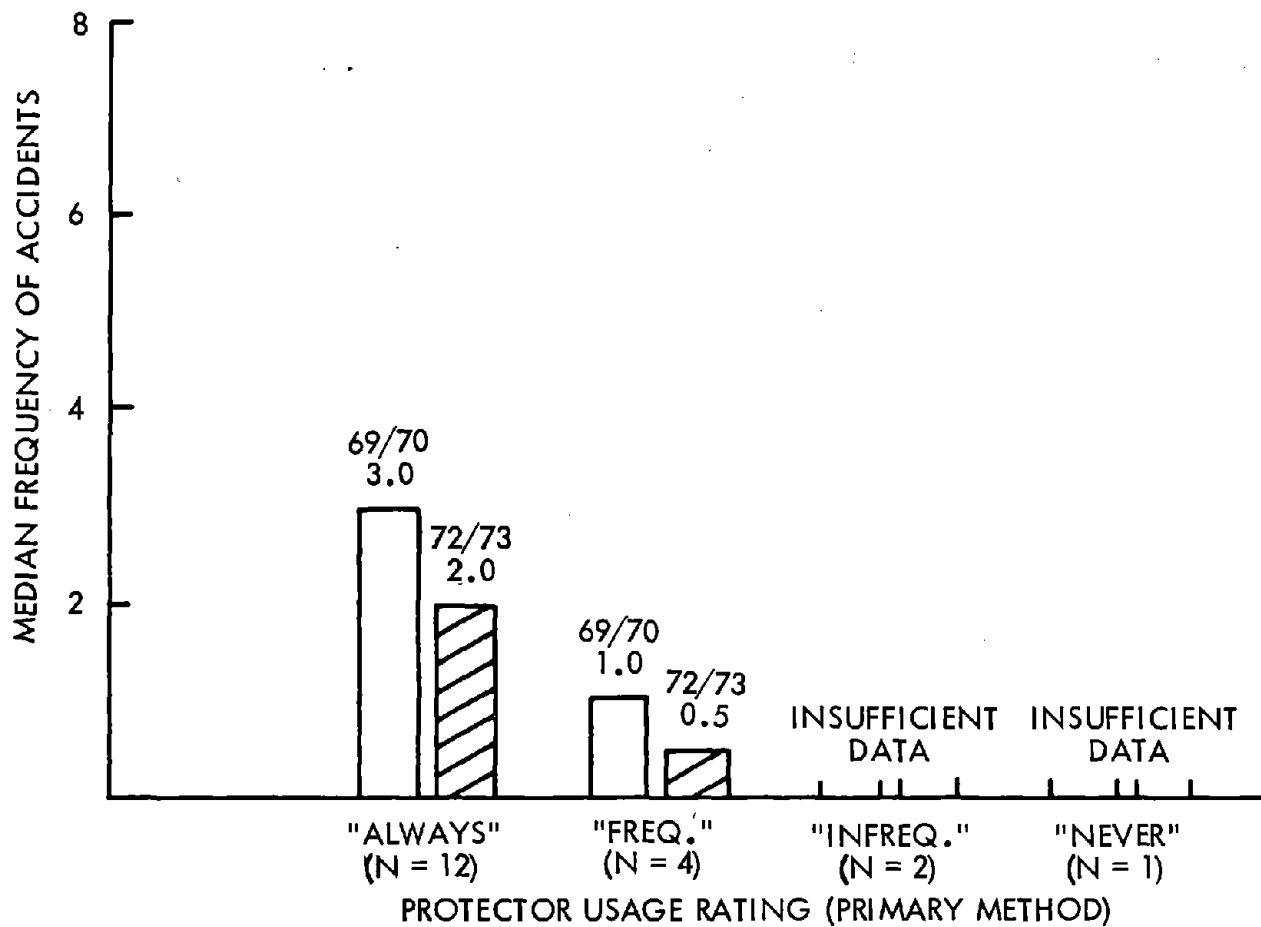


Figure 3-10. Median Frequencies of Accidents for High Noise Group, by Protector Usage Rating (Primary Method), for the "56-65" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

Table 3-7. Results of Wilcoxon Matched-Pairs Signed-Ranks Tests, Comparing 1969/1970 Data With 1972/1973 Data, for Various Ratings (Primary Rating Method) of Ear Protector Usage, With Respect to Frequency of Accidents in High Noise Group

Null Hypothesis - 1969/70 Data is Equivalent to 1972/73 Data
 Test Hypothesis - 1972/73 Data is Less Than 1969/70 Data

Sort Factors		Z	Significance
Ear Protector Usage- Always			
Sample- 128	Total	-2.6097	0.0045**
Ear Protector Usage- Frequent			
Sample- 40	Total	-1.0899	0.1379
Ear Protector Usage- Infrequent			
Sample- 16	Total	-0.9784	0.1639
Ear Protector Usage- Never			
Sample- 15	Total	-1.6008	0.0547*
Ear Protector Usage- Always Age Group- Below 26			
Sample- 15	Total	0.1420	0.5565
Ear Protector Usage- Frequent Age Group- Below 26			
Sample- 8	Total	-0.7606	0.2234

Note: (1) A negative (-) 'Z' value indicates a difference in the predicted (test hypothesis) direction, while a positive 'Z' indicates a difference in a direction opposite to the hypothesis.
 (2) Statistical significance indicated by asterisks; * .05 level, ** .01 level.

Table 3-7. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
 Usage (Primary Rating Method): Accidents

Sort Factors		Z	Significance
Ear Protector Usage- Always			
Age Group-	26 - 35		
Sample-	52		
	Total	1.8254	0.0340*
Ear Protector Usage- Frequent			
Age Group-	26 - 35		
Sample-	14		
	Total	-2.0396	0.0207*
Ear Protector Usage- Infreqnt			
Age Group-	26 - 35		
Sample-	7		
	Total	-0.8452	0.1990
Ear Protector Usage- Never			
Age Group-	26 - 35		
Sample-	8		
	Total	-1.3303	0.0917
Ear Protector Usage- Always			
Age Group-	36 - 45		
Sample-	22		
	Total	-0.8057	0.2102
Ear Protector Usage- Frequent			
Age Group-	36 - 45		
Sample-	6		
	Total	0.9439	0.8274
Ear Protector Usage- Infreqnt			
Age Group-	36 - 45		
Sample-	4		
	Total	-1.6036	0.0544*

Table 3-7. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
 Usage (Primary Rating Method): Accidents

Sort Factors		Z	Significance
Ear Protector Usage- Always Age Group- 46 - 55 Sample- 27	Total	-2.2350	0.0127**
Ear Protector Usage- Frequent Age Group- 46 - 55 Sample- 8	Total	1.2603	0.8962
Ear Protector Usage- Always Age Group- 56 - 65 Sample- 12	Total	-0.3556	0.3611
Ear Protector Usage- Frequent Age Group- 56 - 65 Sample- 4	Total	-1.0000	0.1587
Ear Protector Usage- Always Age Group- Below 26 Sample- 15	Total	0.1420	0.5565
Ear Protector Usage- Always Age Group- 26 - 35 Sample- 51	Total	-1.7044	0.0442*
Ear Protector Usage- Always Age Group- 26 - 35 Yrs. Pres. Job- 5-10 Sample- 51	Total	-1.7044	0.0442*

Table 3-7. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
 Usage (Primary Rating Method): Accidents

Sort Factors		Z	Significance
Ear Protector Usage- Always Age Group- 36 - 45 Yrs. Pres. Job- 5-10 Sample- 17			
Total		-0.9784	0.1639
Ear Protector Usage- Always Age Group- 46 - 55 Yrs. Pres. Job- 5-10 Sample- 21			
Total		-1.3382	0.0904
Ear Protector Usage- Always Age Group- 56 - 65 Yrs. Pres. Job- 5-10 Sample- 7			
Total		1.4676	0.9289
Ear Protector Usage- Frequent Age Group- Below 26 Yrs. Pres. Job- 5-10 Sample- 8			
Total		-0.7606	0.2234
Ear Protector Usage- Frequent Age Group- 26 - 35 Yrs. Pres. Job- 5-10 Sample- 12			
Total		-1.7782	0.0377*
Ear Protector Usage- Frequent Age Group- 36 - 45 Yrs. Pres. Job- 5-10 Sample- 5			
Total		-0.9439	0.8274

Table 3-7. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
 Usage (Primary Rating Method): Accidents

Sort Factors		Z	Significance
Ear Protector Usage-Infreqnt Age Group- 26-35 Yrs. Pres. Job- 5-10 Sample- 6	Total	-0.6290	0.2647
Ear Protector Usage-Never Age Group- 26 - 35 Yrs. Pres. Job- 5-10 Sample- 7	Total	-1.0987	0.1359
Ear Protector Usage-Always Yrs. Pres. Job- 5-10 Sample- 111	Total	-1.8073	0.0354*
Ear Protector Usage-Frequent Yrs. Pres. Job- 5-10 Sample- 29	Total	-0.0286	0.1518
Ear Protector Usage-Infreqnt Yrs. Pres. Job- 5-10 Sample- 12	Total	-1.0703	0.1423
Ear Protector Usage-Never Yrs. Pres. Job- 5-10 Sample- 12	Total	-1.2551	0.1047
Ear Protector Usage-Always Yrs. Pres. Job- 11-15 Sample- 7	Total	-1.4368	0.0754

Table 3-7. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
 Usage (Primary Rating Method): Accidents

Sort Factors		Z	Significance
Ear Protector Usage- Frequent Yrs. Pres. Job- 11-15			
Sample- 5	Total	0.3651	0.6425
Ear Protector Usage- Always Yrs. Pres. Job- 16-20			
Sample- 7	Total	-1.6903	0.0455*
Ear Protector Usage- Frequent Yrs. Pres. Job- 16-20			
Sample- 4	Total	-0.8018	0.2113

- Results by Ratings of Ear Protector Usage (Secondary Method)

Figure 3-11 shows the median frequencies of accidents before and after the issuance of ear protectors for those workers in the High-Noise Group found to be wearing ("Yes") or not wearing ("No") them during unannounced visits by the study director to their work areas. None of these workers could be rated by the primary method so this secondary method was used. As shown, the accident frequencies for the 1972/1973 vs. 1969/1970 time periods yielded differential effects of an expected nature; the differences being greater for the users of ear protection than for the non-users. Statistical analyses showed the user group to have a significant lowering of their accident rate relative to the pre-hearing conservation time period, with the non-users having non-significant reduction. The results of these analyses are found in Table 3-8.

- Results by Ratings of Ear Protector Usage (Secondary Method) by Age

Less consistent evidence for observed use or non-use of ear protectors in affecting accident frequency is seen in the evaluations by age (See Figure 3-12). Indeed, those not wearing ear protectors show as much relative reduction in accident occurrences as those who do in many of the age groups. On the other hand, the users in 3 out of 5 age groups showed a lower median number of accidents in the post-hearing conservation period than did the non-users. Statistical analysis of the differences between the accident frequencies for the 1972/1973 vs. 1969/1970 time periods by ear protection use and age are summarized in Table 3-8. Significant difference in the expected direction were mostly found for the user group.

- Accidents in the Low-Noise Group

The frequencies of accidents in the Low-Noise Group for 1969/1970 vs. 1972/1973 were compared as a control factor to ascertain any plant-wide changes in such problems over the time periods of data collection.

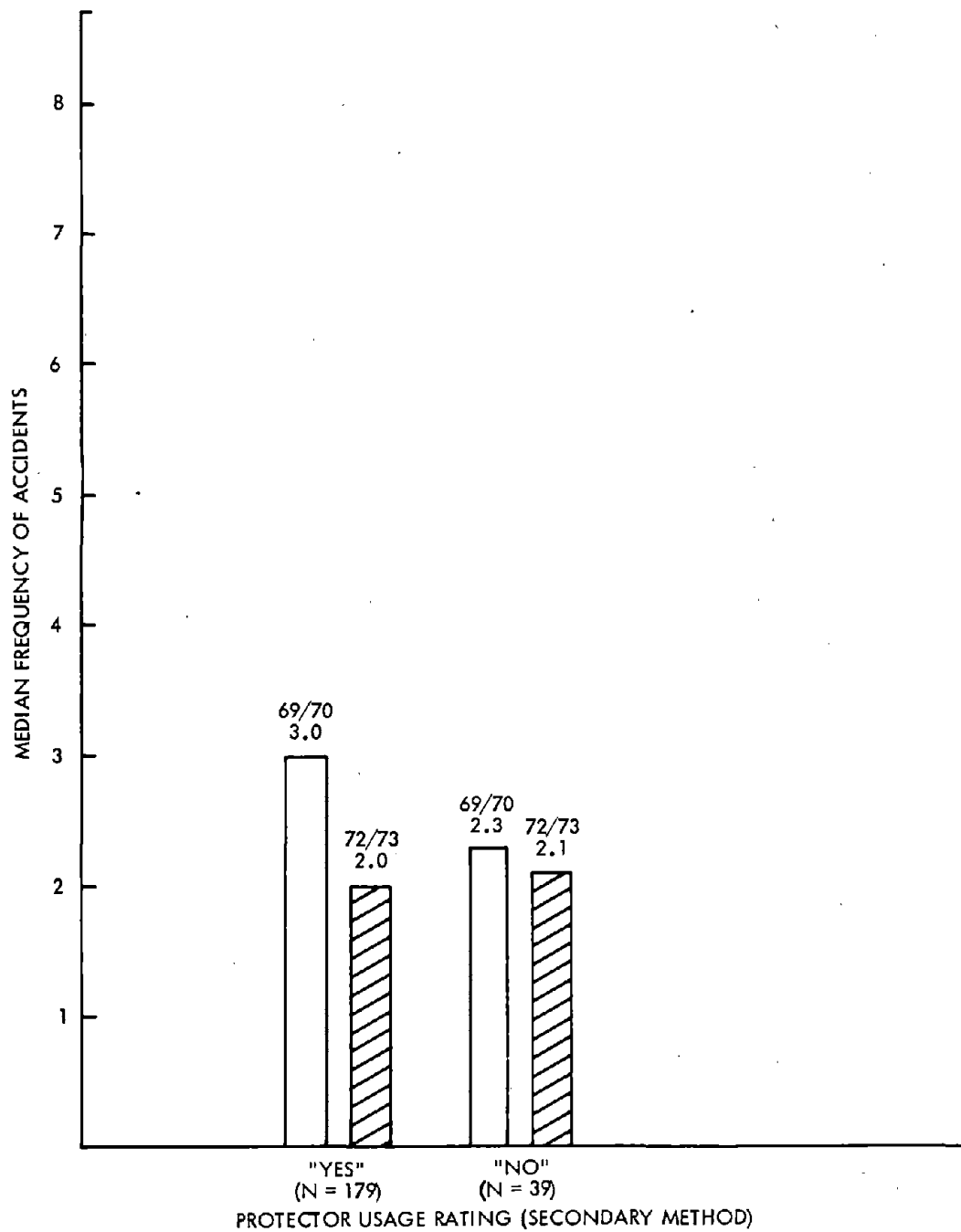


Figure 3-11. Median Frequencies of Accidents for High Noise Group, by Protector Usage Rating (Secondary Method), During the 1969/1970 vs 1972/1973 Time Periods

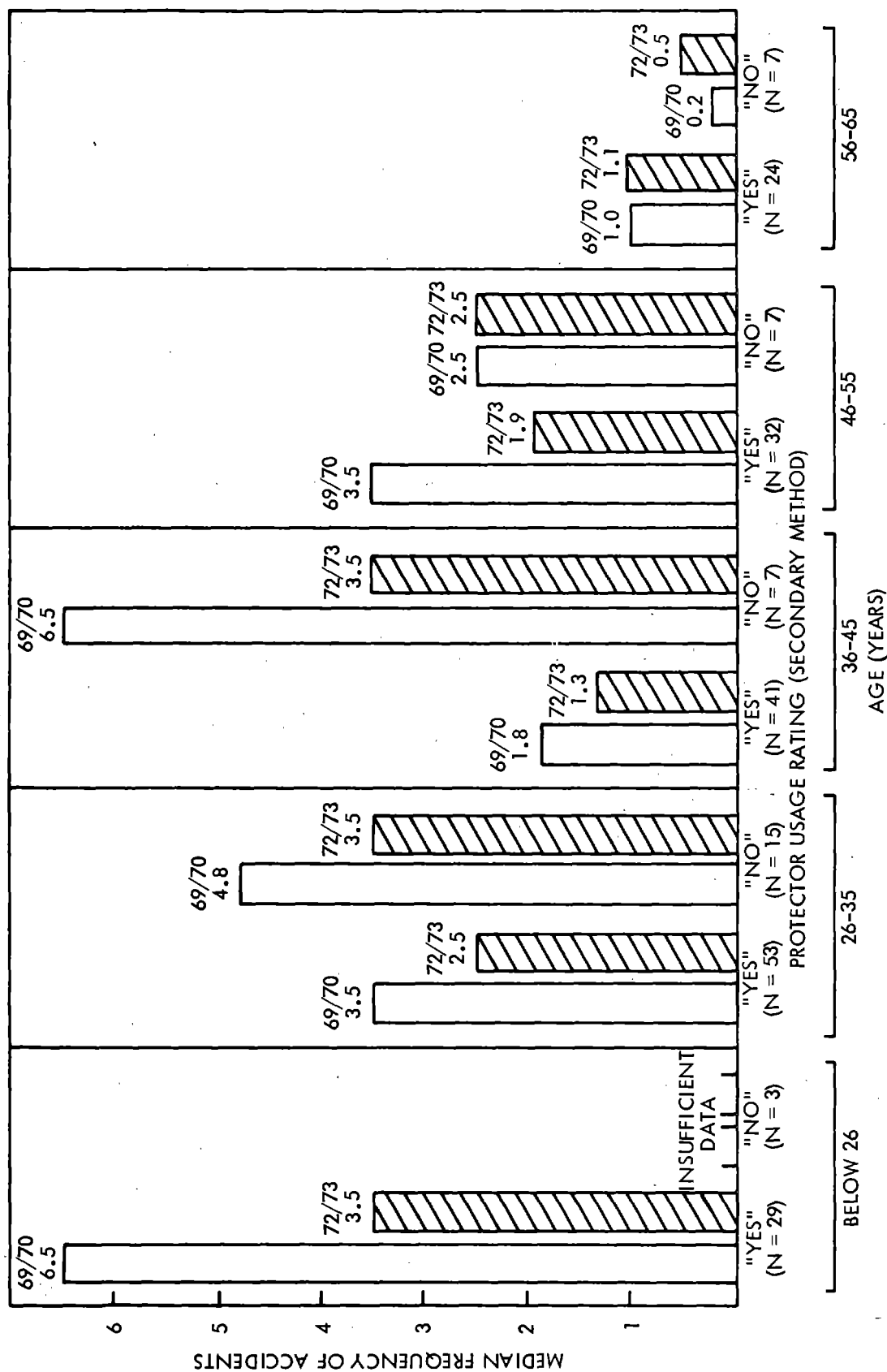


Figure 3-12. Median Frequencies of Accidents for High Noise Group, by Protector Usage Rating (Secondary Method), and by Age Group, During the 1969/1970 vs 1972/1973 Time Periods

Table 3-8. Results of Wilcoxon Matched-Pairs Signed-Ranks Tests, Comparing 1969/1970 Data with 1972/1973 Data, for Various Ratings (Secondary Rating Method) of Ear Protector Usage, with Respect to Frequency of Accidents for High Noise Group

Null Hypothesis - 1969/70 Data is Equivalent to 1972/73 Data
 Test Hypothesis - 1972/73 Data is Less Than 1969/70 Data

Sort Factors	Z	Significance
Ear Protector Usage - Yes Total Sample - 179 Total	-4.4641	0.0000**
Ear Protector Usage - No Sample - 39 Total	-1.0691	0.1425
Ear Protector Usage - Yes Age Group - Below 26 Sample - 29 Total	-2.9732	0.0015**
Ear Protector Usage - Yes Age Group - 26 - 35 Sample - 53 Total	-1.6818	0.0463*
Ear Protector Usage - No Age Group - 26 - 35 Sample - 15 Total	-1.7258	0.0422*
Ear Protector Usage - Yes Age Group - 36 - 45 Sample - 41 Total	-2.5898	0.0048**

Note: (1) A negative (-) 'Z' value indicates a difference in the predicted (test hypothesis) direction, while a positive 'Z' indicates a difference in a direction opposite to the hypothesis.
 (2) Statistical significance indicated by asterisks; * .05 level, ** .01 level.

Table 3-8. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Secondary Rating Method)

Accidents

Sort Factors		Z	Significance
Ear Protector Usage - No			
Age Group -	36 - 45		
Sample- 7			
	Total	-1.2780	0.1006
Ear Protector Usage - Yes			
Age Group -	46 - 55		
Sample- 32			
	Total	-2.3785	0.0087**
Ear Protector Usage - No			
Age Group -	46 - 55		
Sample- 7			
	Total	1.3484	0.9112
Ear Protector Usage - Yes			
Age Group -	56 - 65		
Sample- 24			
	Total	0.2178	0.5862
Ear Protector Usage - No			
Age Group -	56 - 65		
Sample- 7			
	Total	0.2673	0.6054
Ear Protector Usage - Yes			
Age Group -	Below 26		
Yrs. Pres. Job -	5 - 10		
Sample- 29			
	Total	-2.9732	0.0015**

Table 3-8. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
 (Secondary Rating Method)
 Accidents

Sort Factors		Z	Significance
Ear Protector Usage - Yes Age Group - 26 - 35 Yrs. Pres. Job - 5 - 10 Sample- 52			
Total		-1.5113	0.0654
Ear Protector Usage - Yes Age Group - 36 - 45 Yrs. Pres. Job - 5 - 10 Sample- 30			
Total		-2.1138	0.0173**
Ear Protector Usage - Yes Age Group - 46 - 55 Yrs. Pres. Job - 5 - 10 Sample- 11			
Total		-2.3953	0.0083**
Ear Protector Usage - Yes Age Group - 56 - 65 Yrs. Pres. Job - 5 - 10 Sample- 8			
Total		-0.5071	0.3060
Ear Protector Usage - No Age Group - 26 - 35 Yrs. Pres. Job - 5 - 10 Sample- 15			
Total		-1.7258	0.0422*
Ear Protector Usage - No Age Group - 36 - 45 Yrs. Pres. Job - 5 - 10 Sample- 5			
Total		-1.0690	0.1425

Table 3-8. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
 (Secondary Rating Method)
 Accidents

Sort Factors		Z	Significance
Ear Protector Usage -Yes Age Group - 36 - 45 Yrs. Pres. Job - 11 - 15 Sample- 7			
Total		-1.3628	0.0865
Ear Protector Usage -Yes Age Group - 46 - 55 Yrs. Pres. Job - 11 - 15 Sample- 4			
Total		0.3651	0.6425
Ear Protector Usage -Yes Age Group - 56 - 65 Yrs. Pres. Job - 11 - 15 Sample- 5			
Total		0.5345	0.7035
Ear Protector Usage -Yes Age Group - 36 - 45 Yrs. Pres. Job - 16 - 20 Sample- 4			
Total		-0.8018	0.2113
Ear Protector Usage -Yes Age Group - 46 - 55 Yrs. Pres. Job - 16 - 20 Sample- 14			
Total		-1.2448	0.1066
Ear Protector Usage -Yes Age Group - 56 - 65 Yrs. Pres. Job - 16 - 20 Sample- 4			
Total		-1.000	0.1587

Table 3-8. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
 (Secondary Rating Method)
 Accidents

Sort Factors		Z	Significance
Ear Protector Usage -Yes Age Group - 56 - 65 Yrs. Pres. Job - Over 20			
Sample- 7	Total	1.8593	0.9685
Ear Protector Usage -Yes Yrs. Pres. Job - 5 - 10			
Sample- 130	Total	-4.2900	0.0000**
Ear Protector Usage -Yes Yrs. Pres. Job - 5 - 10			
Sample- 28	Total	-1.1268	0.1299
Ear Protector Usage -Yes Yrs. Pres. Job - 11 - 15			
Sample- 17	Total	-0.9103	0.1813
Ear Protector Usage -No Yrs. Pres. Job - 11 - 15			
Sample- 4	Total	1.8257	0.9661
Ear Protector Usage -Yes Yrs. Pres. Job - 16 - 20			
Sample- 22	Total	-1.7039	0.0442*

Table 3-8. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Secondary Rating Method)

Accidents

Sort Factors		Z	Significance
Ear Protector Usage -Yes Yrs. Pres. Job - Over 20			
Sample- 10	Total	1.1847	0.8819
Ear Protector Usage -No Yrs. Pres. Job - Over 20			
Sample- 4	Total	-0.4472	0.3274

Such changes could question similar differences if found also in the High-Noise Group and deemed ascribable to the noise reduction from ear protectors. These comparisons for different variable classifications are summarized in Table 3-9. The differences in median frequency of accidents between the 1969/1970 versus 1972/1973 time periods for the Low-Noise Group are small and equivocal in direction. Only one of the 63 comparisons yielded a difference achieving statistical significance. These results suggested no systematic changes in the accident frequencies of workers in the Low-Noise Group between the two time periods of the study. This finding stands in contrast to the accident differentials found for the High-Noise Group in similar comparisons.

- Frequency of Specifiable Injuries

Table 3-10 indicates the frequency of specifiable types of injuries reported in the two time periods of data collection, referencing numbers of workers experiencing such mishaps in both the High- and Low-Noise Groups as well as their total number of occurrences. Injuries due to foreign bodies, abrasions, and burns were most numerous for both the High- and Low-Noise Groups, though the High-Noise Group shows higher frequencies of such mishaps for all injury types. The data for 1972/1973 showed fewer injuries of specified types for the High-Noise Group relative to the period 1969/1970. Non-classifiable injury cases, however, gave results in the opposite direction which was also noted for the Low-Noise Group. Reasons for this finding were not apparent.

The relative size of reductions for the High-Noise Group in the post hearing conservation period offer little insight into noise factors of consequence to the different mishaps. The greatest reduction occurred for sprains followed in order by foreign bodies, burns, and abrasions.

Table 3-9. Summary Table of Results of Wilcoxon Matched-Pairs Signed-Ranks Tests (2-Tailed) and Median Frequencies for the Low Noise Group, Comparing 1969/1970 Data with 1972/1973 Data, with Respect to Accidents

Group/Sub Group Combination	Sample Size	Median Frequency		Significance
		1969/1970	1972/1973	
Total Sample	432	0.2	0.2	0.7982
Age: Below 26	9	0.2	0.2	0.4226
26 - 35	98	0.2	0.2	0.4698
36 - 45	133	0.2	0.3	0.3322
46 - 55	137	0.2	0.2	0.5324
56 - 65	55	0.2	0.2	0.5972
Occupation: Foreman				
Age: 26 - 35	25	0.7	0.5	0.2330
36 - 45	43	1.1	1.3	0.5848
46 - 55	41	0.6	0.8	0.3836
56 - 65	24	0.8	0.3	0.1252
Occupation: Test and Inspection				
Age: 26 - 35	6	1.0	0.3	0.1088
36 - 45	12	0.4	1.2	0.0858
46 - 55	16	0.5	0.5	0.3740
Occupation: Engineer/Draftsman				
Age: Below 26	7	0.3	0.2	0.1798
26 - 35	51	0.1	0.2	0.3520
36 - 45	63	0.1	0.1	0.6464
46 - 55	61	0.0	0.1	0.0858
56 - 65	23	0.1	0.3	0.2488
Occupation: Plant Support				
Age: 26 - 35	4	0.2	0.5	0.3174
46 - 55	4	0.2	0.2	0.9999
Occupation: Administrator				
Age: 26 - 35	11	0.1	0.2	0.3174
36 - 45	12	0.0	0.0	0.3174
46 - 55	15	0.2	0.0	0.1088
56 - 65	5	0.0	0.3	0.3174
Marital Status: Single				
Age: 26 - 35	23	0.2	0.3	0.4838
36 - 45	6	0.1	0.1	0.9999
46 - 55	7	0.2	0.5	0.4226
Marital Status: Married				
Age: Below 26	8	0.2	0.2	0.4226
26 - 35	75	0.2	0.2	0.2548
36 - 45	125	0.2	0.3	0.2468
46 - 55	128	0.2	0.2	0.5440
56 - 65	51	0.2	0.3	0.7610

*Significant difference $p < .05$

Table 3-9. Summary Table of Results of Wilcoxon Matched-Pairs Signed-Ranks Tests (2-Tailed) and Median Frequencies for the Low Noise Group, Comparing 1969/1970 Data with 1972/1973 Data, with Respect to Accidents (Cont.)

Group/Sub Group Combination	Sample Size	Median Frequencies		Significance
		1969/1970	1972/1973	
Shift: Rotating				
Age: 26 - 35	4	0.0	0.0	No Difference
36 - 45	4	0.0	0.0	No Difference
46 - 55	7	0.5	0.3	0.9999
Shift: First				
Age: Below 26	9	0.2	0.2	0.4226
26 - 35	76	0.1	0.2	0.6668
36 - 45	98	0.2	0.2	0.9456
46 - 55	110	0.1	0.1	0.9052
56 - 65	40	0.2	0.2	0.8160
Shift: Second				
Age: 26 - 35	7	3.5	1.0	0.0278*
36 - 45	18	0.8	1.5	0.3280
46 - 55	11	0.5	2.0	0.3454
56 - 65	10	0.3	0.2	0.6750
Shift: Third				
Age: 26 - 35	11	0.5	1.5	0.5896
36 - 45	13	1.0	1.5	0.3862
46 - 55	9	1.5	1.5	0.7998
56 - 65	4	1.0	0.5	0.1798
Years Present Job: 5 - 10				
Age: Below 26	7	0.3	0.2	0.1798
26 - 35	81	0.2	0.3	0.8934
36 - 45	91	0.4	0.4	0.4506
46 - 55	63	0.2	0.2	0.3754
56 - 65	16	0.2	0.3	0.5542
Years Present Job: 11 - 15				
Age: 26 - 35	14	0.1	0.1	0.1798
36 - 45	22	0.1	0.2	0.9999
46 - 55	37	0.2	0.2	0.8128
56 - 65	24	0.1	0.2	0.8590
Years Present Job: 16 - 20				
Age: 36 - 45	14	0.1	0.1	0.5002
46 - 55	17	0.2	0.3	0.4990
56 - 65	7	0.5	0.2	0.1088
Years Present Job: Over 20				
Age: 36 - 45	6	0.0	0.1	0.3174
46 - 55	20	0.1	0.1	0.2734
56 - 65	8	0.5	0.5	0.5002

*Significant difference $p < .05$

Table 3-10. Incidence of Specified Types of Job Connected Injuries in Records of Workers in High and Low Noise Groups, During the 1969/1970 vs 1972/1973 Time Periods

Type Of Injury	Number of Workers Afflicted						Number of Occurrences			
	High Noise Group		Low Noise Group		High Noise Group		Low Noise Group			
	1969/1970	1972/1973	1969/1970	1972/1973	1969/1970	1972/1973	1969/1970	1972/1973	1969/1970	1972/1973
Abrasions, Punctures, Lacerations	259	231	68	87	666	520	109	123		
Breks and Fractures	1	0	0	0	1	0	0	0		
Burns	232	201	36	28	1215	853	53	37		
Sprains/Strains	48	21	19	10	69	26	22	11		
Foreign Bodies	223	182	64	27	1064	716	89	39		
Non-Classifiable Injury Data	34	88	7	50	39	150	7	66		

3.3 Diagnosed Medical Problems

- Overall Results

Figure 3-13 depicts the cumulative percent frequency distributions of workers in the High-Noise Group with a specified number of diagnosed medical problems among their record entries during the 1969/1970 (pre-hearing conservation) and 1972/1973 (post-hearing conservation) time periods. As shown, the frequency of diagnosed medical problems during the 1972/1973 time period was less than that of the 1969/1970 time period, for workers with less than ten (10) problems. The percentages of workers with ten (10) problems or more were approximately equivalent for the two time periods. The difference in the percentage of effected workers was particularly large at the level of 2 or more diagnosed problems. During the 1969/1970 time period, approximately 40% of the workers had 2 or more diagnosed medical problems, whereas, during the 1972/1973 time period, only approximately 24% of the workers had 2 or more problems.

Figure 3-14 provides a comparison of the median frequencies of diagnosed medical problems for the two time periods. A Wilcoxon test applied to this frequency difference in diagnosed disorders between the two time periods yielded significance at the .01 level (see Table 3-14).

- Results by Age

Figure 3-15 shows that the median frequencies of diagnosed medical problems for all age groups in the High-Noise areas were consistently lower during the 1972/1973 time period, as opposed to the 1969/1970 period. These differences in frequency of diagnosed medical problems were significant for all age groups at the .01 level, with the exception of the youngest age group (below 26 yrs., see Table 3-14). Differential frequencies of medical problems before and after hearing conservation

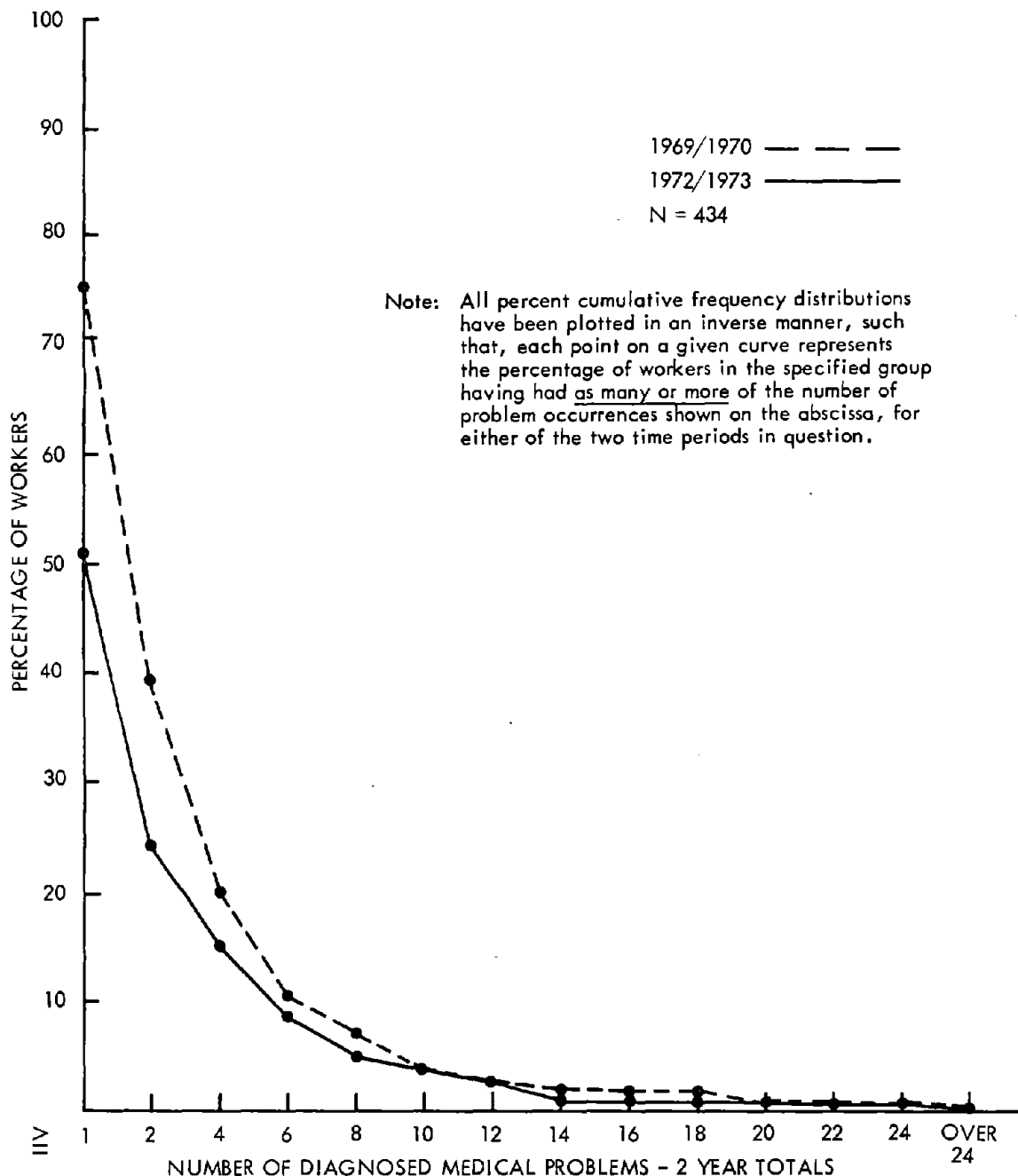


Figure 3-13. Cumulative Percent Frequency Distributions of Workers from the High Noise Group, with a Specifiable Number of Diagnosed Medical Problems, During the 2-Year Periods Before (1969/1970) and After (1972/1973) the Advent of a Company Hearing Conservation Program

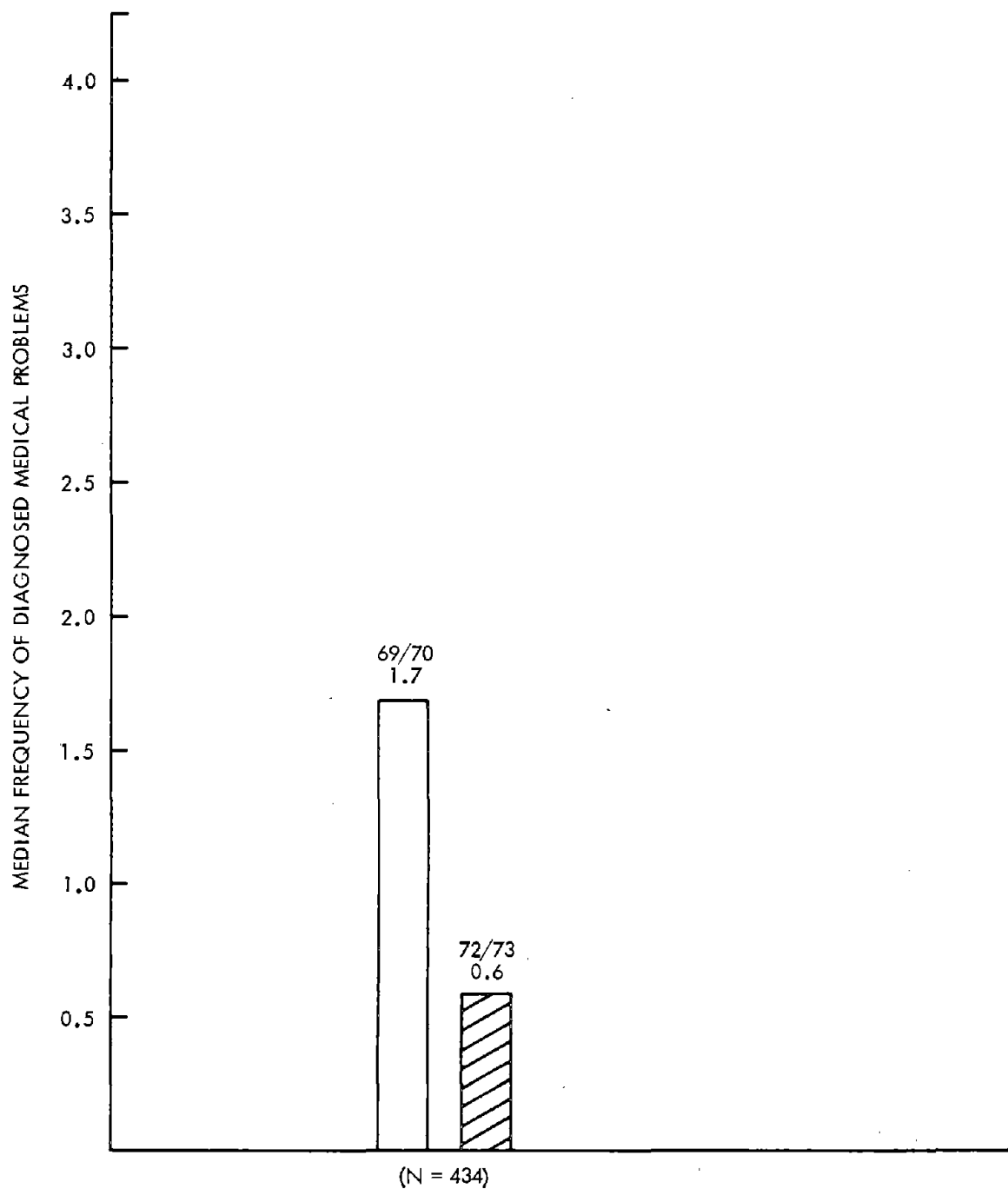


Figure 3-14. Median Frequencies of Diagnosed Medical Problems, for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

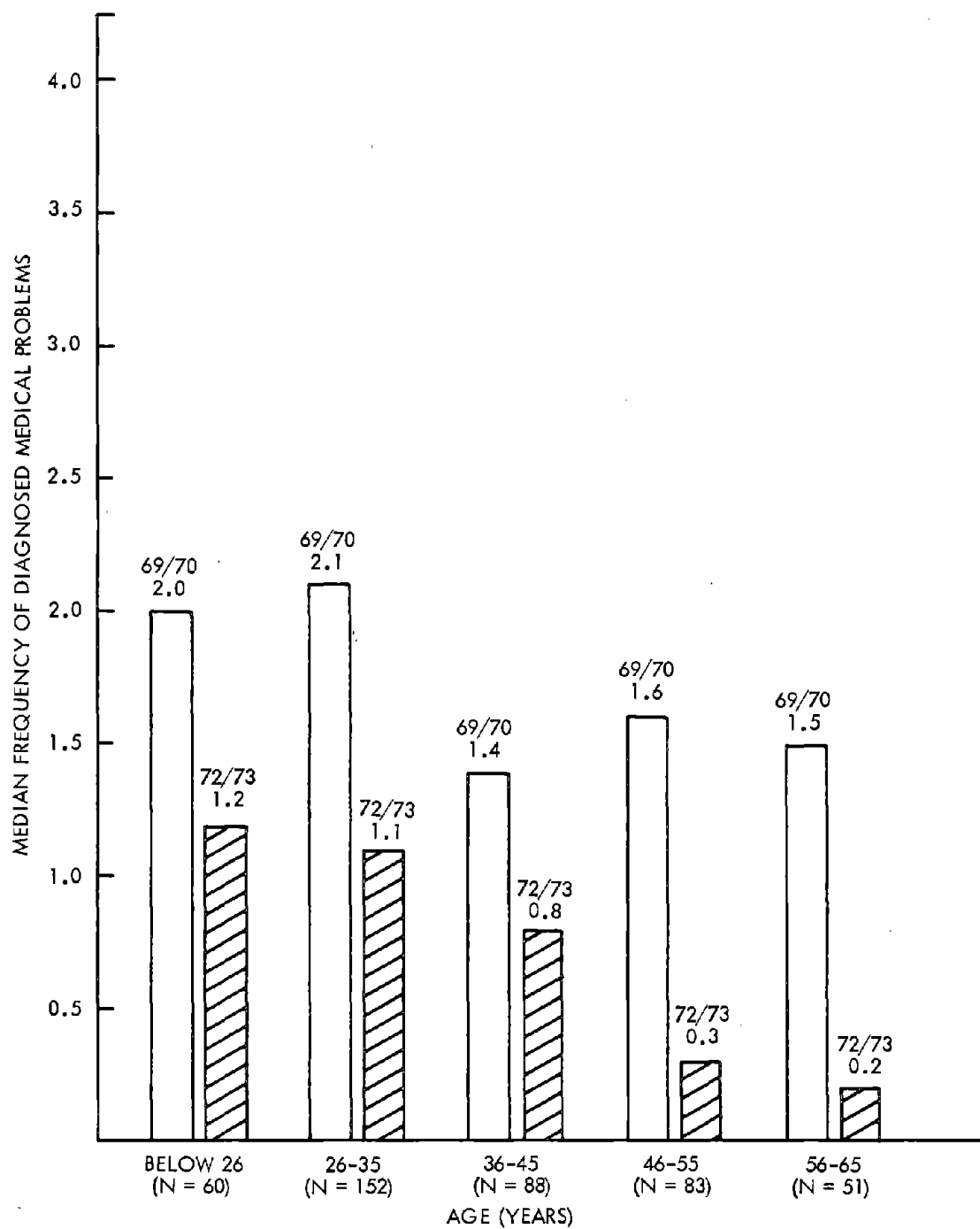


Figure 3-15. Median Frequencies of Diagnosed Medical Problems, by Age, for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

are greatest for the older age groups, these showing the fewest medical disorders in the post-1972/1973 period relative to the pre-1969/1970 one.

- Results by Experience (Years at Present Job)

Figure 3-16 presents a comparison of average frequencies of diagnosed medical problems, by experience, for the two time periods. With the exception of the "Over 20" years experience category, all differences were of relatively large magnitude, and in the predicted direction (1969/1970 frequencies higher than 1972/1973 frequencies). No statistical tests were performed on these data. Rather they were applied to the before-after differences in medical problems observed for combinations of age and job experience (see Table 3-14).

- Results by Age-Experience Combinations

Table 3-11 summarizes the median frequencies of diagnosed medical problems in the High-Noise Group during the 1969/1970 vs. 1972/1973 time periods for various combinations of age and experience. All frequency differences were in the predicted direction in that the post-hearing conservation data uniformly showed fewer medical problems as compared to the pre-hearing conservation period. In 6 out of 14 combinations were these differences found statistically significant, most being confined to the relatively shorter lengths of job experience (15 years or less). The statistical results are summarized in Table 3-14.

- Results by Shift

The average frequencies of diagnosed medical problems, by work shift, for the 1969/1970 vs. 1972/1973 time periods, are presented in Table 3-12. For all shifts (1, 2, 3 and rotating), the differences in relative frequency were in the predicted direction. The rotating shift showed the difference with the largest magnitude, but was based on a very small

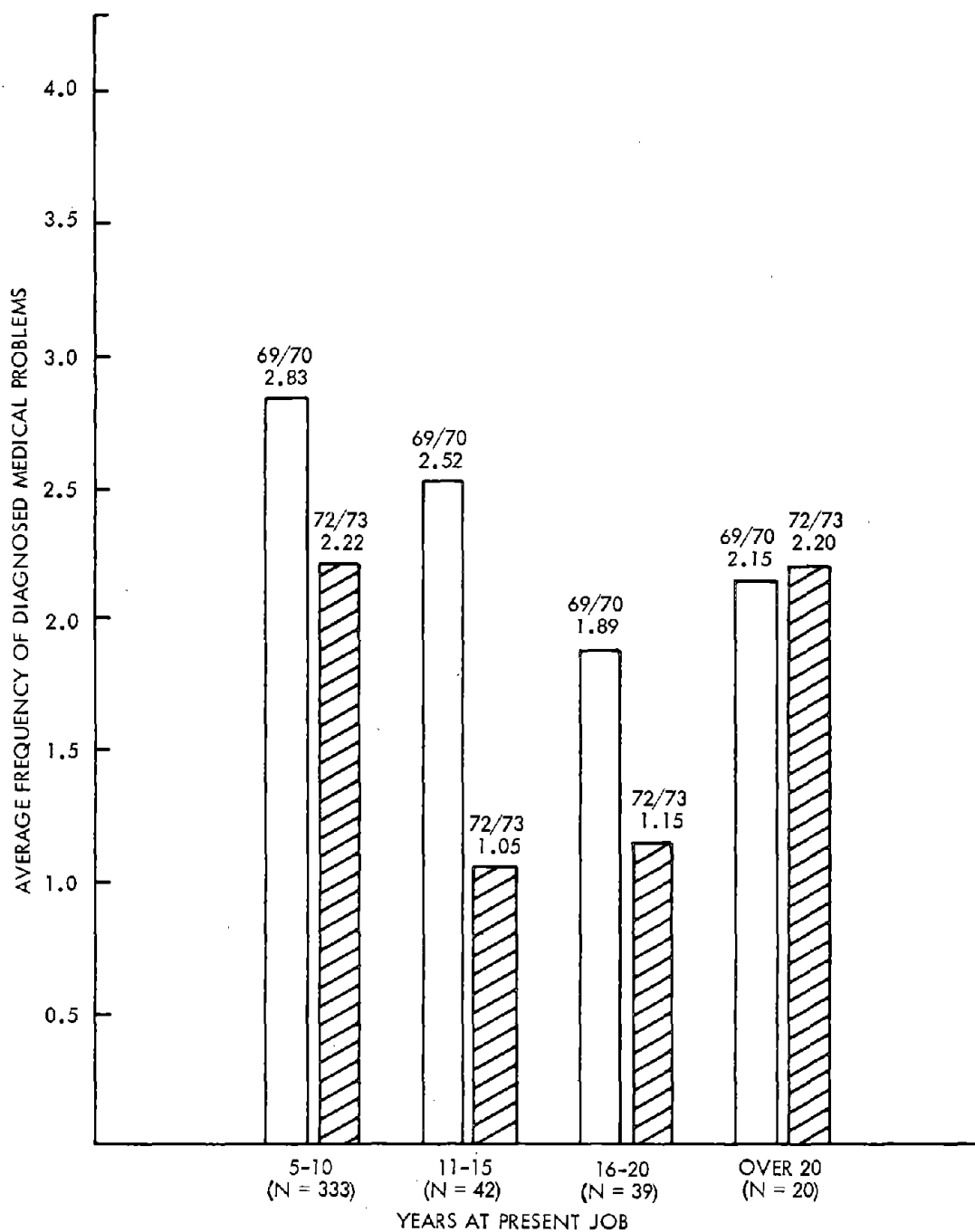


Figure 3-16. Average Frequencies of Diagnosed Medical Problems, by Years at Present Job, for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

Table 3-11. Age-Experience Comparisons of Median Frequencies of Diagnosed Medical Problems, for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

Years at Present Job	Age (Years)							
	Below 26		26-35		36-45		46-55	
	1969/ 1970	1972/ 1973	1969/ 1970	1972/ 1973	1969/ 1970	1972/ 1973	1969/ 1970	1972/ 1973
5-10	2.0 (59)	1.3 (59)	(Sig. < .01) 2.1 (146)	1.1 (146)	1.5 (66)	1.0 (66)	(Sig. < .01) 1.7 (41)	0.4 (41)
11-15	0.0 (0)	0.0 (0)	(Sig. < .05) 1.5 (6)	1.0 (6)	1.5 (10)	0.2 (10)	(Sig. < .05) 1.5 (15)	0.3 (15)
16-20	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.8 (12)	0.3 (12)	1.7 (20)	0.3 (20)
Over 20	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	(Sig. < .01) 2.0 (7)	0.3 (7)
							(Sig. < .01) 1.8 (21)	0.3 (21)
							1.5 (10)	0.8 (10)
							2.5 (7)	0.2 (7)
							(Sig. < .01) 1.0 (13)	0.1 (13)

Notes: 1 Numbers In Parentheses Refer to Sample Sizes

2 Parenthetic expressions (Sig. < .01 or < .05) indicate statistically significant differences in comparing the data collected over the two time periods, based upon Wilcoxon Matched-Pair Signed-Ranks Tests.

Table 3-12. Comparison of Average Frequencies of Diagnosed Medical Problems,
for High Noise Group, During the 1969/1970 vs 1972/1973 Time
Periods

	Shift 1	Shift 2	Shift 3	Rotating Shift
1969/ 1970	2.64 (210)	2.85 (125)	3.19 (96)	3.67 (3)
1972/ 1973	1.53 (210)	1.94 (125)	3.00 (96)	0.33 (3)

Note: Numbers in Parentheses Refer to Sample Sizes

sample size, while the third shift indicated the smaller difference. Although these comparisons were not tested statistically, the uniform direction of their differences (in the predicted direction) is important, in that, it adds support to the basic Test Hypothesis.

- Results by Job Type

Table 3-13 provides a comparison of average frequencies of diagnosed medical problems, by job-type, for the 1969/1970 vs. 1972/1973 time periods. With the exception of the Plant Support job category (which had a sample size of 2), all other job categories yielded differences in the predicted direction. Again, these comparisons were not tested statistically, however, Table 3-14 includes results of statistical tests of these before-after differences by various Age/Job-Type combinations. Of the twenty (20) Age-by-Job-Type combinations tested, eight (8) proved to be statistically significant, and most of these occurred for Production Workers.

- Results by Ratings of Ear Protector Usage (Primary Method)

Figure 3-17 indicates the frequency differences in medical problems between the 1969/1970 vs. 1972/1973 time periods, classified by ratings of ear protector use (Primary Method). All differences were in the predicted direction in that 1969/1970 frequencies were higher than 1972/1973 frequencies, and all were significant except for the "Never" rating. As expected, the workers judged to have always used their protectors showed the greatest reduction in the frequency of medical problems relative to their pre-hearing conservation data, while those rated as never using their protectors showed the smallest relative change. Statistical test of these differences are given in Table 3-15.

Table 3-13. Comparison of Average Frequencies of Diagnosed Medical Problems, by Job Type, for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

	Job Type					
	Foreman	Test and Inspect	Machine Operator	Plant Support	Administrator	Production Worker
1969/1970	2.25 (32)	1.87 (47)	3.17 (86)	0.00 (2)	2.20 (10)	4.63 (167)
1972/1973	1.03 (32)	1.08 (47)	1.72 (86)	0.50 (2)	1.40 (10)	3.63 (167)

Note: Numbers in Parentheses Refer to Sample Sizes

Table 3-14. Results of Wilcoxon Matched-Pairs Signed Ranks Tests, Comparing 1969/1970 Data with 1972/1973 Data, with Respect to Frequency of Diagnosed Medical Problems in High Noise Group

Null Hypothesis - 1969/1970 Data is Equivalent to 1972/73 Data

Test Hypothesis - 1972/73 Data is Less Than 1969/70 Data

	Sort Factors	Z	Significance
Age Group- Total Sample- 434	All		
	Neurological	-0.7317	0.2322
	Digestive	3.7192	0.9999
	Cardiovascular	-4.0129	0.0000**
	Otological/Audio	-0.6036	0.2730
	Allergenic/Derma	-3.9335	0.0000**
	Respiratory	-4.4441	0.0000**
	Glandular	-3.6214	0.0001**
	Urological	-3.0594	0.0011**
	Musculo/Skeletal	-3.7635	0.0001**
	Total	-5.4014	0.0
Age Group- Sample- 60	Below 26		
	Neurological	0.3651	0.6425
	Digestive	2.3953	0.9917
	Cardiovascular	-1.8257	0.0339*
	Otological/Audio	0.4045	0.6571
	Allergenic/Derma	-2.0725	0.0191**
	Respiratory	-0.3016	0.3815
	Glandular	-1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	-1.5724	0.0579*
	Total	-0.6468	0.2589
Age Group- Sample- 152	26 - 35		
	Neurological	0.8037	0.7892
	Digestive	3.3939	0.9997
	Cardiovascular	-0.6301	0.2643
	Otological/Audio	-0.3381	0.3677
	Allergenic/Derma	-0.8139	0.2078
	Respiratory	-3.8864	0.0001**
	Glandular	-1.6036	0.0544*
	Urological	-1.8257	0.0339*
	Musculo/Skeletal	-2.0267	0.0213*
	Total	-2.7367	0.0031**

Note: (1) A negative (-)'Z' value indicates a difference in the predicted (test hypothesis) direction, while a positive 'Z' indicates a difference in a direction opposite to the hypothesis.

(2) Statistical significance indicated by asterisks; * .05 level, ** .01 level.

Table 3-14. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests
 Category - Diagnosed Medical Problems

	Sort Factors	Z	Significance
Age Group -	36 - 45		
Sample - 88			
	Neurological	-0.7701	0.2206
	Digestive	0.9825	0.8371
	Cardiovascular	-2.0226	0.0216*
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	-2.6937	0.0035**
	Respiratory	-1.6296	0.0516*
	Glandular	-1.8257	0.0339*
	Urological	-1.6036	0.0544*
	Musculo/Skeletal	0.0	0.5000
	Total	-2.4295	0.0076**
Age Group -	46 - 55		
Sample - 83			
	Neurological	-1.4003	0.0807
	Digestive	1.0198	0.8461
	Cardiovascular	-2.3953	0.0083**
	Otological/Audio	0.5345	0.7035
	Allergenic/Derma	-2.6571	0.0039**
	Respiratory	-1.5300	0.0630
	Glandular	-2.0226	0.0216*
	Urological	-1.6036	0.0544*
	Musculo/Skeletal	-2.1339	0.0164**
	Total	-3.0782	0.0010
Age Group -	56 - 65		
Sample - 51			
	Neurological	-1.6036	0.0544*
	Digestive	-0.7606	0.2234
	Cardiovascular	-2.1004	0.0178**
	Otological/Audio	-1.6036	0.0544*
	Allergenic/Derma	-1.2741	0.1013
	Respiratory	2.1795	0.0146**
	Glandular	-1.8257	0.0339*
	Urological	-1.3416	0.0899
	Musculo/Skeletal	-2.3664	0.0090**
	Total	-3.5625	0.0002**

Table 3-14. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests
 Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Age Group- Occup. Title- Sample- 5	26 - 35 Foreman		
	Neurological	Identical Data	
	Digestive	1.0000	0.8413
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	-0.4472	0.3274
	Respiratory	-1.1832	0.1184
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-0.6742	0.2501
Age Group- Occup. Title- Sample- 5	36 - 45 Foreman		
	Neurological	Identical Data	
	Digestive	Identical Data	
	Cardiovascular	Identical Data	
	Otological/Audio	1.0000	0.1587
	Allergenic/Derma	Identical Data	
	Respiratory	1.2780	0.8994
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	0.9439	0.8274
Age Group- Occup. Title- Sample- 9	46 - 55 Foreman		
	Neurological	-1.0000	0.1587
	Digestive	Identical Data	
	Cardiovascular	-1.3416	0.0899
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.6036	0.0544**
	Respiratory	-1.3416	0.0899
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-2.2014	0.0139

Table 3-14. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Diagnosed Medical Problems

	Sort Factors	Z	Significance
Age Group - Occup. Title - Sample - 10	56 - 65 Foreman		
	Neurological	-1.3416	0.0899
	Digestive	-1.0000	0.1587
	Cardiovascular	-1.3416	0.0899
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.6036	0.0544*
	Respiratory	-1.6181	0.0528*
	Glandular	-1.3416	0.0899
	Urological	Identical Data	
	Musculo/Skeletal	-1.3416	0.0899
	Total	-2.3664	0.0090**
Age Group - Occup. Title - Sample - 6	Below 26 Test & I		
	Neurological	Identical Data	
	Digestive	1.0000	0.8413
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	-1.0000	0.1587
	Respiratory	-0.5345	0.2965
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-0.7303	0.2326
Age Group - Occup. Title - Sample - 8	26 - 35 Test & I		
	Neurological	-1.0000	0.1587
	Digestive	0.0	0.5000
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.0000	0.1587
	Respiratory	-1.8257	0.0339*
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-2.3664	0.0090**

Table 3-14. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests
 Category - Diagnosed Medical Problems

	Sort Factors	Z	Significance
Age Group- Occup. Title- Sample- 18	36 - 45		
	Test & I		
	Neurological	1.0000	0.8413
	Digestive	1.3416	0.9101
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	-0.9129	0.1807
	Respiratory	-1.2551	0.1047
	Glandular	Identical Data	
	Urological	Identical Data	
Age Group- Occup. Title- Sample- 11	46 - 55		
	Test & I		
	Neurological	0.5345	0.7035
	Digestive	-1.0000	0.1587
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	0.0	0.5000
	Respiratory	-1.2780	0.1006
	Glandular	-1.0000	0.1587
	Urological	-1.0000	0.1587
Age Group- Occup. Title- Sample- 4	56 - 65		
	Test & I		
	Neurological	Identical Data	
	Digestive	0.0	0.5000
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.0000	0.1587
	Respiratory	0.0	0.5000
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-0.4472	0.3274

Table 3-14. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests
 Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Age Group- Occup. Title- Sample- 18	Below 26 Mach. Op.		
	Neurological	1.0000	0.8413
	Digestive	1.6036	0.9456
	Cardiovascular	Identical Data	
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	-2.0226	0.0216*
	Respiratory	-0.6981	0.2426
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-0.8047	0.2105
Age Group- Occup. Title- Sample- 28	26 - 35 Mach. Op.		
	Neurological	1.0000	0.8413
	Digestive	0.4226	0.6637
	Cardiovascular	-1.6036	0.0544*
	Otological/Audio	Identical Data	
	Allergenic/Derma	-0.6742	0.2501
	Respiratory	-2.5596	0.0052**
	Glandular	-1.0000	0.1587
	Urological	-1.3416	0.0899
	Musculo/Skeletal	Identical Data	
	Total	2.4824	0.0065**
Age Group- Occup. Title- Sample- 17	36 - 45 Mach. Op.		
	Neurological	0.0	0.5000
	Digestive	0.0	0.5000
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	-0.9129	0.1807
	Respiratory	0.1400	0.5557
	Glandular	Identical Data	
	Urological	-1.0000	0.1587
	Musculo/Skeletal	Identical Data	
	Total	0.1569	0.5623

Table 3-14. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Age Group- Occup. Title Sample- 13	46 - 55 Mach. Op.		
	Neurological	-1.3416	0.0899
	Digestive	1.0000	0.8413
	Cardiovascular	-1.3416	0.0899
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	-1.3416	0.0899
	Respiratory	1.0987	0.8641
	Glandular	-1.6036	0.0544*
	Urological	Identical Data	
	Musculo/Skeletal	-1.6036	0.0544*
	Total	-1.0703	0.1423
Age Group- Occup. Title- Sample- 10	56 - 65 Mach. Op.		
	Neurological	Identical Data	
	Digestive	0.0	0.5000
	Cardiovascular	0.0	0.5000
	Otological/Audio	-1.3416	0.0899
	Allergenic/Derma	-1.0000	0.1587
	Respiratory	0.4045	0.6571
	Glandular	-1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	-1.3416	0.0899
	Total	0.7108	0.2386
Age Group- Occup. Title: Sample- 4	56 - 65 Admin.		
	Neurological	Identical Data	
	Digestive	Identical Data	
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	1.3416	0.9101
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	0.5345	0.7035

Table 3-14. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests
 Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Age Group- Occup. Title- Sample- 35	Below 26 Prod. Wk.		
	Neurological	0.0	0.5000
	Digestive	1.6773	0.9533
	Cardiovascular	-1.6036	0.0544*
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	-1.0483	0.1473
	Respiratory	0.2402	0.5949
	Glandular	-1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	-0.9129	0.1807
	Total	-0.0569	0.4773
Age Group- Occup. Title- Sample- 105	26 - 35 Prod. Wk.		
	Neurological	0.8447	0.8008
	Digestive	3.5225	0.9998
	Cardiovascular	0.9129	0.8193
	Otological/Audio	-0.3381	0.3677
	Allergenic/Derma	-0.4978	0.3093
	Respiratory	2.7148	0.0033**
	Glandular	-1.3416	0.0899
	Urological	-1.3416	0.0899
	Musculo/Skeletal	-1.8827	0.0299*
	Total	-1.3793	0.0839
Age Group- Occup. Title- Sample- 48	36 - 45 Prod. Wk.		
	Neurological	-1.1531	0.1244
	Digestive	0.5096	0.6949
	Cardiovascular	-2.0226	0.0216*
	Otological/Audio	Identical Data	
	Allergenic/Derma	-2.4111	0.0080**
	Respiratory	-2.0380	0.0208*
	Glandular	1.8257	0.0339*
	Urological	-1.3416	0.0899
	Musculo/Skeletal	0.0	0.5000
	Total	-3.0422	0.0012**

Table 3-14. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests
 Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Age Group- Occup. Title- Sample- 47	46 - 55 Prod. Wk.		
	Neurological	-1.0000	0.1587
	Digestive	0.8885	0.8129
	Cardiovascular	-1.0954	0.1367
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	-1.8357	0.0332*
	Respiratory	-1.2012	0.1148
	Glandular	-1.0000	0.1587
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-0.9439	0.1726
	Total	-1.5677	0.0585*
Age Group- Occup. Title- Sample- 22	56 - 65 Prod. Wk.		
	Neurological	-1.0000	0.1587
	Digestive	-1.0000	0.1587
	Cardiovascular	-1.6036	0.0544*
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	0.4045	0.6571
	Respiratory	-2.5784	0.0050**
	Glandular	-1.0000	0.1587
	Urological	1.3416	0.0899
	Musculo/Skeletal	-1.3416	0.0899
	Total	-2.8563	0.0021**
Age Group- Mar. Status- Sample- 29	Below 26 Single		
	Neurological	-0.4472	0.3274
	Digestive	1.4832	0.9310
	Cardiovascular	-1.6036	0.0544*
	Otological/Audio	0.5345	0.7035
	Allergenic/Derma	-2.4895	0.0064**
	Respiratory	-1.7086	0.0438*
	Glandular	1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	-0.5345	0.2965
	Total	-2.0064	0.0224*

Table 3-14. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Age Group- Mar. Status- Sample- 25	26 - 35 Single		
	Neurological	-1.3416	0.0899
	Digestive	0.9439	0.8274
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	0.0	0.5000
	Respiratory	0.6154	0.7309
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	0.5040	0.6929
Age Group- Mar. Status- Sample- 30	Below 26 Married		
	Neurological	1.3416	0.9101
	Digestive	2.0226	0.9784
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	-0.2801	0.3897
	Respiratory	1.3798	0.9162
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.6036	0.0544*
	Total	1.4286	0.9234
Age Group- Mar. Status- Sample- 125	26 - 35 Married		
	Neurological	1.7178	0.9571
	Digestive	3.3779	0.9996
	Cardiovascular	-0.3381	0.3677
	Otological/Audio	-0.7338	0.2315
	Allergenic/Derma	-1.0369	0.1499
	Respiratory	4.2671	0.0000**
	Glandular	-1.6036	0.0544*
	Urological	-1.8257	0.0339*
	Musculo/Skeletal	-1.8827	0.0299*
	Total	-3.0333	0.0012**

Table 3-14. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Age Group- Mar. Status- Sample- 85	36 - 45 Married		
	Neurological	-0.2801	0.3897
	Digestive	0.9825	0.8371
	Cardiovascular	-2.0226	0.0216*
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	-2.6937	0.0035**
	Respiratory	-1.8458	0.0325*
	Glandular	-1.8257	0.0339*
	Urological	-1.6036	0.0544*
	Musculo/Skeletal	0.0	0.5000
	Total	2.6218	0.0044**
Age Group- Mar. Status- Sample- 80	46 - 55 Married		
	Neurological	-1.4003	0.0807
	Digestive	1.0198	0.8461
	Cardiovascular	-2.3953	0.0083**
	Otological/Audio	0.5345	0.7035
	Allergenic/Derma	-2.6571	0.0039**
	Respiratory	-1.5300	0.0630
	Glandular	2.0226	0.0216*
	Urological	-1.6036	0.0544*
	Musculo/Skeletal	-2.1339	0.0164**
	Total	-3.0782	0.0010
Age Group- Mar. Status- Sample- 50	56 - 65 Married		
	Neurological	-1.6036	0.0544*
	Digestive	-0.7606	0.2234
	Cardiovascular	-2.1004	0.0178**
	Otological/Audio	-1.6036	0.0544*
	Allergenic/Derma	-1.2741	0.1013
	Respiratory	2.0857	0.0185**
	Glandular	-1.8257	0.0339*
	Urological	-1.3416	0.0899
	Musculo/Skeletal	-2.3664	0.0090**
	Total	-3.4962	0.0002**

Table 3-14. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Age Group- Shift- Sample- 23	Below 26 First		
	Neurological	-0.4472	0.3274
	Digestive	1.3416	0.9101
	Cardiovascular	-1.6036	0.0544*
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	-1.6903	0.0455*
	Respiratory	0.3361	0.6316
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-0.1493	0.4406
Age Group- Shift- Sample- 57	26 - 35 First		
	Neurological	-0.1826	0.4276
	Digestive	-0.2369	0.4064
	Cardiovascular	-0.9129	0.1807
	Otological/Audio	-1.3416	0.0899
	Allergenic/Derma	-0.5688	0.2847
	Respiratory	-3.2996	0.0005**
	Glandular	-1.6036	0.0544*
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.6036	0.0544*
	Total	3.3025	0.0005**
Age Group- Shift- Sample- 53	36 - 45 First		
	Neurological	-0.9435	0.1727
	Digestive	1.1722	0.8794
	Cardiovascular	-1.3416	0.0899
	Otological/Audio	Identical Data	
	Allergenic/Derma	-2.5424	0.0055**
	Respiratory	-0.6919	0.2445
	Glandular	-1.6036	0.0544*
	Urological	-1.3416	0.0899
	Musculo/Skeletal	-1.0000	0.1587
	Total	-1.3477	0.0889

Table 3-14. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Diagnosed Medical Problems

	Sort Factors	Z	Significance
Age Group- Shift- Sample- 46	46 - 55 First		
	Neurological	-1.3484	0.0888
	Digestive	0.6301	0.7357
	Cardiovascular	-2.3664	0.0090**
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	-2.5424	0.0055**
	Respiratory	-0.5835	0.2798
	Glandular	-1.6036	0.0544*
	Urological	-1.3416	0.0899
	Musculo/Skeletal	-2.5205	0.0059**
	Total	-2.9544	0.0016
Age Group- Shift- Sample- 31	56 - 65 First		
	Neurological	-1.3416	0.0899
	Digestive	0.1826	0.5724
	Cardiovascular	-2.0226	0.0216*
	Otological/Audio	-1.6036	0.0544*
	Allergenic/Derma	-0.3381	0.3677
	Respiratory	-1.3063	0.0957
	Glandular	-1.3416	0.0899
	Urological	-1.3416	0.0899
	Musculo/Skeletal	-1.8257	0.0339*
	Total	-2.3809	0.0086**
Age Group- Shift- Sample- 13	Below 26 Second		
	Neurological	1.0000	0.8413
	Digestive	-1.0000	0.1587
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	-0.6742	0.2501
	Respiratory	-1.3977	0.0811
	Glandular	-1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-1.6074	0.0540*

Table 3-14. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Diagnosed Medical Problems

	Sort Factors	Z	Significance
Age Group- Shift- Sample- 50	26 - 35 Second		
	Neurological	0.8018	0.7887
	Digestive	2.6502	0.9960
	Cardiovascular	0.0	0.5000
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	-0.6639	0.2534
	Respiratory	-1.4932	0.0677
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.9435	0.1727
	Total	-0.2442	0.4035
Age Group- Shift- Sample- 24	36 - 45 Second		
	Neurological	-1.0000	0.1587
	Digestive	0.0	0.5000
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	-0.7338	0.2315
	Respiratory	-1.7515	0.0399*
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-2.3809	0.0086**
Age Group- Shift- Sample- 25	46 - 55 Second		
	Neurological	-1.0000	0.1587
	Digestive	0.0	0.5000
	Cardiovascular	-0.5345	0.2965
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	-1.1531	0.1244
	Respiratory	-0.3556	0.3611
	Glandular	-1.0000	0.1587
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.3416	0.0899
	Total	-0.8161	0.2072

Table 3-14. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests
 Category - Diagnosed Medical Problems

	Sort Factors	Z	Significance
Age Group- Shift- Sample- 13	56 - 65 Second		
	Neurological	-1.0000	0.1587
	Digestive	-1.6036	0.0544*
	Cardiovascular	0.0	0.5000
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.3416	0.0899
	Respiratory	-1.6903	0.0455*
	Glandular	-1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	-1.3416	0.0899
	Total	-2.2934	0.0199**
Age Group- Shift- Sample- 24	Below 26 Third		
	Neurological	1.0000	0.8413
	Digestive	2.3664	0.9910
	Cardiovascular	Identical Data	
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	-1.3522	0.0881
	Respiratory	0.2831	0.6114
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.5724	0.0579*
	Total	0.3787	0.6475
Age Group- Shift- Sample- 45	26 - 35 Third		
	Neurological	0.7338	0.7685
	Digestive	2.8304	0.9977
	Cardiovascular	0.0	0.5000
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	-0.2130	0.4157
	Respiratory	-1.7596	0.0392*
	Glandular	Identical Data	
	Urological	-1.6036	0.0544*
	Musculo/Skeletal	-1.0954	0.1367
	Total	-0.9934	0.1603

Table 3-14. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Diagnosed Medical Problems

	Sort Factors	Z	Significance
Age Group- Shift- Sample- 10	36 - 45 Third		
	Neurological	1.3416	0.9101
	Digestive	-0.5345	0.2965
	Cardiovascular	-1.3416	0.0899
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.0000	0.1587
	Respiratory	-0.3145	0.3766
	Glandular	-1.0000	0.1587
	Urological	-1.0000	0.1587
	Musculo/Skeletal	1.0000	0.8413
	Total	-0.2801	0.3897
Age Group- Shift- Sample- 11	46 - 55 Third		
	Neurological	0.0	0.5000
	Digestive	1.0000	0.8413
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	-0.3651	0.3575
	Respiratory	-1.5213	0.0641
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.0000	0.8413
	Total	-0.5916	0.2771
Age Group- Shift- Sample- 6	56 - 65 Third		
	Neurological	Identical Data	
	Digestive	Identical Data	
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	-0.4472	0.3274
	Glandular	-1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-1.0690	0.1425

Table 3-14. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests
 Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Age Group- Yrs. Pres. Job- Sample- 59	Below 26 5-10		
	Neurological	0.3651	0.6425
	Digestive	2.3953	0.9917
	Cardiovascular	-1.8257	0.0339*
	Otological/Audio	0.4045	0.6571
	Allergenic/Derma	-2.0725	0.0191**
	Respiratory	-0.2567	0.3987
	Glandular	-1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	-1.5724	0.0579*
	Total	-0.5968	0.2753
Age Group- Yrs. Pres. Job- Sample- 146	26 - 35 5-10		
	Neurological	0.6276	0.7349
	Digestive	3.3939	0.9997
	Cardiovascular	-0.6301	0.2643
	Otological/Audio	-0.3381	0.3677
	Allergenic/Derma	-1.2015	0.1148
	Respiratory	-3.8233	0.0001**
	Glandular	-1.6036	0.0544*
	Urological	-1.8257	0.0339*
	Musculo/Skeletal	-2.0267	0.0213*
	Total	-2.7525	0.0030**
Age Group- Yrs. Pres. Job- Sample- 66	36 - 45 5-10		
	Neurological	-0.3381	0.3677
	Digestive	1.7338	0.9585
	Cardiovascular	-1.6036	0.0544*
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	-1.9775	0.0240*
	Respiratory	-1.2860	0.0992
	Glandular	-1.6036	0.0544*
	Urological	-1.3416	0.0899
	Musculo/Skeletal	0.0	0.5000
	Total	-1.4896	0.0682

Table 3-14. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Age Group- Yrs. Pres. Job- Sample- 41	46 -55 5-10		
	Neurological	-1.3416	0.0899
	Digestive	0.6290	0.7353
	Cardiovascular	-1.7748	0.0380*
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	-2.0304	0.0212*
	Respiratory	1.4772	0.0698
	Glandular	-1.0000	0.1587
	Urological	-1.3416	0.0899
	Musculo/Skeletal	-1.3522	0.0881
	Total	-2.4286	0.0076**
Age Group- Yrs. Pres. Job- Sample- 21	56 - 65 5-10		
	Neurological	-1.0000	0.1587
	Digestive	0.3651	0.6425
	Cardiovascular	-0.9129	0.1807
	Otological/Audio	-1.6036	0.0544*
	Allergenic/Derma	-1.8257	0.0339*
	Respiratory	-1.3497	0.0886
	Glandular	Identical Data	
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.0000	0.1587
	Total	-2.0686	0.0193
Age Group- Yrs. Pres. Job- Sample- 6	26 - 35 11-15		
	Neurological	1.0000	0.8413
	Digestive	Identical Data	
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0690	0.8575
	Respiratory	-0.6742	0.2501
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-0.3145	0.3766

Table 3-14. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Age Group- Yrs. Pres. Job- Sample- 10	36 - 45 11-15		
	Neurological	-1.0000	0.1587
	Digestive	-0.9129	0.1807
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.6036	0.0544*
	Respiratory	-1.6803	0.0464*
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-1.8955	0.0290*
Age Group- Yrs. Pres. Job- Sample- 15	46 - 55 11-15		
	Neurological	0.0	0.5000
	Digestive	Identical Data	
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	-1.3522	0.0881
	Respiratory	-1.1832	0.1184
	Glandular	1.3416	0.0899
	Urological	Identical Data	
	Musculo/Skeletal	-1.3416	0.0899
	Total	-2.0004	0.0227*
Age Group- Yrs. Pres. Job- Sample- 10	56 - 65 11-15		
	Neurological	-1.0000	0.1587
	Digestive	Identical Data	
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	-0.4472	0.3274
	Respiratory	-1.0954	0.1367
	Glandular	-1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	-1.3416	0.0899
	Total	-1.8257	0.0339*

Table 3-14. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests
 Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Age Group- Yrs. Pres. Job- Sample- 12	36 - 45 16-20		
	Neurological	-1.0000	0.1587
	Digestive	-1.0000	0.1587
	Cardiovascular	-1.3416	0.0899
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.0954	0.1367
	Respiratory	1.0954	0.8633
	Glandular	-1.0000	0.1587
	Urological	-1.0000	0.1587
	Musculo/Skeletal	Identical Data	
	Total	-1.0502	0.1468
Age Group- Yrs. Pres. Job- Sample- 20	46 - 55 16-20		
	Neurological	0.0	0.5000
	Digestive	0.1348	0.5536
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	-0.3145	0.3766
	Respiratory	0.0	0.5000
	Glandular	-1.0000	0.1587
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.0000	0.1587
	Total	-0.7847	0.2163
Age Group- Yrs. Pres. Job- Sample- 7	56 - 65 16-20		
	Neurological	Identical Data	
	Digestive	-1.0000	0.1587
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	-0.7303	0.2326
	Glandular	-1.0000	0.1587
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.6036	0.0544*
	Total	-1.2136	0.1125

Table 3-14. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Age Group- Yrs. Pres. Job- Sample- 7	46 - 55 Over 20		
	Neurological	-1.3416	0.0899
	Digestive	1.0000	0.8413
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.6036	0.0544*
	Respiratory	1.3416	0.9101
	Glandular	-1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-0.3651	0.3575
Age Group- Yrs. Pres. Job- Sample- 13	56 - 65 Over 20		
	Neurological	-1.0000	0.1587
	Digestive	-1.3416	0.0899
	Cardiovascular	-1.3416	0.0899
	Otological/Audio	Identical Data	
	Allergenic/Derma	0.0	0.5000
	Respiratory	-1.6036	0.0544*
	Glandular	-1.3416	0.0899
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-2.2404	0.0125**

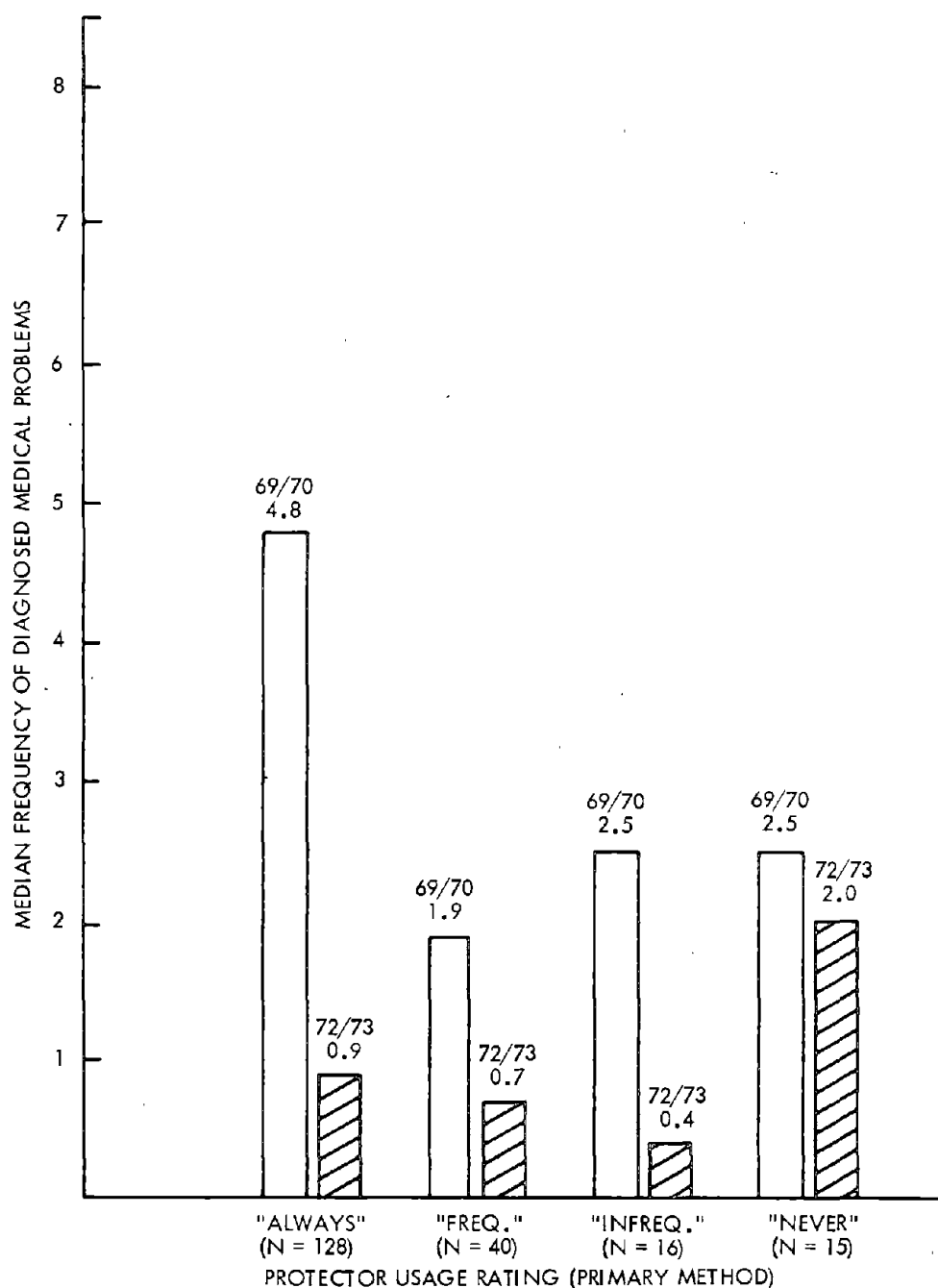


Figure 3-17. Median Frequencies of Diagnosed Medical Problems, for High Noise Group, by Protector Usage Rating (Primary Method), During the 1969/1970 vs 1972/1973 Time Periods

- Results by Ratings of Ear Protector Usage (Primary Method), by Age

Figures 3-18, 3-19, 3-20, 3-21, and 3-22 present comparisons for the High-Noise Group of median frequencies of diagnosed medical problems for combinations of ear protector usage (Primary Method) and age for the two time periods in question. These comparisons indicate no clear pattern within the specified age groups with respect to age. While most frequency differences are in the predicted direction, (i. e., fewer medical problems after hearing conservation) they do not vary in an orderly fashion with ear protector use. Reflecting the above, statistical analyses of these differences revealed a scattering of significant findings (see Table 3-15).

- Results by Ratings of Ear Protector Usage (Secondary Method)

Figure 3-23 presents for the High-Noise Group a comparison of the median frequencies of diagnosed medical problems, for each of the two periods as a function of ear protector usage (Secondary Method). Differences between data for the 1969/1970 and 1972/1973 time periods were fairly large and in the predicted direction (1972/1973 frequencies lower than 1969/1970 frequencies) for the users of ear protection ("Yes" group), the same held true for the non-users ("No" group). Results of statistical tests of these data are included in Table 3-16, and indicate significant differences for both sets of comparisons.

- Results by Ratings of Ear Protector Usage (Secondary Method) and Age

Figure 3-24 presents comparisons of the median frequencies of diagnosed medical problems in the High-Noise Group for the 1969/1970 vs. 1972/1973 time periods by age and rated ear protection usage (Secondary Method). In all but the youngest age group, the observed differences showed fewer medical problems in the post-hearing conservation period. However, the magnitudes of these differences did not co-vary with the rated use of ear protection. Indeed, the non-users displayed differential reductions in medical problems that were as large, if not larger, than

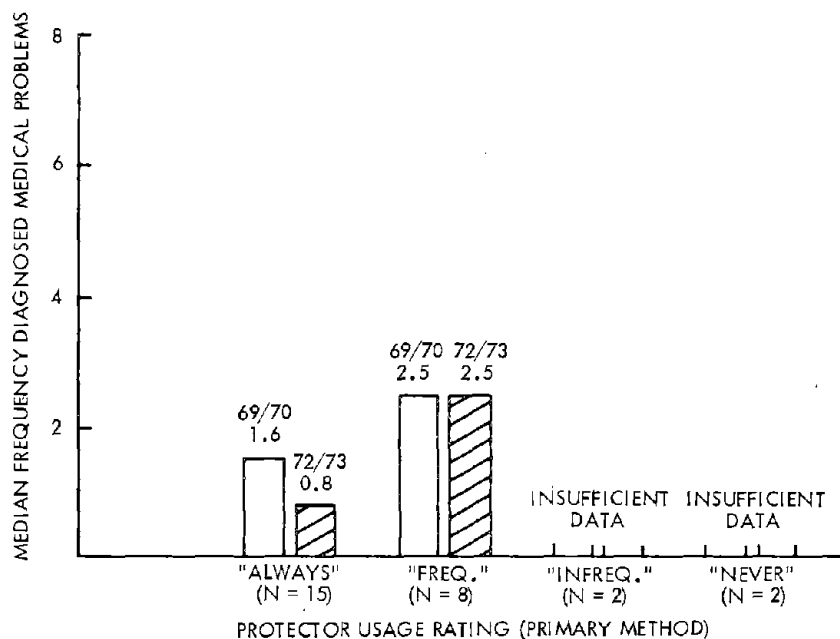


Figure 3-18. Median Frequencies of Diagnosed Medical Problems, for High Noise Group, by Protector Usage Rating (Primary Method), for the "Below 26" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

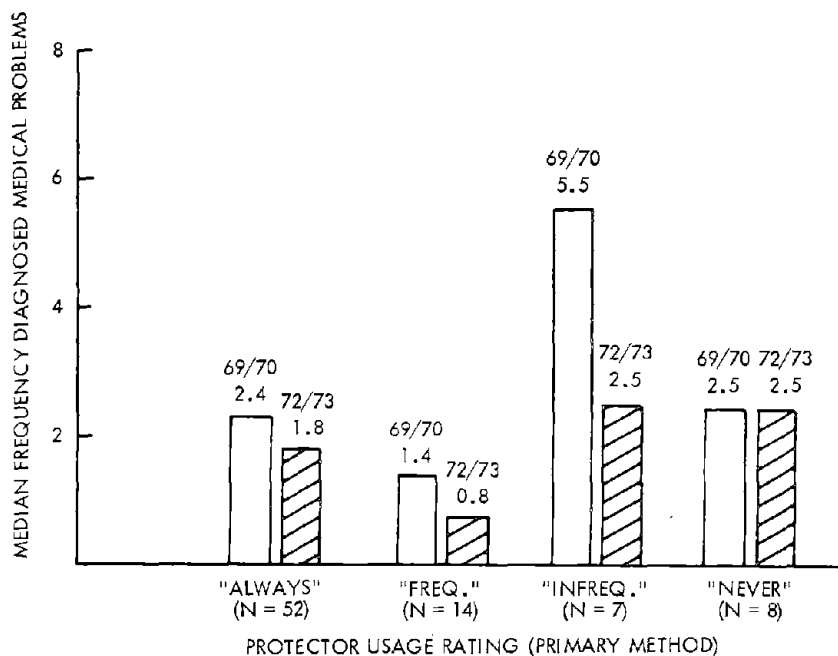


Figure 3-19. Median Frequencies of Diagnosed Medical Problems, for High Noise Group, by Protector Usage Rating (Primary Method), for the "26-35" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

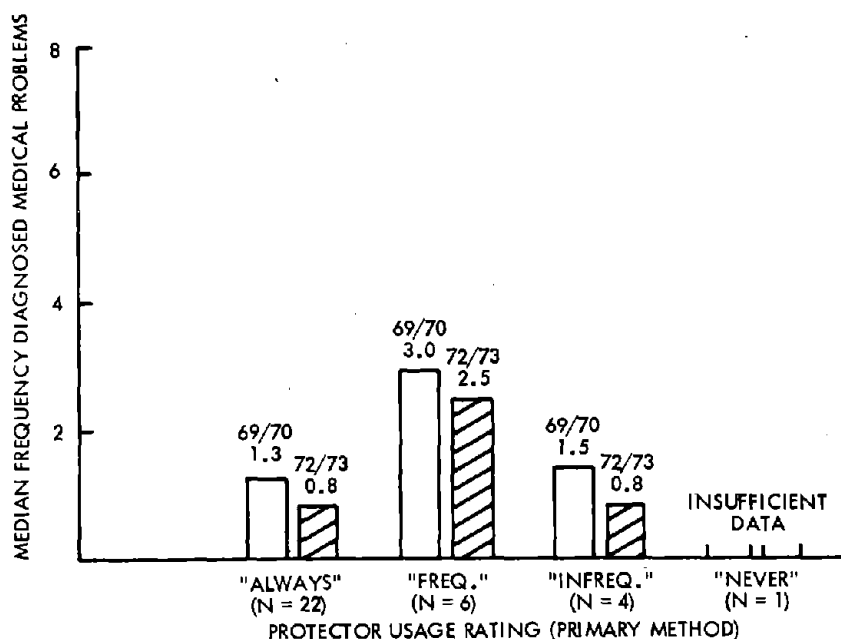


Figure 3-20. Median Frequencies of Diagnosed Medical Problems, for High Noise Group, by Protector Usage Rating (Primary Method), for the "36-45" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

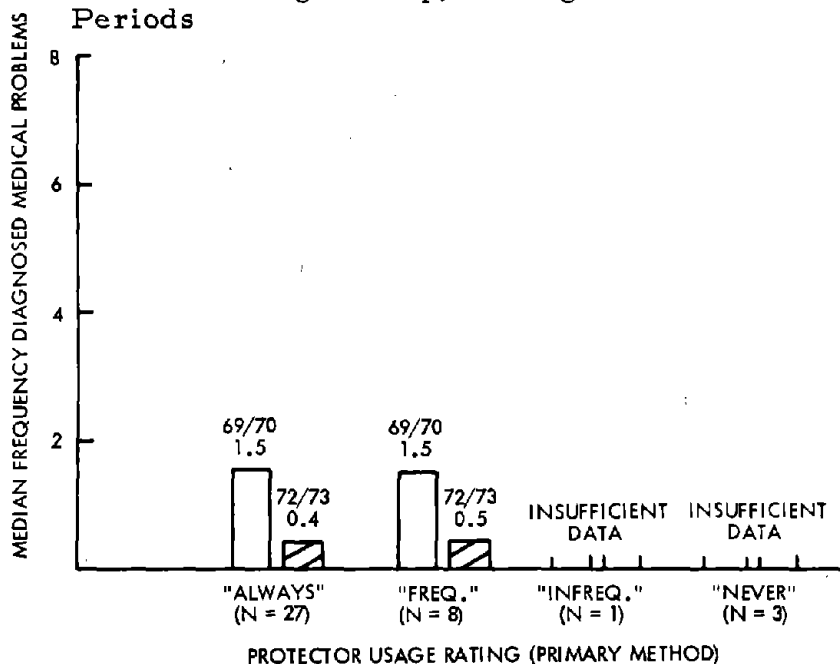


Figure 3-21. Median Frequencies of Diagnosed Medical Problems, for High Noise Group, by Protector Usage Rating (Primary Method), for the "46-55" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

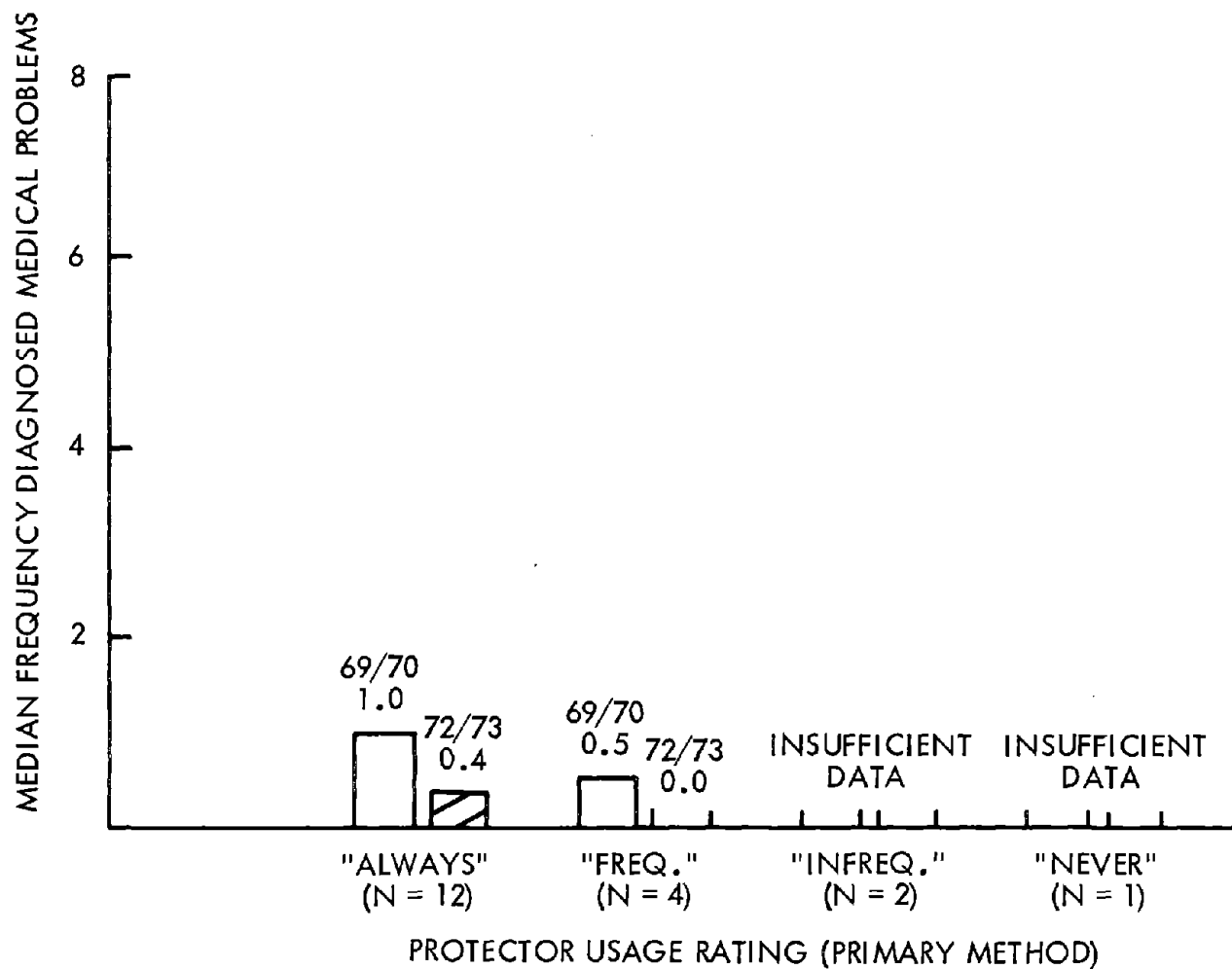


Figure 3-22. Median Frequencies of Diagnosed Medical Problems, for High Noise Group, by Protector Usage Rating (Primary Method), for the "56-65" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

Table 3-15. Results of Wilcoxon Matched-Pairs Signed-Ranks Tests, Comparing 1969/1970 Data with 1972/1973 for Various Ratings (Primary Rating Method) of Ear Protector Usage, with Respect to Frequency of Diagnosed Medical Problems in High Noise Group

Null Hypothesis - 1969/70 Data is Equivalent to 1972/73 Data

Test Hypothesis - 1972/73 Data is Less Than 1969/70 Data

Sort Factors		Z	Significance
Ear Protector Usage- Age Group-	Always		
Sample- 128			
	Neurological	-0.4137	0.3396
	Digestive	2.3538	0.9907
	Cardiovascular	-2.0449	0.0204*
	Otological/Audio	-0.5345	0.2965
	Allergenic/Derma	-2.9343	0.0017**
	Respiratory	-2.1728	0.0149**
	Glandular	-2.3664	0.0090**
	Urological	-1.3416	0.0899
	Musculo/Skeletal	-1.5051	0.0661
	Total	-2.4484	0.0072**
Ear Protector Usage- Age Group-	Frequent		
Sample- 40			
	Neurological	-1.3416	0.0899
	Digestive	1.5403	0.9383
	Cardiovascular	-0.5345	0.2965
	Otological/Audio	1.6036	0.9456
	Allergenic/Derma	-0.5916	0.2771
	Respiratory	-1.2646	0.1030
	Glandular	-1.8257	0.0339*
	Urological	-1.6036	0.0544*
	Musculo/Skeletal	-1.6036	0.0544*
	Total	-1.9107	0.0280*

Note: (1) A negative (-) Z value indicates a difference in the predicted (test hypothesis) direction, while a positive 'Z' indicates a difference in a direction opposite to the hypothesis.

(2) Statistical significance indicated by asterisks; * .05 level, ** .01 level.

Table 3-15. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Primary Rating Method)

Category - Diagnosed Medical Problems

	Sort Factors	Z	Significance
Ear Protector Usage- Age Group-	Infreqnt		
Sample- 16			
	Neurological	1.0000	0.8413
	Digestive	1.0000	0.8413
	Cardiovascular	-1.8257	0.0339*
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.2439	0.1068
	Respiratory	-2.1915	0.0142**
	Glandular	-1.0000	0.1587
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.3416	0.0899
	Total	-2.9191	0.0018**
Ear Protector Usage- Age Group-	Never		
Sample- 15			
	Neurological	0.0	0.5000
	Digestive	1.0954	0.8633
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	0.3651	0.6425
	Respiratory	1.0142	0.8448
	Glandular	-1.0000	0.1587
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.0000	0.1587
	Total	0.3494	0.6366
Ear Protector Usage- Age Group-	Always Below 26		
Sample- 15			
	Neurological	0.0	0.5000
	Digestive	Identical Data	
	Cardiovascular	-1.3416	0.0899
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.4676	0.0711
	Respiratory	-0.3554	0.3611
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.0	0.5000
	Total	-0.9085	0.1818

Table 3-15. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
 (Primary Rating Method)
 Category - Diagnosed Medical Problems

	Sort Factors	Z	Significance
Ear Protector Usage- Age Group-	Frequent Below 26		
Sample- 8			
	Neurological	Identical Data	
	Digestive	1.6036	0.9456
	Cardiovascular	Identical Data	
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	Identical Data	
	Respiratory	0.0845	0.5337
	Glandular	-1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-0.3381	0.3677
Ear Protector Usage- Age Group-	Always 26 - 35		
Sample- 52			
	Neurological	1.2780	0.8994
	Digestive	1.7838	0.9628
	Cardiovascular	0.0	0.5000
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.5771	0.0574*
	Respiratory	-1.7444	0.0405*
	Glandular	-1.3416	0.0899
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.4003	0.0807
	Total	-1.0384	0.1495
Ear Protector Usage- Age Group-	Frequent 26 - 35		
Sample- 14			
	Neurological	Identical Data	
	Digestive	1.0954	0.8633
	Cardiovascular	Identical Data	
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	-0.6742	0.2501
	Respiratory	-2.2404	0.0125**
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-1.5993	0.0549**

Table 3-15. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Primary Rating Method)

Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage- Age Group-	Infrequent 26 - 35		
Sample- 7			
	Neurological	1.0000	0.8413
	Digestive	1.0000	0.8413
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	0.5345	0.7035
	Respiratory	-1.4676	0.0711
	Glandular	-1.0000	0.1587
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.0000	0.1587
	Total	-1.7529	0.0398*
Ear Protector Usage- Age Group-	Never 26 - 35		
Sample- 8			
	Neurological	1.0000	0.8413
	Digestive	1.3416	0.9101
	Cardiovascular	Identical Data	
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	0.8018	0.7887
	Respiratory	-0.1826	0.4276
	Glandular	Identical Data	
	Urological	-1.0000	0.1587
	Musculo/Skeletal	Identical Data	
	Total	0.6301	0.7357
Ear Protector Usage- Age Group-	Always 36 - 45		
Sample- 22			
	Neurological	-0.9439	0.1726
	Digestive	1.3522	0.9119
	Cardiovascular	-1.3416	0.0899
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.8257	0.0339*
	Respiratory	0.0284	0.5113
	Glandular	-1.3416	0.0899
	Urological	Identical Data	
	Musculo/Skeletal	1.0000	0.8413
	Total	0.0805	0.5321

Table 3-15. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(PPrimary Rating Method)
Category - Diagnosed Medical Problems

	Sort Factors	Z	Significance
Ear Protector Usage- Age Group-	Frequent 36 - 45		
Sample- 6	Neurological	Identical Data	
	Digestive	Identical Data	
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0000	0.8413
	Respiratory	-1.2136	0.1125
	Glandular	Identical Data	
	Urological	-1.0000	0.1587
	Musculo/Skeletal	Identical Data	
	Total	-1.6773	0.0467*
Ear Protector Usage- Age Group-	Infreqnt 36 - 45		
Sample- 4	Neurological	Identical Data	
	Digestive	Identical Data	
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	0.0	0.5000
	Respiratory	-1.0000	0.1587
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-1.0954	0.1367
Ear Protector Usage- Age Group-	Always 46 - 55		
Sample- 27	Neurological	-1.3416	0.0899
	Digestive	1.2780	0.8994
	Cardiovascular	-1.6036	0.0544*
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	-1.4003	0.0807
	Respiratory	-1.1928	0.1165
	Glandular	-1.6036	0.0544*
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.8257	0.0339*
	Total	-2.2249	0.0130**

Table 3-15. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Primary Rating Method)

Category - Diagnosed Medical Problems

	Sort Factors	Z	Significance
Ear Protector Usage- Age Group-	Frequent 46 - 55		
Sample- 8			
	Neurological	-1.3416	0.0899
	Digestive	-1.0000	0.1587
	Cardiovascular	-1.0000	0.8413
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	-1.0000	0.1587
	Respiratory	1.2780	0.8994
	Glandular	-1.0000	0.1587
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.3416	0.0899
	Total	-0.3381	0.3677
Ear Protector Usage- Age Group-	Always 56 - 65		
Sample- 12			
	Neurological	-1.3416	0.0899
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	-0.5345	0.2965
	Respiratory	-0.9439	0.1726
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-1.6903	0.0455*
Ear Protector Usage- Age Group-	Frequent 56 - 65		
Sample- 4			
	Neurological	Identical Data	
	Digestive	Identical Data	
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	-1.0000	0.1587
	Glandular	-1.3416	0.0899
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.0000	0.1587
	Total	-1.3416	0.0899

Table 3-15. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
 (Primary Rating Method)
 Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage-	Always		
Age Group-	Below 26		
Yrs Pres Job-	5 - 10		
Sample- 15			
	Neurological	0.0	0.5000
	Digestive	Identical Data	
	Cardiovascular	-1.3416	0.0899
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.4676	0.0711
	Respiratory	-0.3554	0.3611
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.0	0.5000
	Total	-0.9085	0.1818
Ear Protector Usage-	Always		
Age Group-	26 - 35		
Yrs Pres Job-	5 - 10		
Sample- 51			
	Neurological	1.2780	0.8994
	Digestive	1.7838	0.9628
	Cardiovascular	0.0	0.5000
	Otological/Audio	Identical Data	
	Allergenic/Derma	-2.0447	0.0204*
	Respiratory	-2.0521	0.0201*
	Glandular	-1.3416	0.0899
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.4003	0.0807
	Total	-1.3066	0.0957
Ear Protector Usage-	Always		
Age Group-	36 - 45		
Yrs Pres Job-	5 - 10		
Sample- 17			
	Neurological	-0.7303	0.2326
	Digestive	1.3522	0.9119
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.6036	0.0544*
	Respiratory	-0.5099	0.3051
	Glandular	-1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	1.0000	0.8413
	Total	0.0259	0.5103

Table 3-15. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Primary Rating Method)

Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage -	Always		
Age Group -	46 - 55		
Yrs Pres Job -	5 - 10		
Sample - 21			
	Neurological	-1.0000	0.1587
	Digestive	0.8018	0.7887
	Cardiovascular	-1.6036	0.0544*
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	-1.8257	0.0339*
	Respiratory	-2.2228	0.0131**
	Glandular	-1.0000	0.1587
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.3416	0.0899
	Total	-2.8241	0.0024**
Ear Protector Usage -	Always		
Age Group -	56 - 65		
Yrs Pres Job -	5 - 10		
Sample - 7			
	Neurological	-1.0000	0.1587
	Digestive	Identical Data	
	Cardiovascular	Identical Data	
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	-1.0000	0.1587
	Respiratory	0.0	0.5000
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-0.9439	0.1726
Ear Protector Usage -	Frequent		
Age Group -	Below 26		
Yrs Pres Job -	5 - 10		
Sample - 8			
	Neurological	Identical Data	
	Digestive	1.6036	0.9456
	Cardiovascular	Identical Data	
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	Identical Data	
	Respiratory	0.0845	0.5337
	Glandular	-1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-0.3381	0.3677

Table 3-15. (Cont.)
 Wilcoxon Matched-Pairs Signed Ranks Tests, Ear Protector Usage
 (Primary Rating Method)
 Category - Diagnosed Medical Problems

	Sort Factors	Z	Significance
Ear Protector Usage- Age Group- Yrs Pres Job- Sample- 12	Frequent 26 - 35 5 - 10		
	Neurological	Identical Data	
	Digestive	1.0954	0.8633
	Cardiovascular	Identical Data	
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	-0.6742	0.2501
	Respiratory	-1.8869	0.0296*
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-1.2677	0.1024
Ear Protector Usage- Age Group- Yrs Pres Job- Sample- 5	Frequent 36 - 45 5 - 10		
	Neurological	Identical Data	
	Digestive	Identical Data	
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0000	0.8413
	Respiratory	-1.2136	0.1125
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-1.4832	0.0690
Ear Protector Usage- Age Group- Yrs Pres Job- Sample- 6	Infreqnt 26 - 35 5 - 10		
	Neurological	1.0000	0.8413
	Digestive	1.0000	0.8413
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	0.5345	0.7035
	Respiratory	-1.2136	0.1125
	Glandular	-1.0000	0.1587
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.0000	0.1587
	Total	-1.4606	0.0721

Table 3-15. (Cont.)

Wilcoxon Matched-Pairs Signed Ranks Tests, Ear Protector Usage
(Primary Rating Method)

Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage-	Never		
Age Group-	26 - 35		
Yrs Pres Job-	5 - 10		
Sample- 7			
	Neurological	1.0000	0.8413
	Digestive	1.3416	0.9101
	Cardiovascular	Identical Data	
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	0.0	0.5000
	Respiratory	-0.1826	0.4276
	Glandular	Identical Data	
	Urological	-1.0000	0.1587
	Musculo/Skeletal	Identical Data	
	Total	0.2535	0.6001
Ear Protector Usage-	Always		
Yrs Pres Job-	5 - 10		
Sample- 111			
	Neurological	0.1747	0.5693
	Digestive	2.4826	0.9935
	Cardiovascular	-1.8857	0.0297*
	Otological/Audio	-1.3416	0.0899
	Allergenic/Derma	-3.4057	0.0003**
	Respiratory	-2.7405	0.0031**
	Glandular	-1.8257	0.0339*
	Urological	-1.3416	0.0899
	Musculo/Skeletal	-1.0483	0.1473
	Total	-2.5132	0.0060**
Ear Protector Usage-	Frequent		
Yrs Pres Job-	5 - 10		
Sample- 29			
	Neurological	-1.0000	0.1587
	Digestive	1.5403	0.9383
	Cardiovascular	0.0	0.5000
	Otological/Audio	1.6036	0.9456
	Allergenic/Derma	-0.3145	0.3766
	Respiratory	-0.9037	0.1831
	Glandular	-1.0000	0.1587
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.0000	0.1587
	Total	-0.9415	0.1732

Table 3-15. (Cont.)

Wilcoxon Matched-Pairs Signed Ranks Tests, Ear Protector Usage
(Primary Rating Method)

Category - Diagnosed Medical Problems

	Sort Factors	Z	Significance
Ear Protector Usage-	Infreqnt		
Yrs Pres Job-	5 - 10		
Sample- 12			
	Neurological	1.0000	0.8413
	Digestive	1.0000	0.8413
	Cardiovascular	-1.3416	0.0899
	Otological/Audio	Identical Data	
	Allergenic/Derma	-0.7338	0.2315
	Respiratory	-1.8204	0.0344*
	Glandular	-1.0000	0.1587
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.3416	0.0899
	Total	-2.5482	0.0054**
Ear Protector Usage-	Never		
Yrs Pres Job-	5 - 10		
Sample- 12			
	Neurological	0.0	0.5000
	Digestive	1.0954	0.8633
	Cardiovascular	Identical Data	
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	-0.5345	0.2965
	Respiratory	1.0142	0.8448
	Glandular	-1.0000	0.1587
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.0000	0.1587
	Total	0.3556	0.6389
Ear Protector Usage-	Always		
Yrs Pres Job-	11 - 15		
Sample- 7			
	Neurological	-1.0000	0.1587
	Digestive	Identical Data	
	Cardiovascular	Identical Data	
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	0.3651	0.6425
	Respiratory	1.4606	0.9279
	Glandular	-1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	0.9439	0.8274

Table 3-15. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Primary Rating Method)

Category - Diagnosed Medical Problems

	Sort Factors	Z	Significance
Ear Protector Usage-	Frequent		
Yrs Pres Job-	11 - 15		
Sample- 5			
	Neurological	-1.0000	0.1587
	Digestive	Identical Data	
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.0000	0.1587
	Respiratory	-1.3416	0.0899
	Glandular	-1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-2.0226	0.0216*
Ear Protector Usage-	Always		
Yrs Pres Job-	16 - 20		
Sample- 7			
	Neurological	Identical Data	
	Digestive	1.0000	0.8413
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.3416	0.9101
	Respiratory	0.0	0.5000
	Glandular	1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-0.1826	0.4276
Ear Protector Usage-	Frequent		
Yrs Pres Job-	16 - 20		
Sample- 4			
	Neurological	Identical Data	
	Digestive	Identical Data	
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	-1.3416	0.0899
	Glandular	-1.0000	0.1587
	Urological	-1.3416	0.0899
	Musculo/Skeletal	-1.0000	0.1587
	Total	-1.6036	0.0544*

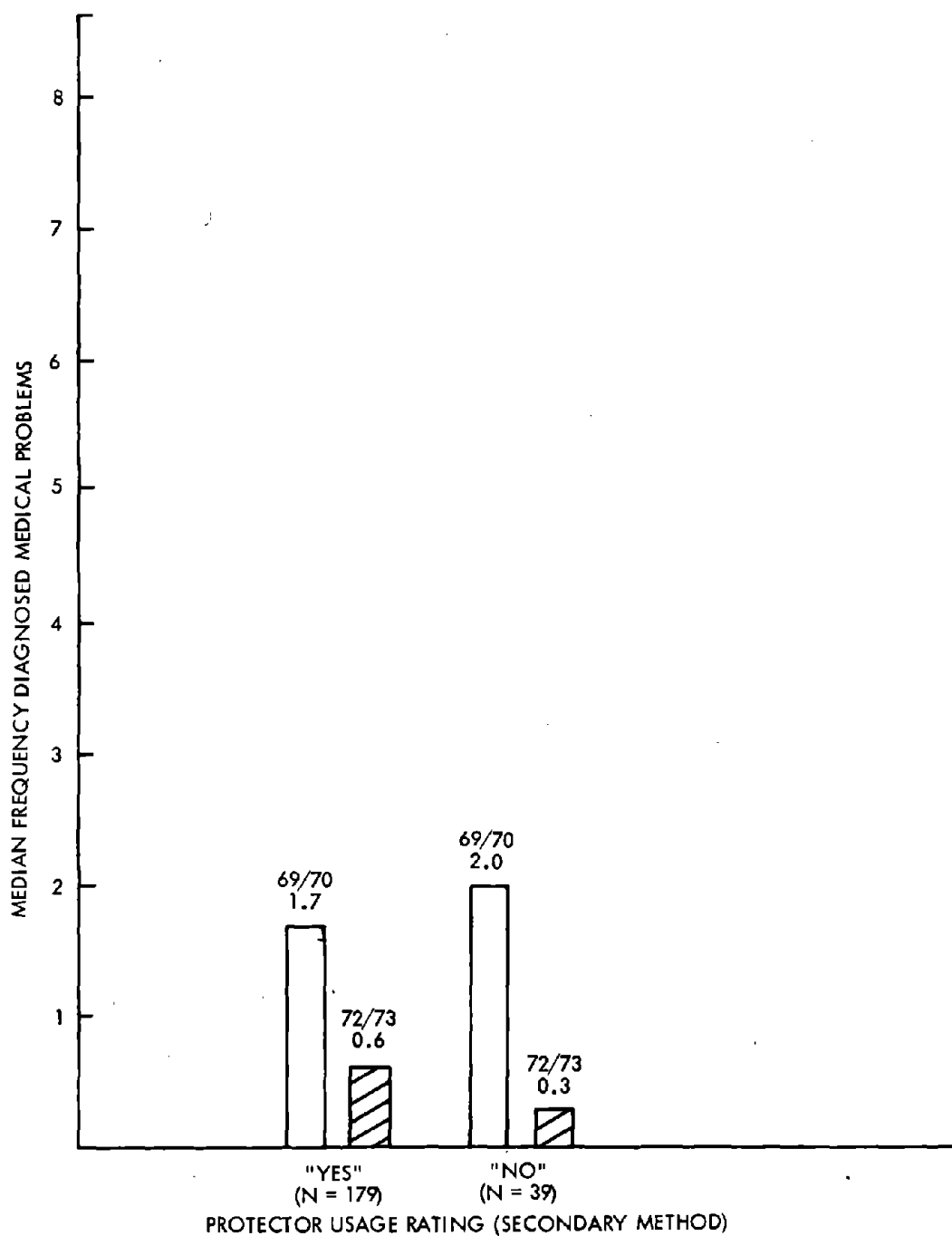


Figure 3-23. Median Frequencies of Diagnosed Medical Problems, for High Noise Group, by Protector Usage Rating (Secondary Method), During the 1969/1970 vs 1972/1973 Time Periods

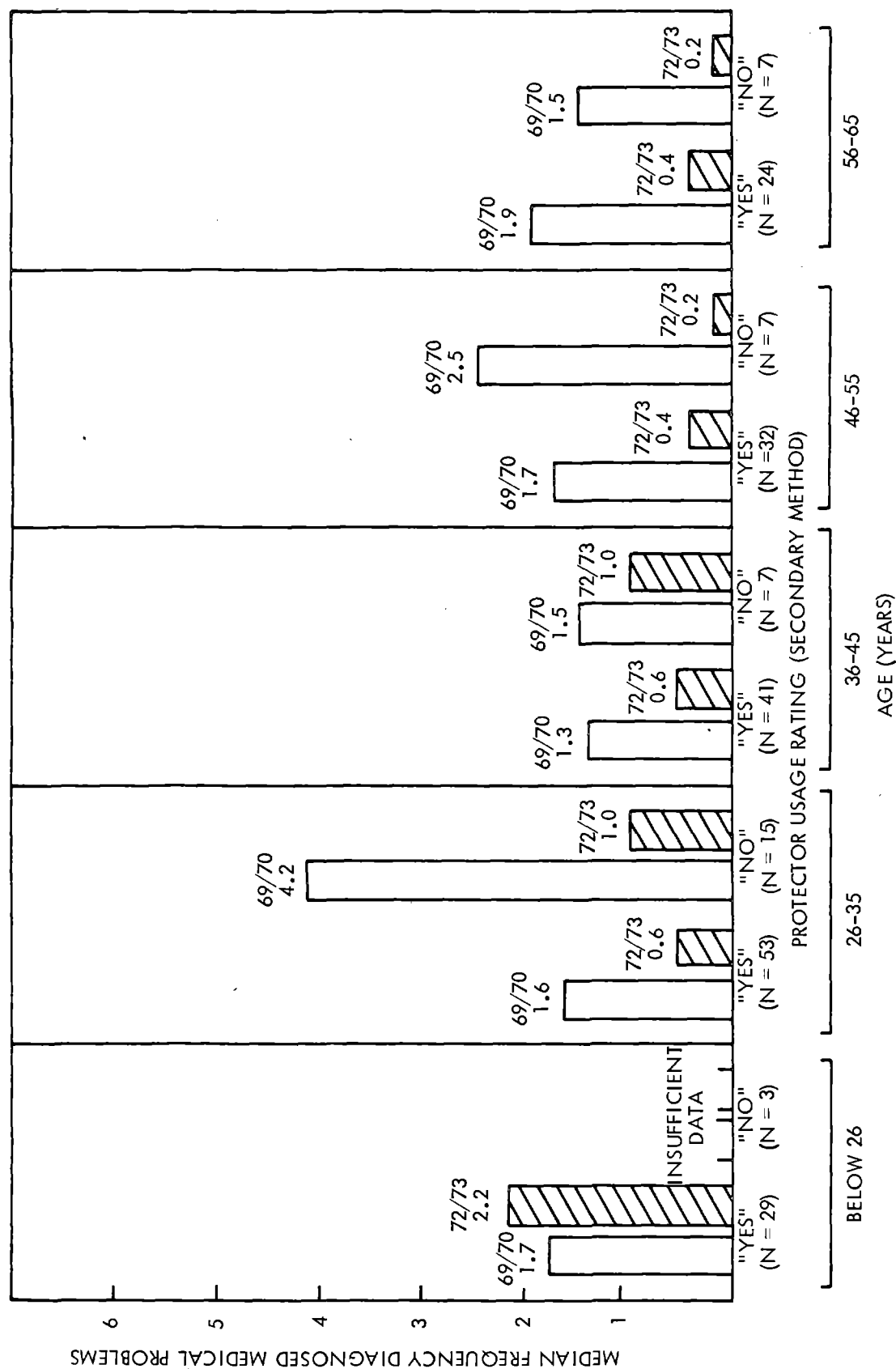


Figure 3-24. Median Frequencies of Diagnosed Medical Problems, for High Noise Group, by Protector Usage Rating (Secondary Method), and Age Group, During the 1969/1970 vs 1972/1973 Time Periods

Table 3-16. Results of Wilcoxon Matched-Pairs Signed-Ranks Tests, Comparing 1969/1970 Data with 1972/1973 Data, for Various Ratings (Secondary Rating Method) of Ear Protector Usage, with Respect to Frequency of Diagnosed Medical Problems in High Noise Group

Null Hypothesis - 1969/70 Data is Equivalent to 1972/73 Data
 Test Hypothesis - 1972/73 Data is Less Than 1969/70 Data

Sort Factors		Z	Significance
Ear Protector Usage-	Yes		
Sample- 179			
	Neurological	1.26 3	0.8962
	Digestive	2.4309	0.9925
	Cardiovascular	-1.7838	0.0372*
	Otological/Audio	-0.8885	0.1871
	Allergenic/Derma	-1.0497	0.1469
	Respiratory	-2.5512	0.0054**
	Glandular	-1.8257	0.0339*
	Urological	-1.6036	0.0544*
	Musculo/Skeletal	-2.7219	0.0032**
	Total	-2.2609	0.0119**
Ear Protector Usage-	No		
Sample- 39			
	Neurological	-1.8593	0.0315*
	Digestive	0.3145	0.6234
	Cardiovascular	-1.6036	0.0544*
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	-2.5887	0.0048**
	Respiratory	-2.5810	0.0049**
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-3.7300	0.000**

- Note: (1) A negative (-) 'Z' value indicates a difference in the predicted (test hypothesis) direction, while a positive 'Z' indicates a difference in a direction opposite to the hypothesis.
 (2) Statistical significance indicated by asterisks; * .05 level, ** .01 level.

Table 3-16. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Secondary Rating Method)

Category - Diagnosed Medical Problems

	Sort Factors	Z	Significance
Ear Protector Usage- Age Group-	Yes Below 26		
Sample- 29			
	Neurological	1.0000	0.8413
	Digestive	2.0226	0.9784
	Cardiovascular	-1.3416	0.0899
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	-0.7001	0.2419
	Respiratory	-0.4036	0.3433
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.8257	0.0339*
	Total	-0.3571	0.3605
Ear Protector Usage- Age Group-	Yes 26 - 35		
Sample- 53			
	Neurological	0.5345	0.7035
	Digestive	2.3117	0.9896
	Cardiovascular	-0.5345	0.2965
	Otological/Audio	-0.5345	0.2965
	Allergenic/Derma	0.7667	0.7784
	Respiratory	-1.8839	0.0298*
	Glandular	Identical Data	
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.0954	0.1367
	Total	-0.8553	0.1962
Ear Protector Usage- Age Group-	No 26 - 35		
Sample- 15			
	Neurological	-1.0954	0.1367
	Digestive	0.5345	0.7035
	Cardiovascular	Identical Data	
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	-1.0954	0.1367
	Respiratory	-1.6893	0.0456*
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-2.1573	0.0155**

Table 3-16. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
 (Secondary Rating Method)
 Category - Diagnosed Medical Problems

	Sort Factors	Z	Significance
Ear Protector Usage- Age Group-	Yes 36 - 45		
Sample- 41			
	Neurological	0.0	0.5000
	Digestive	-0.4045	0.3429
	Cardiovascular	Identical Data	
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	-0.9435	0.1727
	Respiratory	-1.6382	0.0507*
	Glandular	-1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-1.7894	0.0368
Ear Protector Usage- Age Group-	No 36 - 45		
Sample- 7			
	Neurological	Identical Data	
	Digestive	1.0000	0.8413
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.6036	0.0544*
	Respiratory	-0.8018	0.2113
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-1.4832	0.0690
Ear Protector Usage- Age Group-	Yes 46 - 55		
Sample- 32			
	Neurological	1.3416	0.9101
	Digestive	0.8386	0.7992
	Cardiovascular	-1.3416	0.0899
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.3337	0.0912
	Respiratory	-0.8161	0.2072
	Glandular	-1.0000	0.1587
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-0.5477	0.2919
	Total	-0.5444	0.2931

Table 3-16. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Secondary Rating Method)

Category - Diagnosed Medical Problems

	Sort Factors	Z	Significance
Ear Protector Usage- Age Group-	No 46 - 55		
Sample- 7			
	Neurological	-1.3416	0.0899
	Digestive	Identical Data	
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.3416	0.0899
	Respiratory	-1.8257	0.0339*
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-2.0226	0.0216*
Ear Protector Usage- Age Group-	Yes 56 - 65		
Sample- 24			
	Neurological	Identical Data	
	Digestive	-0.1348	0.4464
	Cardiovascular	-0.8018	0.2113
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	-0.4045	0.3429
	Respiratory	-1.1614	0.1227
	Glandular	-1.3416	0.0899
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-2.0226	0.0216*
	Total	-1.9115	0.0280*
Ear Protector Usage- Age Group-	No 56 - 65		
Sample- 7			
	Neurological	-1.0000	0.1587
	Digestive	-1.0000	0.1587
	Cardiovascular	-1.3416	0.0899
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.0000	0.1587
	Respiratory	0.0	0.5000
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-1.8257	0.0339*

Table 3-16. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Secondary Rating Method)

Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage-	Yes		
Age Group-	Below 26		
Yrs. Pres. Job.-	5 - 10		
Sample- 29			
	Neurological	1.0000	0.8413
	Digestive	2.0226	0.9784
	Cardiovascular	-1.3416	0.0899
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	-0.7001	0.2419
	Respiratory	-0.4036	0.3433
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.8257	0.0339*
	Total	-0.3571	0.3605
Ear Protector Usage-	Yes		
Age Group-	26 - 35		
Yrs. Pres. Job-	5 - 10		
Sample- 52			
	Neurological	0.0	0.5000
	Digestive	2.3117	0.9894
	Cardiovascular	-0.5345	0.2965
	Otological/Audio	-0.5345	0.2965
	Allergenic/Derma	0.9730	0.8347
	Respiratory	-1.7330	0.0415*
	Glandular	Identical Data	
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.0954	0.1367
	Total	0.7057	0.2402
Ear Protector Usage-	Yes		
Age Group-	36 - 45		
Yrs. Pres. Job-	5 - 10		
Sample- 30			
	Neurological	1.0000	0.8413
	Digestive	1.3416	0.9101
	Cardiovascular	Identical Data	
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	0.0	0.5000
	Respiratory	-0.8928	0.1860
	Glandular	-1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-0.7647	0.2222

Table 3-16. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Secondary Rating Method)

Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage-	Yes		
Age Group-	46 - 55		
Yrs. Pres. Job-	5 - 10		
Sample- 11			
	Neurological	Identical Data	
	Digestive	1.0000	0.8413
	Cardiovascular	-1.3416	0.0899
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.0954	0.1367
	Respiratory	-0.7606	0.2234
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.2673	0.3946
	Total	-0.7338	0.2315
Ear Protector Usage-	Yes		
Age Group-	56 - 65		
Yrs. Pres. Job-	5 - 10		
Sample- 8			
	Neurological	Identical Data	
	Digestive	0.8018	0.7887
	Cardiovascular	0.0	0.5000
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	-1.6036	0.0544*
	Respiratory	-0.7001	0.2419
	Glandular	Identical Data	
	Urological	-1.0000	0.1587
	Musculo/Skeletal	Identical Data	
	Total	-0.7001	0.2419
Ear Protector Usage-	No		
Age Group-	26 - 35		
Yrs. Pres. Job-	5 - 10		
Sample- 15			
	Neurological	-1.0954	0.1367
	Digestive	0.5345	0.7035
	Cardiovascular	Identical Data	
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	-1.0954	0.1367
	Respiratory	-1.6893	0.0456*
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-2.1573	0.0155**

Table 3-16. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Secondary Rating Method)

Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage-	No		
Age Group-	36 - 45		
Yrs. Pres. Job-	5 - 10		
Sample- 5			
	Neurological	Identical Data	
	Digestive	1.0000	0.8413
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.3416	0.0899
	Respiratory	-0.8018	0.2113
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-1.2780	0.1006
Ear Protector Usage-	Yes		
Age Group-	36 - 45		
Yrs. Pres. Job	11 - 15		
Sample- 7			
	Neurological	Identical Data	
	Digestive	-1.6036	0.0544*
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.0000	0.1587
	Respiratory	-1.7821	0.0374*
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-1.8869	0.0296*
Ear Protector Usage-	Yes		
Age Group-	46 - 55		
Yrs. Pres. Job-	11 - 15		
Sample- 4			
	Neurological	1.0000	0.8413
	Digestive	Identical Data	
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.3416	0.9101
	Respiratory	-1.3416	0.0899
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	0.0	0.5000

Table 3-16. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Secondary Rating Method)

Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage-	Yes		
Age Group-	56 - 65		
Yrs. Pres. Job-	11 - 15		
Sample- 5			
	Neurological	Identical Data	
	Digestive	Identical Data	
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	-1.0000	0.1587
	Glandular	-1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	-1.3416	0.0899
	Total	-1.6036	0.0544*
Ear Protector Usage-	Yes		
Age Group-	36 - 45		
Yrs. Pres. Job-	16 - 20		
Sample- 4			
	Neurological	-1.0000	0.1587
	Digestive	Identical Data	
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.0000	0.1587
	Respiratory	1.13416	0.9101
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	0.0	0.5000
Ear Protector Usage-	Yes		
Age Group-	46 - 55		
Yrs. Pres. Job-	16 - 20		
Sample- 14			
	Neurological	1.0000	0.8413
	Digestive	-0.5477	0.2919
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.0954	0.1367
	Respiratory	0.5477	0.7081
	Glandular	-1.0000	0.1587
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.0000	0.1587
	Total	-0.7701	0.2206

Table 3-16. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Secondary Rating Method)

Category - Diagnosed Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage-	Yes		
Age Group-	56 - 65		
Yrs. Pres. Job-	16 - 20		
Sample- 4			
	Neurological	Identical Data	
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	0.4472	0.6726
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.3416	0.0899
	Total	0.0	0.5000
Ear Protector Usage-	Yes		
Age Group-	56 - 65		
Yrs. Pres. Job-	Over 20		
Sample- 7			
	Neurological	Identical Data	
	Digestive	-1.0000	0.1587
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.3417	0.9101
	Respiratory	-1.6036	0.0544*
	Glandular	-1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-1.6181	0.0528*
Ear Protector Usage-	Yes		
Yrs. Pres. Job-	5 - 10		
Sample- 130			
	Neurological	0.9129	0.8193
	Digestive	3.4251	0.9997
	Cardiovascular	-1.4809	0.0693
	Otological/Audio	-0.8885	0.1871
	Allergenic/Derma	-0.5092	0.3053
	Respiratory	-1.9752	0.0241*
	Glandular	-1.0000	0.1587
	Urological	-1.3416	0.0890
	Musculo/Skeletal	-1.8827	0.0299*
	Total	-1.2414	0.1072

Table 3-16. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Secondary Rating Method)

Category - Diagnosed Medical Problems

	Sort Factors	Z	Significance
Ear Protector Usage-	No		
Yrs. Pres. Job-	5 - 10		
Sample- 28			
	Neurological	-1.0954	0.1367
	Digestive	0.3145	0.6234
	Cardiovascular	1.3416	0.0899
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	-1.9604	0.0250*
	Respiratory	-2.2864	0.0111**
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-3.0567	0.001**
Ear Protector Usage-	Yes		
Yrs. Pres. Job-	11 - 15		
Sample- 17			
	Neurological	1.3416	0.9101
	Digestive	-1.6036	0.0544*
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	0.0	0.5000
	Respiratory	-2.4973	0.0063**
	Glandular	-1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	-1.3416	0.0899
	Total	-2.5103	0.0060
Ear Protector Usage-	No		
Yrs. Pres. Job-	11 - 15		
Sample- 4			
	Neurological	-1.0000	0.1587
	Digestive	Identical Data	
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.0000	0.1587
	Respiratory	-0.8018	0.2113
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-1.3416	0.0899

Table 3-16. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Secondary Rating Method)

Category - Diagnosed Medical Problems

	Sort Factors	Z	Significance
Ear Protector Usage-	Yes		
Yrs. Pres. Job-	16 - 20		
Sample- 22			
	Neurological	0.0	0.5000
	Digestive	-0.8090	0.2092
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.4832	0.0690
	Respiratory	1.1902	0.8830
	Glandular	1.0000	0.1587
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-1.6036	0.0544*
	Total	-0.9655	0.1671
Ear Protector Usage-	Yes		
Yrs. Pres. Job-	Over 20		
Sample- 10			
	Neurological	Identical Data	
	Digestive	0.4472	0.6726
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	0.0	0.5000
	Respiratory	-1.2780	0.1006
	Glandular	1.0000	0.1587
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	0.6290	0.2647
Ear Protector Usage-	No		
Yrs. Pres. Job-	Over 20		
Sample- 4			
	Neurological	-1.0000	0.1587
	Digestive	Identical Data	
	Cardiovascular	-1.0000	0.1587
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.3416	0.0899
	Respiratory	Identical Data	
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-1.3416	0.0899

the user group in a few comparisons. Statistical tests of these differences are summarized in Table 3-17, both user and non-user groups showing significant changes in select comparisons.

- Diagnosed Medical Problems in the Low-Noise Group

To insure that the apparent drop in occurrences of diagnosed medical problems among the High-Noise Group was not really a plant-wide change, not necessarily due to a noise reduction factor, the frequency of such disorders was compared for workers in the Low-Noise Group for the same two time periods, i.e., 1969/1970 vs. 1972/1973. The median frequency values for these two time periods for 63 combinations of sort variables are shown for the Low-Noise Group in Table 3-17, together with the results of Wilcoxon (two-tailed) tests applied to them to ascertain statistically significant differences. Differences between the frequency data for the two time periods are shown to be quite small. Of the 63 listed comparisons, 8 were found statistically significant, 7 in the same direction as the Test Hypothesis for the High-Noise Group, and one in the opposite direction. In contrast, 30 of the same comparisons for the High-Noise Group attained statistical significance in the expected direction. The thrust of these results suggest that the frequency variations noted for the Low Noise Group between the two time periods in question were quite modest, and not sufficient to nullify the changes shown in the data for the High-Noise Group.

- Diagnostic Categories of Medical Problems in the High- and Low-Noise Groups

Table 3-18 gives a breakdown of diagnosed medical problems by specified categories of disorders for the 1969/1970 and 1972/1973 time periods, including both the numbers of workers afflicted, and the number of occurrences for members of the High- and Low-Noise Groups. With the exception of digestive disorders, fewer medical problems of all other types were noted in the 1972/1973 period relative to the 1969/1970

Table 3-17. Summary Table of Results of Wilcoxon Matched Pairs Signed-Ranks Tests (2-Tailed) and Median Frequencies for the Low Noise Group, Comparing 1969/1970 Data with 1972/1973 Data, with Respect to Diagnosed Medical Problems

Group/Sub Group Combination	Sample Size	Median Frequencies		Significance
		1969/1970	1972/1973	
Total Sample	432	0.3	0.2	0.2478
Age: Below 26	9	3.5	0.5	0.0592*
26 - 35	98	0.2	0.1	0.0320*
36 - 45	133	0.3	0.3	0.2306
46 - 55	137	0.2	0.2	0.8734
56 - 65	55	0.3	0.1	0.0714
Occupation: Foreman				
Age: 26 - 35	25	0.4	0.3	0.6378
36 - 45	43	1.1	1.6	0.1098
46 - 55	41	0.6	0.6	0.7750
56 - 65	24	0.5	0.2	0.2330
Occupation: Test and Inspection				
Age: 26 - 35	6	0.5	0.3	0.7150
36 - 45	12	0.8	0.4	0.9999
46 - 55	16	0.4	0.7	0.9528
Occupation: Engineer/Draftsman				
Age: Below 26	7	3.5	0.3	0.1056
26 - 35	51	0.2	0.0	0.0054**
36 - 45	63	0.1	0.1	0.9322
46 - 55	61	0.1	0.1	0.2788
56 - 65	23	0.2	0.1	0.6744
Occupation: Plant Support				
Age: 26 - 35	4	1.5	0.5	0.2012
46 - 55	4	2.0	0.2	0.3174
Occupation: Administrator				
Age: 26 - 35	11	0.2	0.2	0.4226
36 - 45	12	0.3	0.0	0.3614
46 - 55	15	0.2	0.1	0.3614
56 - 65	5	0.3	0.0	0.3174
Marital Status: Single				
Age: 26 - 35	23	0.4	0.1	0.0166**
36 - 45	6	0.3	0.0	0.1798
46 - 55	7	0.2	0.3	0.1798
Marital Status: Married				
Age: Below 26	8	2.0	0.5	0.1056
26 - 35	75	0.2	0.1	0.2214
36 - 45	125	0.3	0.3	0.1048
46 - 55	128	0.2	0.2	0.7936
56 - 65	51	0.3	0.1	0.1362

*Significant difference $p < .05$, **Significant difference $p < .01$

Table 3-17. Summary Table of Results of Wilcoxon Matched-Pairs Signed-Ranks Tests (2-Tailed) and Median Frequencies for the Low Noise Group, Comparing 1969/1970 Data with 1972/1973 Data, with Respect to Diagnosed Medical Problems (Cont.)

Group/Sub Group Combination	Sample Size	Median Frequencies		Significance
		1969/1970	1972/1973	
Shift: Rotating				
Age: 26 - 35	4	0.0	0.0	No Difference
36 - 45	4	0.2	0.2	No Difference
46 - 55	7	0.3	0.3	0.3174
Shift: First				
Age: Below 26	9	3.5	0.5	0.0592*
26 - 35	76	0.2	0.1	0.0184**
36 - 45	98	0.2	0.2	0.6502
46 - 55	110	0.2	0.2	0.7844
56 - 65	40	0.3	0.1	0.0394*
Shift: Second				
Age: 26 - 35	7	0.5	0.5	0.8552
36 - 45	18	0.5	1.8	0.0426*
46 - 55	11	0.8	1.2	0.2340
56 - 65	10	0.3	0.5	0.1776
Shift: Third				
Age: 26 - 35	11	1.0	0.3	0.5286
36 - 45	13	1.2	1.5	0.2026
46 - 55	9	1.1	1.8	0.8886
56 - 65	4	1.0	0.0	0.1088
Years Present Job: 5 - 10				
Age: Below 26	7	3.5	0.3	0.1056
26 - 35	81	0.2	0.1	0.0686
36 - 45	91	0.3	0.4	0.1414
46 - 55	63	0.2	0.2	0.2768
56 - 65	16	0.5	0.1	0.2362
Years Present Job: 11 - 15				
Age: 26 - 35	14	0.3	0.1	0.2368
36 - 45	22	0.7	0.1	0.3984
46 - 55	37	0.3	0.3	0.1842
56 - 65	24	0.3	0.1	0.4412
Years Present Job: 16 - 20				
Age: 36 - 45	14	0.2	0.2	0.5002
46 - 55	17	0.3	0.3	0.7150
56 - 65	7	0.3	0.3	0.7150
Years Present Job: Over 20				
Age: 36 - 45	6	0.0	0.3	0.1798
46 - 55	20	0.1	0.1	0.9166
56 - 65	8	0.3	0.1	0.2734

*Significant difference $p < .05$, **Significant difference $p < .01$

Table 3-18. Incidence of Diagnosed Medical Problems by Subcategory, Reported During the 1969/1970 and 1972/1973 Time Periods, for the High and Low Noise Groups

Diagnosed Medical Problem Sub-Category	Number of Workers Afflicted				Number of Occurrences			
	High Noise Group		Low Noise Group		High Noise Group		Low Noise Group	
	1969/1970	1972/1973	1969/1970	1972/1973	1969/1970	1972/1973	1969/1970	1972/1973
Neurological	21	17	7	14	30	25	21	17
Digestive	30	54	11	28	35	123	15	77
Cardiovascular	30	5	19	2	48	5	23	2
Otological/Audiological	11	8	3	2	11	8	3	2
Allergenic/Dermatological	100	53	39	21	135	66	45	24
Respiratory	259	181	98	90	889	615	228	215
Glandular	17	0	5	0	21	0	5	0
Urological	13	1	8	0	14	1	8	0
Musculo-Skeletal	36	8	14	1	45	10	16	1

period in the records of the High- and Low-Noise Groups. The number of digestive disorders in the 1972/1973 time period exceeded that for the 1969/1970 period in both the High- and Low-Noise Groups. This suggested some plant-wide effect. When queried about this, the Medical Department of the complex could offer no explanation.

As noted in the previous study (1, 2), and still evident in this follow-up one, is the relatively great preponderance of respiratory disorders among the High-Noise Group. A certain number of these cases may involve sore throats and laryngitis caused by shouting to overcome the interference effects of noise. Other prevalent medical problems among the High-Noise Group were those diagnosed as allergenic and dermatologic in nature. Health examination surveys of workers in noisy industries have noted an increased incidence of these and other ailments as compared with those in quieter occupations (3, 4, 5, 6, 14, 23). These latter studies, however, have not always considered other adverse workplace or job conditions, apart from noise which could have influenced the results. In this effort, the same workers in the same jobs were evaluated, in effect, under high and then low noise conditions. When expressed as percentages of the frequencies of specified disorders noted in 1969/1970 for their respective groups, the High-Noise Group showed greater reductions in the number of workers affected and the number of occurrences than did the Low-Noise Group during 1972/1973. This differential amount of reduction could be reflective of the benefits of noise attenuation afforded the High-Noise Group through the use of ear protectors.

3.4 Symptomatic Medical Problems

- Overall Results

Figure 3-25 illustrates the cumulative percent frequency distribution of workers in the High-Noise Group having had a specified number of symptomatic complaints entered into their medical records during the

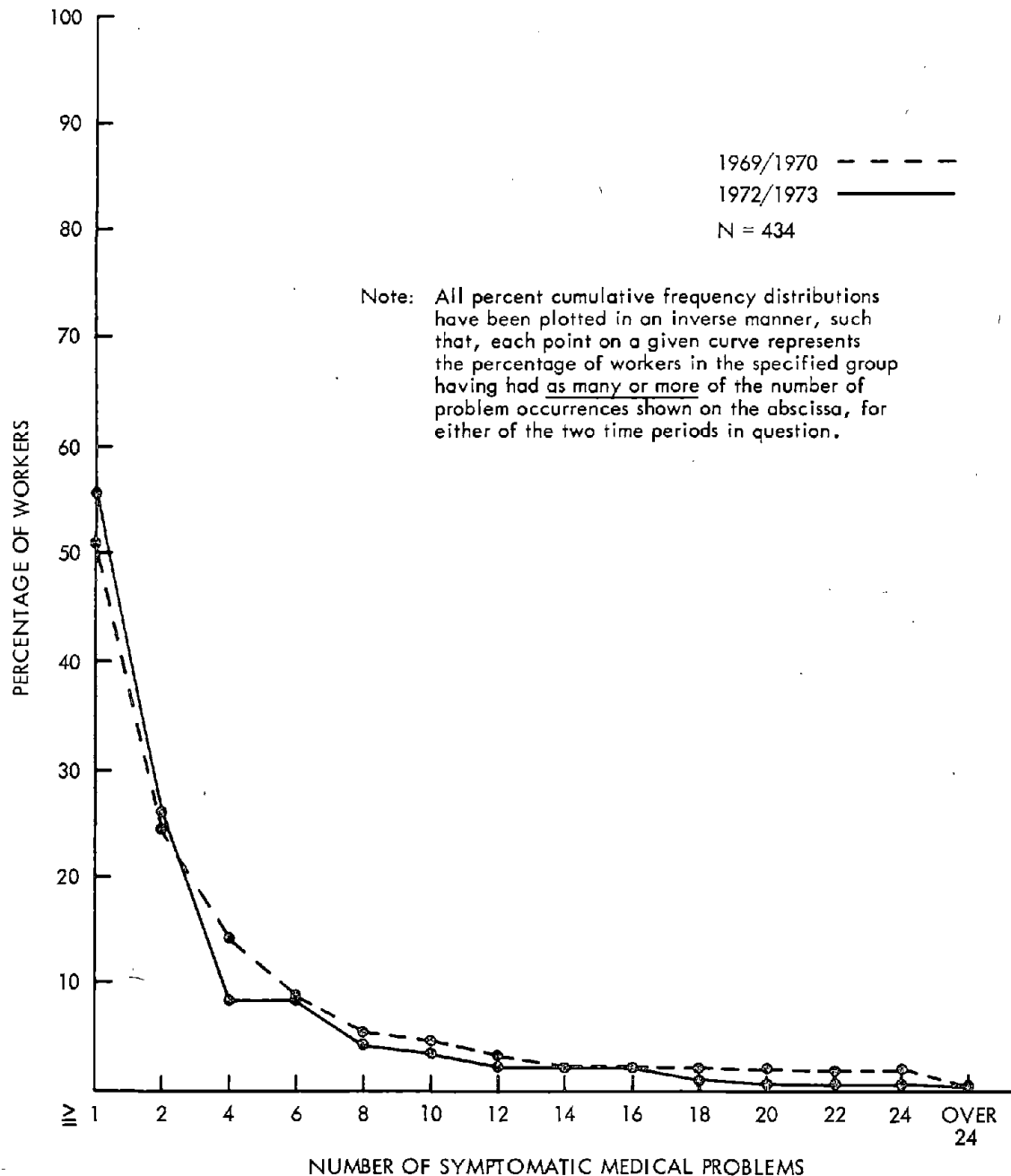


Figure 3-25. Cumulative Percent Frequency Distributions of Workers from the High Noise Group, with a Specifiabale Number of Symptomatic Medical Problems, During 2-Year Periods Before (1969/1970) and After (1972/1973) the Advent of a Company Hearing Conservation Program

1969/1970 vs. 1972/1973 time periods. The curves depicting these data from the two time periods are essentially coincident, indicating essentially equivalent results.

A comparison of the median frequencies of symptomatic medical problems for the two time periods (shown in Figure 3-26), shows a slightly higher median frequency for the 1972/1973 period, as opposed to the 1969/1970 time period. This result was in a direction opposite to that predicted in the Test Hypothesis, however the magnitude of the difference was quite small, and not statistically significant. Results of statistical tests of these data are included in Table 3-22. (NOTE: For those results in a direction opposite to the Test Hypothesis--indicated by a positive Z value--a two-tailed significant test was employed. This was equivalent to subtracting the probability values in the table from one and multiplying the result by two.)

- Results by Age

As shown in Figure 3-27, with the exception of the 56-65 age group, comparisons of median frequencies of symptomatic medical problems in all other age categories, indicated near equivalent values, or differences in the direction opposite to that of the Test Hypothesis, i.e., more somatic complaints subsequent to the establishment of the hearing conservation program. Table 3-19 includes the results of Wilcoxon Matched-Pairs Signed-Ranks Tests of these differences in frequency. In four (4) of the five (5) age-group comparisons, the frequencies of symptomatic medical problems for the 1972/1973 time period were not significantly different from those noted during the 1969/1970 period. The one significant difference was in a direction counter to the Test Hypothesis (age group: below 26 yrs.).

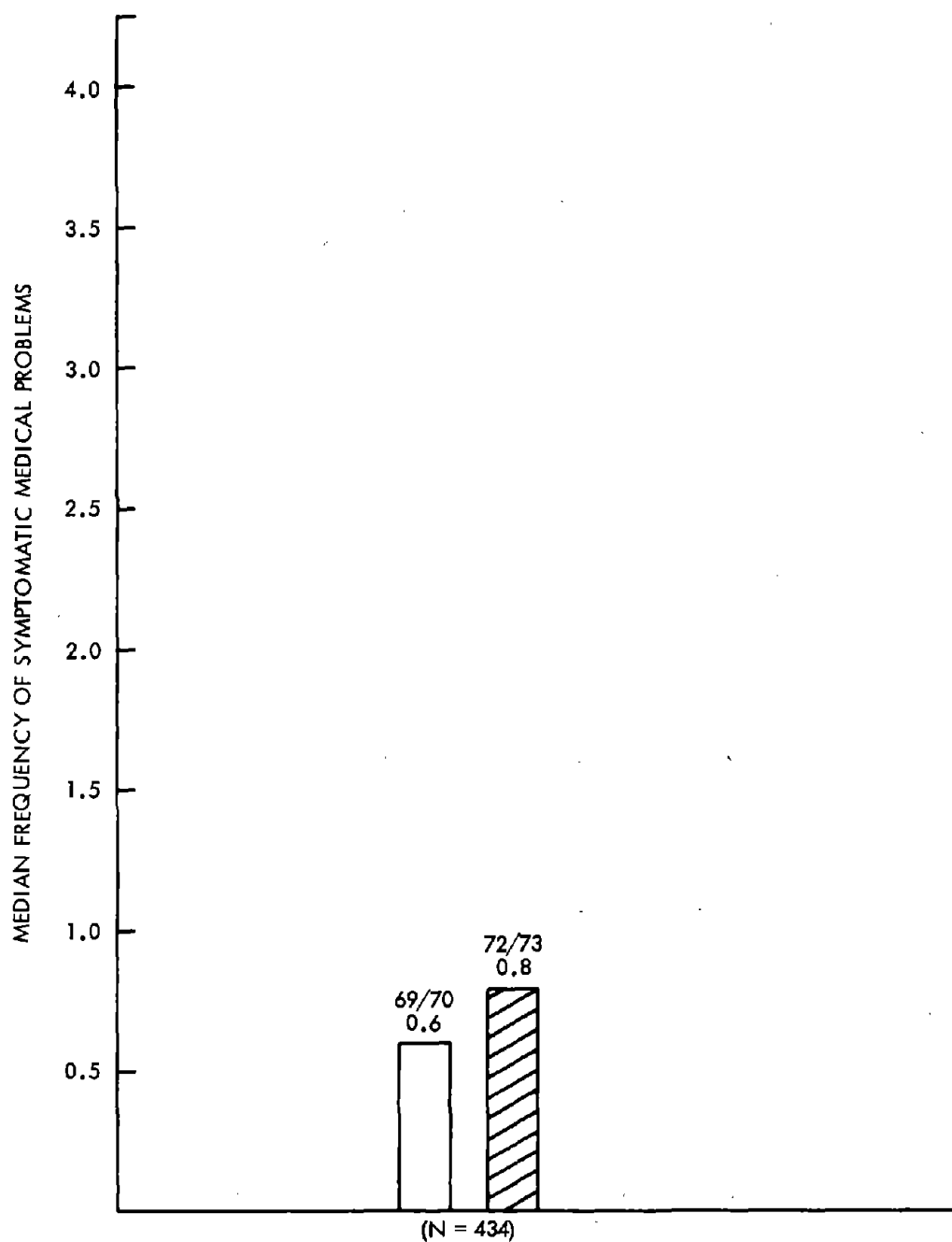


Figure 3-26. Median Frequencies of Symptomatic Medical Problems, for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

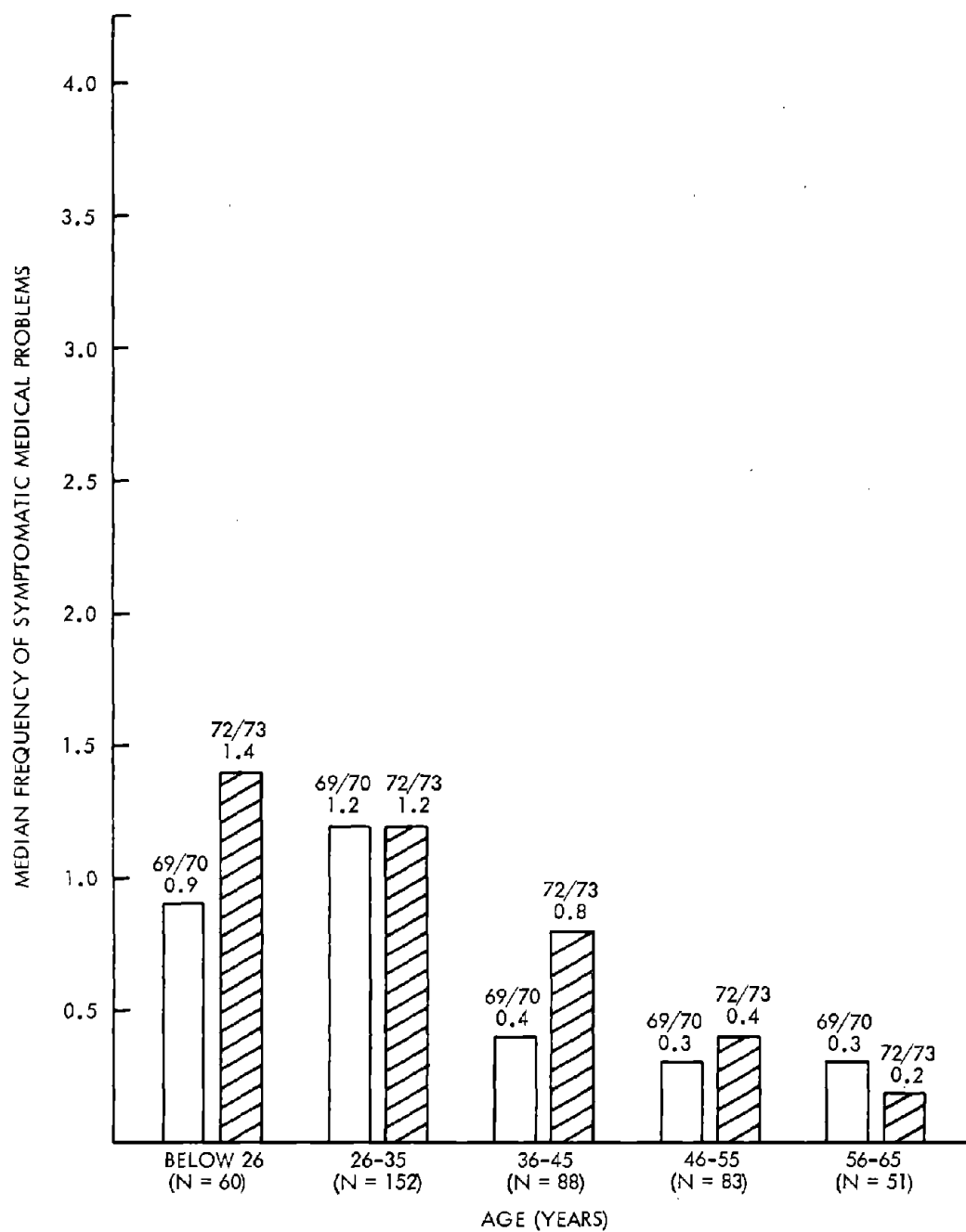


Figure 3-27. Median Frequencies of Symptomatic Medical Problems, for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods When Classified By Age

- Results by Experience (Years at Present Job)

Figure 3-28 presents a comparison of average frequencies of symptomatic problems reported by the High-Noise Group for the two time periods when sorted by length of job service. In this case, as opposed to the age comparisons above, differences were all fairly large, and in the predicted direction, in that less frequent complaints occurred in 1972/1973 than in 1969/1970. Tests for statistical significance of these differences were not applied but rather conducted in the age-experience evaluations below.

- Results by Age-Experience Combinations

Table 3-19 presents comparisons of median frequencies of symptomatic medical problems, for the two time periods, for various combinations of age and experience for the High-Noise Group. Nine (9) out of fourteen (14) comparisons indicated differences counter to the Test Hypothesis. However, all differences were comparatively small, and only one (Age: Below 26/ Years at Pres. Job: 5-10) indicated statistical significance. The results of Wilcoxon Tests performed on these various combinations are included in Table 3-22.

- Results by Shift

Comparisons by work shifts of average frequencies of symptomatic medical problems in the High-Noise Group for the two time periods are included in Table 3-20. Of the differential frequencies displayed for the 4 different shifts, 3 indicated relatively lower values for the 1972/1973 time period which would be consistent with the Test Hypothesis.

- Results by Job Type

Table 3-21 presents the average frequencies of symptomatic problems, by job-type, for the two time periods. Of the six (6) job-types, only

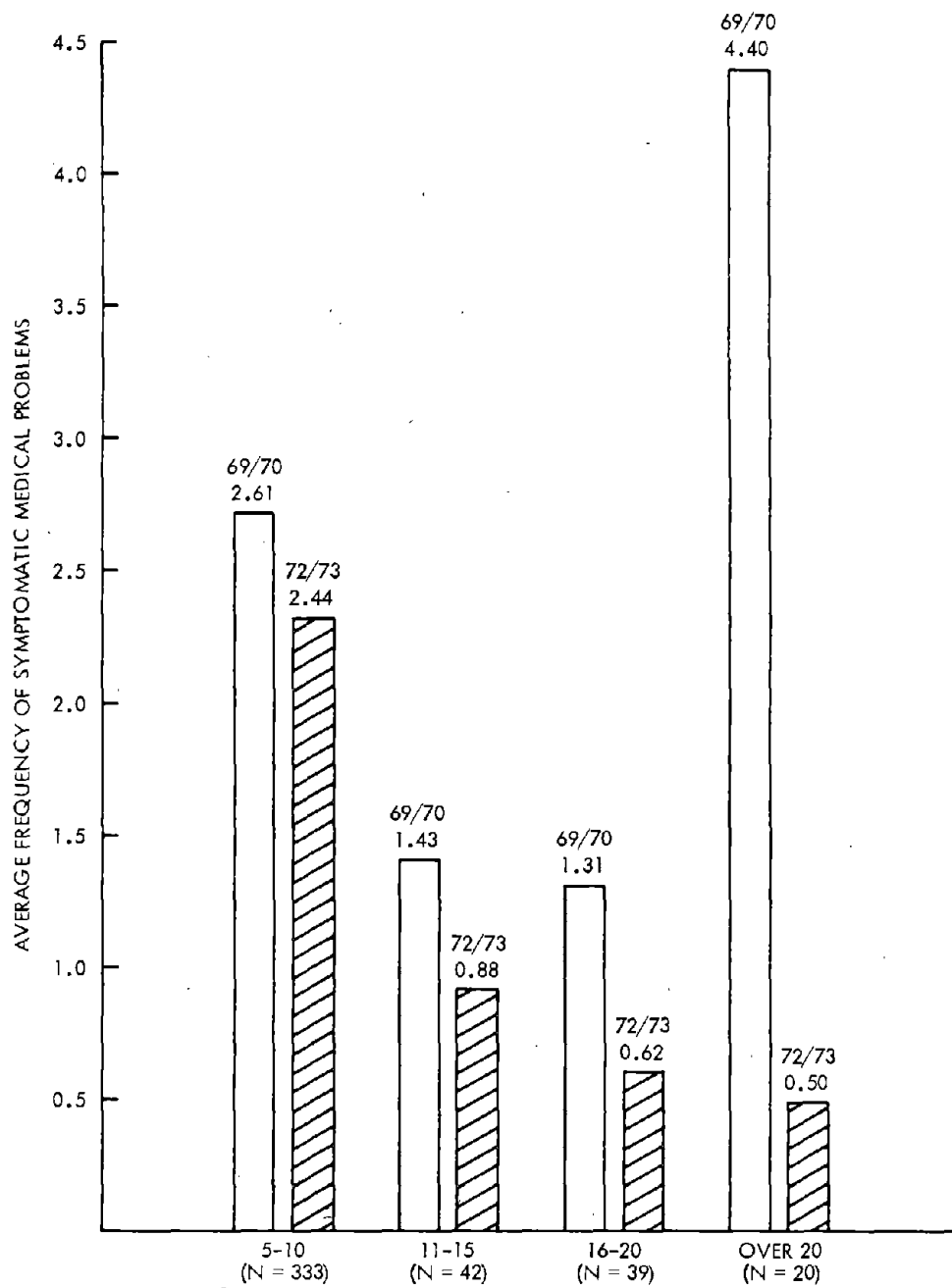


Figure 3-28. Average Frequencies of Symptomatic Medical Problems, by Years at Present Job, for High Noise Group, During the 1969/1970 Time Periods

Table 3-19. Age-Experience Comparisons of Median Frequencies of Symptomatic Medical Problems, for High Noise-Group, During the 1969/1970 vs 1972/1973 Time Periods

Years at Present Job	Age (Years)							
	Below 26		26-35		36-45		46-55	
	1969/ 1970	1972/ 1973	1969/ 1970	1972/ 1973	1969/ 1970	1972/ 1973	1969/ 1970	1972/ 1973
5-10	1.0 (59)	1.5 (59)	1.3 (146)	1.2 (146)	0.5 (66)	1.0 (66)	0.4 (41)	0.7 (41)
11-15	1.0 (1)	0.0 (1)	0.3 (6)	1.0 (6)	0.5 (10)	1.0 (10)	0.8 (15)	0.4 (15)
16-20	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.3 (12)	0.3 (12)	0.2 (20)	0.3 (20)
Over 20	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.2 (7)	0.3 (7)
							0.4 (13)	0.1 (13)

Notes: 1 Numbers in Parentheses Refer to Sample Sizes

2 There were no statistically significant differences in comparing the data collected over the two time periods, based upon Wilcoxon Matched-Pair Signed-Ranks Tests.

Table 3-20. Comparison of Average Frequencies of Symptomatic Medical Problems, for High Noise Group, by Shift, During the 1969/1970 vs 1972/1973 Time Periods

	Shift 1	Shift 2	Shift 3	Rotating Shift
1969/ 1970	2.63 (210)	1.27 (125)	3.61 (96)	2.33 (3)
1972/ 1973	1.84 (210)	2.36 (125)	2.83 (96)	0.00 (3)

Note: Numbers in Parentheses Refer to Sample Sizes

Table 3-21. Comparison of Average Frequencies of Symptomatic Medical Problems, by Job Type, for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

	Job Type					
	Foreman	Test and Inspect	Machine Operator	Plant Support	Administrator	Production Worker
1969/1970	0.72 (32)	0.94 (47)	2.62 (86)	0.50 (2)	1.30 (10)	3.94 (167)
1972/1973	1.22 (32)	1.04 (47)	1.65 (86)	0.50 (2)	1.40 (10)	4.25 (167)

Note: Numbers in Parentheses Refer to Sample Sizes

Table 3-22. Results of Wilcoxon Matched-Pairs Signed-Ranks Tests, Comparing 1969/1970 Data with 1972/1973 Data, with Respect to Frequency of Symptomatic Medical Problems in the High Noise Group

Null Hypothesis - 1969/70 Data is Equivalent to 1972/73 Data
 Test Hypothesis - 1972/73 Data is Less Than 1969/70 Data

Sort Factors		Z	Significance
Age Group-			
Total Sample- 434			
	Neurological	0.5364	0.7041
	Digestive	-5.3527	0.0 **
	Cardiovascular	1.6036	0.9456
	Otological/Audio	1.0189	0.8459
	Allergenic/Derma	4.4771	1.0000
	Respiratory	6.1242	1.0000
	Glandular	1.3416	0.9101
	Urological	1.0000	0.1587
	Musculo/Skeletal	1.4718	0.9295
	Total	1.0371	0.8502
Age Group-			
Sample- 60			
	Below 26		
	Neurological	1.3125	0.9053
	Digestive	-1.6429	0.0502*
	Cardiovascular	1.3416	0.9101
	Otological/Audio	1.0954	0.8633
	Allergenic/Derma	1.5724	0.9421
	Respiratory	2.9341	0.9983**(2-tail)
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	2.0061	0.9776*(2-tail)
	Total	3.3154	0.9866*(2-tail)

Note: A negative "Z" value indicates a difference in the predicted direction, and the associated probability (significance) value is for a one-tailed test. A positive "Z" value indicates a result in a direction opposite to the test hypothesis. Two-tailed tests were employed here, the probability value for significance being taken as one (1) minus that indicated in the table, multiplied by two (2) (i.e., $2(1-P)$ = adjustment of tabled probability value for a two-tailed test. Level of significance designated by asterisks; * = .05, ** = .01.

Table 3-22. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Age Group-	26 - 35		
Sample- 152			
	Neurological	-0.6575	0.2554
	Digestive	-4.0769	0.0000**
	Cardiovascular	1.0000	0.8413
	Otological/Audio	0.0510	0.5203
	Allergenic/Derma	2.1315	0.9835*(2-tail)
	Respiratory	4.1437	1.0000*(2-tail)
	Glandular	Identical Data	
	Urological	-1.0000	0.1587
	Musculo/Skeletal	1.5915	0.9443
	Total	-0.5802	0.2809
Age Group-	36 - 45		
Sample- 88			
	Neurological	0.6060	0.7278
	Digestive	-1.4532	0.0731
	Cardiovascular	Identical Data	
	Otological/Audio	0.8018	0.7887
	Allergenic/Derma	2.7255	0.9968**(2-tail)
	Respiratory	1.9560	0.9748
	Glandular	1.0000	0.8413
	Urological	Identical Data	
	Musculo/Skeletal	0.2379	0.5940
	Total	0.9291	0.8236
Age Group-	46 - 55		
Sample- 83			
	Neurological	0.5081	0.6943
	Digestive	-2.5695	0.0051**
	Cardiovascular	Identical Data	
	Otological/Audio	0.3651	0.6425
	Allergenic/Derma	2.2014	0.9861*(2-tail)
	Respiratory	2.8031	0.9975**(2-tail)
	Glandular	1.0000	0.8413
	Urological	Identical Data	
	Musculo/Skeletal	-1.1406	0.1270
	Total	0.0938	0.5374

Table 3-22. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Symptomatic Medical Problems

	Sort Factors	Z	Significance
Age Group-	56 - 65		
Sample- 51			
	Neurological	0.2585	0.6020
	Digestive	-2.0304	0.0212*
	Cardiovascular	Identical Data	
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	1.6036	0.9456
	Respiratory	1.3484	0.9112
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.2353	0.4070
	Total	-0.0635	0.4747
Age Group-	26 - 35		
Occup. Title-	Foreman		
Sample- 8			
	Neurological	1.0954	0.8633
	Digestive	-0.5345	0.2965
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0000	0.8413
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.5345	0.7035
	Total	1.6773	0.9533
Age Group-	36 - 45		
Occup. Title-	Foreman		
Sample- 5			
	Neurological	0.0	0.5000
	Digestive	0.8018	0.7887
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.6036	0.9456
	Total	1.0787	0.8594

Table 3-22. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Age Group - Occup. Title - Sample - 9	46 - 55 Foreman		
	Neurological	1.0000	0.8413
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0000	0.8413
	Respiratory	Identical Data	
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.8018	0.2113
	Total	0.0	0.5000
Age Group - Occup. Title - Sample - 10	56 - 65 Foreman		
	Neurological	-1.6036	0.0544*
	Digestive	-1.3416	0.0899
	Cardiovascular	Identical Data	
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	Identical Data	
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.5345	0.7035
	Total	-1.1531	0.1244
Age Group - Occup. Title - Sample - 6	Below 26 Test & I		
	Neurological	1.0000	0.8413
	Digestive	0.0	0.5000
	Cardiovascular	1.0000	0.8413
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	Identical Data	
	Respiratory	1.3416	0.9101
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.0	0.5000
	Total	1.2780	0.8994

Table 3-22. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Symptomatic Medical Problems

	Sort Factors	Z	Significance
Age Group- Occup. Title- Sample- 8	26 - 35 Test & I		
	Neurological	-0.7303	0.2326
	Digestive	-1.3416	0.0899
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	Identical Data	
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.5345	0.2965
	Total	-1.4832	0.0690
Age Group- Occup. Title- Sample- 18	36 - 45 Test & I		
	Neurological	0.4201	0.6628
	Digestive	1.0954	0.1367
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.8257	0.9661
	Respiratory	1.3416	0.9101
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.0	0.5000
	Total	0.2353	0.5930
Age Group- Occup. Title- Sample- 11	46 - 55 Test & I		
	Neurological	0.0	0.5000
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	1.3416	0.9101
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	0.0	0.5000

Table 3-22. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Age Group- Occup. Title- Sample- 4	56 - 65 Test & I		
	Neurological	-1.0000	0.1587
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	Identical Data	
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-1.0000	0.1587
Age Group- Occup. Title- Sample- 18	Below 26 Mach. Op.		
	Neurological	0.1778	0.5706
	Digestive	-1.0662	0.1432
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0000	0.8413
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.5213	0.9359
	Total	0.3361	0.6316
Age Group- Occup. Title- Sample- 28	26 - 35 Mach. Op.		
	Neurological	0.5606	0.7125
	Digestive	-2.1965	0.0140**
	Cardiovascular	Identical Data	
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	1.0000	0.8413
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.9414	0.8267
	Total	-0.6391	0.2614

Table 3-22. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Age Group- Occup. Title- Sample- 17	36 - 45 Mach. Op.		
	Neurological	-0.1348	0.4464
	Digestive	-0.3651	0.3575
	Cardiovascular	Identical Data	
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	1.3416	0.9101
	Respiratory	-1.0000	0.1587
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.9414	0.8267
	Total	-0.6391	0.2614
Age Group- Occup. Title- Sample- 13	46 - 55 Mach. Op.		
	Neurological	-0.6742	0.2501
	Digestive	-0.5345	0.2965
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	1.3416	0.9101
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.4832	0.9310
	Total	1.1832	0.8816
Age Group- Occup. Title- Sample- 10	56 - 65 Mach. Op.		
	Neurological	0.6742	0.7499
	Digestive	-1.3416	0.0899
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0000	0.8413
	Respiratory	0.0	0.5000
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.0	0.5000
	Total	0.0700	0.5279

Table 3-22. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Age Group- Occup. Title- Sample- 4	56 - 65 Admin.		
	Neurological	-1.0000	0.1587
	Digestive	Identical Data	
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	Identical Data	
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-1.0000	0.1587
Age Group- Occup. Title- Sample- 35	Below 26 Prod. Wk.		
	Neurological	1.2781	0.8994
	Digestive	-1.2579	0.1042
	Cardiovascular	1.000	0.8413
	Otological/Audio	0.8018	0.7887
	Allergenic/Derma	1.3484	0.9112
	Respiratory	2.5205	0.9441*(2-tail)
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.4438	0.9256
	Total	2.1974	0.9860*(2-tail)
Age Group- Occup. Title- Sample- 105	26 - 35 Prod. Wk.		
	Neurological	-1.2116	0.1128
	Digestive	-3.3073	0.0005**
	Cardiovascular	1.0000	0.8413
	Otological/Audio	0.2962	0.6165
	Allergenic/Derma	1.6004	0.9452
	Respiratory	3.8796	0.9999***(2-tail)
	Glandular	Identical Data	
	Urological	-1.0000	0.1587
	Musculo/Skeletal	1.4792	0.9305
	Total	-0.5226	0.3006

Table 3-22. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Age Group- Occup. Title- Sample- 48	36 - 45 Prod. Wk.		
	Neurological	0.4293	0.6662
	Digestive	-1.4799	0.0695
	Cardiovascular	Identical Data	
	Otological/Audio	1.3416	0.9101
	Allergenic/Derma	1.6903	0.9545
	Respiratory	2.3664	0.9910*(2-tail)
	Glandular	1.0000	0.8413
	Urological	Identical Data	
	Musculo/Skeletal	-0.2844	0.3881
	Total	0.7058	0.7598
Age Group- Occup. Title- Sample- 47	46 - 55 Prod. Wk.		
	Neurological	0.7847	0.7837
	Digestive	-2.4895	0.0064**
	Cardiovascular	Identical Data	
	Otological/Audio	0.3651	0.6425
	Allergenic/Derma	2.0226	0.9784*(2-tail)
	Respiratory	2.2014	0.9861*(2-tail)
	Glandular	1.0000	0.8413
	Urological	Identical Data	
	Musculo/Skeletal	-1.7821	0.0374*
	Total	-0.4171	0.3383
Age Group- Occup. Title- Sample- 22	56 - 65 Prod. Wk.		
	Neurological	1.1531	0.8756
	Digestive	-0.8018	0.2113
	Cardiovascular	Identical Data	
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	1.3416	0.9101
	Respiratory	1.3416	0.9101
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.0	0.5000
	Total	1.1255	0.8698

Table 3-22. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Age Group - Mar. Status - Sample - 29	Below 26 Single		
	Neurological	1.9600	0.9750*(2-tail)
	Digestive	-0.7135	0.2378
	Cardiovascular	1.0000	0.8413
	Otological/Audio	1.3416	0.9101
	Allergenic/Derma	1.0954	0.8633
	Respiratory	1.8257	0.9661
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.1375	0.8723
	Total	1.9770	0.9760*(2-tail)
Age Group - Mar. Status - Sample - 25	26 - 35 Single		
	Neurological	-0.5335	0.2969
	Digestive	-2.1915	0.0142**
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	1.8257	0.9661
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.2446	0.5966
	Total	0.6816	0.2478
Age Group - Mar. Status - Sample - 30	Below 26 Married		
	Neurological	-0.0259	0.4897
	Digestive	-1.5025	0.0665
	Cardiovascular	1.0000	0.8413
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	1.3416	0.9101
	Respiratory	2.3664	0.9910*(2-tail)
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.7039	0.9558
	Total	1.2571	0.8956

Table 3-22. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Age Group - Mar. Status - Sample - 125	26 - 35 Married		
	Neurological	-0.5110	0.3047
	Digestive	-3.3605	0.0004**
	Cardiovascular	1.0000	0.8413
	Otological/Audio	0.0510	0.5203
	Allergenic/Derma	1.8827	0.9701
	Respiratory	3.7712	0.9999**(2-tail)
	Glandular	Identical Data	
	Urological	-1.0000	0.1587
	Musculo/Skeletal	1.6000	0.9452
	Total	-0.3662	0.3571
Age Group - Mar. Status - Sample - 85	36 - 45 Married		
	Neurological	0.7779	0.7817
	Digestive	-1.3421	0.0898
	Cardiovascular	Identical Data	
	Otological/Audio	0.8018	0.7887
	Allergenic/Derma	2.5887	0.9952**(2-tail)
	Respiratory	1.7838	0.9628
	Glandular	1.0000	0.8413
	Urological	Identical Data	
	Musculo/Skeletal	0.2379	0.5940
	Total	1.1012	0.8646
Age Group - Mar. Status - Sample - 80	46 - 55 Married		
	Neurological	0.5081	0.6943
	Digestive	-2.5695	0.0051**
	Cardiovascular	Identical Data	
	Otological/Audio	0.3651	0.6425
	Allergenic/Derma	2.0226	0.9784**(2-tail)
	Respiratory	2.8031	0.9975**(2-tail)
	Glandular	1.0000	0.8413
	Urological	Identical Data	
	Musculo/Skeletal	-1.1406	0.1270
	Total	0.0259	0.5103

Table 3-22. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Symptomatic Medical Problems

	Sort Factors	Z	Significance
Age Group- Mar. Status- Sample- 50	56 - 65 Married		
	Neurological	0.2585	0.6020
	Digestive	-2.0304	0.0212*
	Cardiovascular	Identical Data	
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	1.6036	0.9456
	Respiratory	1.3484	0.9112
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.2353	0.4070
	Total	-0.0635	0.4747
Age Group- Shift- Sample- 23	Below 26 First		
	Neurological	-0.3976	0.3455
	Digestive	-1.5025	0.0665
	Cardiovascular	Identical Data	
	Otological/Audio	0.8018	0.7887
	Allergenic/Derma	0.0	0.5000
	Respiratory	1.6036	0.9456
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.9478	0.8284
	Total	0.0933	0.5372
Age Group- Shift- Sample- 57	26 - 35 First		
	Neurological	-1.0359	0.1501
	Digestive	-2.7626	0.0029**
	Cardiovascular	Identical Data	
	Otological/Audio	-1.8257	0.0339
	Allergenic/Derma	1.0000	0.8413
	Respiratory	2.3664	0.9910*(2-tail)
	Glandular	Identical Data	
	Urological	-1.0000	0.1587
	Musculo/Skeletal	0.7429	0.7712
	Total	-1.3995	0.0808

Table 3-22. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Age Group- Shift- Sample- 53	36 - 45 First		
	Neurological	0.8342	0.7979
	Digestive	-2.0129	0.0221*
	Cardiovascular	Identical Data	
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	2.2014	0.9861*(2-tail)
	Respiratory	0.9435	0.8273
	Glandular	1.0000	0.8413
	Urological	Identical Data	
	Musculo/Skeletal	-0.6816	0.2478
	Total	-0.1197	0.4524
Age Group- Shift- Sample- 46	46 - 55 First		
	Neurological	0.7845	0.7836
	Digestive	1.0502	0.1468
	Cardiovascular	Identical Data	
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	1.6036	0.9456
	Respiratory	2.0226	0.9784*(2-tail)
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.7338	0.2315
	Total	0.7604	0.7765
Age Group- Shift- Sample- 31	56 - 65 First		
	Neurological	0.5096	0.6949
	Digestive	-1.6773	0.0467*
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.6036	0.9456
	Respiratory	1.3416	0.9101
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.0	0.50000
	Total	-0.1089	0.4567

Table 3-22. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests
 Category - Symptomatic Medical Problems

	Sort Factors	Z	Significance
Age Group- Shift- Sample- 13	Below 26 Second		
	Neurological	0.5241	0.6999
	Digestive	0.0	0.5000
	Cardiovascular	1.0000	0.8413
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0000	0.8413
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.3145	0.6234
	Total	1.0070	0.8430
Age Group- Shift- Sample- 50	26 - 35 Second		
	Neurological	2.0157	0.9781*(2-tail)
	Digestive	-1.0017	0.1583
	Cardiovascular	1.0000	0.8413
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	1.4832	0.9310
	Respiratory	2.3694	0.9911*(2-tail)
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.7064	0.9560
	Total	2.1969	0.9860*(2-tail)
Age Group- Shift- Sample- 24	36 - 45 Second		
	Neurological	0.5601	0.7123
	Digestive	0.4201	0.6627
	Cardiovascular	Identical Data	
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	0.9129	0.8193
	Respiratory	1.8257	0.9661
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	2.1325	0.9835*(2-tail)
	Total	2.4562	0.9930*(2-tail)

Table 3-22. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Symptomatic Medical Problems

	Sort Factors	Z	Significance
Age Group- Shift- Sample- 25	46 - 55 Second		
	Neurological	0.1334	0.5530
	Digestive	-1.6036	0.0544*
	Cardiovascular	Identical Data	
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	1.6036	0.9456
	Respiratory	1.6036	0.9456
	Glandular	1.0000	0.8413
	Urological	Identical Data	
	Musculo/Skeletal	0.0	0.5000
	Total	0.2039	0.5808
Age Group - Shift- Sample- 13	56 - 65 Second		
	Neurological	0.3651	0.3575
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	Identical Data	
	Respiratory	0.4472	0.6726
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.0	0.5000
	Total	-0.1348	0.4464
Age Group- Shift- Sample- 24	Below 26 Third		
	Neurological	1.2669	0.8974
	Digestive	-0.8885	0.1871
	Cardiovascular	1.0000	0.8413
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	1.6036	0.9456
	Respiratory	2.3664	0.9910*(2-tail)
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.8043	0.9644
	Total	2.0322	0.9789*(2-tail)

Table 3-22. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Symptomatic Medical Problems

	Sort Factors	Z	Significance
Age Group- Shift- Sample- 45	26 - 35 Third		
	Neurological	-2.3862	0.0085**
	Digestive	-3.0001	0.0013**
	Cardiovascular	Identical Data	
	Otological/Audio	1.2780	0.8994
	Allergenic/Derma	1.3522	0.9119
	Respiratory	2.6656	0.9962**(2-tail)
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.4545	0.6753
	Total	-1.8136	0.0349
Age Group- Shift- Sample- 10	36 - 45 Third		
	Neurological	-0.8386	0.2008
	Digestive	-0.3145	0.3766
	Cardiovascular	Identical Data	
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	1.6036	0.9456
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.6742	0.2501
	Total	-0.4201	0.3372
Age Group- Shift- Sample- 11	46 - 55 Third		
	Neurological	-0.1048	0.4583
	Digestive	-1.6773	0.0467*
	Cardiovascular	Identical Data	
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	Identical Data	
	Respiratory	1.3416	0.9101
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.2780	0.1006
	Total	-0.7702	0.2206

Table 3-22. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Age Group - Shift - Sample - 6	56 - 65 Third		
	Neurological	0.0	0.5000
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	Identical Data	
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	0.0	0.5000
Age Group - Yrs. Pres. Job - Sample - 59	Below 26 5 - 10		
	Neurological	1.3125	0.9053
	Digestive	-1.6429	0.0502*
	Cardiovascular	1.3416	0.9101
	Otological/Audio	1.0954	0.8633
	Allergenic/Derma	1.5724	0.9421
	Respiratory	2.9341	0.9983**(2-tail)
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	2.1461	0.9841*(2-tail)
	Total	2.2540	0.9879*(2-tail)
Age Group - Yrs. Pres. Job - Sample - 146	26 - 35 5 - 10		
	Neurological	-0.6384	0.2616
	Digestive	-4.2662	0.0000**
	Cardiovascular	1.0000	0.8413
	Otological/Audio	0.0510	0.5203
	Allergenic/Derma	2.1315	0.9835*(2-tail)
	Respiratory	4.0429	1.0000**(2-tail)
	Glandular	Identical Data	
	Urological	-1.0000	0.1587
	Musculo/Skeletal	1.6880	0.9543
	Total	-0.7040	0.2407

Table 3-22. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Age Group-	36 - 45		
Yrs. Pres. Job-	5 - 10		
Sample-	66		
	Neurological	0.8818	0.8111
	Digestive	-1.0133	0.1555
	Cardiovascular	Identical Data	
	Otological/Audio	0.8018	0.7887
	Allergenic/Derma	2.4450	0.9928*(2-tail)
	Respiratory	2.5205	0.9941*(2-tail)
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.3311	0.9084
	Total	1.6311	0.9486
Age Group-	46 - 55		
Yrs. Pres. Job-	5 - 10		
Sample-	41		
	Neurological	0.8047	0.7895
	Digestive	-1.6309	0.0515*
	Cardiovascular	Identical Data	
	Otological/Audio	0.8018	0.7887
	Allergenic/Derma	1.3416	0.9101
	Respiratory	2.0226	0.9784*(2-tail)
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.0349	0.4861
	Total	0.6143	0.7305
Age Group-	56 - 65		
Yrs. Pres. Job-	5 - 10		
Sample-	21		
	Neurological	1.6803	0.9536
	Digestive	-0.8018	0.2113
	Cardiovascular	Identical Data	
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	1.3416	0.9101
	Respiratory	1.3416	0.9101
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.8257	0.9661
	Total	1.7838	0.9628

Table 3-22. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Age Group-	26 - 35		
Yrs. Pres. Job-	11 - 15		
Sample- 6			
	Neurological	0.0	0.5000
	Digestive	1.0000	0.8413
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	1.3416	0.9101
Age Group-	36 - 45		
Yrs. Pres. Job-	11 - 15		
Sample- 10			
	Neurological	-0.5345	0.2965
	Digestive	-1.0954	0.1367
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0000	0.8413
	Respiratory	-0.4472	0.3274
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.2780	0.1006
	Total	-1.1202	0.1313
Age Group-	46 - 55		
Yrs. Pres. Job-	11 - 15		
Sample- 15			
	Neurological	0.5477	0.7081
	Digestive	-1.8257	0.0339*
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0000	0.8413
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.3628	0.0865
	Total	-0.3501	0.3631

Table 3-22. (Cont.)
Wilcoxon Matched-Pairs Signed Ranks Tests
Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Age Group-	56 - 65		
Yrs. Pres. Job-	11 - 15		
Sample- 10			
	Neurological	-0.8018	0.2113
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.3651	0.3575
	Total	-0.6290	0.2 47
Age Group-	36 - 45		
Yrs. Pres. Job-	16 - 20		
Sample- 12			
	Neurological	-1.0000	0.1587
	Digestive	-0.9129	0.1807
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0000	0.8413
	Respiratory	1.0000	0.8413
	Glandular	1.0000	0.8413
	Urological	Identical Data	
	Musculo/Skeletal	-0.8018	0.2113
	Total	-0.4045	0.3429
Age Group-	46 - 55		
Yrs. Pres. Job-	16 - 20		
Sample- 20			
	Neurological	0.0845	0.5337
	Digestive	-1.3416	
	Cardiovascular	Identical Data	
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	1.6036	0.9456
	Respiratory	1.6036	0.9456
	Glandular	1.0000	0.8413
	Urological	Identical Data	
	Musculo/Skeletal	-1.6036	0.0544*
	Total	-0.4201	0.3372

Table 3-22. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Age Group- Yrs. Pres. Job- Sample- 7	56 - 65 16 - 20		
	Neurological	-1.3416	0.0899
	Digestive	-1.3416	0.0899
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0000	0.8413
	Respiratory	0.4472	0.6726
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.3416	0.0899
	Total	-0.6742	0.2501
Age Group- Yrs. Pres. Job- Sample- 7	46 - 55 Over 20		
	Neurological	-1.0000	0.1587
	Digestive	-0.4472	0.3274
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.0000	0.8413
	Total	-0.4472	0.3274
Age Group- Yrs. Pres. Job- Sample- 13	56 - 65 Over 20		
	Neurological	-0.8018	0.2113
	Digestive	-1.3416	0.0899
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	Identical Data	
	Glandular	-1.3416	0.0899
	Urological	-1.4832	0.0690
	Musculo/Skeletal		
	Total		

one (Machine Operator) indicated a reduction in the average frequency of symptomatic problems for the 1972/1973 time period relative to the earlier one. No statistical tests were performed on these comparisons. However, statistical tests of job type by age combinations of the before-after differences were run (see Table 3-19). One difference among 20 tested yielded a significant difference and in a direction counter to the Test Hypothesis.

- Results by Ratings of Ear Protector Usage (Primary Method)

Figure 3-29 presents a comparison of median frequencies of symptomatic problems for the High-Noise Group for each of the two time periods when classified by ear protector use (Primary Method). None of the differences between the two time periods for the 4 ratings of protector use were in the predicted direction. Results of Wilcoxon Tests applied to each of these differences yielded no significant findings (see Table 3-23).

- Results by Ratings of Ear Protector Usage (Primary Method) and by Age

As presented in Figures 3-30, 3-31, 3-32, 3-33, and 3-34, there was no orderly pattern to the differences between frequencies of symptomatic complaints in the two time periods as a function of ear protector use for the various age groups. Most observed differences were in directions opposite to the Test Hypothesis and typically small. In a number of comparisons, the sample sizes were too small for any meaningful evaluations. None of the differences in the direction opposite to the Test Hypothesis were significant when tested (see Table 3-23).

- Results by Ratings of Ear Protector Usage (Secondary Method)

Figure 3-35 provides a comparison of the median frequencies of symptomatic medical problems in the High-Noise Group for the two time periods when sorted by ear protection use (Secondary Method). Differences

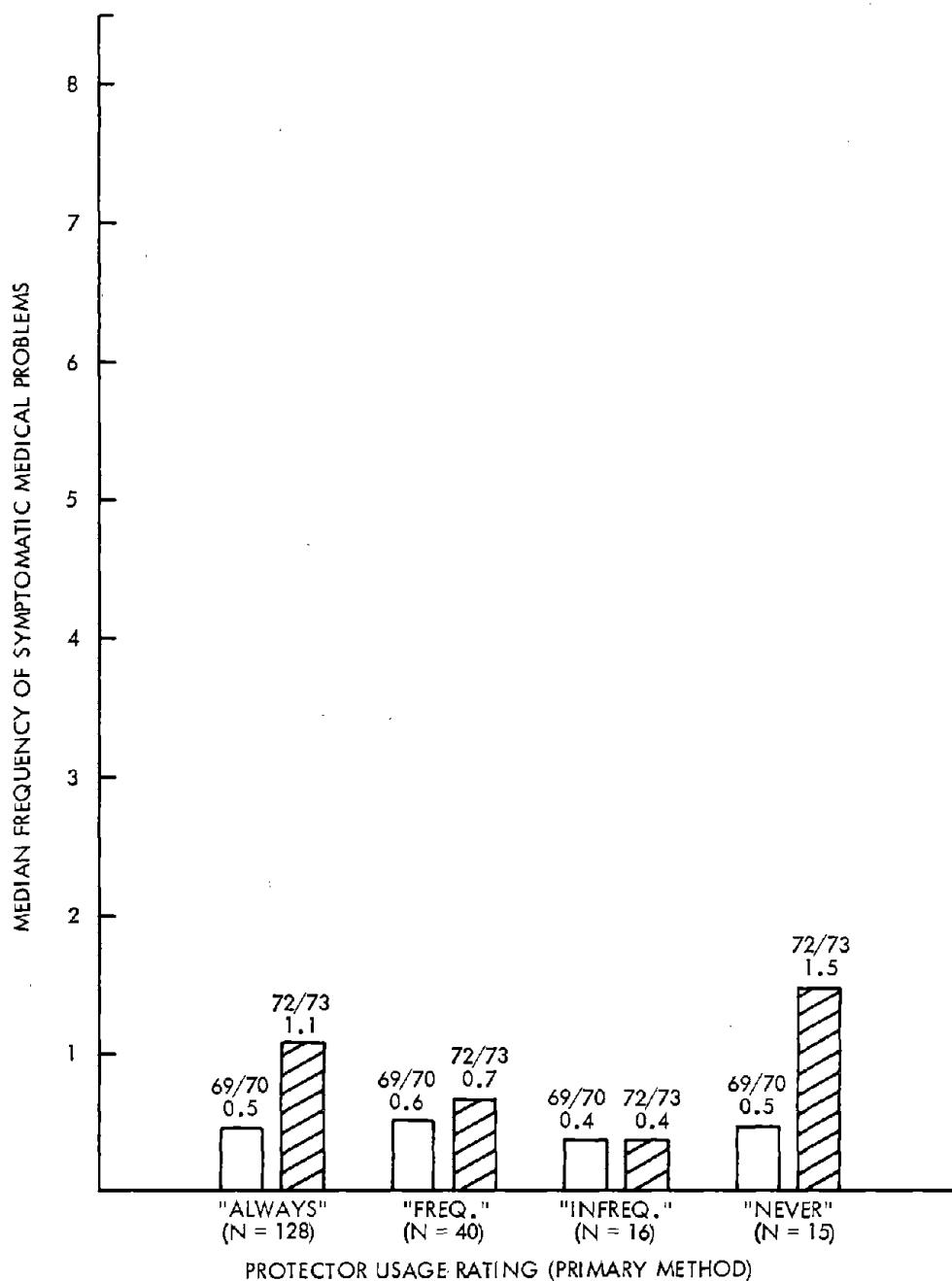


Figure 3-29. Median Frequencies of Symptomatic Medical Problems, for High Noise Group, by Protector Usage Rating (Primary Method), During the 1969/1970 vs 1972/1973 Time Periods

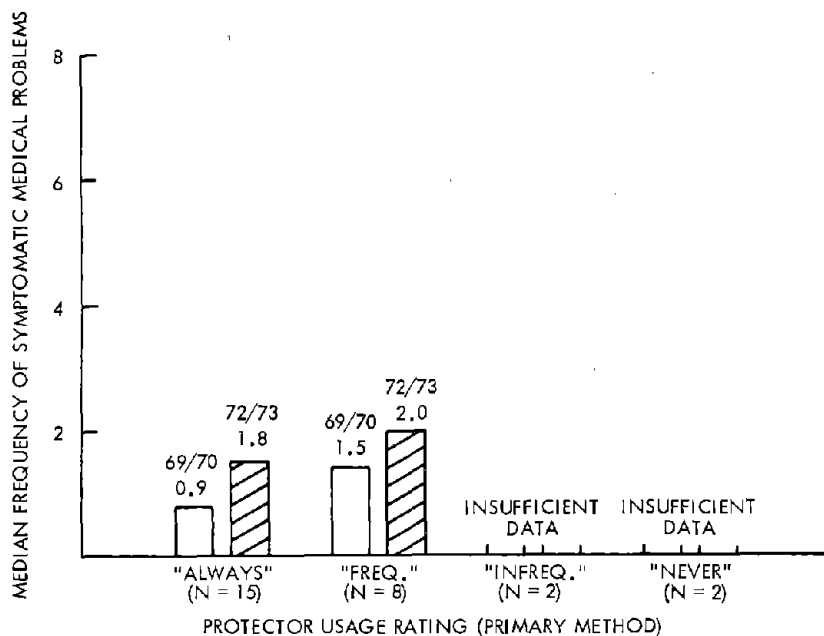


Figure 3-30. Median Frequencies of Symptomatic Medical Problems, for High Noise Group, by Protector Usage Rating (Primary Method), for the "Below 26" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

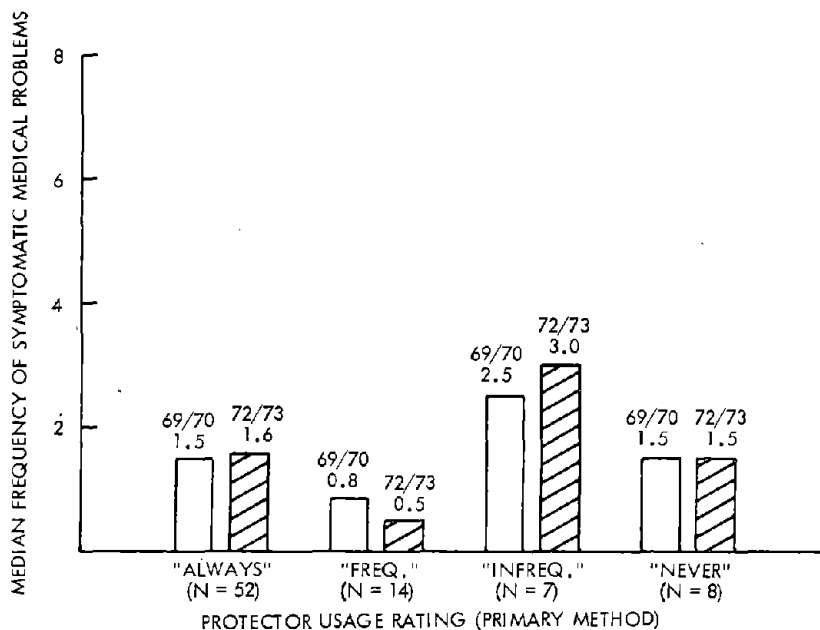


Figure 3-31. Median Frequencies of Symptomatic Medical Problems, for High Noise Group, by Protector Usage Rating (Primary Method), for the "26-35" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

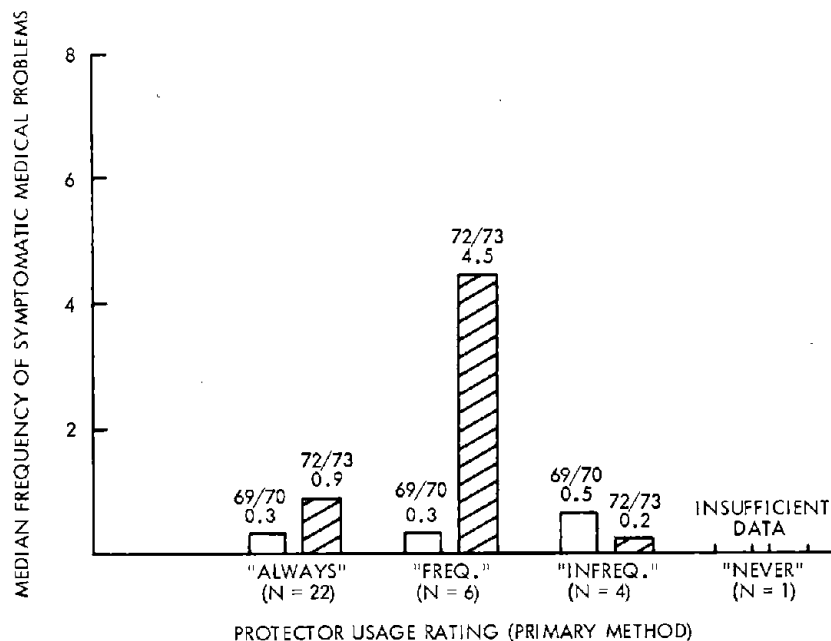


Figure 3-32. Median Frequencies of Symptomatic Medical Problems, for High Noise Group, by Protector Usage Rating (Primary Method), for the "36-45" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

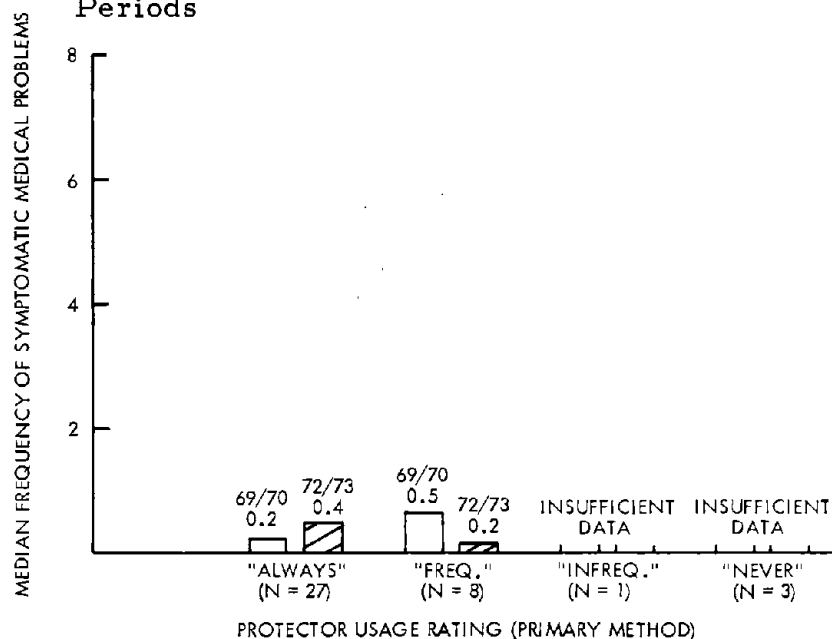


Figure 3-33. Median Frequencies of Symptomatic Medical Problems, for High Noise Group, by Protector Usage Rating (Primary Method), for the "46-55" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

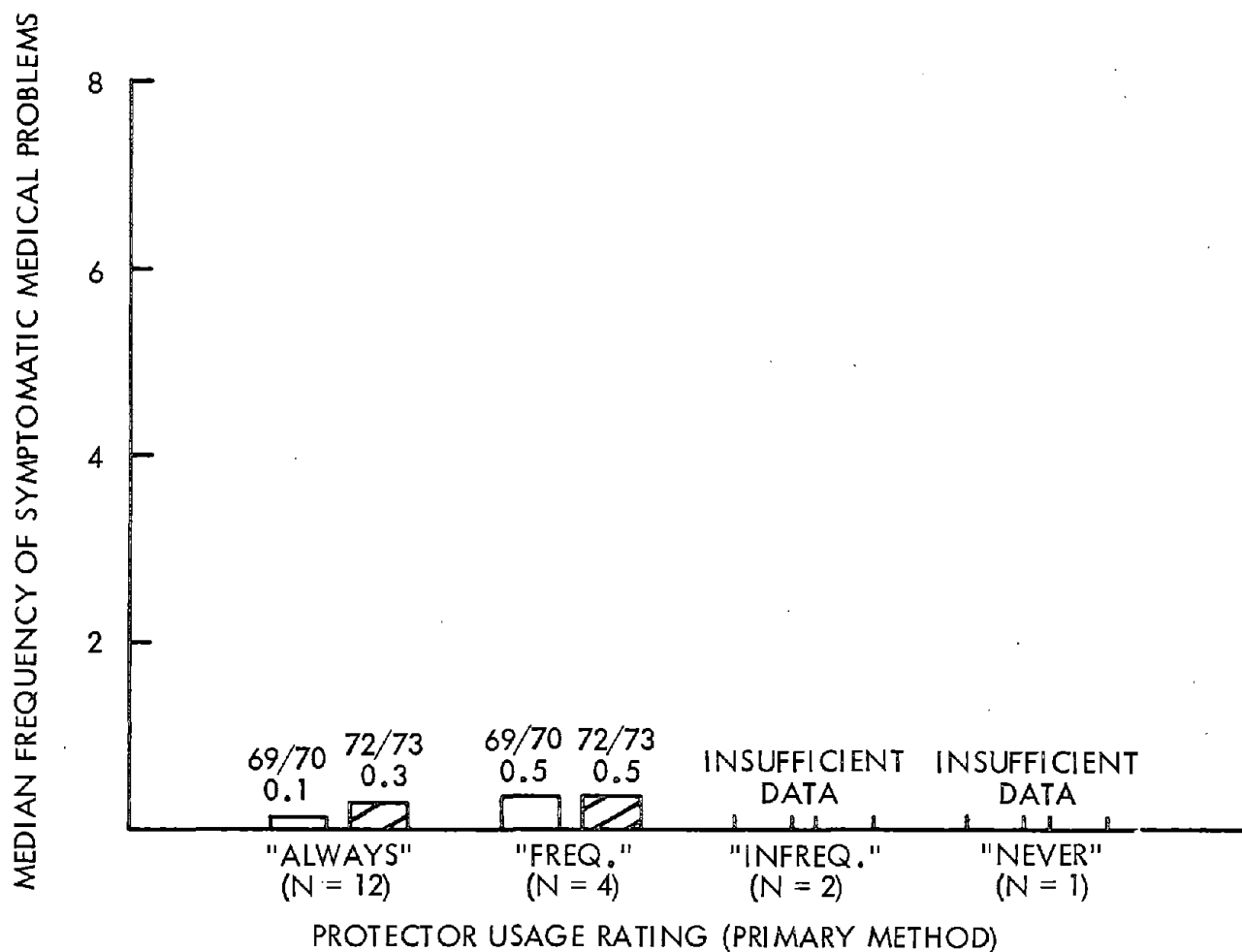


Figure 3-34. Median Frequencies of Symptomatic Medical Problems, for High Noise Group, by Protector Usage Rating (Primary Method), for the "56-65" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

Table 3-23. Results of Wilcoxon Matched-Pairs Signed-Ranks Tests, Comparing 1969/1970 Data with 1972/1973 Data, for Various Ratings (Primary Rating Method) of Ear Protector Usage, with Respect to Frequency of Symptomatic Medical Problems for High Noise Group

Null Hypothesis - 1969/70 Data is Equivalent to 1972/73 Data

Test Hypothesis - 1972/73 Data is Less Than 1969/70 Data

Sort Factors		Z	Significance
Ear Protector Usage-	Always		
Sample- 128			
	Neurological	1.0523	0.8537
	Digestive	-2.8770	0.0020**
	Cardiovascular	Identical Data	
	Otological/Audio	0.5923	0.7232
	Allergenic/Derma	2.4169	0.9922*(2-tail)
	Respiratory	4.0286	1.0000**(2-tail)
	Glandular	1.0000	0.8413
	Urological	Identical Data	
	Musculo/Skeletal	1.7566	0.9605
	Total	1.4313	0.9238
Ear Protector Usage-	Frequent		
Sample- 40			
	Neurological	0.8057	0.7898
	Digestive	-2.0402	0.0207*
	Cardiovascular	Identical Data	
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	0.8018	0.7887
	Respiratory	1.6036	0.9456
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.1361	0.8720
	Total	-0.8452	0.1990

Note: A negative 'Z' value indicates a difference in the predicted direction, and the associated probability (significance) value is for a one-tailed test. A positive 'Z' value indicates a result in a direction opposite to the test hypothesis. Two-tailed tests were employed here, the probability value for significance being taken as one (1) minus that indicated in the table, multiplied by two (2) (i.e., $2(1-P)$ = adjustment of tabled probability value for a two-tailed test. Level of significance indicated by asterisks; * = .05, ** = .01.

Table 3-23. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Primary Rating Method)

Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage-	Infreqnt.		
Sample- 16			
	Neurological	-0.3651	0.3575
	Digestive	-1.8257	0.0339*
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	0.8018	0.7887
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.0	0.5000
	Total	-0.8452	0.1990
Ear Protector Usage-	Never		
Sample- 15			
	Neurological	0.7001	0.7581
	Digestive	0.0	0.5000
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	0.0	0.5000
	Respiratory	1.6036	0.9456
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.6036	0.9456
	Total	1.1255	0.8698
Ear Protector Usage- Age Group-	Always Below 26		
Sample- 15			
	Neurological	-0.0510	0.4797
	Digestive	-0.3651	0.3575
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0000	0.8413
	Respiratory	1.3416	0.9101
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.1847	0.8819
	Total	0.8789	0.8103

Table 3-23. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Primary Rating Method)

Category - Symptomatic Medical Problems

	Sort Factors	Z	Significance
Ear Protector Usage- Age Group-	Frequent Below 26		
Sample- 8			
	Neurological	1.5724	0.9421
	Digestive	-1.6036	0.0544*
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	Identical Data	
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.6036	0.9456
	Total	1.6058	0.9458
Ear Protector Usage- Age Group-	Always 26 - 35		
Sample- 52			
	Neurological	0.6069	0.7281
	Digestive	-2.5906	0.0048**
	Cardiovascular	Identical Data	
	Otological/Audio	-0.9435	0.1727
	Allergenic/Derma	0.6742	0.7499
	Respiratory	3.2318	0.9994*(2-tail)
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	2.3876	0.9915*(2-tail)
	Total	0.4954	0.6898
Ear Protector Usage- Age Group-	Frequent 26 - 35		
Sample- 14			
	Neurological	-1.6036	0.0544*
	Digestive	-1.4832	0.0690
	Cardiovascular	Identical Data	
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	Identical Data	
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.7338	0.2315
	Total	1.2603	0.1038

Table 3-23. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Primary Rating Method)

Category - Symptomatic Medical Problems

	Sort Factors	Z	Significance
Ear Protector Usage- Age Group-	Infreqnt. 26 - 35		
Sample- 7			
	Neurological	-0.4472	0.3274
	Digestive	-1.3416	0.0899
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0000	0.8413
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.0	0.5000
	Total	-0.3651	0.3575
Ear Protector Usage- Age Group-	Never 26 - 35		
Sample- 8			
	Neurological	-0.4045	0.3429
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.0000	0.1587
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.3416	0.9101
	Total	0.2697	0.6063
Ear Protector Usage- Age Group-	Always 36 - 45		
Sample- 22			
	Neurological	0.2097	0.5830
	Digestive	-1.2741	0.1013
	Cardiovascular	Identical Data	
	Otological/Audio	1.3416	0.9101
	Allergenic/Derma	2.0226	0.9784*(2-tail)
	Respiratory	1.3416	0.9101
	Glandular	1.0000	0.8413
	Urological	Identical Data	
	Musculo/Skeletal	-0.4045	0.3429
	Total	0.8161	0.7928

Table 3-23. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Primary Rating Method)

Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage- Age Group-	Frequent 36 - 45		
Sample- 6			
	Neurological	1.6181	0.9472
	Digestive	-0.5345	0.2965
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	0.8018	0.7887
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.8257	0.9661
	Total	1.7529	0.9602
Ear Protector Usage- Age Group-	Infrequent. 36 - 45		
Sample- 4			
	Neurological	-1.0000	0.1587
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	Identical Data	
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.0000	0.8413
	Total	-1.0000	0.1587
Ear Protector Usage- Age Group-	Always 46 - 55		
Sample- 27			
	Neurological	1.1202	0.8687
	Digestive	-0.8386	0.2008
	Cardiovascular	Identical Data	
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	1.0000	0.8413
	Respiratory	1.3416	0.9101
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.3381	0.3677
	Total	0.5429	0.7064

Table 3-23. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Primary Rating Method)

Category - Symptomatic Medical Problems

	Sort Factors	Z	Significance
Ear Protector Usage - Age Group-	Frequent 46 - 55		
Sample- 8			
	Neurological	0.0	0.5000
	Digestive	0.0	0.5000
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.3416	0.0899
	Total	-0.2673	0.3946
Ear Protector Usage - Age Group-	Always 56 - 65		
Sample- 12			
	Neurological	1.0690	0.8575
	Digestive	0.0	0.5000
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.3416	0.9101
	Respiratory	1.3416	0.9101
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.8018	0.2113
	Total	1.2136	0.8875
Ear Protector Usage - Age Group-	Frequent 56 - 65		
Sample- 4			
	Neurological	-0.4472	0.3274
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	Identical Data	
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.0	0.5000
	Total	-0.3651	0.3575

Table 3-23. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Primary Rating Method)

Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage-	Always		
Age Group-	Below 26		
Yrs. Pres. Job-	5 - 10		
Sample- 15			
	Neurological	-0.0510	0.4797
	Digestive	-0.3651	0.3575
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0000	0.8413
	Respiratory	1.3416	0.9101
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.1847	0.8819
	Total	0.8789	0.8103
Ear Protector Usage-	Always		
Age Group-	26 - 35		
Yrs. Pres. Job-	5 - 10		
Sample- 51			
	Neurological	0.5360	0.7040
	Digestive	-2.5906	0.0048**
	Cardiovascular	Identical Data	
	Otological/Audio	-0.9435	0.1727
	Allergenic/Derma	0.6742	0.7499
	Respiratory	0.2318	0.9994**(2-tail)
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	2.5486	0.9946*(2-tail)
	Total	0.4954	0.6898
Ear Protector Usage-	Always		
Age Group-	36 - 45		
Yrs. Pres. Job-	5 - 10		
Sample- 17			
	Neurological	0.2097	0.5830
	Digestive	-1.1847	0.1181
	Cardiovascular	Identical Data	
	Otological/Audio	1.3416	0.9101
	Allergenic/Derma	1.8257	0.9661
	Respiratory	1.3416	0.9101
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.7303	0.2326
	Total	0.5335	0.7031

Table 3-23. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Primary Rating Method)

Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage-	Always		
Age Group-	46 - 55		
Yrs. Pres. Job-	5 - 10		
Sample- 21			
	Neurological	0.9439	0.8274
	Digestive	-0.5477	0.2919
	Cardiovascular	Identical Data	
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	1.0000	0.8413
	Respiratory	1.3416	0.9101
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.2136	0.1125
	Total	0.4707	0.6811
Ear Protector Usage-	Always		
Age Group-	56 - 65		
Yrs. Pres. Job-	5 - 10		
Sample- 7			
	Neurological	1.3416	0.9101
	Digestive	1.0000	0.8413
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0000	0.8413
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.0000	0.8413
	Total	1.3416	0.9101
Ear Protector Usage-	Frequent		
Age Group-	Below 26		
Yrs. Pres. Job-	5 - 10		
Sample- 8			
	Neurological	1.5724	0.9421
	Digestive	-1.6036	0.0544*
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	Identical Data	
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.6036	0.9456
	Total	1.6058	0.9458

Table 3-23. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Primary Rating Method)

Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage - Age Group - Yrs. Pres. Job - Sample - 12	Frequent 26 - 35 5 - 10		
	Neurological	-1.3416	0.0899
	Digestive	-1.4832	0.0690
	Cardiovascular	Identical Data	
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	Identical Data	
	Respiratory	Identical Data	
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.7338	0.2315
	Total	-1.2603	0.1038
Ear Protector Usage - Age Group - Yrs. Pres. Job - Sample - 5	Frequent 36 - 45 5 - 10		
	Neurological	1.6181	0.9472
	Digestive	-0.5345	0.2965
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	0.8018	0.7887
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.8257	0.9661
	Total	1.7529	0.9602
Ear Protector Usage - Age Group - Yrs. Pres. Job - Sample - 6	Infreqnt. 26 - 35 5 - 10		
	Neurological	-1.0000	0.1587
	Digestive	-1.3416	0.0899
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0000	0.8413
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.0	0.5000
	Total	-0.8018	0.2113

Table 3-23. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Primary Rating Method)

Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage-	Never		
Age Group-	26 - 35		
Yrs. Pres. Job-	5 - 10		
Sample- 7			
	Neurological	-0.4045	0.3429
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	-1.0000	0.1587
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.3416	0.9101
	Total	0.2697	0.6063
Ear Protector Usage-	Always		
Yrs. Pres. Job-	5 - 10		
Sample- 111			
	Neurological	0.9299	0.8238
	Digestive	-2.6900	0.0036**
	Cardiovascular	Identical Data	
	Otological/Audio	0.5923	0.7232
	Allergenic/Derma	2.1181	0.9829*(2-tail)
	Respiratory	3.9235	1.0000**(2-tail)
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.9567	0.9748
	Total	1.3299	0.9082
Ear Protector Usage-	Frequent		
Yrs. Pres. Job-	5 - 10		
Sample- 29			
	Neurological	1.2495	0.8943
	Digestive	-1.7821	0.0374*
	Cardiovascular	Identical Data	
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	0.8018	0.7887
	Respiratory	1.3416	0.9101
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.5619	0.9408
	Total	0.9885	0.8385

Table 3-23. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Primary Rating Method)

Category - Symptomatic Medical Problems

	Sort Factors	Z	Significance
Ear Protector Usage-	Infreqnt.		
Yrs. Pres. Job-	5 - 10		
Sample- 12			
	Neurological	-0.8018	0.2113
	Digestive	-1.8257	0.0339*
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	0.8018	0.7887
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.0	0.5000
	Total	-1.1531	0.1244
Ear Protector Usage-	Never		
Yrs. Pres. Job-	5 - 10		
Sample- 12			
	Neurological	0.7001	0.7981
	Digestive	0.0	0.5000
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	0.0	0.5000
	Respiratory	1.6036	0.9456
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.6036	0.9456
	Total	1.1255	0.8698
Ear Protector Usage-	Always		
Yrs. Pres. Job-	11 - 15		
Sample- 7			
	Neurological	-0.4472	0.3274
	Digestive	Identical Data	
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0000	0.8413
	Respiratory	Identical Data	
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.8018	0.2113
	Total	-0.8018	0.2113

Table 3-23. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
(Priority Rating Method)

Category - Symptomatic Medical Problems

	Sort Factors	Z	Significance
Ear Protector Usage-	Frequent		
Yrs. Pres. Job-	11 - 15		
Sample- 5			
	Neurological	-1.0000	0.1587
	Digestive	Identical Data	
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-1.0000	0.1587
Ear Protector Usage-	Always		
Yrs. Pres. Job	16 - 20		
Sample- 7			
	Neurological	1.0690	0.8575
	Digestive	-1.6036	0.0544*
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0000	0.8413
	Respiratory	1.0000	0.8413
	Glandular	1.0000	0.8413
	Urological	Identical Data	
	Musculo/Skeletal	0.0	0.5000
	Total	0.6290	0.7353
Ear Protector Usage-	Frequent		
Yrs. Pres. Job-	16-20		
Sample- 4			
	Neurological	-1.0000	0.1587
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	Identical Data	
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-1.0000	0.1587

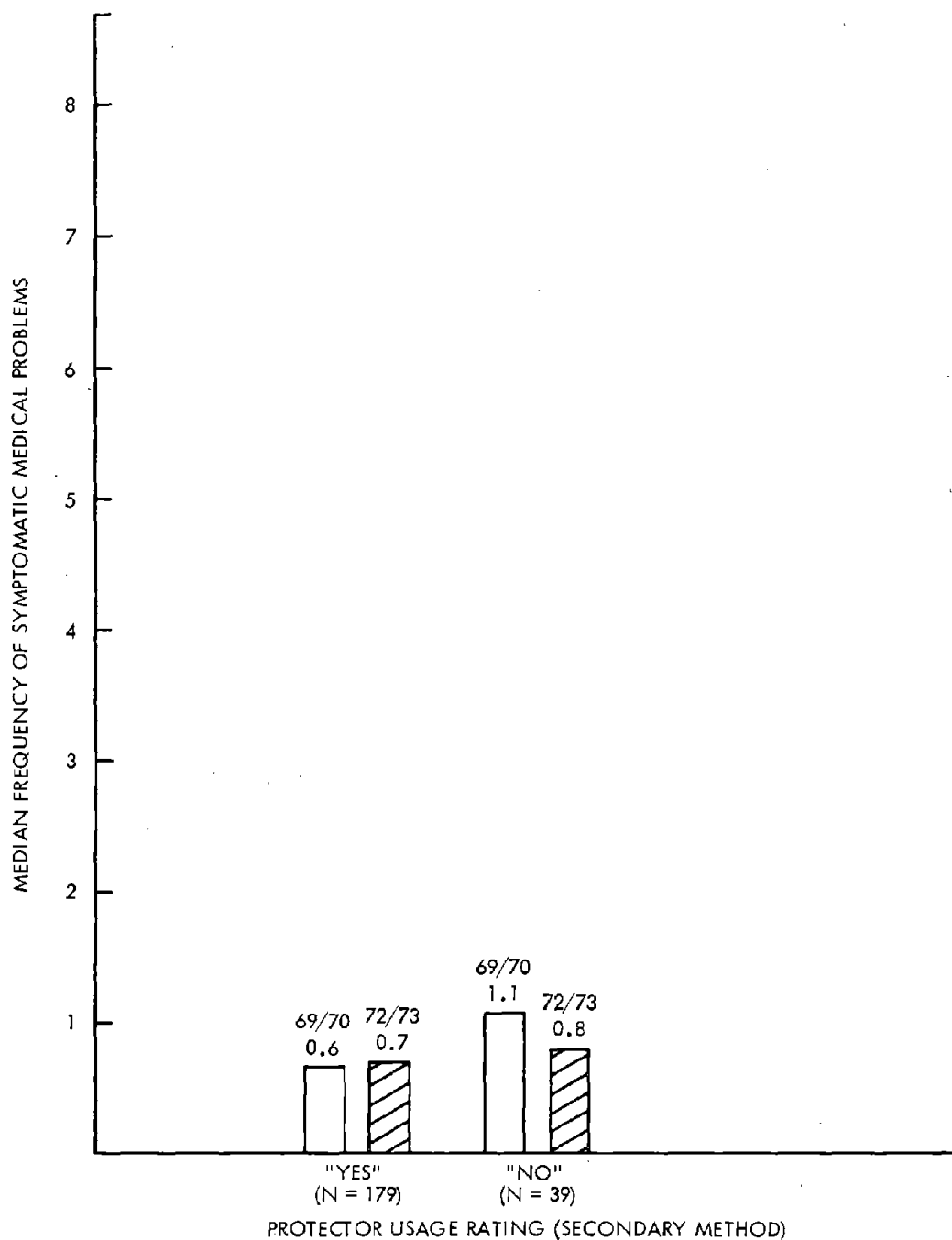


Figure 3-35. Median Frequencies of Symptomatic Medical Problems, for High Noise Group, by Protector Usage Rating (Secondary Method), During the 1969/1970 vs 1972/1973 Time Periods

between these two periods for either the user ("Yes") or non-user ("No") groups of workers were equivocal and not statistically significant (see Table 3-24).

- Results by Ratings of Ear Protector Usage (Secondary Method) and by Age

As shown in Figure 3-36, most of the differences between the median frequency of symptomatic problems for the two time periods when classified by ear protection use and age were small and variable. The most notable differences here, while directionally consistent with the Test Hypothesis, occurred for the non-user group. A number of other comparisons lacked sufficient numbers of workers for meaningful evaluation. In any case, all differences proved statistically non-significant (see Table 3-24).

- Symptomatic Medical Problems in the Low-Noise Group

For control reasons already stated, the frequency of symptomatic medical problems were evaluated for various sort combinations of the data for the Low-Noise worker group, testing the difference between their 1969/1970 and 1972/1973 entries. The results yielded one (1) significant sort-combination in the direction of 1969/1970 data greater than 1972/1973 data (Occupation: Eng./Drafts./Age: 26-35); and two (2) significant sort-combinations in the direction of 1972/1973 data greater than 1969/1970 data (Occupation: Administrator/Age: 26-35, and Shift: First/Age: 36-45) out of a total of sixty-three (63) combinations tested. These few differences in mixed directions plus the absence of any systematic or notable trends in the bulk of comparisons shown in Table 3-25 suggested that the numbers of symptomatic complaints in the Low Noise Group were essentially unchanged for the two time periods in question. In a sense, the same statement could be made for the High-Noise Group which also revealed largely equivocal changes in the frequencies of these problems between 1969/1970 and 1972/1973 for the various sort categories in the analysis.

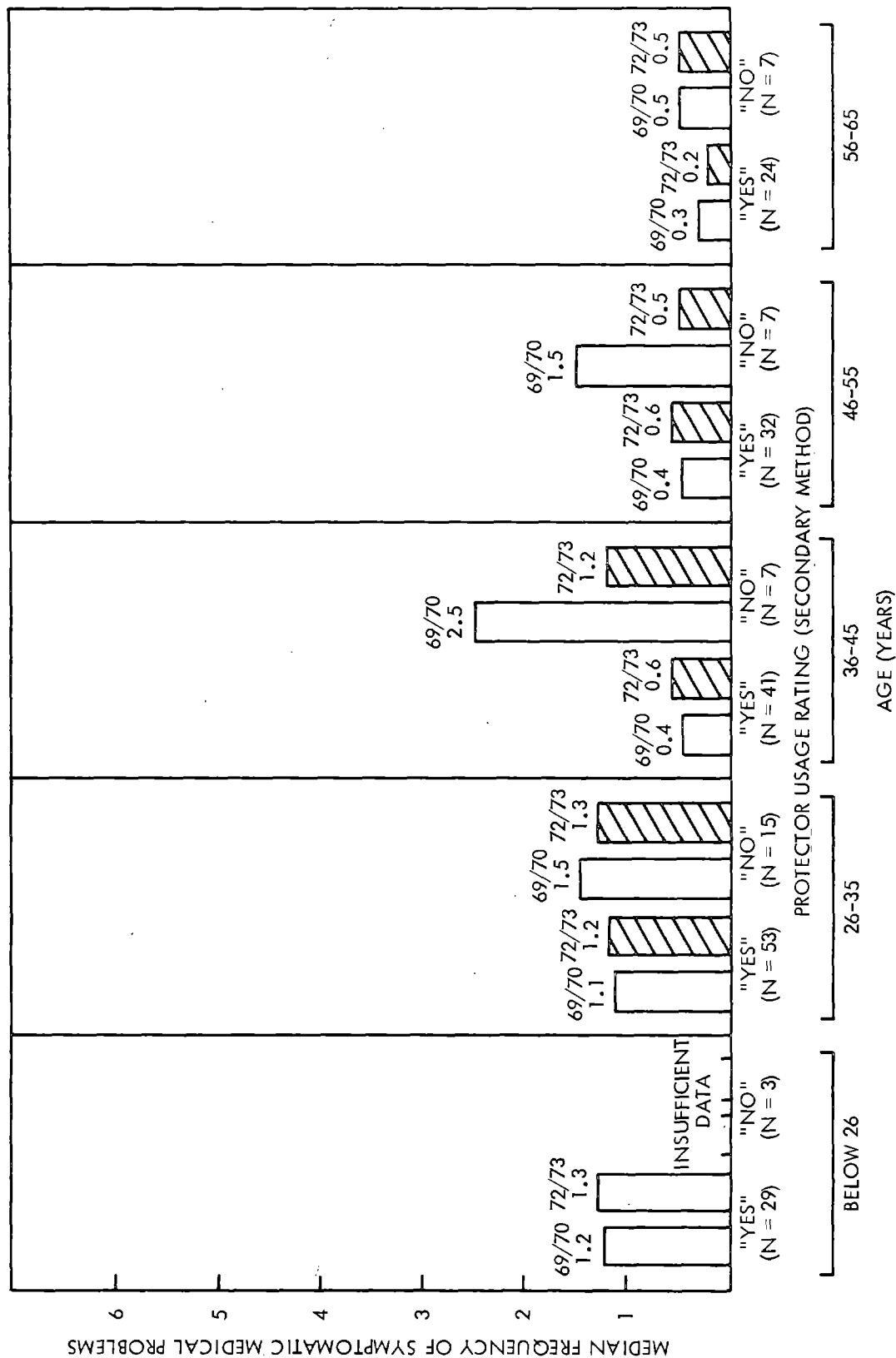


Figure 3-36. Median Frequencies of Symptomatic Medical Problems, for High Noise Group, by Protector Usage Rating (Secondary Method), and Age Group, During the 1969/1970 vs 1972/1973 Time Periods

Table 3-24. Results of Wilcoxon Matched-Pairs Signed-Ranks Tests, Comparing 1969/1970 Data With 1972/1973 Data, for Various Ratings (Secondary Rating Method) of Ear Protector Usage, With Respect to Frequency of Symptomatic Medical Problems in the High Noise Group

Null Hypothesis - 1969/70 Data is Equivalent to 1972/73 Data
 Test Hypothesis - 1972/73 Data is Less Than 1969/70 Data

Sort Factors		Z	Significance
Ear Protector Usage-	Yes		
Sample- 179			
	Neurological	0.1320	0.5525
	Digestive	-3.5668	0.0002**
	Cardiovascular	1.6036	0.9456
	Otological/Audio	0.7645	0.7777
	Allergenic/Derma	3.0594	0.9989
	Respiratory	3.8706	0.9999
	Glandular	1.0000	0.8413
	Urological	Identical Data	
	Musculo/Skeletal	0.8223	0.7946
	Total	0.5870	0.7214
Ear Protector Usage-	No		
Sample- 39			
	Neurological	-0.9704	0.1659
	Digestive	-0.5335	0.2969
	Cardiovascular	Identical Data	
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	1.8257	0.9661
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	1.0000	0.1587
	Musculo/Skeletal	-1.4372	0.0753
	Total	-1.0921	0.1374

Note: A negative 'Z' value indicates a difference in the predicted direction, and the associated probability (significance) value is for a one-tailed test. A positive Z value indicates a result in a direction opposite to the Test Hypothesis. Two-tailed tests were employed here, the probability value for significance being taken as one (1) minus that indicated in the table, multiplied by two (2) (i.e., $2(1-P)$ = adjustment of tabled probability value for a two-tailed test. Level of significance indicated by asterisks; * = .05, ** = .01.

Table 3-24. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
 Category - Symptomatic Medical Problems

	Sort Factors	Z	Significance
Ear Protector Usage- Age Group-	Yes Below 26		
Sample- 29			
	Neurological	0.1183	0.5471
	Digestive	-1.2495	0.1057
	Cardiovascular	1.3416	0.9101
	Otological/Audio	1.0954	0.8633
	Allergenic/Derma	1.3416	0.9101
	Respiratory	2.5205	0.9941
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.1722	0.8794
	Total	1.2339	0.8914
Ear Protector Usage- Age Group-	Yes 26 - 35		
Sample- 53			
	Neurological	0.1749	0.5694
	Digestive	-2.0986	0.0179**
	Cardiovascular	1.0000	0.8413
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	1.8257	0.9661
	Respiratory	2.2014	0.9861* (2 Tail)
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.3484	0.6362
	Total	0.1207	0.5480
Ear Protector Usage- Age Group-	No 26 - 35		
Sample- 15			
	Neurological	1.0987	0.1359
	Digestive	-0.9439	0.1726
	Cardiovascular	Identical Data	
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	1.3416	0.9101
	Respiratory	Identical Data	
	Glandular	Identical Data	
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-0.2801	0.3897
	Total	-1.0225	0.1533

Table 3-24. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
 Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage- Age Group-	Yes 36 - 45		
Sample- 41			
	Neurological	0.6290	0.7353
	Digestive	0.7847	0.2163
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.6036	0.9456
	Respiratory	0.6742	0.7499
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.5022	0.6922
	Total	0.4440	0.6715
Ear Protector Usage- Age Group-	No 36 - 45		
Sample- 7			
	Neurological	-1.0954	0.1367
	Digestive	0.7303	0.7674
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.8018	0.2113
	Total	-0.2145	0.3766
Ear Protector Usage- Age Group-	Yes 46 - 55		
Sample- 32			
	Neurological	-0.6278	0.2651
	Digestive	-2.5205	0.0059**
	Cardiovascular	Identical Data	
	Otological/Audio	-0.5345	0.2965
	Allergenic/Derma	1.6036	0.9456
	Respiratory	2.3664	0.9910* (2 Tail)
	Glandular	1.0000	0.8413
	Urological	Identical Data	
	Musculo/Skeletal	-0.4146	0.3392
	Total	-0.3620	0.3587

Table 3-24. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
 Category - Symptomatic Medical Problems

	Sort Factors	Z	Significance
Ear Protector Usage- Age Group-	No 46 - 55		
Sample- 7			
	Neurological	0.5345	0.7035
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0000	0.8413
	Respiratory	Identical Data	
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.8257	0.0339*
	Total	-1.4606	0.0721
Ear Protector Usage- Age Group-	Yes 56 - 65		
Sample- 24			
	Neurological	0.2369	0.5936
	Digestive	-1.6036	0.0544*
	Cardiovascular	Identical Data	
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	Identical Data	
	Respiratory	0.5345	0.7035
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.0	0.5000
	Total	-0.2746	0.3918
Ear Protector Usage- Age Group-	No 56 - 65		
Sample- 7			
	Neurological	-1.0000	0.1587
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.0000	0.8413
	Respiratory	Identical Data	
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.0000	0.8413
	Total	0.0	0.5000

Table 3-24. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage- Age Group- Yrs. Pres. Job-	Yes Below 26 5-10		
Sample- 29			
	Neurological	0.1183	0.5471
	Digestive	-1.2495	0.1057
	Cardiovascular	1.3416	0.9101
	Otological/Audio	1.0954	0.8633
	Allergenic/Derma	1.3416	0.9101
	Respiratory	2.5205	0.9941* (2 Tail)
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.1722	0.8794
	Total	1.2339	0.8914
Ear Protector Usage- Age Group- Yrs. Pres. Job-	Yes 26 - 35 5-10		
Sample- 52			
	Neurological	0.1749	0.5694
	Digestive	-2.4025	0.0081**
	Cardiovascular	1.0000	0.8413
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	1.8257	0.9661
	Respiratory	2.2014	0.9861* (2 Tail)
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.3484	0.6362
	Total	-0.0236	0.4906
Ear Protector Usage- Age Group- Yrs. Pres. Job-	Yes 36 - 45 5-10		
Sample- 30			
	Neurological	0.4890	0.6876
	Digestive	0.0	0.5000
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	1.6036	0.9456
	Respiratory	1.6036	0.9456
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.7838	0.9628
	Total	1.4807	0.9307

Table 3-24. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
 Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage-	Yes		
Age Group-	46 - 55		
Yrs. Pres. Job-	5-10		
Sample- 11			
	Neurological	-0.3381	0.3677
	Digestive	-1.6036	0.0544*
	Cardiovascular	Identical Data	
	Otological/Audio	0.0	0.5000
	Allergenic/Derma	Identical Data	
	Respiratory	1.3416	0.9101
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.6742	0.7499
	Total	-0.3381	0.3677
Ear Protector Usage-	Yes		
Age Group-	56 - 65		
Yrs. Pres. Job-	5-10		
Sample- 8			
	Neurological	1.4606	0.9279
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	Identical Data	
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	1.3416	0.9101
	Total	1.4606	0.9279
Ear Protector Usage-	No		
Age Group-	26 - 35		
Yrs. Pres. Job-	5-10		
Sample- 15			
	Neurological	-1.0987	0.1339
	Digestive	-0.9439	0.1726
	Cardiovascular	Identical Data	
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	1.3416	0.9101
	Respiratory	Identical Data	
	Glandular	Identical Data	
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-0.2801	0.3897
	Total	-1.0225	0.1533

Table 3-24. (Cont.)

Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage-	No		
Age Group-	36 - 45		
Yrs. Pres. Job-	5-10		
Sample- 5			
	Neurological	-1.0954	0.1367
	Digestive	0.5345	0.7035
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.8018	0.2113
	Total	0.4045	0.3429
Ear Protector Usage-	Yes		
Age Group-	36 - 45		
Yrs. Pres. Job-	11-15		
Sample- 7			
	Neurological	0.4472	0.6726
	Digestive	-0.8018	0.2113
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	-1.0000	0.1587
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.8018	0.2113
	Total	-0.9435	0.1727
Ear Protector Usage-	Yes		
Age Group-	46 - 55		
Yrs. Pres. Job-	11-15		
Sample- 4			
	Neurological	1.3416	0.9101
	Digestive	-1.6036	0.0544*
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.4472	0.3274
	Total	0.8018	0.7887

Table 3-24. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage-	Yes		
Age Group-	56 - 65		
Yrs. Pres. Job-	11-15		
Sample- 5			
	Neurological	-0.8018	0.2113
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	0.0	0.5000
	Total	-0.3651	0.3575
Ear Protector Usage-	Yes		
Age Group-	36 - 45		
Yrs. Pres. Job-	16-20		
Sample- 4			
	Neurological	Identical Data	
	Digestive	-1.3416	0.0899
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-1.0000	0.1587
Ear Protector Usage-	Yes		
Age Group-	46 - 55		
Yrs. Pres. Job-	16-20		
Sample- 14			
	Neurological	-0.7303	0.2326
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	1.6036	0.9456
	Respiratory	1.6036	0.9456
	Glandular	1.0000	0.8413
	Urological	Identical Data	
	Musculo/Skeletal	-1.3416	0.0899
	Total	0.1348	0.5536

Table 3-24. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
 Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage-	Yes		
Age Group-	56 - 65		
Yrs. Pres. Job-	16-20		
Sample- 4			
	Neurological	Identical Data	
	Digestive	Identical Data	
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	-1.0000	0.1587
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-1.3416	0.0890
Ear Protector Usage-	Yes		
Age Group-	56 - 65		
Yrs. Pres. Job-	Over 20		
Sample- 7			
	Neurological	-1.3416	0.0899
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	Identical Data	
	Respiratory	Identical Data	
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-1.3416	0.0899
Ear Protector Usage-	Yes		
Yrs. Pres. Job-	5-10		
Sample- 130			
	Neurological	0.5651	0.7140
	Digestive	2.9394	0.0016**
	Cardiovascular	1.6036	0.9456
	Otological/Audio	1.4003	0.9193
	Allergenic/Derma	2.6656	0.9962** (2 Tail)
	Respiratory	3.9199	1.0000** (2 Tail)
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	2.0769	0.9811* (2 Tail)
	Total	1.4490	0.9263

Table 3-24. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
 Category - Symptomatic Medical Problems

	Sort Factors	Z	Significance
Ear Protector Usage- Yrs. Pres. Job-	No 5-10		
Sample- 28			
	Neurological	-0.9939	0.1601
	Digestive	-0.3501	0.3631
	Cardiovascular	Identical Data	
	Otological/Audio	1.0000	0.8413
	Allergenic/Derma	1.8257	0.9661
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	-1.0000	0.1587
	Musculo/Skeletal	-0.8475	0.1984
	Total	-0.5413	0.2941
Ear Protector Usage- Yrs. Pres. Job-	Yes 11-15		
Sample- 17			
	Neurological	0.5071	0.6940
	Digestive	-1.0502	0.1468
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	0.0	0.5000
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-0.8452	0.1990
	Total	-0.2825	0.3888
Ear Protector Usage- Yrs. Pres. Job-	No 11-15		
Sample- 4			
	Neurological	1.0000	0.8413
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	Identical Data	
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.0690	0.1425
	Total	-1.0690	0.1425

Table 3-24. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
 Category - Symptomatic Medical Problems

Sort Factors		Z	Significance
Ear Protector Usage- Yrs. Pres. Job-	Yes 16-20		
Sample- 22			
	Neurological	-0.7303	0.2326
	Digestive	-1.6036	0.0544*
	Cardiovascular	Identical Data	
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	1.6036	0.9456
	Respiratory	1.2136	0.8875
	Glandular	1.0000	0.8413
	Urological	Identical Data	
	Musculo/Skeletal	-1.8257	0.0339*
	Total	-0.8402	0.2004
Ear Protector Usage- Yrs. Pres. Job-	Yes Over 20		
Sample- 10			
	Neurological	-1.6036	0.0544*
	Digestive	-1.3416	0.0899
	Cardiovascular	Identical Data	
	Otological/Audio	-1.0000	0.1587
	Allergenic/Derma	Identical Data	
	Respiratory	1.0000	0.8413
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	-1.0000	0.1587
	Total	-1.6036	0.0544*
Ear Protector Usage- Yrs. Pres. Job-	No Over 20		
Sample- 4			
	Neurological	Identical Data	
	Digestive	-1.0000	0.1587
	Cardiovascular	Identical Data	
	Otological/Audio	Identical Data	
	Allergenic/Derma	Identical Data	
	Respiratory	Identical Data	
	Glandular	Identical Data	
	Urological	Identical Data	
	Musculo/Skeletal	Identical Data	
	Total	-1.0000	0.1587

- Sub-Categories of Symptomatic Medical Problems for the High-Noise Group in 1969/1970 Versus 1972/1973

Tables 3-22, 3-23, and 3-24 analyzed the differences between frequencies of specified types of symptomatic complaints reported for the High-Noise Group for the two time periods before and after the issuance of ear protection. Though few statistically significant differences emerged in these analyses, considering the total number of comparisons tested, they did appear to be mostly found for the respiratory category of problems followed by those of an allergenic and digestive nature. Moreover, the direction of these significant differences found that respiratory and allergenic type problems were more frequent after the ear protection program was started while digestive complaints dropped in their rate of occurrence. This was especially seen in the comparisons for the workers classified as most frequently wearing their ear protectors which would suggest that there may be side effects, both positive and negative, in using this equipment.

3.5 Attendance Data

3.5.1 Total Days Absent

- Overall Results

Figure 3-37 presents the cumulative percent frequency distributions of workers in the High-Noise Group having had a specified number of days absent during the 1969/1970 and 1972/1973 time periods or just before and after the advent of hearing conservation in the plant supplying the data. The plotted curves reveal a distinct drop in frequencies of accidents per unit number of workers subsequent to the start of the program. For example, during the 1969/1970 period, 10% of the workers had a total of 10 or more days absent; while for the 1972/1973 period, approximately 3% of the workers had a total of 70 or more days absent. More dramatically, during the 1969/1970 period, approximately 43% of the

Table 3-25. Summary Table of Results of Wilcoxon Matched-Pairs Signed Ranks Tests (2-Tailed) and Median Frequencies for the Low Noise Group, Comparing 1969/1970 Data with 1972/1973 Data, with Respect to Symptomatic Medical Problems

Group/Sub Group Combination	Sample Size	Median Frequencies		Significance
		1969/1970	1972/1973	
Total Sample	432	0.2	0.2	0.0502*
Age: Below 26	9	0.1	0.3	0.5930
26 - 35	98	0.2	0.1	0.9386
36 - 45	133	0.2	0.3	0.2734
46 - 55	137	0.1	0.2	0.1262
56 - 65	55	0.1	0.2	0.1330
Occupation: Foreman				
Age: 26 - 35	25	0.4	0.4	0.9722
36 - 45	43	1.2	1.0	0.6172
46 - 55	41	0.3	0.5	0.8758
56 - 65	24	0.1	0.2	0.3628
Occupation: Test and Inspection				
Age: 26 - 35	6	0.3	0.3	0.5930
36 - 45	12	0.3	0.3	0.5542
46 - 55	16	0.2	0.5	0.3104
Occupation: Engineer/Draftsman				
Age: Below 26	7	0.0	0.3	0.1798
26 - 35	51	0.1	0.1	0.3590
36 - 45	63	0.1	0.1	0.0466*
46 - 55	61	0.0	0.1	0.0710
56 - 65	23	0.0	0.1	0.2174
Occupation: Plant Support				
Age: 26 - 35	4	0.5	0.2	0.5930
46 - 55	4	0.2	0.5	0.3174
Occupation: Administrator				
Age: 26 - 35	11	0.2	0.2	0.9999
36 - 45	12	0.0	0.4	0.0432*
46 - 55	15	0.1	0.2	0.3614
56 - 65	5	0.0	0.3	0.3174
Marital Status: Single				
Age: 26 - 35	23	0.2	0.2	0.9999
36 - 45	6	0.3	0.1	0.3174
46 - 55	7	0.0	1.5	0.0678
Marital Status: Married				
Age: Below 26	8	0.1	0.3	0.5930
26 - 35	75	0.2	0.1	0.8854
36 - 45	125	0.2	0.3	0.1672
46 - 55	128	0.1	0.2	0.3344
56 - 65	51	0.1	0.2	0.1330

*Significant difference $p < .05$, **Significant difference $p < .01$

Table 3-25. Summary Table of Results of Wilcoxon Matched-Pairs Signed-Ranks Tests (2-Tailed) and Median Frequencies of the Low Noise Group, Comparing 1969/1970 Data with 1972/1973 Data, with Respect to Symptomatic Medical Problems (Cont.)

Group/Sub Group Combination	Sample Size	Median Frequencies		Significance
		1969/1970	1972/1973	
Shift: Rotating				
Age: 26 - 35	4	0.2	0.0	0.3174
36 - 45	4	0.0	0.2	0.3174
46 - 55	7	0.3	0.3	0.4226
Shift: First				
Age: Below 26	9	0.1	0.3	0.5930
26 - 35	76	0.1	0.1	0.5630
36 - 45	98	0.2	0.2	0.2304
46 - 55	110	0.1	0.2	0.0004**
56 - 65	40	0.0	0.1	0.1158
Shift: Second				
Age: 26 - 35	7	2.0	0.5	0.2850
36 - 45	18	0.7	0.4	0.9688
46 - 55	11	1.5	0.5	0.0796
56 - 65	10	0.1	0.5	0.3454
Shift: Third				
Age: 26 - 35	11	0.3	1.0	0.0796
36 - 45	13	1.2	1.3	0.6890
46 - 55	9	1.5	0.8	0.2718
56 - 65	4	0.5	0.2	0.3174
Years Present Job: 5 - 10				
Age: Below 26	7	0.0	0.3	0.1798
26 - 35	81	0.2	0.2	0.8372
36 - 45	91	0.3	0.4	0.3596
46 - 55	63	0.1	0.3	0.2424
56 - 65	16	0.0	0.2	0.1776
Years Present Job: 11 - 15				
Age: 26 - 35	14	0.1	0.1	0.5002
36 - 45	22	0.1	0.1	0.6744
46 - 55	37	0.1	0.2	0.2136
56 - 65	24	0.1	0.1	0.5002
Years Present Job: 16 - 20				
Age: 36 - 45	14	0.1	0.3	0.2368
46 - 55	17	0.1	0.5	0.4412
56 - 65	7	0.3	0.2	0.3174
Years Present Job: Over 20				
Age: 36 - 45	6	0.0	0.3	0.1782
46 - 55	20	0.2	0.1	0.5002
56 - 65	8	0.1	0.3	0.1782

*Significant difference $p < .05$, **Significant difference $p < .01$

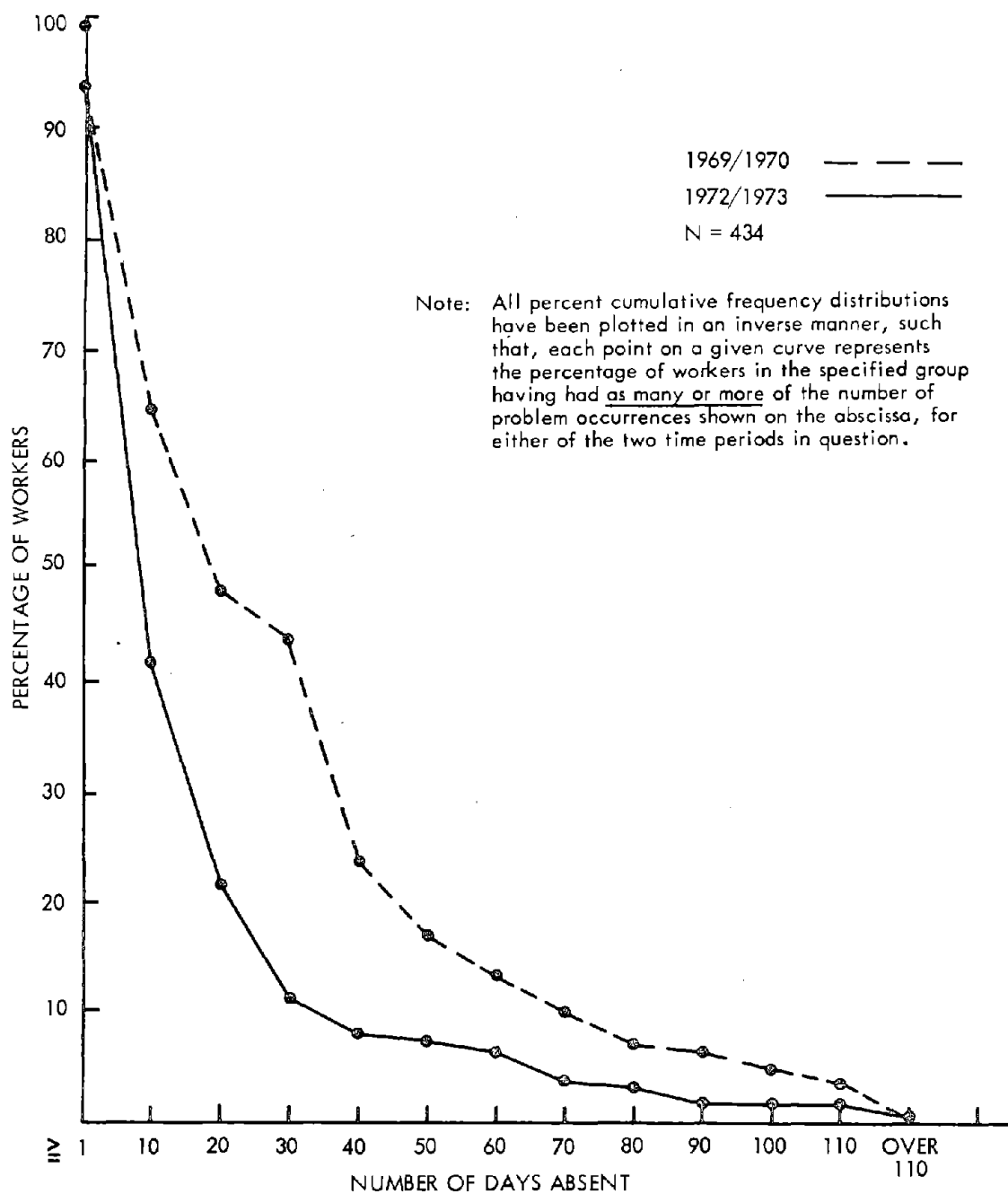


Figure 3-37. Cumulative Percent Frequency Distributions of Workers from the High Noise Group, with a Specifiable Number of Days Absent, During 2-Year Periods Before (1969/1970) and After (1972/1973) the Advent of a Company Hearing Conservation Program

workers had 30 or more total days absent; while for the 1972/1973 period, only approximately 12% of the workers had 30 or more total days absent.

Figure 3-38 presents a comparison of the median number of days absent for the total High-Noise Group, for the two time periods. Wilcoxon Tests Results included in Table 3-26, indicated a difference resulting from this comparison which was significant at the .01 level.

- Results by Age

Comparisons of total number of days absent between the two time periods, for five (5) different age groupings, yielded significant differences at the .01 level, for all groups. Results of these statistical comparisons included in Table 3-29 indicate significant differences for all age groups. Figure 3-39 illustrates these comparisons in terms of median number of days absent before and after the advent of the hearing conservation program. The sizes of the reduction were fairly similar among the different age groups.

- Results by Experience (Years at Present Job)

Figure 3-40 depicts the average number of days absent, for each of the two time periods, by years at present job. Resultant differences between the averages for each of the two time periods were in the predicted direction, for each of the four length-of-service classifications. With the exception of the 16-20 years-at-present-job category, these differences were also relatively large in magnitude. No statistical tests were performed on these data directly. However, the results of Wilcoxon Tests for years at present job-by-age comparisons are included in Table 3-29 as summarized below.

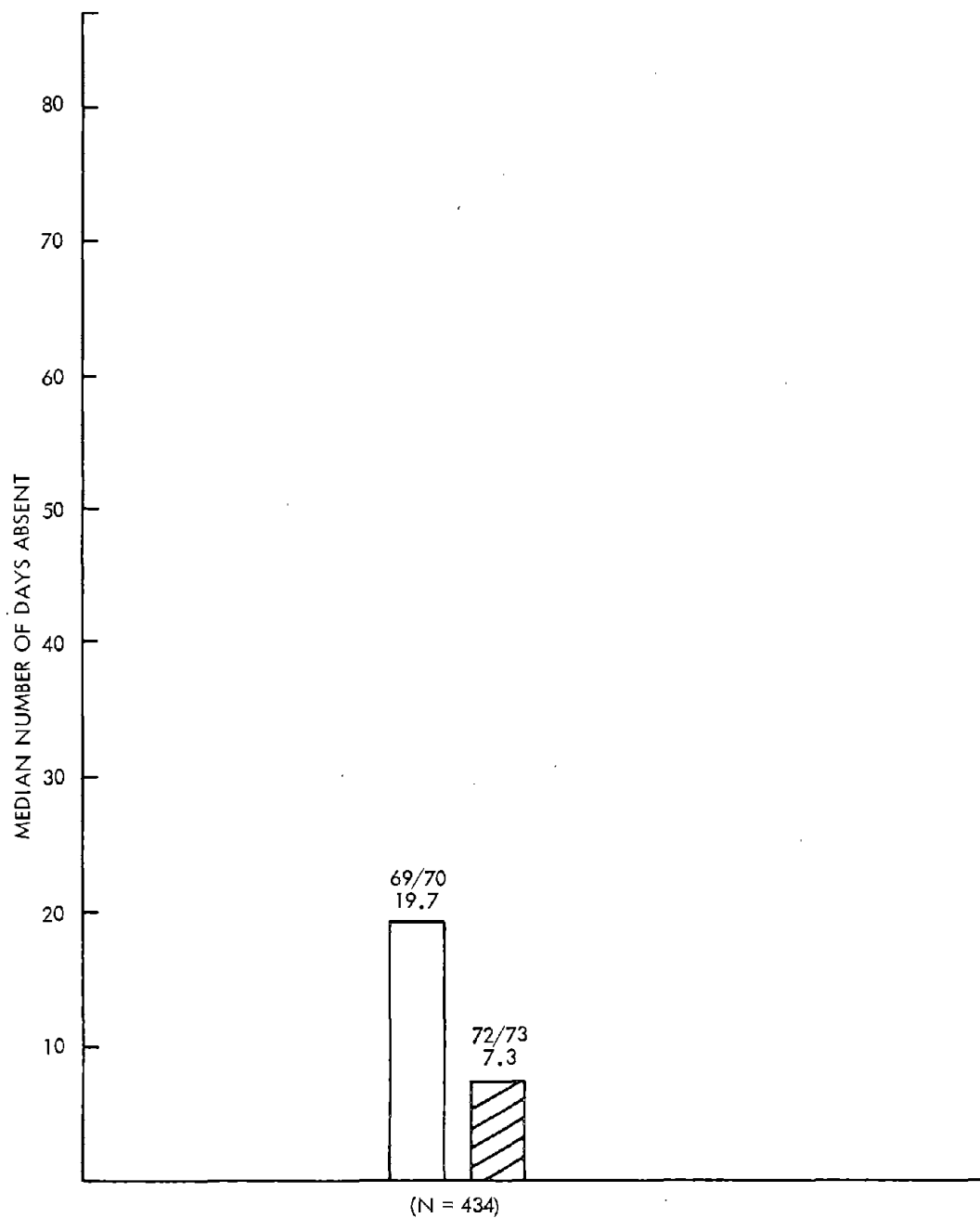


Figure 3-38. Median Number of Days Absent, for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

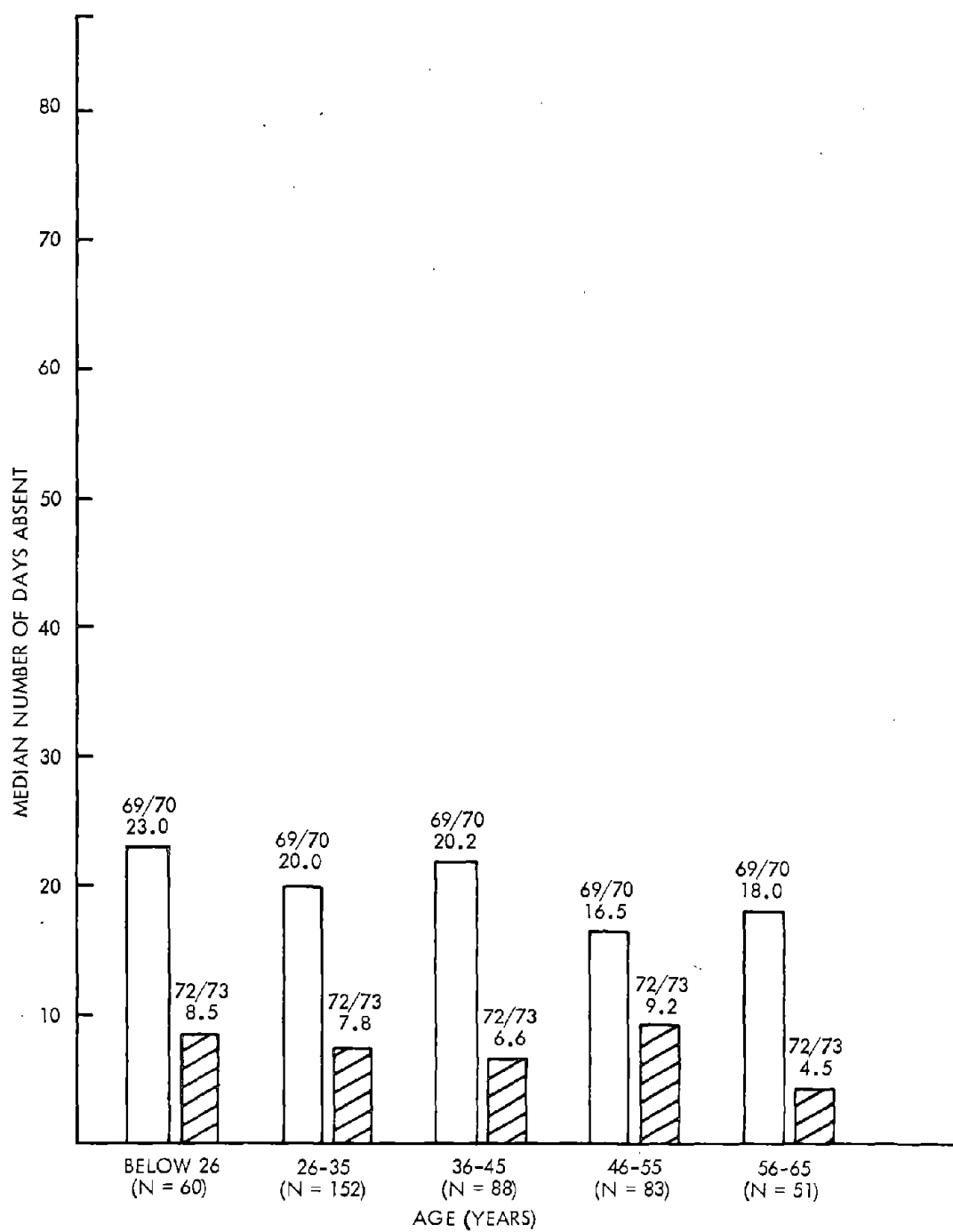


Figure 3-39. Median Number of Days Absent, by Age, for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

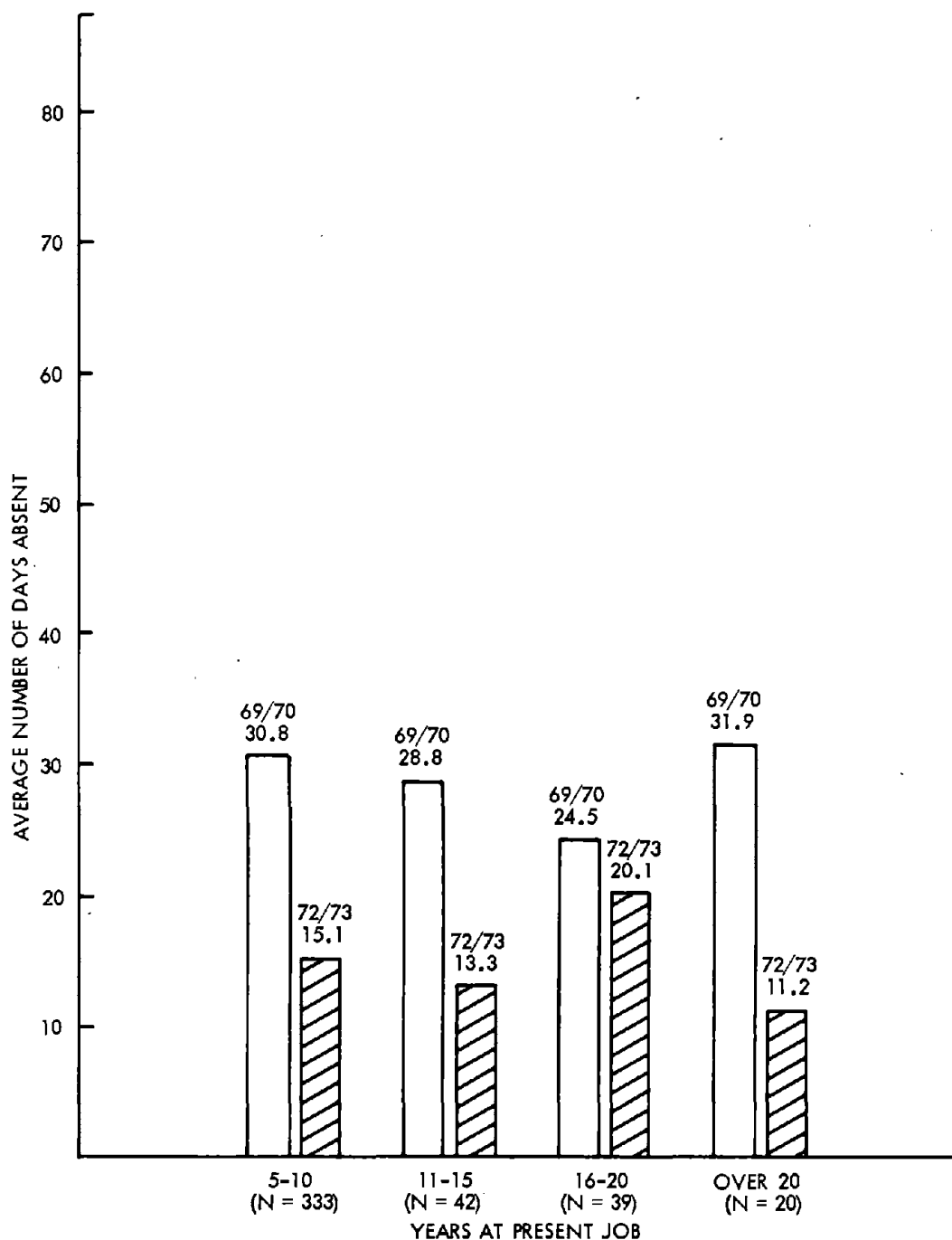


Figure 3-40. Average Number of Days Absent, by Years at Present Job, for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

- Results by Age-Experience Combinations

Table 3-26 presents median number of days absent during each of the two time periods, for various age-experience combinations. Statistical tests of the 1969/1970 vs. 1972/1973 data, for these various combinations, yielded significant differences in the majority of cases (nine cases out of a total of fourteen were statistically significant) with sample sizes sufficiently large for comparison. The results of these tests are included in Table 3-29. All differences were in the expected direction, i.e., fewer absences after establishment of the program.

- Results by Shift

Comparisons of average number of days absent, by work shift, for the two time periods, are shown in Table 3-27. For shifts 1, 2, and 3, the average number of days absent for the 1972/1973 time period was approximately 50% less than for the 1969/1970 period. In the case of the rotating shift, the difference was much greater, however, the sample size was extremely small ($N = 3$), and probably not reliable.

- Results by Job Type

Table 3-28 presents the average number of days absent, by job type, for the two time periods. Averages for Machine Operator, Plant Support, Administrator, and Production Worker job categories for the two time periods, all exhibited clear differences in the predicted direction, i.e., 1972/1973 averages were lower than 1969/1970 averages. Averages for Foreman, and Test/Inspector, for the two time periods, showed differences in the opposite direction opposite but far smaller in magnitude. None of these differences were statistically tested. Rather such tests were applied to age by job type combinations of sufficient size. The results of the analyses are summarized in Table 3-29. Significant differences between the two time periods were significant for Production Worker and Machine Operators across all age groups.

Table 3-26. Age-Experience Comparisons of Median Number of Days Absent, for High-Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

Years at Present Job	Age (Years)									
	Below 26		26-35		36-45		46-55		56-65	
	1969/ 1970	1972/ 1973	1969/ 1970	1972/ 1973	1969/ 1970	1972/ 1973	1969/ 1970	1972/ 1973	1969/ 1970	1972/ 1973
	(Sig. <.01)	(Sig. <.01)	(Sig. <.01)	(Sig. <.01)	(Sig. <.01)	(Sig. <.01)	(Sig. <.01)	(Sig. <.01)	(Sig. <.01)	(Sig. <.01)
5-10	24.5 (59)	8.8 (59)	19.5 (146)	7.5 (146)	14.5 (66)	6.0 (66)	30.5 (41)	10.5 (41)	15.0 (21)	11.5 (21)
11-15	2.0 (1)	0.0 (1)	27.0 (6)	13.5 (6)	28.5 (10)	11.5 (10)	14.0 (15)	7.0 (15)	11.5 (10)	2.5 (10)
16-20	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	23.5 (12)	8.0 (12)	13.5 (20)	10.5 (20)	29.5 (7)	17.5 (7)
Over 20	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	26.5 (7)	13.5 (7)	30.5 (13)	2.0 (13)

Table 3-27. Comparison of Average Number of Days Absent,
for High Noise Group, by Shift, During the 1969/1970
vs 1972/1973 Time Periods

	Shift 1	Shift 2	Shift 3	Rotating Shift
1969/ 1970	30.7 (210)	29.6 (125)	28.7 (96)	90.6 (3)
1972/ 1973	15.3 (210)	15.5 (125)	14.5 (96)	3.7 (3)

Note: Numbers in Parentheses Refer to Sample Sizes

Table 3-28. Comparison of Average Number of Days Absent, by Job Type, for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

	Job Type					
	Foreman	Test and Inspect	Machine Operator	Plant Support	Administrator	Production Worker
1969/1970	10.3 (32)	9.5 (47)	35.3 (86)	35.0 (2)	49.3 (10)	52.1 (167)
1972/1973	11.5 (32)	12.1 (47)	15.3 (86)	16.5 (2)	22.6 (10)	24.3 (167)

Note: Numbers in Parentheses Refer to Sample Sizes

Table 3-29. Results of Wilcoxon Matched-Pairs Signed-Ranks Tests, Comparing 1969/1970 Data with 1972/1973 Data, with Respect to Total Days Absent and Number of Discrete Absences in High Noise Group

Null Hypothesis - 1969/70 Data is Equivalent to 1972/73 Data

Test Hypothesis - 1972/73 Data is Less Than 1969/70 Data

Sort Factors		Z	Significance	
Age Group- All				
Total Sample- 434				
	Tot. Days Absent	-10.6159	0.0	**
	No. Discrete Abst.	-12.1840	0.0	**
Age Group- Below 26				
Sample- 60				
	Tot. Days Absent	-3.9702	0.0000**	
	No. Discrete Abst.	-3.7544	0.0001**	
Age Group- 26 - 35				
Sample- 152				
	Tot. Days Absent	-7.5979	0.0	**
	No. Discrete Abst.	-8.0660	0.0	**
Age Group- 36 - 45				
Sample- 88				
	Tot. Days Absent	-3.6687	0.0001**	
	No. Discrete Abst.	-5.5231	0.0	**
Age Group- 46 - 55				
Sample- 83				
	Tot. Days Absent	-3.9401	0.0000**	
	No. Discrete Abst.	-4.7580	0.0000**	
Age Group- 56 - 65				
Sample- 51				
	Tot. Days Absent	-3.9154	0.0000**	
	No. Discrete Abst.	-4.3592	0.0000**	

Note: (1) A negative (-) 'Z' value indicates a difference in the predicted (test hypothesis) direction, while a positive 'Z' indicates a difference in a direction opposite to the hypothesis.
 (2) Statistical significance indicated by asterisks; * .05 level, ** .01 level.

Table 3-29. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests
 Category - Attendance Data

Sort Factors		Z	Significance
Age Group- 26 - 35 Occup. Title-Foreman			
Sample- 8	Tot. Days Absent	0.0	0.5000
	No. Discrete Abst.	0.0	0.5000
Age Group- 36 - 45 Occup. Title-Foreman			
Sample- 5	Tot. Days Absent	1.2136	0.8875
	No. Discrete Abst.	0.7303	0.7674
Age Group- 46 - 55 Occup. Title-Foreman			
Sample- 9	Tot. Days Absent	-1.9548	0.0253*
	No. Discrete Abst.	-2.3805	0.0086**
Age Group- 56 - 65 Occup. Title-Foreman			
Sample- 10	Tot. Days Absent	-1.9548	0.0253*
	No. Discrete Abst.	-2.3805	0.0086**
Age Group- Below 26 Occup. Title-Test & I			
Sample- 6	Tot. Days Absent	-0.2097	0.4170
	No. Discrete Abst.	-0.8386	0.2008
Age Group- 26 - 35 Occup. Title-Test & I			
Sample- 8	Total Days Absent	-0.1690	0.4329
	No. Discrete Abst.	-0.9297	0.1763

Table 3-29. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests
 Category - Attendance Data

Sort Factors		Z	Significance
Age Group- 36 - 45 Occup. Title-Test & I			
Sample- 18	Tot. Days Absent	-0.0517	0.4794
	No. Discrete Abst.	-1.4737	0.0703
Age Group- 46 - 55 Occup. Title-Test & I			
Sample- 11	Tot. Days Absent	0.9780	0.8360
	No. Discrete Abst.	-0.9174	0.1795
Age Group- 56 - 65 Occup. Title-Test & I			
Sample- 4	Tot. Days Absent	0.0	0.5000
	No. Discrete Abst.	0.0	0.5000
Age Group- Below 26 Occup. Title-Mach. Op.			
Sample- 18	Tot. Days Absent	-2.3735	0.0088**
	No. Discrete Abst.	-2.5477	0.0054**
Age Group- 26 - 35 Occup. Title-Mach. Op.			
Sample- 28	Tot. Days Absent	-3.1953	0.0007**
	No. Discrete Abst.	3.1766	0.0007**
Age Group- 36 - 45 Occup. Title-Mach. Op.			
Sample- 17	Tot. Days Absent	-2.2722	0.0115**
	No. Discrete Abst.	2.9474	0.0016**

Table 3-29. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests
 Category - Attendance Data

Sort Factors		Z	Significance
Age Group- 46 - 55 Occup. Title-Mach. Op.			
Sample- 13	Tot. Days Absent	-2.8653	0.0021**
	No. Discrete Abst.	-2.2352	0.0017**
Age Group- 56 - 65 Occup. Title-Mach. Op.			
Sample- 10	Tot. Days Absent	-1.8363	0.0332*
	No. Discrete Abst.	-1.8347	0.0333*
Age Group- 56 - 65 Occup. Title-Admin.			
Sample- 4	Tot. Days Absent	1.6036	0.9456
	No. Discrete Abst.	1.3416	0.9101
Age Group- Below 26 Occup. Title-Prod. Wk.			
Sample- 35	Tot. Days Absent	-3.2398	0.0006**
	No. Discrete Abst.	2.6125	0.0045**
Age Group- 26 - 35 Occup. Title-Prod. Wk.			
Sample-105	Tot. Days Absent	-6.8244	0.0 **
	No. Discrete Abst.	-7.1194	0.0 **
Age Group- 36 - 45 Occup. Title-Prod. Wk.			
Sample- 48	Tot. Days Absent	-3.5180	0.0002**
	No. Discrete Abst.	-4.5450	0.0000**

Table 3-29. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Attendance Data

Sort Factors		Z	Significance
Age Group- 46 - 55 Occup. Title-Prod. Wk.			
Sample- 47	Tot. Days Absent	-3.6346	0.0001**
	No. Discrete Abst.	-3.6889	0.0001**
Age Group- 56 - 65 Occup. Title-Prod. Wk.			
Sample- 22	Tot. Days Absent	-3.1282	0.0009**
	No. Discrete Abst.	-3.2498	0.0006**
Age Group- Below 26 Mar. Status- Single			
Sample- 29	Tot. Days Absent	-2.7570	0.0029**
	No. Discrete Abst.	-2.6705	0.0038**
Age Group- 26 - 35 Mar. Status- Single			
Sample- 25	Tot. Days Absent	-3.3152	0.0005**
	No. Discrete Abst.	-3.6190	0.0001**
Age Group- Below 26 Mar. Status- Married			
Sample- 30	Tot. Days Absent	-2.6813	0.0037**
	No. Discrete Abst.	2.4991	0.0062**
Age Group- 26 - 35 Mar. Status- Married			
Sample-125	Tot. Days Absent	-6.8593	0.0 **
	No. Discrete Abst.	7.3557	0.0 **

Table 3-29. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Attendance Data

Sort Factors		Z	Significance
Age Group- 36 - 45 Mar. Status- Married			
Sample- 85	Tot. Days Absent	-3.5300	0.0002**
	No. Discrete Abst.	-5.4428	0.0 **
Age Group- 46 - 55 Mar. Status- Married			
Sample- 80	Tot. Days Absent	-3.8766	0.0001**
	No. Discrete Abst.	-4.6344	0.0000**
Age Group- 56 - 65 Mar. Status- Married			
Sample- 50	Tot. Days Absent	-4.1462	0.0000**
	No. Discrete Abst.	-4.5884	0.0000**
Age Group- Below 26 Shift- First			
Sample- 23	Tot. Days Absent	-2.3051	0.0106**
	No. Discrete Abst.	-2.3572	0.0092**
Age Group- 26 - 35 Shift- First			
Sample- 57	Tot. Days Absent	-4.8519	0.0000**
	No. Discrete Abst.	5.0355	0.0000**
Age Group- 36 - 45 Shift- First			
Sample- 53	Tot. Days Absent	-2.8506	0.0022**
	No. Discrete Abst.	-4.7570	0.0000**

Table 3-29. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Attendance Data

	Sort Factors	Z	Significance
Age Group- Shift-	46 - 55 First		
Sample- 46			
	Tot. Days Absent	-3.6685	0.0001**
	No. Discrete Abst.	-3.4813	0.0002**
Age Group- Shift-	56 - 65 First		
Sample- 31			
	Tot. Days Absent	-3.5960	0.0002**
	No. Discrete Abst.	-3.8360	0.0001**
Age Group- Shift-	Below 26 Second		
Sample- 13			
	Tot. Days Absent	-2.7954	0.0026**
	No. Discrete Abst.	-2.3412	0.0096**
Age Group- Shift-	26 - 35 Second		
Sample- 50			
	Tot. Days Absent	-4.3374	0.0000**
	No. Discrete Abst.	-4.4763	0.0000**
Age Group- Shift-	36 - 45 Second		
Sample- 24			
	Tot. Days Absent	-1.5097	0.0656
	No. Discrete Abst.	-2.3809	0.0086**
Age Group- Shift-	46 - 55 Second		
Sample- 25			
	Tot. Days Absent	-2.0986	0.0179**
	No. Discrete Abst.	-3.2857	0.0005**

Table 3-29. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests
 Category - Attendance Data

	Sort Factors	Z	Significance
Age Group- Shift-	56 - 65 Second		
Sample- 13			
	Tot. Days Absent	-0.5335	0.2969
	No. Discrete Abst.	-1.4120	0.0790
Age Group- Shift-	Below 26 Third		
Sample- 24			
	Tot. Days Absent	-1.8571	0.0316*
	No. Discrete Abst.	-1.9143	0.0278*
Age Group- Shift-	26 - 35 Third		
Sample- 45			
	Tot. Days Absent	-4.0074	0.0000**
	No. Discrete Abst.	-4.5326	0.0000**
Age Group- Shift-	36 - 45 Third		
Sample- 10			
	Tot. Days Absent	-1.2232	0.1106
	No. Discrete Abst.	-1.2741	0.1013
Age Group- Shift-	46 - 55 Third		
Sample- 11			
	Tot. Days Absent	0.3112	0.6222
	No. Discrete Abst.	-0.3112	0.3778
Age Group- Shift-	56 - 65 Third		
Sample- 6			
	Tot. Days Absent	-1.4606	0.0721
	No. Discrete Abst.	-1.6036	0.0544*

Table 3-29. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests
Category - Attendance Data

Sort Factors		Z	Significance
Age Group- Below 26 Yrs. Pres. Job- 5-10			
Sample- 59			
	Tot. Days Absent	-3.9486	0.0000**
	No. Discrete Abst.	-3.7362	0.0001**
Age Group- 26 - 35 Yrs. Pres. Job- 5-10			
Sample-146			
	Tot. Days Absent	-7.3398	0.0 **
	No. Discrete Abst.	-7.7308	0.0 **
Age Group- 36 - 45 Yrs. Pres. Job- 5-10			
Sample- 66			
	Tot. Days Absent	-2.7252	0.0032**
	No. Discrete Abst.	-4.1506	0.0000**
Age Group- 46 - 55 Yrs. Pres. Job- 5-10			
Sample- 41			
	Tot. Days Absent	-3.4988	0.0002**
	No. Discrete Abst.	-3.5082	0.0002**
Age Group- 56 - 65 Yrs. Pres. Job- 5-10			
Sample- 21			
	Tot. Days Absent	-1.5493	0.0607
	No. Discrete Abst.	-2.0686	0.0193**
Age Group- 26 - 35 Yrs. Pres. Job- 11-15			
Sample- 6			
	Tot. Days Absent	-1.9917	0.0232*
	No. Discrete Abst.	-2.2314	0.0139**

Table 3-29. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests
 Category - Attendance Data

Sort Factors		Z	Significance
Age Group- 36 - 45 Yrs. Pres. Job- 11-15			
Sample- 10	Tot. Days Absent	-2.2934	0.0109**
	No. Discrete Abst.	-2.6656	0.0038**
Age Group- 46 - 55 Yrs. Pres. Job- 11-15			
Sample- 15	Tot. Days Absent	-0.9730	0.1653
	No. Discrete Abst.	-1.3278	0.0921
Age Group- 56 - 65 Yrs. Pres. Job- 11-15			
Sample- 10	Tot. Days Absent	-2.0896	0.0183**
	No. Discrete Abst.	-2.1325	0.0165**
Age Group- 36 - 45 Yrs. Pres. Job- 16-20			
Sample- 12	Tot. Days Absent	-1.4120	0.0790
	No. Discrete Abst.	-2.6672	0.0038**
Age Group- 46 - 55 Yrs. Pres. Job- 16-20			
Sample- 20	Tot. Days Absent	-0.8250	0.2047
	No. Discrete Abst.	-2.4606	0.0069**
Age Group- 56 - 65 Yrs. Pres. Job- 16-20			
Sample- 7	Tot. Days Absent	-0.8386	0.2008
	No. Discrete Abst.	-0.8452	0.1990

Table 3-29. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests
 Category - Attendance Data

Sort Factors		Z	Significance
Age Group- 46 - 55 Yrs. Pres. Job- Over 20			
Sample- 7	Tot. Days Absent	-2.2014	0.0139**
	No. Discrete Abst.	-2.0226	0.0216*
Age Group- 56 - 65 Yrs. Pres. Job- Over 20			
Sample- 13	Tot. Days Absent	-2.9025	0.0019**
	No. Discrete Abst.	-3.0594	0.0011**

- Results by Ratings of Ear Protector Usage (Primary Method)

Figure 3-41 illustrates comparisons of median number of days absent, by ratings of ear protector use (Primary Method), for the two time periods. Differences between medians within each usage rating were all in the predicted direction, in that median number of days absent for 1972/1973 were all lower than corresponding 1969/1970 medians in each case. Table 3-30 includes the results of statistical tests of these comparisons, which were all significant. The size of the frequency differentials observed here do not reveal any orderly progression reflecting greater reduction in absences with increasing use of ear protection as would be expected.

- Results by Ratings of Ear Protector Usage (Primary Method) by Age

Figures 3-42, 3-43, 3-44, 3-45, and 3-46 include comparisons by age group of the median number of days absent for each of the two time periods, by ear protector usage (Primary Method). All differences tested were in the predicted direction, with most being statistically significant (see Table 3-30). However, five comparisons could not be tested due to insufficient sample sizes. In both the "26-35" and the "46-55" age groups, a decreased median number of days absent was coincident with increased protector usage. In the other age groups, this relationship was absent.

- Results by Ratings of Ear Protector Usage (Secondary Method)

Comparisons of median number of days absent, for the two time periods, by ratings of ear protector usage (Secondary Method), are presented in Figure 3-47. Differences were significant at the .01 level for both the user ("Yes") and the non-user ("No") groups (see Table 3-31). Both of these groups showed the same relative amounts of reduced absence in comparing their attendance data for the pre- and post-hearing conservation periods. The user group, however, had fewer absences in the latter period than did the non-users.

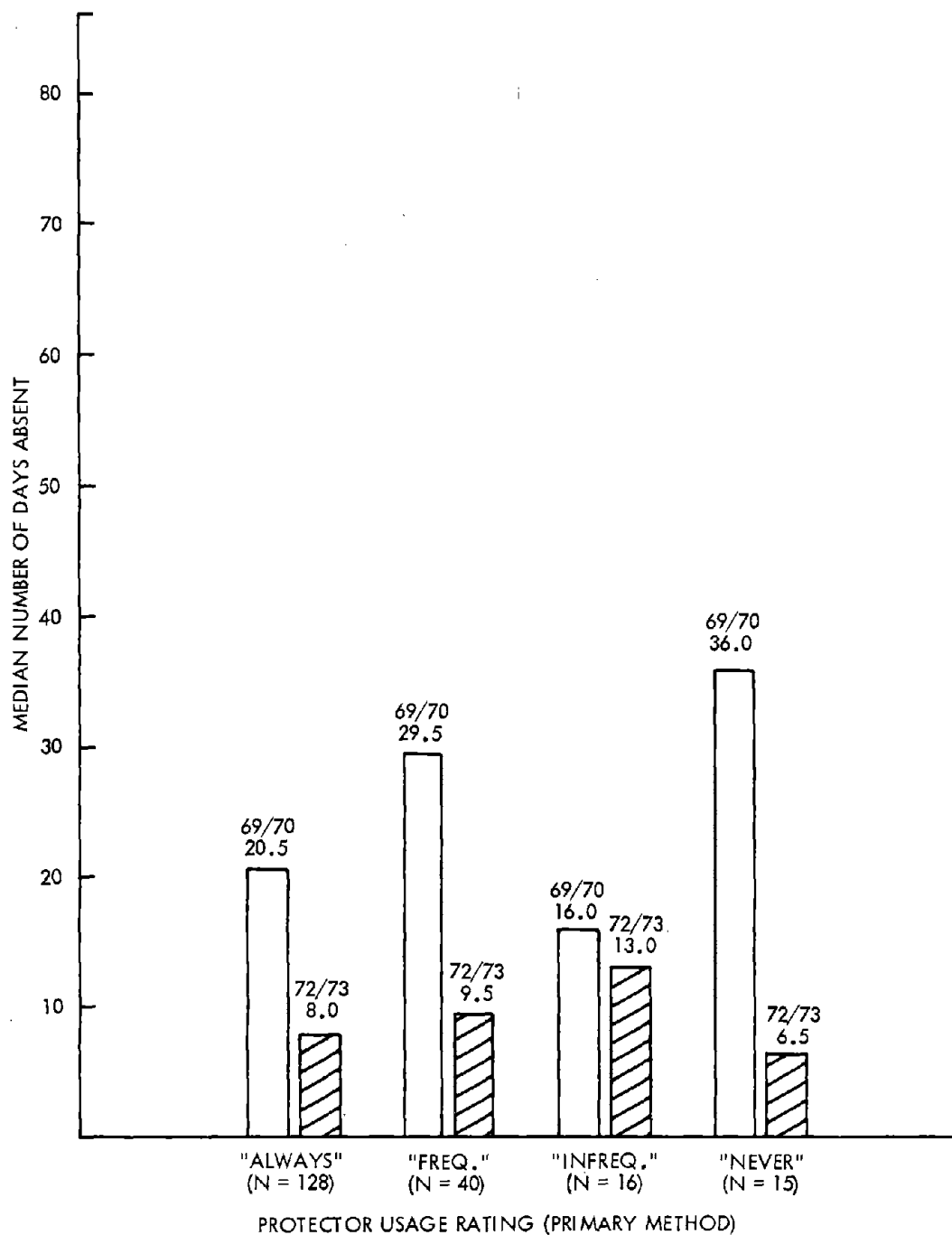


Figure 3-41. Median Number of Days Absent, for High Noise Group, by Protector Usage Rating (Primary Method), During the 1969/1970 vs 1972/1973 Time Periods

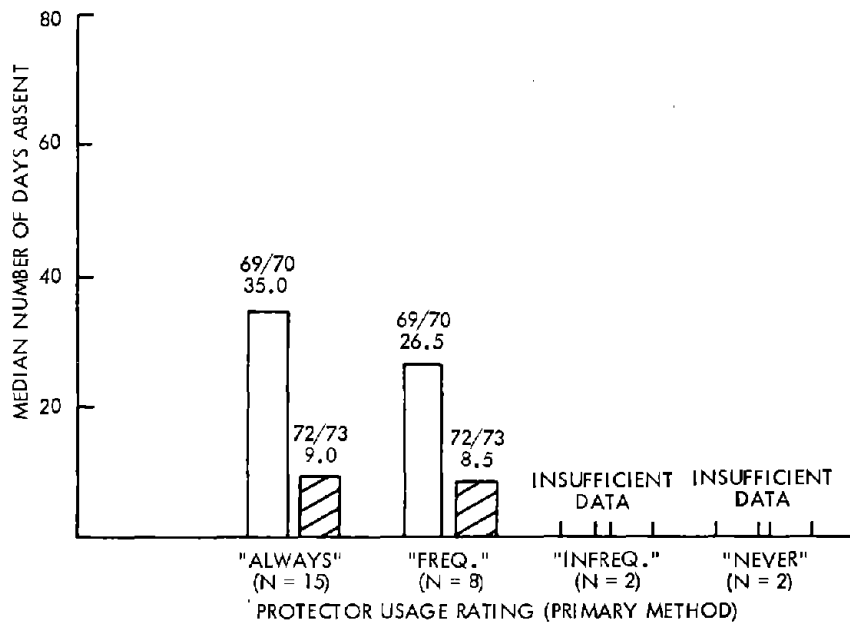


Figure 3-42. Median Number of Days Absent, for High Noise Group, by Protector Usage Rating (Primary Method), for the "Below 26" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

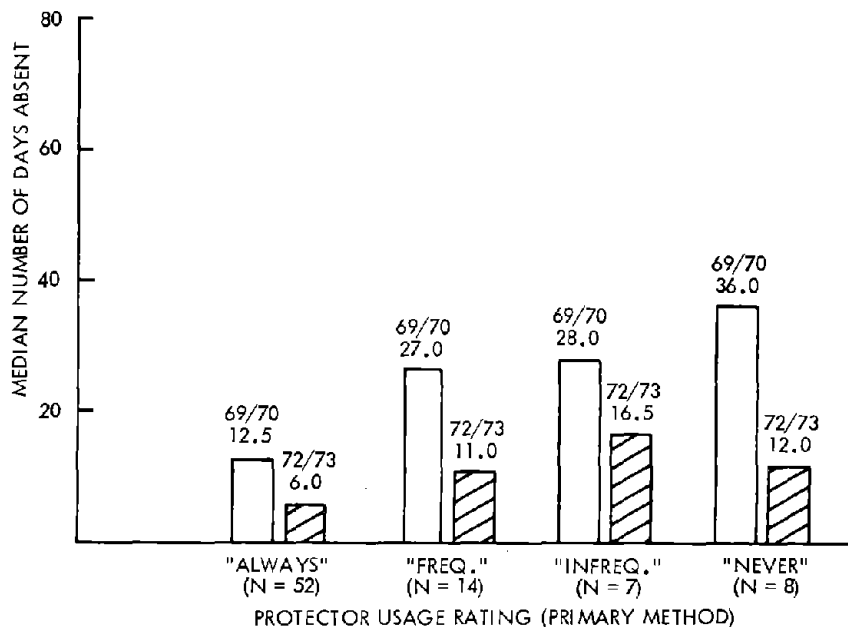


Figure 3-43. Median Number of Days Absent, for High Noise Group, by Protector Usage Rating (Primary Method), for the "26-35" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

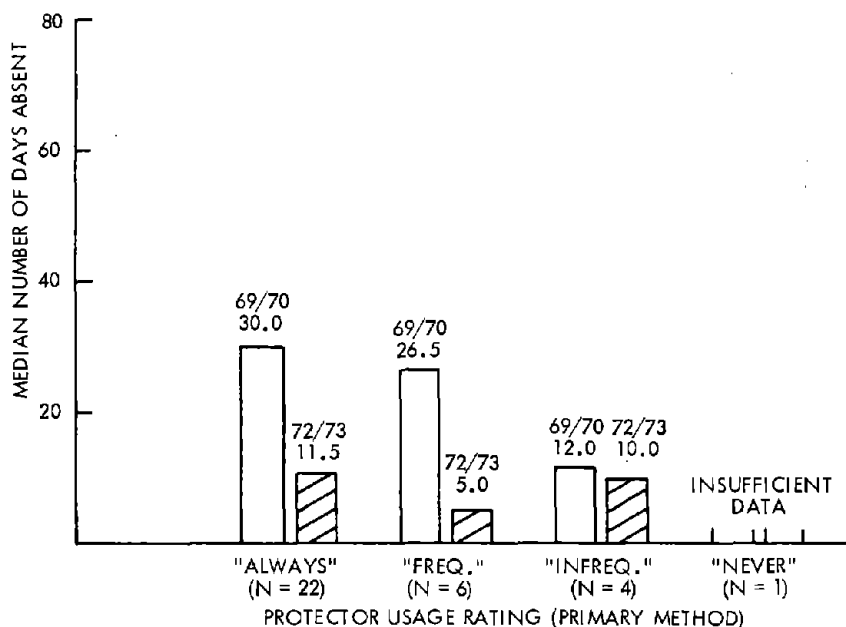


Figure 3-44. Median Number of Days Absent, for High Noise Group, by Protector Usage Rating (Primary Method), for the "36-45" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

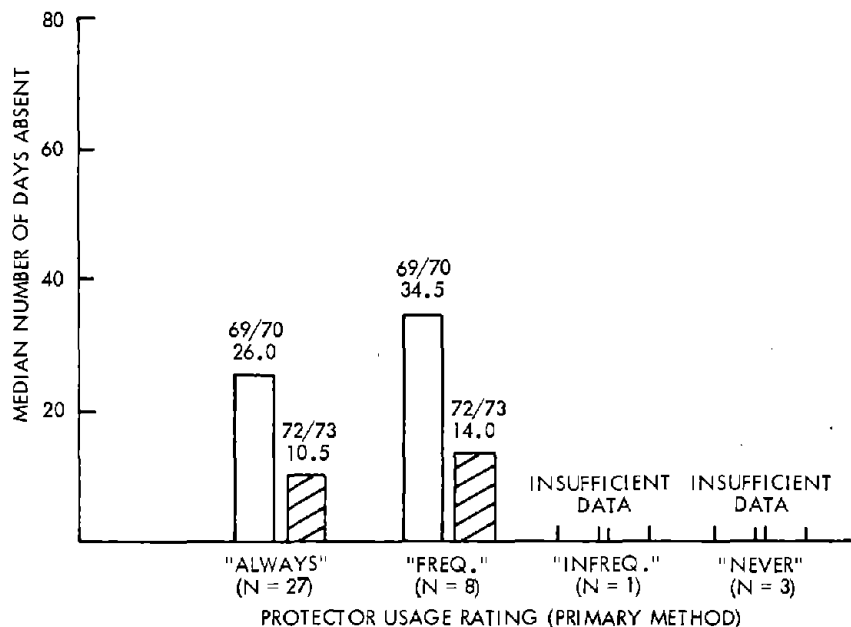


Figure 3-45. Median Number of Days Absent, for High Noise Group, by Protector Usage Rating (Primary Method), for the "46-55" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

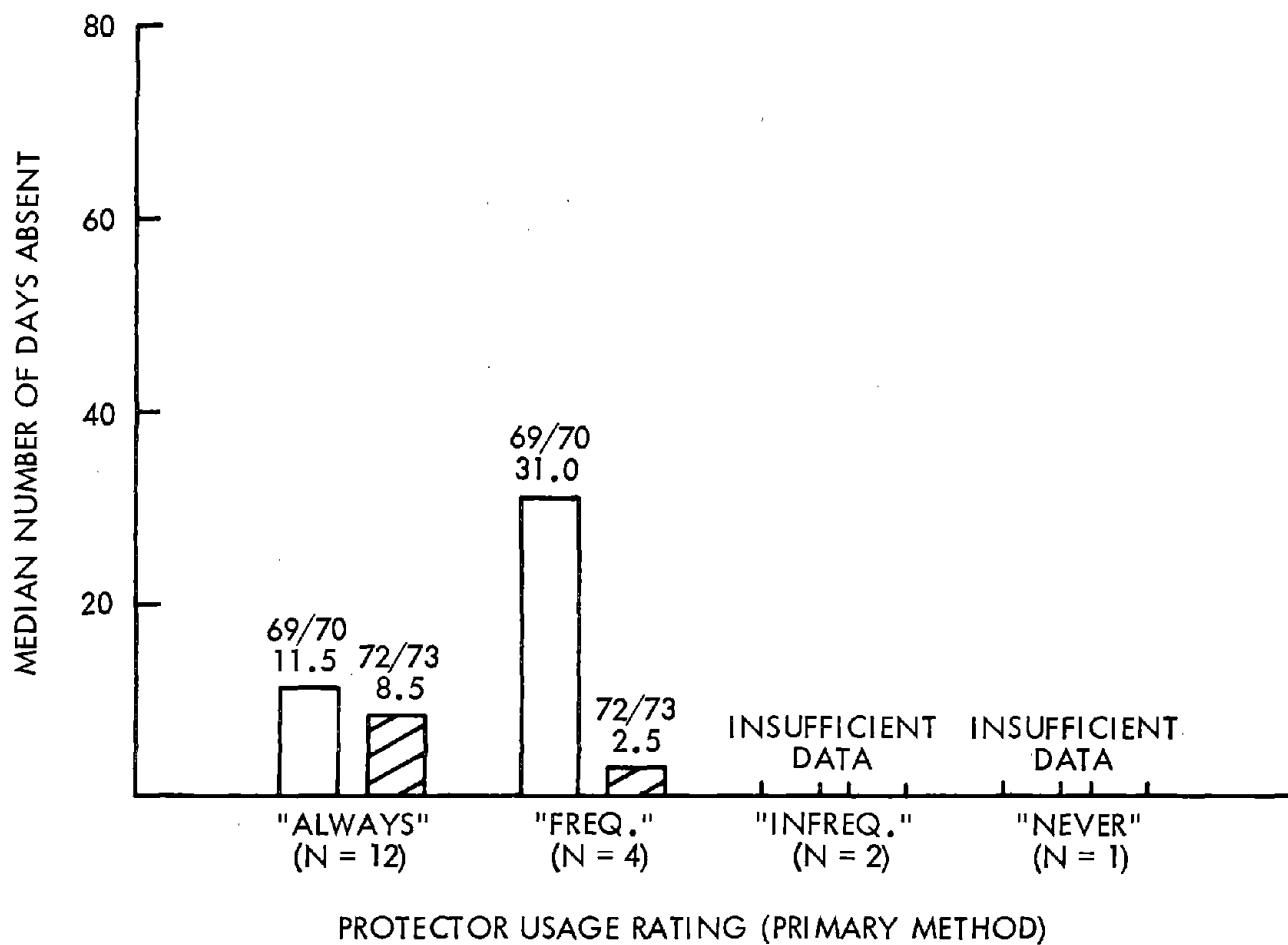


Figure 3-46. Median Number of Days Absent, for High Noise Group, by Protector Usage Rating (Primary Method), for the "56-65" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

Table 3-30. Results of Wilcoxon Matched-Pairs Signed-Ranks Tests, Comparing 1969/1970 Data with 1972/1973 Data, for Various Ratings (Primary Rating Method) of Ear Protector Usage, with Respect to Total Days Absent and Number of Discrete Absences in High-Noise Group

Null Hypothesis - 1969/70 Data is Equivalent to 1972/73 Data

Test Hypothesis - 1972/73 Data is Less Than 1969/70 Data

Sort Factors		Z	Significance
Ear Protector Usage- Always			
Sample- 128			
	Tot. Days Absent	-6.6396	0.0 **
	No. Discrete Abst.	-7.3539	0.0 **
Ear Protector Usage- Frequent			
Sample- 40			
	Tot. Days Absent	-4.0190	0.0000**
	No. Discrete Abst.	-3.8375	0.0001**
Ear Protector Usage- Infreqnt.			
Sample- 16			
	Tot. Days Absent	-1.9132	0.0279*
	No. Discrete Abst.	-1.1075	0.1340
Ear Protector Usage- Never			
Sample- 15			
	Tot. Days Absent	-3.1074	0.0009**
	No. Discrete Abst.	-3.0447	0.0012**
Ear Protector Usage- Always			
Age Group- Below 26			
Sample- 15			
	Tot. Days Absent	-2.0163	0.0219*
	No. Discrete Abst.	-2.3854	0.0085**

Note: (1) A negative (-)'Z' value indicates a difference in the predicted (test hypothesis) direction, while a positive 'Z' indicates a difference in a direction opposite to the hypothesis.
 (2) Statistical significance indicated by asterisks; * .05 level, ** .01 level.

Table 3-30. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
 (Primary Rating Method)
 Category - Attendance Data

Sort Factors		Z	Significance
Ear Protector Usage-	Frequent		
Age Group-	Below 26		
Sample-	8		
	Tot. Days Absent	-1.8204	0.0344*
	No. Discrete Abst.	-1.6803	0.0464*
Ear Protector Usage-	Always		
Age Group-	26 - 35		
Sample-	52		
	Tot. Days Absent	-4.8508	0.0000**
	No. Discrete Abst.	-5.0101	0.0000**
Ear Protector Usage-	Frequent		
Age Group-	26 - 35		
Sample-	14		
	Tot. Days Absent	-2.1665	0.0151**
	No. Discrete Abst.	-2.4169	0.0078**
Ear Protector Usage-	Infreqnt.		
Age Group-	26 - 35		
Sample-	7		
	Tot. Days Absent	-1.2677	0.1024
	No. Discrete Abst.	-0.8452	0.1990
Ear Protector Usage-	Never		
Age Group-	26 - 35		
Sample-	8		
	Tot. Days Absent	-2.3664	0.0090**
	No. Discrete Abst.	-2.1004	0.0178**

Table 3-30. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
 (Primary Rating Method)
 Category - Attendance Data

Sort Factors		Z	Significance
Ear Protector Usage-	Always		
Age Group-	36 - 45		
Sample-	22		
	Tot. Days Absent	-2.5161	0.0059**
	No. Discrete Abst.	-3.440	0.0004**
Ear Protector Usage-	Frequent		
Age Group-	36 - 45		
Sample-	6		
	Tot. Days Absent	-1.9917	0.0232*
	No. Discrete Abst.	-1.5724	0.0579*
Ear Protector Usage-	Infreqnt.		
Age Group-	36 - 45		
Sample-	4		
	Tot. Days Absent	-0.1826	0.4276
	No. Discrete Abst.	-0.3651	0.3575
Ear Protector Usage-	Always		
Age Group-	46 - 55		
Sample-	27		
	Tot. Days Absent	-3.3034	0.0005**
	No. Discrete Abst.	-3.3017	0.0005**
Ear Protector Usage-	Frequent		
Age Group-	46 - 55		
Sample-	8		
	Tot. Days Absent	-1.2603	0.1038
	No. Discrete Abst.	-1.1202	0.1313

Table 3-30. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
 (Primary Rating Method)
 Category - Attendance Data

Sort Factors		Z	Significance
Ear Protector Usage-	Always		
Age Group-	56 - 65		
Sample-	12		
	Tot. Days Absent	-0.8002	0.2118
	No. Discrete Abst.	-1.8347	0.0333*
Ear Protector Usage-	Frequent		
Age Group-	56 - 65		
Sample-	4		
	Tot. Days Absent	-1.8257	0.0339*
	No. Discrete Abst.	-1.8257	0.0339*
Ear Protector Usage-	Always		
Age Group-	Below 26		
Yrs. Pres. Job-	5 - 10		
Sample-	15		
	Tot. Days Absent	-2.0163	0.0219*
	No. Discrete Abst.	-2.3854	0.0085**
Ear Protector Usage-	Always		
Age Group-	26 - 35		
Yrs. Pres. Job-	5 - 10		
Sample-	51		
	Tot. Days Absent	-4.7880	0.0000**
	No. Discrete Abst.	-4.9328	0.0000**

Table 3-30. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
 (Primary Rating Method)
 Category - Attendance Data

Sort Factors		Z	Significance
Ear Protector Usage-	Always		
Age Group-	36 - 45		
Yrs. Pres. Job-	5 - 10		
Sample-	17		
	Tot. Days Absent	-1.8699	0.0308*
	No. Discrete Abst.	-2.7929	0.0026**
Ear Protector Usage-	Always		
Age Group-	46 - 55		
Yrs. Pres. Job-	5 - 10		
Sample-	21		
	Tot. Days Absent	-2.6416	0.0041**
	No. Discrete Abst.	-2.6693	0.0038**
Ear Protector Usage-	Always		
Age Group-	56 - 65		
Yrs. Pres. Job-	5 - 10		
Sample-	7		
	Tot. Days Absent	-0.5241	0.3001
	No. Discrete Abst.	-1.2136	0.1125
Ear Protector Usage-	Frequent		
Age Group-	Below 26		
Yrs. Pres. Job-	5 - 10		
Sample-	8		
	Tot. Days Absent	-1.8204	0.0344*
	No. Discrete Abst.	-1.6803	0.0249*

Table 3-30. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
 (Primary Rating Method)
 Category - Attendance Data

Sort Factors		Z	Significance
Ear Protector Usage- Frequent			
Age Group-	26 - 35		
Yrs. Pres. Job-	5 - 10		
Sample-	12		
	Tot. Days Absent	-1.9560	0.0252*
	No. Discrete Abst.	-1.9612	0.0249*
Ear Protector Usage- Frequent			
Age Group-	36 - 45		
Yrs. Pres. Job-	5 - 10		
Sample-	5		
	Tot. Days Absent	-1.7529	0.0398*
	No. Discrete Abst.	-1.2136	0.1125
Ear Protector Usage- Infreqnt.			
Age Group-	26 - 35		
Yrs. Pres. Job-	5 - 10		
Sample-	6		
	Tot. Days Absent	-0.8386	0.2008
	No. Discrete Abst.	-0.3145	0.3766
Ear Protector Usage- Never			
Age Group-	26 - 35		
Yrs. Pres. Job-	5 - 10		
Sample-	7		
	Tot. Days Absent	-2.2014	0.0139**
	No. Discrete Abst.	-1.8593	0.0315*

Table 3-30. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
 (Primary Rating Method)
 Category - Attendance Data

Sort Factors		Z	Significance
Ear Protector Usage-	Always		
Yrs. Pres. Job-	5 - 10		
Sample-	111		
	Tot. Days Absent	-5.9875	0.0 **
	No. Discrete Abst.	-6.7086	0.0 **
Ear Protector Usage-	Frequent		
Yrs. Pres. Job-	5 - 10		
Sample-	29		
	Tot. Days Absent	-3.6207	0.0001**
	No. Discrete Abst.	-3.3192	0.0005**
Ear Protector Usage-	Infreqnt.		
Yrs. Pres. Job-	5 - 10		
Sample-	12		
	Tot. Days Absent	-1.7650	0.0388*
	No. Discrete Abst.	-0.9806	0.1634
Ear Protector Usage-	Never		
Yrs. Pres. Job-	5 - 10		
Sample-	12		
	Tot. Days Absent	-2.6673	0.0038**
	No. Discrete Abst.	-2.5784	0.0050**
Ear Protector Usage-	Always		
Yrs. Pres. Job-	11 - 15		
Sample-	7		
	Tot. Days Absent	-2.3664	0.0090**
	No. Discrete Abst.	-2.3664	0.0090**

Table 3-30. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector Usage
 (Primary Rating Method)
 Category - Attendance Data

Sort Factors		Z	Significance
Ear Protector Usage- Frequent			
Yrs. Pres. Job- 11 - 15			
Sample- 5			
	Tot. Days Absent	0.1348	0.5536
	No. Discrete Abst.	-0.4045	0.3429
Ear Protector Usage- Always			
Yrs. Pres. Job- 16 - 20			
Sample- 7			
	Tot. Days Absent	-1.1832	0.1184
	No. Discrete Abst.	-1.2677	0.1024
Ear Protector Usage- Frequent			
Yrs. Pres. Job- 16 - 20			
Sample- 4			
	Tot. Days Absent	-1.8257	0.0339*
	No. Discrete Abst.	-1.8257	0.0339*

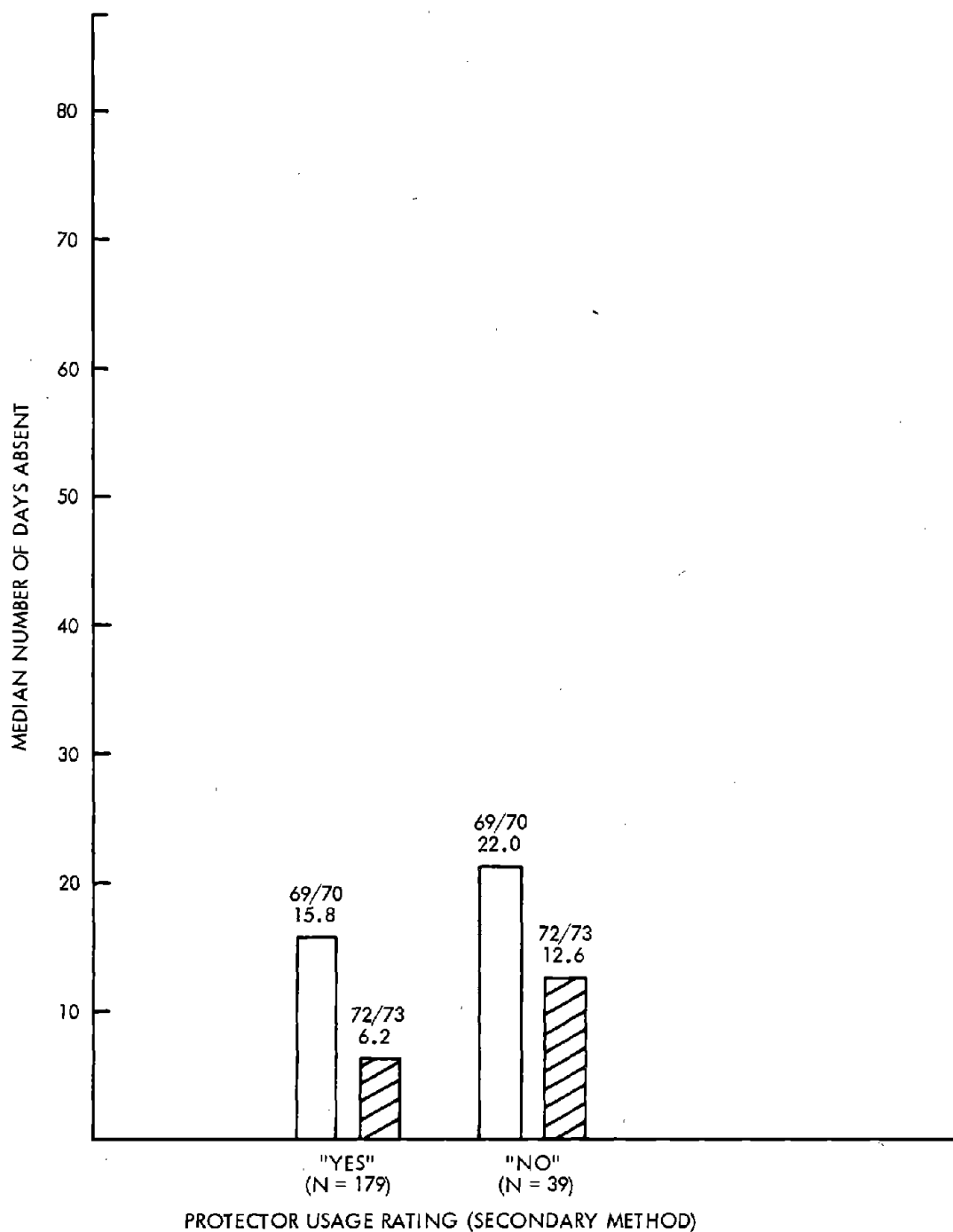


Figure 3-47. Median Number of Days Absent, for High Noise Group, by Protector Usage Rating (Secondary Method), During 1969/1970 vs 1972/1973 Time Periods

- Results by Ratings of Ear Protector Usage (Secondary Method) and By Age

Figure 3-48 presents a summary of comparisons of median number of days absent during each of the two time periods, by ratings of ear protector usage (Secondary Method), for each of five (5) age groups. While the majority of these differences showed fewer absences after the hearing conservation (1972/1973) than before (1969/1970), indications that the magnitudes of such differences were greater for the user vs. non-user groups were not always seen for the specified age groups in this evaluation. On the other hand, in all age groups with sufficient sample size, the median number of days absent during the 1972/1973 time period was higher for the non-users than for the corresponding user groups. This was consistent with the prediction that greater usage of hearing protectors would be directly associated with greater reduction in numbers of days absent. Table 3-31 indicates the results of statistical tests applied to the paired data by age and ear protector use. Most significant differences occurred for the user group in these analyses, their direction conforming to the the Test Hypothesis.

3.5.2 Number of Discrete Absences

- Overall Results

Again, as in the case of total days absent, the cumulative percent frequency distribution curve for discrete absences for the 1969/1970 time period, was considerably elevated from the similar curve for the 1972/1973 period. (Figure 3-49 presents these data). For example, during the 1969/1970 time period, 20% of the workers had thirty (30) or more discrete absences, while for the 1972/1973 time period, only approximately 4% of the workers had thirty (30) or more discrete absences. Similarly, for the 1969/1970 time period, approximately 64% of the workers had ten (10) or more discrete absences, while for the 1972/1973 time period, only 25% of the workers had ten (10) or more discrete absences.

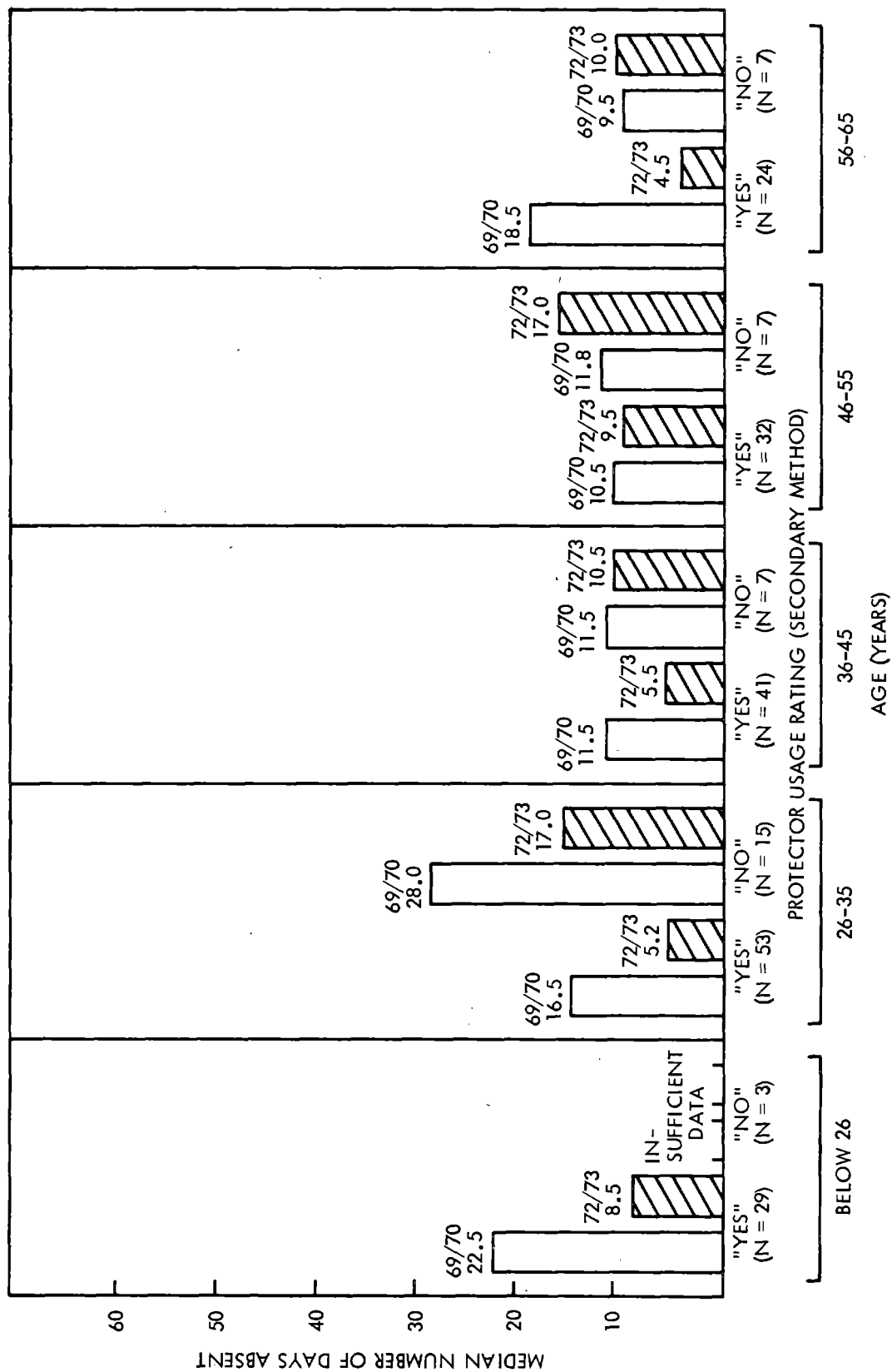


Figure 3-48. Median Number of Days Absent, for High Noise Group, by Protector Usage Rating (Secondary Method), and Age Group, During the 1969/1970 vs 1972/1973 Time Periods

Table 3-31. Results of Wilcoxon Matched-Pairs Signed Ranks Tests, Comparing 1969/1970 Data With 1972/1973 Data, for Various Ratings (Secondary Rating Method) of Ear Protector Usage, With Respect to Total Days Absent, and Number of Discrete Absences in High Noise Group.

Null Hypothesis - 1969/70 Data is Equivalent to 1972/73 Data
 Test Hypothesis - 1972/73 Data is Less Than 1969/70 Data

Sort Factors		Z	Significance
Ear Protector Usage- Yes			
Sample-179			
	Tot. Days Absent	-6.0108	0.0**
	No. Discrete Abst.	7.2248	0.0**
Ear Protector Usage- No			
Sample- 39			
	Tot. Days Absent	-2.0894	0.0183**
	No. Discrete Abst.	-3.7156	0.0001**
Ear Protector Usage- Yes			
Age Group- Below 26			
Sample- 29			
	Tot. Days Absent	-2.6301	0.0043**
	No. Discrete Abst.	-2.2056	0.0137**
Ear Protector Usage- Yes			
Age Group- 26 - 35			
Sample- 53			
	Tot. Days Absent	-4.1079	0.0000**
	No. Discrete Abst.	-4.4521	0.0000**
Ear Protector Usage- No			
Age Group- 26 - 35			
Sample- 15			
	Tot. Days Absent	-2.3570	0.0092**
	No. Discrete Abst.	2.6126	0.0045**

Note: (1) A negative (-) 'Z' value indicates a difference in the predicted (test hypothesis) direction, while a positive 'Z' indicates a difference in a direction opposite to the hypothesis.
 (2) Statistical significance indicated by asterisks; *.05 level, **.01 level.

Table 3-31. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
Category - Attendance Data

Sort Factors		Z	Significance
Ear Protector Usage- Yes Age Group- 36 - 45			
Sample- 41			
	Tot. Days Absent	-2.4463	0.0072**
	No. Discrete Abst.	-3.7489	0.0001**
Ear Protector Usage- No Age Group- 36 - 45			
Sample- 7			
	Tot. Days Absent	-0.1048	0.4583
	No. Discrete Abst.	-1.4368	0.0756
Ear Protector Usage- Yes Age Group- 46 - 55			
Sample- 32			
	Tot. Days Absent	-1.7441	0.0406*
	No. Discrete Abst.	2.7150	0.0033**
Ear Protector Usage- No Age Group- 46 - 55			
Sample- 7			
	Tot. Days Absent	0.1690	0.5671
	No. Discrete Abst.	-0.4193	0.3375
Ear Protector Usage- Yes Age Group- 56 - 65			
Sample- 24			
	Tot. Days Absent	-2.7920	0.0026**
	No. Discrete Abst.	-2.7221	0.0032**
Ear Protector Usage- No Age Group- 56 - 65			
Sample- 7			
	Tot. Days Absent	-0.7338	0.2315
	No. Discrete Abst.	-1.2136	0.1125

Table 3-31. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
 Category - Attendance Data

Sort Factors		Z	Significance
Ear Protector Usage- Yes			
Age Group- Below 26			
Yrs. Pres. Job- 5-10			
Sample- 29			
Tot. Days Absent		-2.6301	0.0043**
No. Discrete Abst.		-2.2056	0.0137**
Ear Protector Usage- Yes			
Age Group- 26 - 35			
Yrs. Pres. Job- 5-10			
Sample- 52			
Tot. Days Absent		-4.0579	0.0000**
No. Discrete Abst.		-4.4078	0.0000**
Ear Protector Usage- Yes			
Age Group- 36 - 45			
Yrs. Pres. Job- 5-10			
Sample- 30			
Tot. Days Absent		-2.2488	0.0123**
No. Discrete Abst.		-2.6067	0.0046**
Ear Protector Usage- Yes			
Age Group- 46 - 55			
Yrs. Pres. Job- 5-10			
Sample- 11			
Tot. Days Absent		-0.7113	0.2385
No. Discrete Abst.		-1.0669	0.1430

Table 3-31. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
 Category - Attendance Data

Sort Factors		Z	Significance
Ear Protector Usage- Yes			
Age Group- 56 - 65			
Yrs. Pres. Job- 5-10			
Sample- 8			
Tot. Days Absent		-0.5071	0.3060
No. Discrete Abst.		0.5071	0.3060
Ear Protector Usage- No			
Age Group- 26 - 35			
Yrs. Pres. Job- 5-10			
Sample- 15			
Tot. Days Absent		-2.3570	0.0092**
No. Discrete Abst.		-2.6126	0.0045**
Ear Protector Usage- No			
Age Group- 36 - 45			
Yrs. Pres. Job- 5-10			
Sample- 5			
Tot. Days Absent		0.7303	0.7674
No. Discrete Abst.		-0.6742	0.2501
Ear Protector Usage- Yes			
Age Group- 36 - 45			
Yrs. Pres. Job- 11-15			
Sample- 7			
Tot. Days Absent		-1.5213	0.0641
No. Discrete Abst.		-2.2014	0.0139**

Table 3-31. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
 Category - Attendance Data

Sort Factors		Z	Significance
Ear Protector Usage- Yes			
Age Group- 46 - 55			
Yrs. Pres. Job- 11-15			
Sample- 4			
	Tot. Days Absent	-1.4606	0.0721
	No. Discrete Abst.	-1.8257	0.0339*
Ear Protector Usage- Yes			
Age Group- 56 - 65			
Yrs. Pres. Job- 11-15			
Sample- 5			
	Tot. Days Absent	-1.2136	0.1125
	No. Discrete Abst.	-1.2136	0.1125
Ear Protector Usage- Yes			
Age Group- 36 - 45			
Yrs. Pres. Job- 16-20			
Sample- 4			
	Tot. Days Absent	0.0	0.5000
	No. Discrete Abst.	-1.4606	0.0721
Ear Protector Usage- Yes			
Age Group- 46 - 55			
Yrs. Pres. Job- 16-20			
Sample- 14			
	Tot. Days Absent	-0.4892	0.3124
	No. Discrete Abst.	-1.4120	0.0790

Table 3-31. (Cont.)
Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
Category - Attendance Data

Sort Factors		Z	Significance
Ear Protector Usage- Yes			
Age Group- 56 - 65			
Yrs. Pres. Job- 16-20			
Sample- 4			
	Tot. Days Absent	-1.0690	0.1425
	No. Discrete Abst.	-0.7303	0.2326
Ear Protector Usage- Yes			
Age Group- 56 - 65			
Yrs. Pres. Job- Over 20			
Sample- 7			
	Tot. Days Absent	-2.3664	0.0090**
	No. Discrete Abst.	-2.3664	0.0090**
Ear Protector Usage- Yes			
Yrs. Pres. Job- 5-10			
Sample-130			
	Tot. Days Absent	-5.0060	0.0000**
	No. Discrete Abst.	-5.5449	0.0 **
Ear Protector Usage- No			
Yrs. Pres. Job- 5-10			
Sample- 28			
	Tot. Days Absent	-2.2583	0.0120**
	No. Discrete Abst.	-3.2677	0.0005**
Ear Protector Usage- Yes			
Yrs. Pres. Job- 11-15			
Sample- 17			
	Tot. Days Absent	-2.4142	0.0079**
	No. Discrete Abst.	-3.2059	0.0007**

Table 3-31. (Cont.)
 Wilcoxon Matched-Pairs Signed-Ranks Tests, Ear Protector
 Category - Attendance Data

Sort Factors		Z	Significance
Ear Protector Usage- No			
Yrs. Pres. Job- 11-15			
Sample- 4			
	Tot. Days Absent	1.4606	0.9279
	No. Discrete Abst.	0.2673	0.6054
Ear Protector Usage- Yes			
Yrs. Pres. Job- 16-20			
Sample- 22			
	Tot. Days Absent	-0.7467	0.2276
	No. Discrete Abst.	1.9973	0.0229*
Ear Protector Usage- Yes			
Yrs. Pres. Job- Over 20			
Sample- 10			
	Tot. Days Absent	-2.8031	0.0025**
	No. Discrete Abst.	-2.8031	0.0025**
Ear Protector Usage- No			
Yrs. Pres. Job- Over 20			
Sample- 4			
	Tot. Days Absent	-1.6036	0.0544*
	No. Discrete Abst.	-1.3416	0.0899

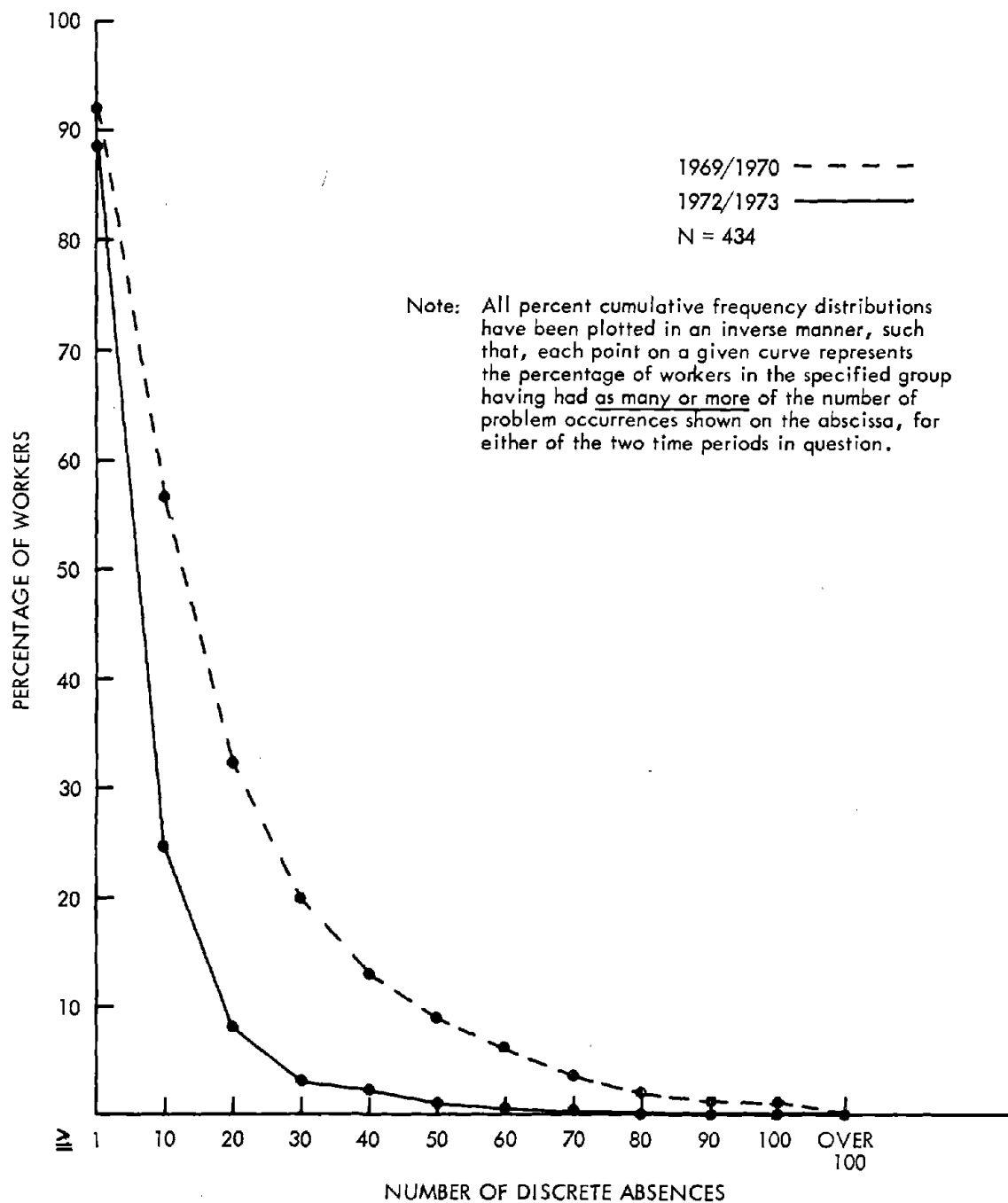


Figure 3-49. Cumulative Percent Frequency Distributions of Workers from the High Noise Group, with a Specifiable Number of Discrete Absences, During 2-Year Periods Before (1969/1970) and After (1972/1973) the Advent of a Company Hearing Conservation Program

Figure 3-50 presents a comparison of the median number of discrete absences for the total high noise sample during each of the two time periods. The difference in the median number of discrete absences was in the predicted direction of fewer discrete absences for the 1972/1973 time period. The results of a Wilcoxon Test on the number of discrete absences between the two time periods yielded a difference which was significant at the .01 level (see Table 3-29).

- Results by Age

As shown in Figure 3-51, comparisons of median number of discrete absences for the two time periods, for each of five (5) age groupings, resulted in differences which were all in the predicted direction. Results of Wilcoxon Tests indicated that these differences between the 1969/1970 and 1972/1973 time periods, with respect to the number of discrete absences, were significant at the .01 level, for each of the five (5) age groupings. These statistical results are shown in Table 3-29.

- Results by Experience (Years at Present Job)

Figure 3-52 illustrates the average number of discrete absences during each of the two (2) time periods, for each of four (4) categories of experience (years at present job). Although no statistical tests were performed on these data, relatively large differences in the predicted direction (1969/1970 average values higher than 1972/1973 values), were noted for each of the four (4) categories of experience, with the larger differences appearing in the "5-10" and "Over 20" experience categories.

- Results by Age-Experience Combinations

Table 3-32 presents comparisons of the median number of discrete absences, during the two time periods, for various combinations of the age and experience categories. All differences were in the expected direction and with few exceptions attained statistical significance. Table 3-29 includes the results of Wilcoxon Tests on these data.

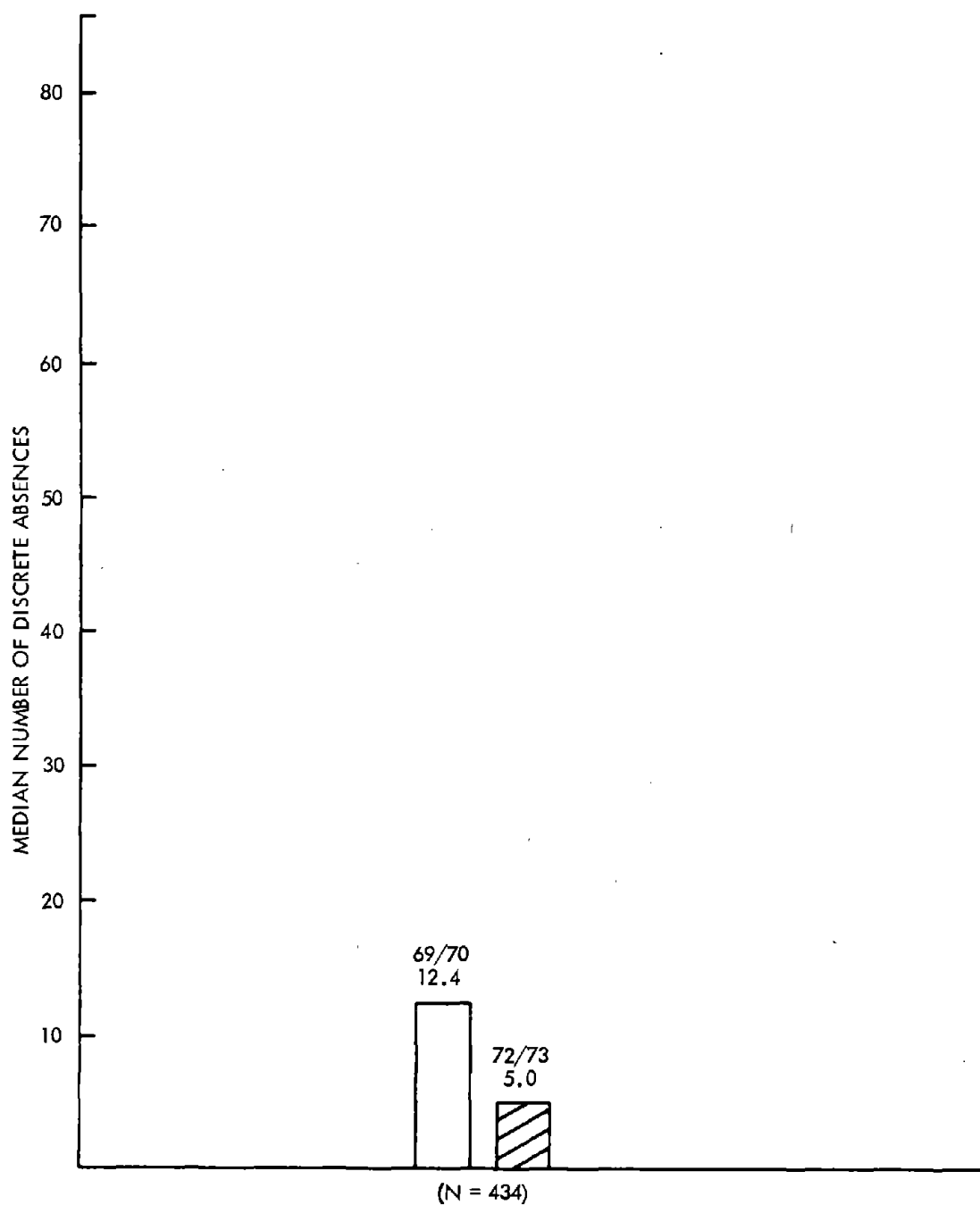


Figure 3-50. Median Number of Discrete Absences for High Noise Group, During the 1969/1970 vs 1972/1973 Time Period

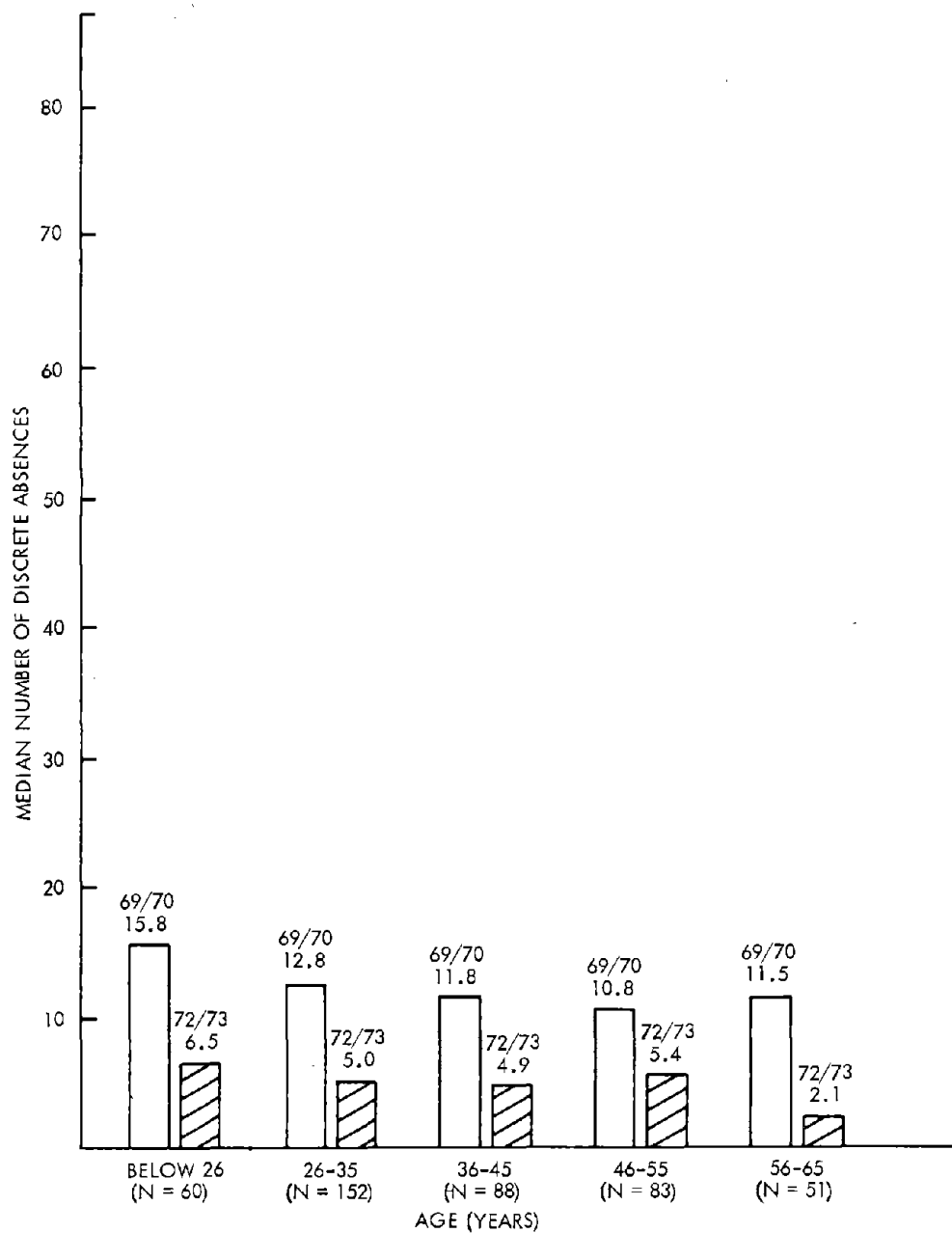


Figure 3-51. Median Number of Discrete Absences, by Age, for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

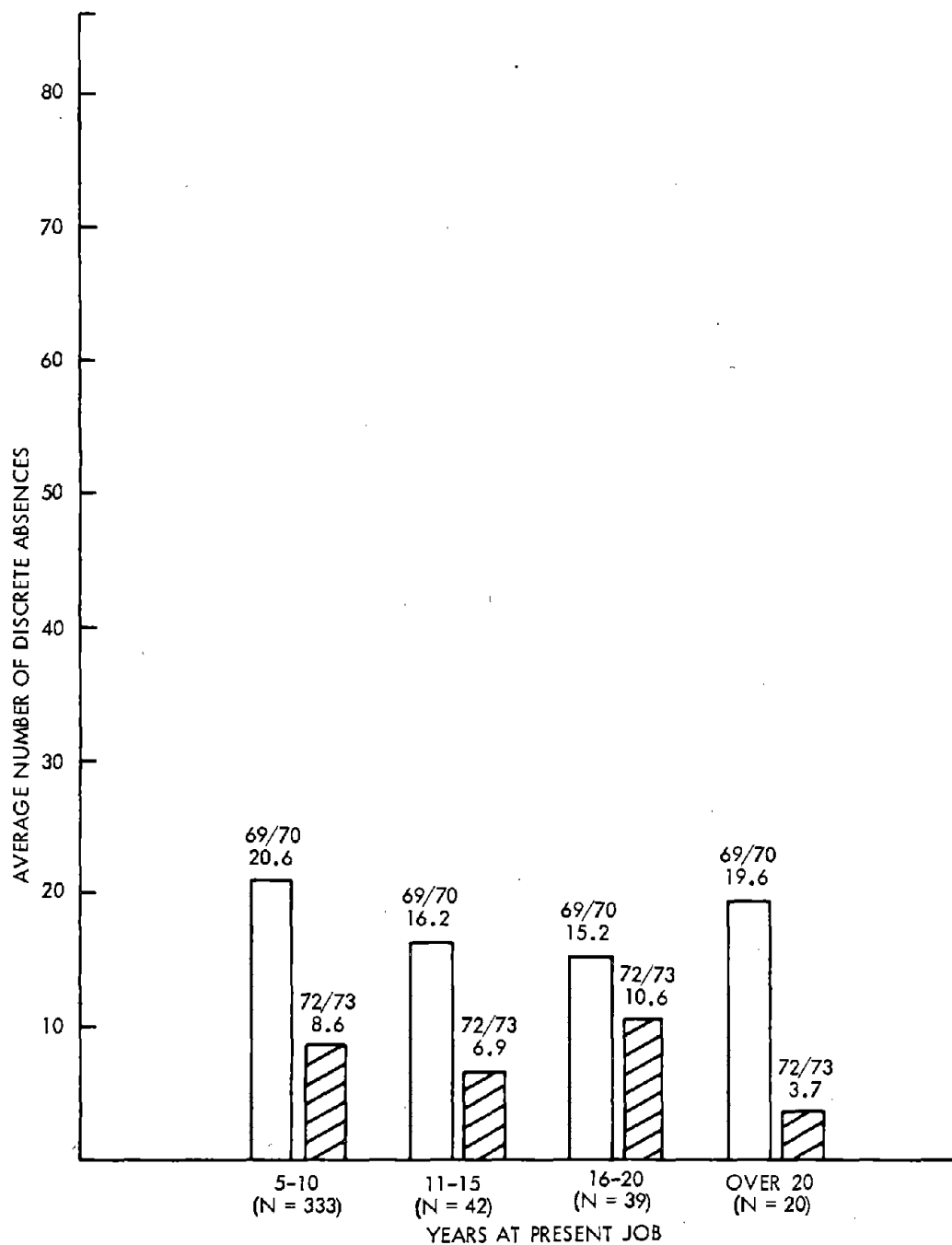


Figure 3-52. Average Number of Discrete Absences, by Years at Present Job, for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

Table 3-32. Age-Experience Comparisons of Median Number of Discrete Absences, for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

Years at Present Job	Age (Years)									
	Below 26		26-35		36-45		46-55		56-65	
	1969/ 1970	1972/ 1973	1969/ 1970	1972/ 1973	1969/ 1970	1972/ 1973	1969/ 1970	1972/ 1973	1969/ 1970	1972/ 1973
5-10	16.2 (59)	6.8 (59)	12.3 (146)	5.0 (146)	11.2 (66)	4.5 (66)	16.0 (41)	6.8 (41)	12.5 (21)	6.0 (21)
	(Sig. < .01)		(Sig. < .01)		(Sig. < .01)		(Sig. < .01)		(Sig. < .01)	
11-15	2.0 (1)	0.0 (1)	26.0 (6)	5.0 (6)	22.5 (10)	6.0 (10)	9.0 (15)	4.5 (15)	6.0 (10)	1.5 (10)
	(Sig. < .01)		(Sig. < .01)		(Sig. < .01)		(Sig. < .01)		(Sig. < .01)	
16-20	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	15.5 (12)	5.5 (12)	8.5 (20)	5.0 (20)	15.0 (7)	6.0 (7)
	(Sig. < .01)		(Sig. < .01)		(Sig. < .01)		(Sig. < .01)		(Sig. < .01)	
Over 20	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	26.5 (7)	8.5 (7)	17.0 (13)	1.5 (13)
	(Sig. < .05)		(Sig. < .05)		(Sig. < .05)		(Sig. < .05)		(Sig. < .05)	

Notes: 1 Numbers In Parentheses Refer to Sample Sizes

2 Parenthetic expressions (Sig. < .01 or < .05) indicate statistically significant differences in comparing the data collected over the two time periods, based upon Wilcoxon Matched-Pair Signed-Ranks Tests.

- Results by Shift

Comparisons of average numbers of discrete absences, during each of the two time periods, for Shifts 1, 2, 3, and Rotating, are included in Table 3-33. Although no statistical tests were performed on these data, all differences were relatively large in magnitude, and in the predicted direction.

- Results by Job Type

As shown in Table 3-34, 1969/1970 vs. 1972/1973 time period comparisons for each of six (6) Job Types indicated fewer average numbers of discrete absences in the latter period in all cases. No statistical analyses were performed on these data. However, statistical tests of job by age differences in discrete absences between the two time periods yielded significant findings, primarily for the Production Workers and Machine Operators (see Table 3-29).

- Results by Ratings of Ear Protector Usage (Primary Method)

Figure 3-53 presents a comparison of the median number of discrete absences during the two time periods, for each of four (4) ratings of ear protector usage. Irrespective of usage rating, all differences were in the predicted direction of fewer absence entries in post-hearing conservation period (1972/1973) as compared to the pre-hearing conservation period. All but the "infrequently" used classification yielded differences which were significant at the .01 level. The difference in median number of discrete absences for the "Infrequently" usage rating was not significant (see Table 3-30 for Wilcoxon Test results). There was no apparent order to the magnitudes of pre-post differences suggesting greater reductions in absence with increasing use of the ear protectors. In fact, the lowest median frequency of discrete absences was found for the group rated as never using ear protection in the 1972/1973 period.

Table 3-33. Comparison of Average Number of Discrete Absences,
for High Noise Group, by Shift, During the 1969/1970 vs
1972/1973 Time Periods

	Shift 1	Shift 2	Shift 3	Rotating Shift
1969/ 1970	20.0 (210)	18.7 (125)	19.7 (96)	26.7 (3)
1972/ 1973	8.1 (210)	7.3 (125)	8.8 (96)	3.3 (3)

Note: Numbers in Parentheses Refer to Sample Sizes

Table 3-34. Comparison of Average Number of Discrete Absences, by Job Type, for High Noise Group, During the 1969/1970 vs 1972/1973 Time Periods

Job Type						
	Foreman	Test and Inspect	Machine Operator	Plant Support	Administrator	Production Worker
1969/1970	4.1 (32)	6.1 (47)	23.2 (86)	28.5 (2)	36.2 (10)	34.1 (167)
1972/1973	3.3 (32)	3.9 (47)	8.8 (86)	12.0 (2)	9.9 (10)	13.8 (167)

Note: Numbers in Parentheses Refer to Sample Sizes

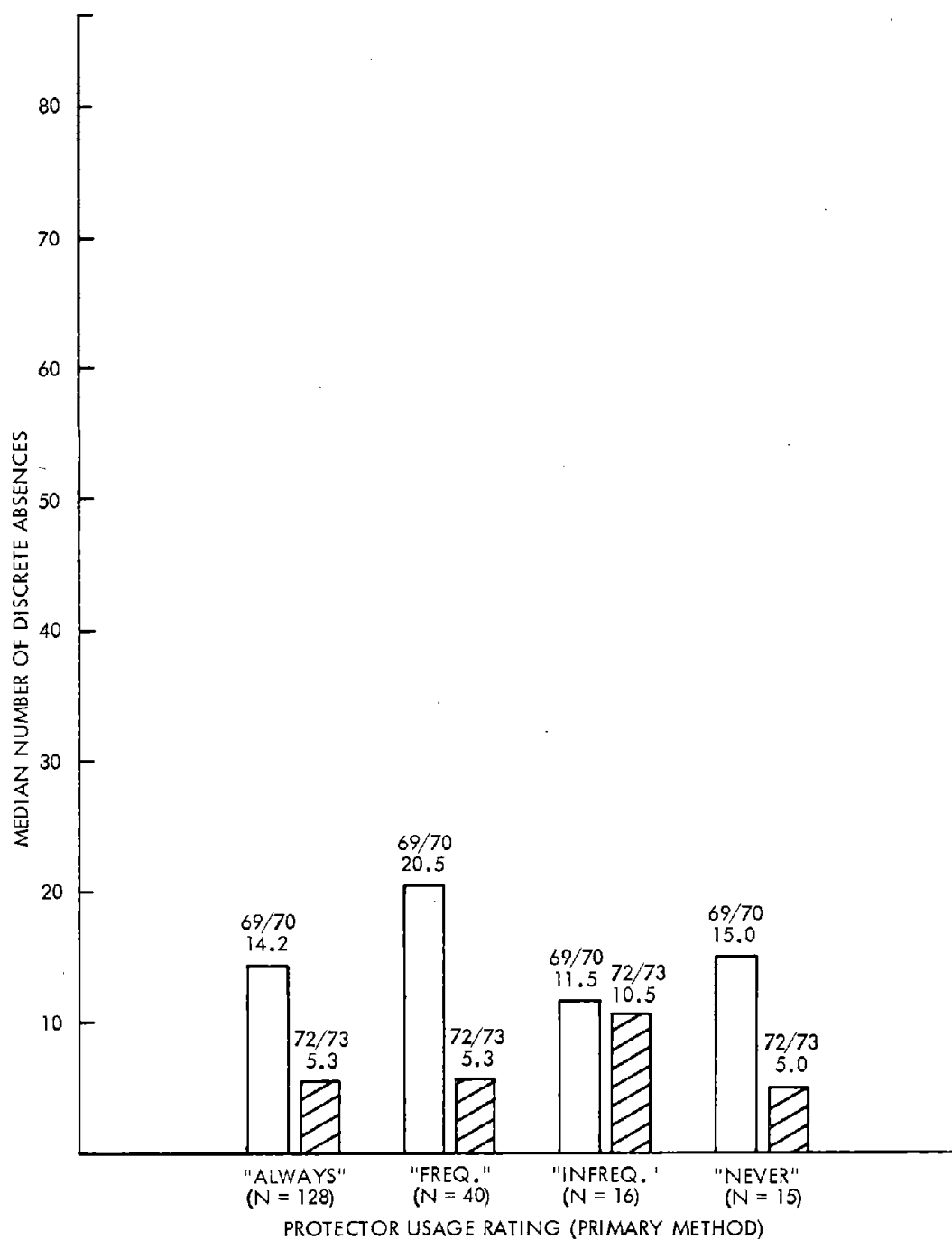


Figure 3-53. Median Number of Discrete Absences, for High Noise Group, by Protector Usage Rating (Primary Method), During the 1969/1970 vs 1972/1973 Time Periods

- Results by Ratings of Ear Protector Usage (Primary Method) by Age

Figures 3-54, 3-55, 3-56, 3-57, and 3-58 present comparisons of median number of discrete absences during each of the two time periods, by level of device use for each of five (5) age categories. In all cases with sufficient sample size, differences were in the predicted direction, irrespective of ear protector use. Wilcoxon Tests (Table 3-30) indicated significant differences in nine (9) of the twelve (12) age/device usage combinations with sufficient sample size. The frequency differentials between the two time periods and the median values indicated for the 1972/1973 time period show only a slight tendency for progressively smaller reductions with decreasing use of ear protection among the various age groups.

- Results by Ratings of Ear Protector Usage (Secondary Method)

As shown in Figure 3-59, the median number of discrete absences for the 1972/1973 time period was smaller than the corresponding median for the 1969/1970 period for both the rated users ("Yes") and non-users ("No") of ear protection. Statistical tests of these data, included in Table 3-31, yielded differences which were significant at the .01 level for both usage ratings. The median number of days absent during the 1972/1973 time period was higher for the non-users than for the users as was anticipated. However, the extent of reduced absence from 1969/1970 to 1972/1973 time periods was about the same, irrespective of the use factor.

- Results by Ratings of Ear Protector Usage (Secondary Method) and by Age

Figure 3-60 presents comparisons of median number of discrete absences, during each of the two time periods, by ear protector usage, for each of five (5) age groups. Irrespective of usage rating, differences for all cases with sufficient sample size were in the predicted direction. Of

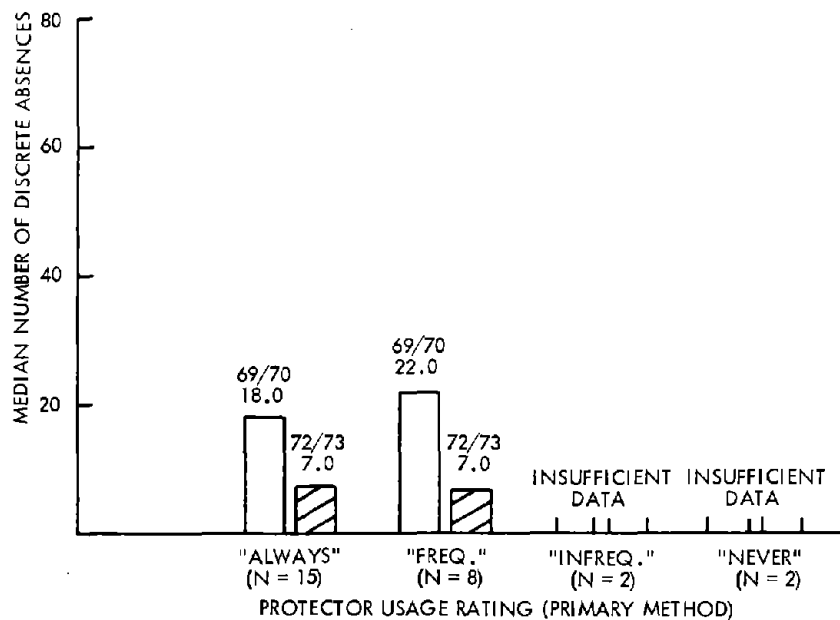


Figure 3-54. Median Number of Discrete Absences, for High Noise Group, by Protector Usage Rating (Primary Method), for the "Below 26" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

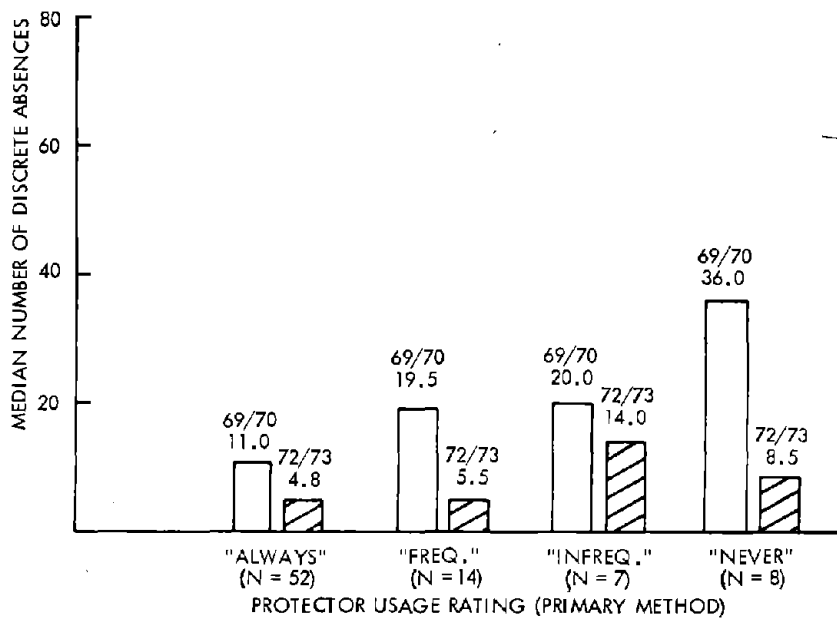


Figure 3-55. Median Number of Discrete Absences, for High Noise Group, by Protector Usage Rating (Primary Method), for the "26-35" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

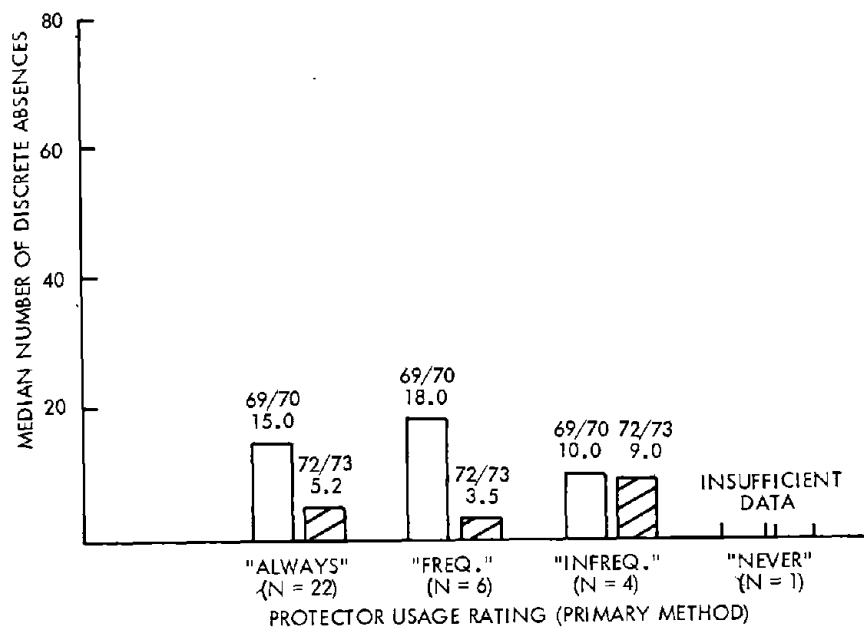


Figure 3-56. Median Number of Discrete Absences, for High Noise Group, by Protector Usage Rating (Primary Method), for the "36-45" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

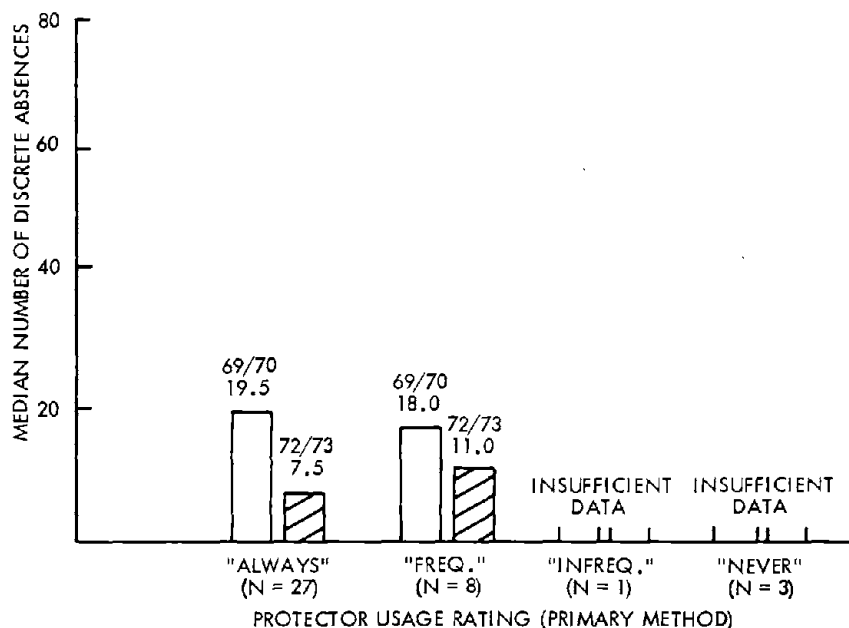


Figure 3-57. Median Number of Discrete Absences, for High Noise Group, by Protector Usage Rating (Primary Method), for the "46-55" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

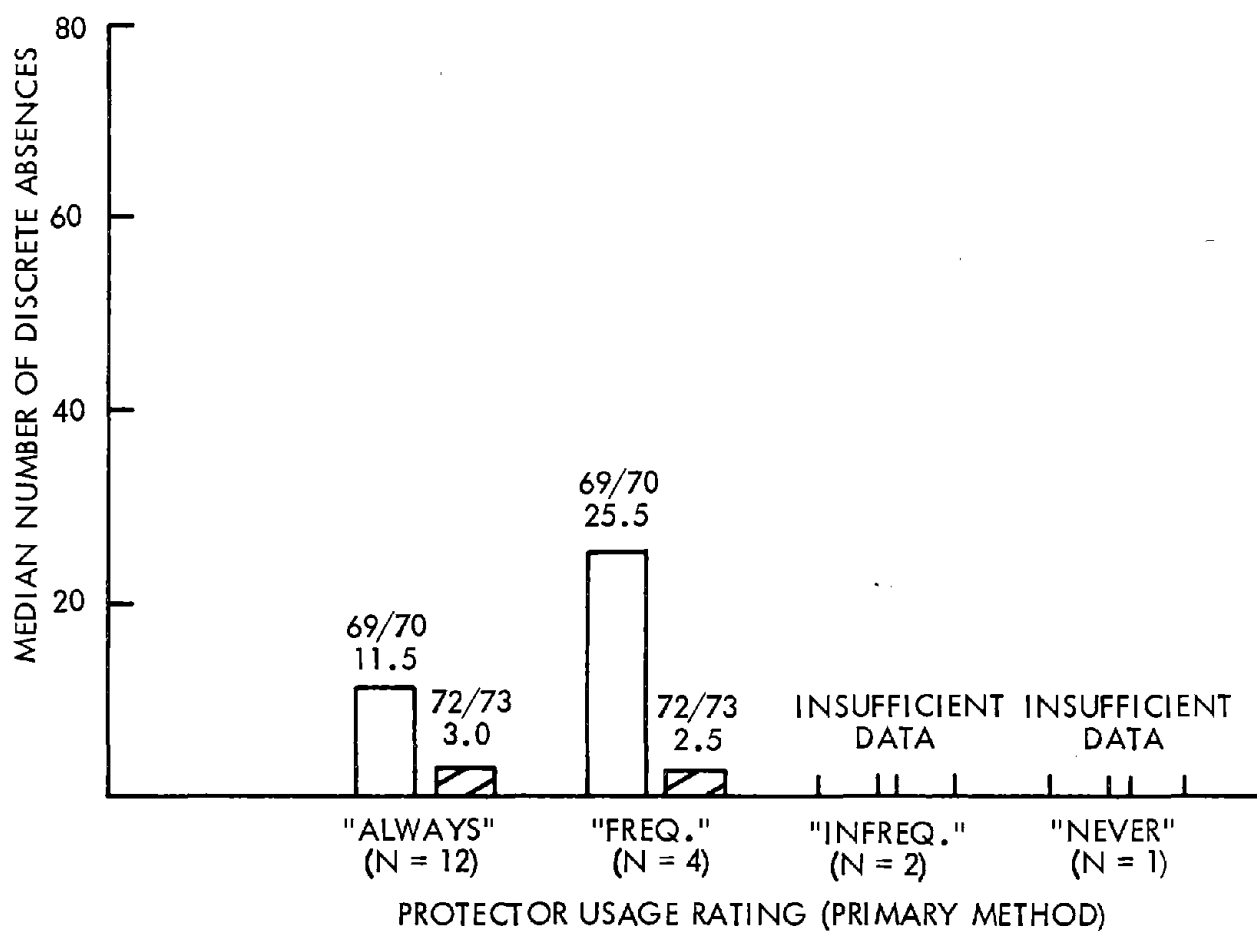


Figure 3-58. Median Number of Discrete Absences, for High Noise Group, by Protector Usage Rating (Primary Method, for the "56-65" Age Group, During the 1969/1970 vs 1972/1973 Time Periods

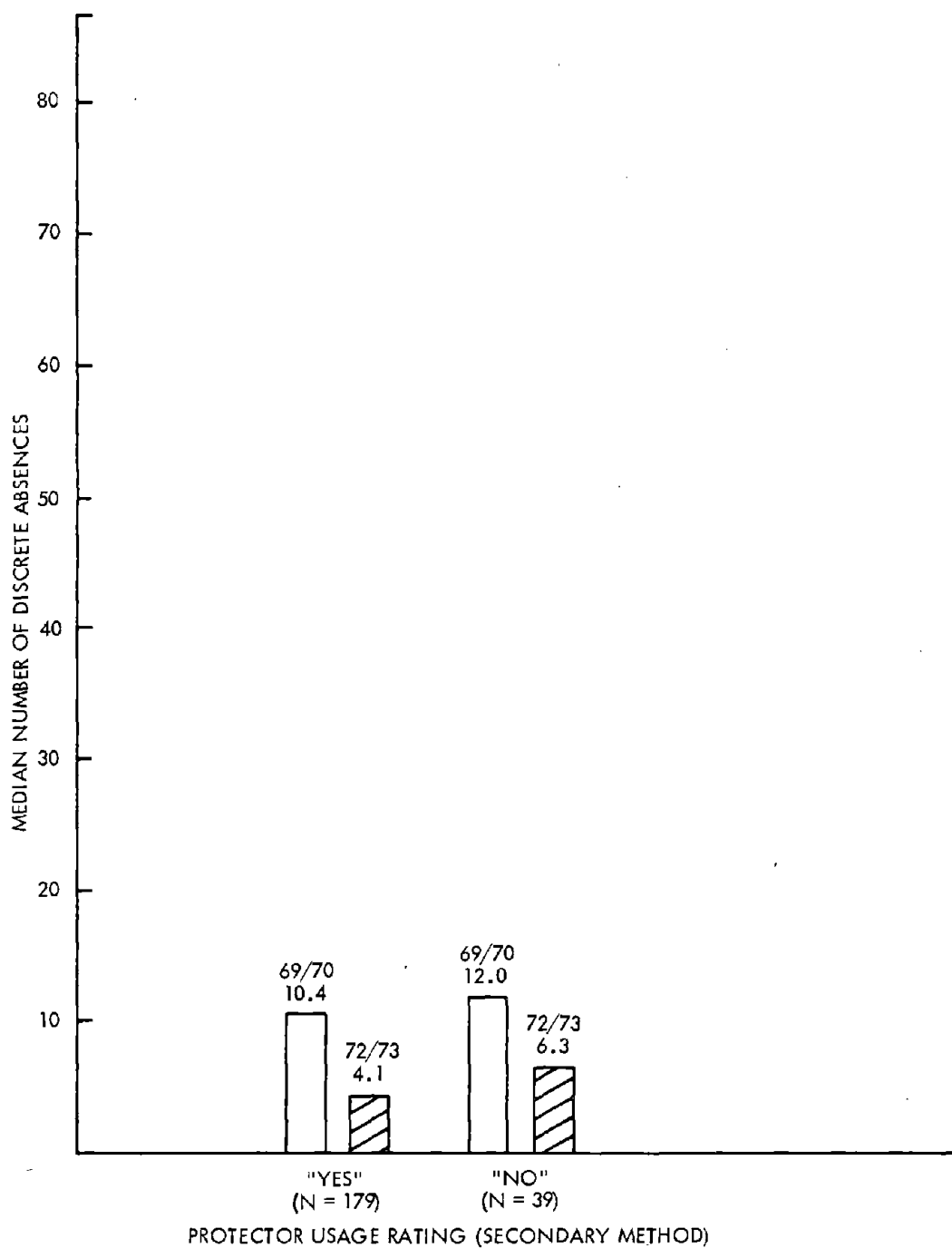


Figure 3-59. Median Number of Discrete Absences, for High Noise Group, by Protector Usage Rating (Secondary Method), During the 1969/1970 vs 1972/1973 Time Periods

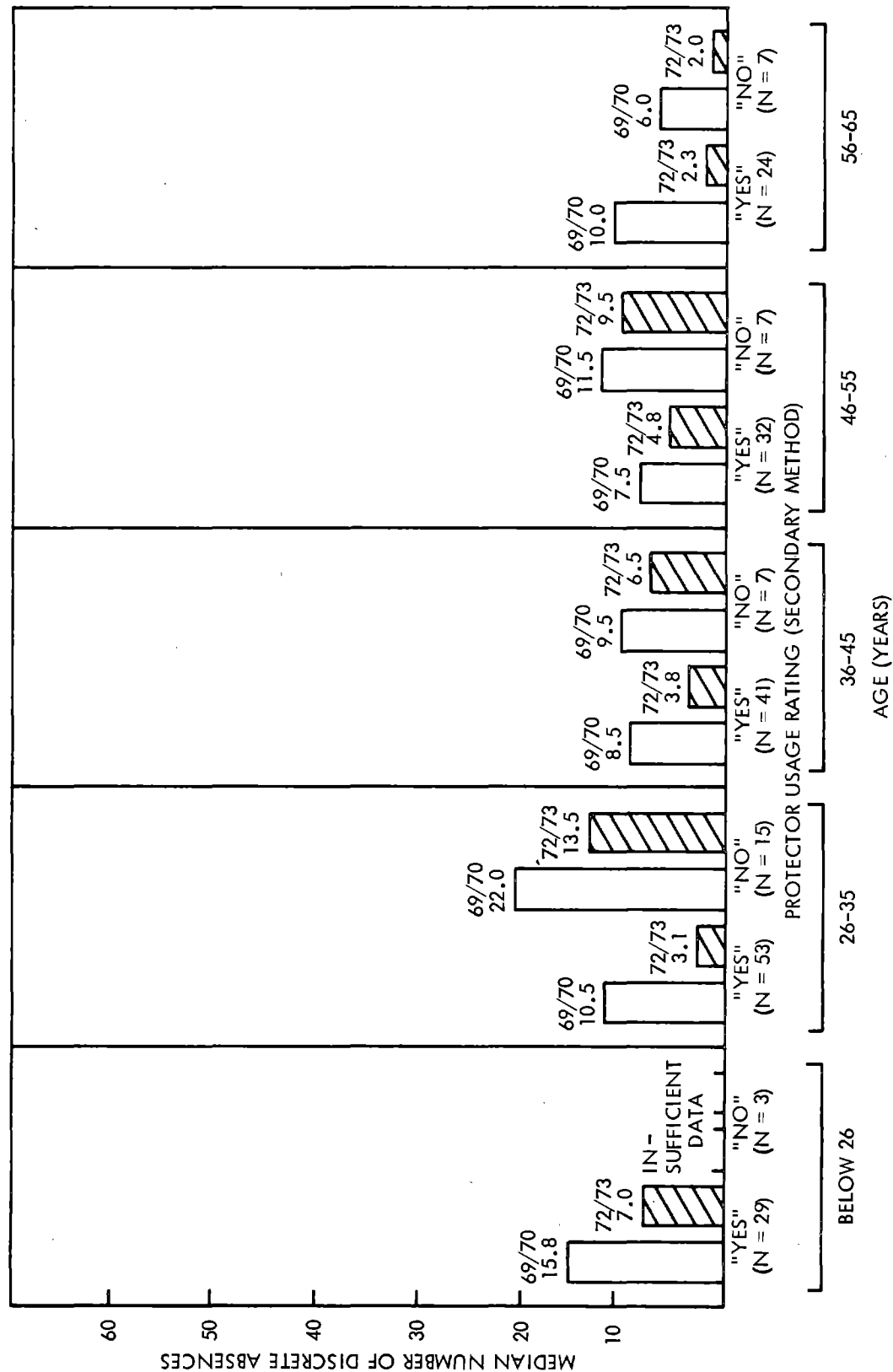


Figure 3-60. Median Number of Discrete Absences, for High Noise Group, by Protector Usage Rating (Secondary Method), and Age Group, During the 1969/1970 vs 1972/1973 Time Periods

the eleven (11) combinations with sufficient sample size for comparison, eight (8) were statistically significant (see Table 3-31). In all but one age category (56-65 yrs.), the median number of discrete absences during the 1972/1973 time period was higher for the non-users of ear protection. The 1972/1973 median absence values for the 56-65 yr. age group showed the users to have more absences. Relative differences between the two time periods for the users and non-user groups showed greater reductions in absence for the former as compared to the latter group. This is consistent with the Test Hypothesis.

● Absence Data in the Low-Noise Group

For control purposes as previously explained, the two absence measures (total days absent, number of discrete absences) were tested by the Wilcoxon Test for any significant differences between the two time periods (1969/1970 vs. 1972/1973) for all sort combinations involving such data for the Low-Noise Group. The results of these comparisons are included in Table 3-35. Of the sixty-three (63) comparisons made for the Low-Noise Group, seven (7) yielded significantly different results for the "Days Absent" measure, and twenty-two (22) yielded significantly different results for the "Discrete Absences" measures. Interestingly, all of these differences were in the direction showing the 1972/1973 data to have more absences than the 1969/1970 data. Differences in this direction for the Low-Noise Group lent further contrast to the findings for the High-Noise Group on the same measures. As already described, significant reductions in both "Total Days Absent" and "Discrete Absences" were revealed for the High-Noise Group in comparing their 1972/1973 absence data against their 1969/1970 data for the majority of sort combinations noted in Table 3-35. Thus, the changes in absenteeism for the Low-Noise Group between the two periods of data collection were clearly different from those found for the High-Noise Group.

Table 3-35. Summary Table of Results of Wilcoxon Matched-Pairs Signed-Ranks Tests (2-Tailed), and Median Frequencies for the Low Noise Group, Comparing 1969/1970 Data with 1972/1973 Data, with Respect to Total Days Absent and Number of Discrete Absences

		Median Frequency					
Group/Sub Group Combination	Sample Size	Days Absent		Disc. Absences		Significance	
		1969/1970	1972/1973	1969/1970	1972/1973	Days Abs.	Disc. Abs.
Total Sample	432	2.8	4.7	1.5	2.5	0.0152**	0.0000**
Age: Below 26	9	2.5	6.5	1.5	5.5	0.5146	0.0756
26 - 35	98	4.5	4.3	2.3	2.8	0.6396	0.0064**
36 - 45	133	3.7	4.6	1.7	2.6	0.3554	0.0002**
46 - 55	137	1.9	5.0	1.2	2.6	0.0110**	0.0000**
56 - 65	55	2.1	4.8	1.4	1.6	0.1362	0.9950
Occupation: Foreman							
Age: 26 - 35	25	0.4	3.5	0.4	2.3	0.1004	0.1298
36 - 45	43	3.2	5.8	1.5	2.7	0.5766	0.0348*
46 - 55	41	0.5	5.0	0.5	2.1	0.2014	0.0406*
56 - 65	24	2.0	4.3	1.3	1.5	0.0620	0.8788
Occupation: Test and Inspec.							
Age: 26 - 35	6	3.5	3.0	2.0	3.0	0.7874	0.7150
36 - 45	12	3.5	3.0	2.5	1.5	0.5336	0.7598
46 - 55	16	5.0	5.5	1.5	2.5	0.3794	0.1184
Occupation: Eng. /Drafts.							
Age: Below 26	7	7.5	6.5	3.5	5.5	0.9999	0.1508
26 - 35	51	8.5	6.0	3.2	3.8	0.1154	0.0470*
36 - 45	63	4.2	4.1	1.9	2.7	0.9366	0.0116**
46 - 55	61	2.5	5.4	1.4	3.1	0.1002	0.0016**
56 - 65	23	2.2	5.3	1.4	2.0	0.8966	0.8722
Occupation: Plant Support							
Age: 26 - 35	4	0.2	3.5	0.2	2.0	0.9999	0.1108
46 - 55	4	1.5	11.0	1.5	5.5	0.4652	0.0678
Occupation: Administrator							
Age: 26 - 35	11	0.5	5.5	0.5	4.5	0.7212	0.3140
36 - 45	12	2.0	5.5	1.5	2.5	0.3268	0.1824
46 - 55	15	1.5	3.2	1.5	2.5	0.2788	0.5098
56 - 65	5	1.5	4.0	1.5	2.5	0.4652	0.4226
Marital Status: Single							
Age: 26 - 35	23	3.5	4.5	2.0	2.8	0.3760	0.0138**
36 - 45	6	3.5	5.5	1.5	1.5	0.9999	0.9999
46 - 55	7	0.3	2.0	0.3	1.5	0.4016	0.5294
Marital Status: Married							
Age: Below 26	8	2.5	6.0	1.5	5.5	0.6744	0.1234
26 - 35	75	4.8	4.3	2.5	2.9	0.9374	0.0598*
36 - 45	125	3.8	4.6	1.7	2.7	0.3702	0.0004**
46 - 55	128	2.1	5.0	1.2	2.6	0.0058**	0.0000**
56 - 65	51	2.1	5.0	1.5	1.6	0.1100	0.9944

*Significant difference $p < .05$, **Significant difference $p < .01$.

Table 3-35. Summary Table of Results of Wilcoxon Matched-Pairs Signed-Ranks Tests (2-Tailed), and Median Frequencies for the Low Noise Group, Comparing 1969/1970 Data with 1972/1973 Data, with Respect to Total Days Absent and Number of Discrete Absences (Cont.)

		Median Frequency					
Group/Sub Group Combination	Sample Size	Days Absent		Disc. Absences		Significance	
		1969/1970	1972/1973	1969/1970	1972/1973	Days Abs.	Disc. Abs.
Shift: Rotating							
Age: 26 - 35	4	3.0	2.0	2.5	1.5	0.7150	0.5930
36 - 45	4	3.0	4.5	1.8	4.0	0.5930	0.1798
46 - 55	7	8.5	7.5	2.8	5.5	0.8658	0.0520*
Shift: First							
Age: Below 26	9	2.5	6.5	1.5	5.5	0.5146	0.0756
26 - 35	76	4.9	4.5	2.4	3.2	0.3702	0.0026**
36 - 45	98	3.9	4.4	1.7	2.6	0.5610	0.0022**
46 - 55	110	1.7	4.8	1.1	2.5	0.0288*	0.0002**
56 - 65	40	2.0	4.7	1.5	1.5	0.2740	0.7892
Shift: Second							
Age: 26 - 35	7	3.0	8.5	1.5	2.5	0.3980	0.9999
36 - 45	18	2.5	5.0	2.0	2.9	0.5700	0.5894
46 - 55	11	8.0	7.5	2.5	2.8	0.6464	0.7598
56 - 65	10	2.5	4.0	1.0	1.8	0.5940	0.1834
Shift: Third							
Age: 26 - 35	11	3.0	3.5	2.0	2.5	0.8590	0.3980
36 - 45	13	3.5	5.5	1.2	2.2	0.9166	0.0528*
46 - 55	9	0.5	4.0	0.5	2.2	0.0380*	0.1834
56 - 65	4	7.5	19.5	6.0	3.0	0.2734	0.7892
Years at Present Job: 5 - 10							
Age: Below 26	7	7.5	6.5	3.5	5.5	0.9999	0.1508
26 - 35	81	3.3	4.0	1.9	2.8	0.6756	0.0052**
36 - 45	91	3.5	5.3	1.7	2.8	0.5474	0.0006**
46 - 55	63	1.5	5.1	1.1	2.6	0.0048**	0.0018**
56 - 65	16	0.8	3.8	0.8	1.4	0.0962	0.5302
Years Present Job: 11 - 15							
Age: 26 - 35	14	5.5	6.3	3.5	3.5	0.6248	0.6948
36 - 45	22	3.0	4.5	1.3	2.6	0.1120	0.1590
46 - 55	37	2.0	4.8	1.0	2.5	0.8958	0.0202*
56 - 65	24	3.5	8.0	1.5	2.8	0.3382	0.5228
Years Present Job: 16 - 20							
Age: 36 - 45	14	4.5	2.0	2.0	1.5	0.5830	0.3140
46 - 55	17	4.0	4.5	1.3	2.0	0.8870	0.1080
56 - 65	7	7.0	5.0	2.5	1.2	0.2048	0.1158
Years Present Job: Over 20							
Age: 36 - 45	6	3.5	4.0	3.0	2.5	0.6002	0.5294
46 - 55	20	4.5	7.5	2.1	3.5	0.0070**	0.3048
56 - 65	8	2.0	4.5	1.8	1.5	0.2426	0.3526

*Significant difference $p < .05$, **Significant difference $p < .01$.

3.6 Audiometric Data

Table 3-36 presents the mean hearing levels for the High-Noise Group, at each of six (6) test frequencies, individually, for right and left ears, and independently, for the 1969/1970 and 1972/1973 time periods. Table 3-37 presents similar data for the Low-Noise Group. Figures 3-61 and 3-62, respectively, present graphic plots of these data. As depicted in the Low-Noise Group curves, (Figure 3-62) the mean 1972/1973 levels (thresholds), were approximately equal to the mean 1969/1970 levels. This could be expected since, by definition, the Low-Noise Group had not been exposed to damaging intensity levels. In the case of the High-Noise Group curves (Figure 3-61), however, 1972/1973 mean hearing levels also were equal to their 1969/1970 levels, across all test frequencies, if not slightly better. This was interpreted as providing evidence that the High-Noise Worker Group had generally been wearing ear protective devices, during the 1972/1973 time period. Moreover, it could be concluded that these devices had been effective in offsetting a furtherance of hearing loss, since the noise levels for the 1972/1973 time period were essentially unchanged from those of the 1969/1970 time period (see Table 2-1).

3.7 High-Noise Group vs. Low-Noise Group Comparisons Before and After the Advent of the Hearing Conservation Program

As an alternative means of gauging the extent to which the hearing conservation program in the plant complex may have had a favorable effect in reducing extra-auditory problems in the High-Noise Group, frequencies of accidents, diagnosed medical disorders, symptomatic complaints, and absences for the High- versus Low-Noise Groups were compared separately for 1969/1970 and for 1972/1973. Reflecting presumably the benefits of reduced noise exposure through use of ear protectors, the 1972/1973 differences in problem indicators for the High- and Low-Noise Groups were smaller than those found in 1969/1970 (see Tables 3-38, 3-39, 3-40, 3-41, 3-42). This holds true in 30 of 47 comparisons for accidents (Table 3-38), 40 out of 47 comparisons for diagnosed medical problems (Table 3-39), 38 out of 47 comparisons for total days absent (Table 3-41), and 42 out of 47 comparisons in terms of discrete absences (Table 3-42). Only the symptomatic

Table 3-36. Mean Hearing Levels (dB) for High Noise Group re Audiometric "0"

		Frequency in Hertz					
		500	1000	2000	3000	4000	6000
1969/1970	Right Ear	12	9	17	36	40	48
Data	Left Ear	14	10	15	31	37	46
1972/1973	Right Ear	9	8	14	33	39	39
Data	Left Ear	9	8	13	28	36	37

Table 3-37. Mean Hearing Levels (dB) for Low Noise Group re Audiometric "0"

		Frequency in Hertz					
		500	1000	2000	3000	4000	6000
1969/1970	Right Ear	12	6	10	24	28	42
Data	Left Ear	12	7	9	20	26	39
1972/1973	Right Ear	9	5	9	24	30	40
Data	Left Ear	8	5	7	21	28	37

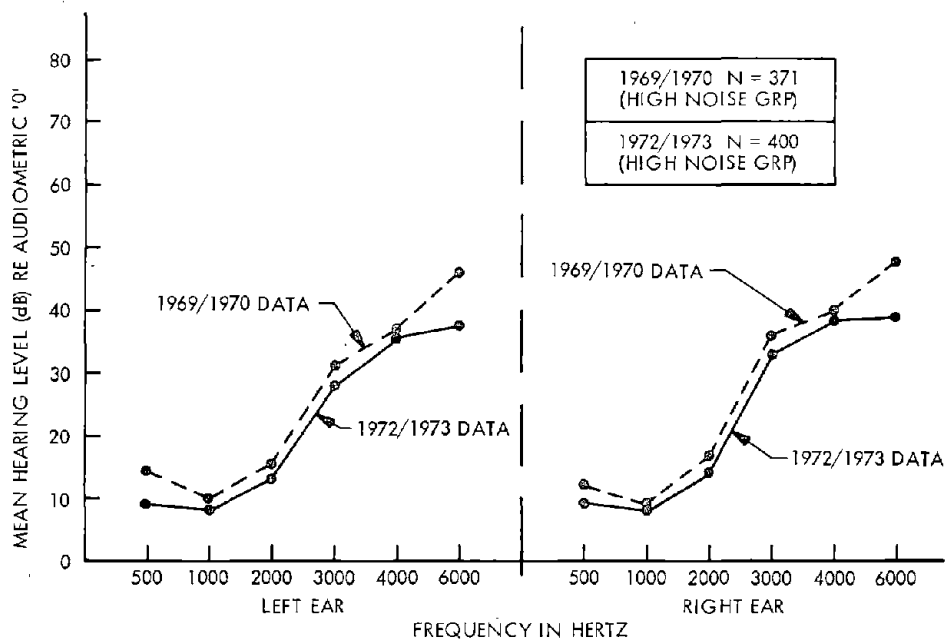


Figure 3-61. Mean Hearing Levels for High Noise Group

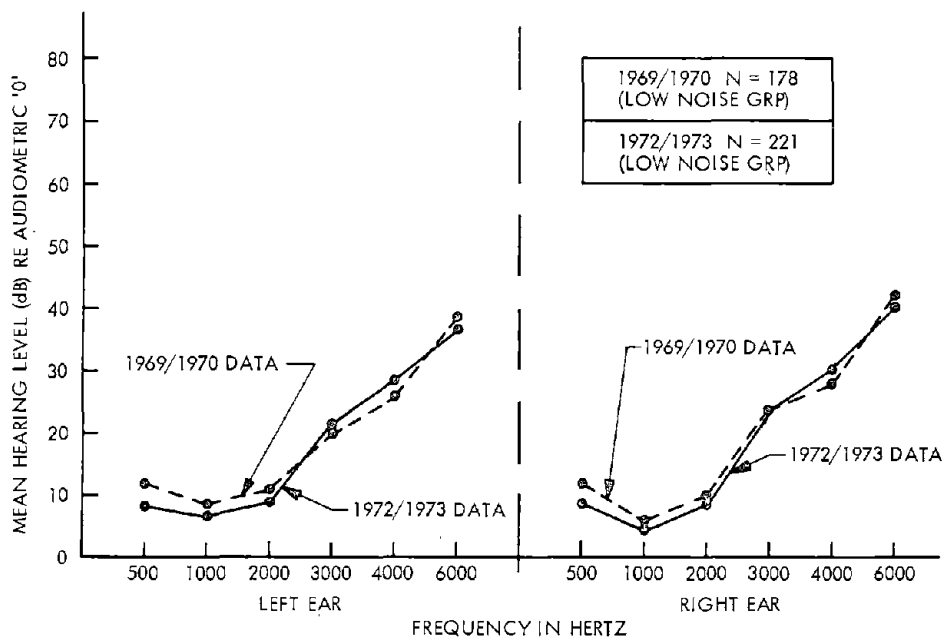


Figure 3-62. Mean Hearing Levels for Low Noise Group

complaint measure failed to follow this predominant trend with only 19 of 47 comparisons showing such reductions (Table 3-40).

In regards to diagnosed medical problems, the abovementioned reductions resulted in 50% fewer significant differences in High- vs. Low-Noise Group comparisons for 1972/1973 data than were found in 1969/1970 comparisons. Similarly, the absence data for 1972/1973 showed less than half the number of significant differences found in 1969/1970 comparisons between the High- and Low-Noise Groups. For accident and symptomatic complaint measures, the 1972/1973 and 1969/1970 sets of data indicated essentially similar numbers of significant differences. Greater accident risks inherent to the jobs performed in the noisy work areas might have not permitted substantial enough reductions, despite the noise suppression via ear protection, to match the accident tendencies of quieter jobs. That the use of ear protectors can produce discomfort resulting in added symptomatic complaints could be offsetting the positive benefits being received in reference to this particular problem measure.

Taken together, these results suggest differential alleviation in the frequency of extra-auditory problems as a consequence of the establishment of a hearing conservation program using ear protectors as a primary means of noise control.

Table 3-38. Comparison of Frequency of Accidents Median Test Results for High Noise Group vs Low Noise Group, 1969/1970 Data; and High Noise Group vs Low Noise Group, 1972/1973 Data

Group/Subgroup (Independent Factor)	Group Size (No. Wkrs.)	Median Values					
		1969/1970 Data			1972/1973 Data		
		High Noise Group	Low Noise Group	Difference	High Noise Group	Low Noise Group	Difference
Total Sample	High: 434 Low: 432	3.8	0.2	3.6**	2.3	0.2	1.9**
Age: Below 26	High: 60 Low: 9	4.7	0.2	4.5*	3.2	0.2	3.0**
Age: Below 26 Yrs. Pres. Job: 5-10	High: 59 Low: 7	4.8	0.3	4.5	3.3	0.2	3.1**
Age: Below 26 Shift: First	High: 23 Low: 9	4.8	0.2	4.6**	4.5	0.2	4.3**
Age: Below 26 Marital Status: Married	High: 30 Low: 8	4.5	0.2	4.3*	2.7	0.2	2.5**
Age: 26-35	High: 152 Low: 98	5.0	0.2	4.8**	3.9	0.2	3.7**
Age: 26-35 Yrs. Pres. Job: 5-10	High: 146 Low: 81	5.0	0.2	4.8**	3.9	0.3	3.6**
Age: 26-35 Yrs. Pres. Job: 11-15	High: 6 Low: 14	7.5	0.1	7.9**	3.0	0.1	2.9**
Age: 26-35 Shift: First	High: 57 Low: 76	3.5	0.1	3.4**	2.1	0.2	1.9**
Age: 26-35 Shift: Second	High: 50 Low: 7	4.5	3.5	1.0	3.8	1.0	2.8
Age: 26-35 Shift: Third	High: 45 Low: 11	6.9	0.5	6.4**	8.0	1.5	6.5**
Age: 26-35 Marital Status: Single	High: 25 Low: 23	6.5	0.2	6.3**	6.0	0.3	6.3**
Age: 26-35 Marital Status: Married	High: 125 Low: 75	4.9	0.2	4.7**	3.5	0.2	3.3**
Age: 26-35 Occupation: Foreman	High: 8 Low: 25	0.3	0.7	0.4	0.1	0.5	0.4
Age: 26-35 Occupation: Test & Inspect	High: 8 Low: 6	0.3	1.0	0.7	1.0	0.3	0.7
Age: 36-45	High: 88 Low: 133	3.3	0.2	3.1**	2.0	0.3	1.7**

Note: Statistically Significant Median Comparisons are Indicated by: * = .05 Level; and
** = .01 Level, as Noted in the Difference Columns.

Table 3-38. Comparison of Frequency of Accidents Median Test Results for High Noise Group vs Low Noise Group, 1969/1970 Data; and High Noise Group vs Low Noise Group, 1972/1973 (Cont.)

Group/Subgroup (Independent Factor)	Group Size (No. Wkrs.)	Median Values					
		1969/1970 Data			1972/1973 Data		
		High Noise Group	Low Noise Group	Difference	High Noise Group	Low Noise Group	Difference
Age: 36-45 Yrs. Pres. Job: 5-10	High: 66 Low: 91	3.0	0.4	0.1**	2.0	0.4	1.6**
Age: 36-45 Yrs. Pres. Job: 11-15	High: 10 Low: 22	4.5	0.1	4.4*	4.0	0.2	3.8**
Age: 36-45 Yrs. Pres. Job: 16-20	High: 12 Low: 14	3.5	0.1	3.4**	0.4	0.1	0.3
Age: 36-45 Shift: First	High: 53 Low: 98	3.5	0.2	3.3**	2.1	0.2	1.9**
Age: 36-45 Shift: Second	High: 24 Low: 18	2.3	0.8	1.5	1.9	1.5	0.4
Age: 36-45 Shift: Third	High: 10 Low: 13	4.0	1.0	3.0**	2.5	1.5	1.0
Age: 36-45 Marital Status: Married	High: 85 Low: 125	3.3	0.2	3.1**	2.0	0.3	1.7**
Age: 36-45 Occupation: Foreman	High: 5 Low: 43	2.5	1.1	1.4	1.0	1.3	0.3
Age: 36-45 Occupation: Test & Inspect	High: 18 Low: 12	0.8	0.4	0.4	1.5	1.2	0.3
Age: 46-55	High: 83 Low: 137	2.8	0.2	2.6**	1.9	0.2	1.7**
Age: 46-55 Yrs. Pres. Job: 5-10	High: 41 Low: 63	4.6	0.2	4.4**	2.2	0.2	2.0**
Age: 46-55 Yrs. Pres. Job: 11-15	High: 15 Low: 37	1.5	0.2	1.3	2.5	0.2	2.3**
Age: 46-55 Yrs. Pres. Job: 16-20	High: 20 Low: 17	1.1	0.2	0.9*	1.2	0.3	0.9
Age: 46-55 Yrs. Pres. Job: Over 20	High: 7 Low: 20	3.0	0.1	2.9*	2.0	1.0	1.9*
Age: 46-55 Shift: First	High: 46 Low: 110	2.4	0.1	2.3**	1.5	0.1	1.4**
Age: 46-55 Shift: Second	High: 25 Low: 11	3.0	0.5	2.5	2.2	2.0	0.2

Note: Statistically Significant Median Comparisons are Indicated by: * = .05 Level; and
 ** = .01 Level, as Noted in the Difference Columns.

Table 3-38. Comparison of Frequency of Accidents Median Test Results for High Noise Group vs Low Noise Group, 1969/1970 Data; and High Noise Group vs Low Noise Group, 1972/1973 Data (Cont.)

Group/Subgroup (Independent Factor)	Group Size (No. Wkrs.)	Median Values					
		1969/1970 Data			1972/1973 Data		
		High Noise Group	Low Noise Group	Difference	High Noise Group	Low Noise Group	Difference
Age: 46-55 Shift: Third	High: 11 Low: 9	6.0	1.5	4.5	3.5	1.5	2.0
Age: 46-55 Marital Status: Married	High: 80 Low: 128	3.0	0.2	2.8**	1.9	0.2	1.7**
Age: 46-55 Occupation: Foreman	High: 9 Low: 41	0.3	0.6	0.3	1.5	0.8	0.7
Age: 46-55 Occupation: Test & Inspect	High: 11 Low: 16	0.5	0.5	0.0	0.8	0.5	0.3
Age: 56-65	High: 51 Low: 55	1.2	0.2	1.0**	1.1	0.2	0.9**
Age: 56-65 Yrs. Pres. Job: 5-10	High: 21 Low: 16	2.0	0.2	1.8	1.5	0.3	1.2
Age: 56-65 Yrs. Pres. Job: 11-15	High: 10 Low: 24	0.5	0.1	0.4	1.2	0.2	1.0*
Age: 56-65 Yrs. Pres. Job: 16-20	High: 7 Low: 7	3.5	0.5	3.0	0.5	0.2	0.3
Age: 56-65 Yrs. Pres. Job: Over 20	High: 13 Low: 8	0.8	0.5	0.3	1.2	0.5	0.7
Age: 56-65 Shift: First	High: 31 Low: 40	0.8	0.2	0.6	1.1	0.2	0.9**
Age: 56-65 Shift: Second	High: 13 Low: 10	2.5	0.3	2.2	1.3	0.2	1.1
Age: 56-65 Shift: Third	High: 6 Low: 4	1.0	1.0	0.0	0.5	0.5	0.0
Age: 56-65 Marital Status: Married	High: 50 Low: 51	1.1	0.2	0.9**	1.1	0.3	0.8**
Age: 56-65 Occupation: Foreman	High: 10 Low: 24	0.5	0.8	0.3	1.0	0.3	0.8*
Age: 56-65 Occupation: Administrator	High: 4 Low: 5	0.5	0.0	0.5	0.2	0.3	0.1
Total Number of Statis- tically Significant High/ Low Comparisons				26			28

Note: Statistically Significant Median Comparisons are Indicated by: * = .05 Level; and
** = .01 Level, as Noted in the Difference Columns.

Table 3-39. Comparison of Diagnosed Medical Problems Median Test Results, for High Noise Group vs Low Noise Group, 1969/1970 Data; and High Noise Group vs Low Noise Group, 1972/1973 Data

Group/Subgroup (Independent Factor)	Group Size (No. Wkrs.)	Median Values					
		1969/1970 Data			1972/1973 Data		
		High Noise Group	Low Noise Group	Difference	High Noise Group	Low Noise Group	Difference
Total Sample	High: 434 Low: 432	1.7	0.3	1.4**	0.6	0.2	0.4**
Age: Below 26	High: 60 Low: 1	2.0	3.5	1.5	1.2	0.5	0.7
Age: Below 26 Yrs. Pres. Job: 5-10	High: 59 Low: 7	2.0	3.5	1.5	1.3	0.3	1.0
Age: Below 26 Shift: First	High: 23 Low: 9	1.4	3.5	2.1	1.2	0.5	0.7
Age: Below 26 Marital Status: Married	High: 30 Low: 8	1.4	2.0	0.6	1.7	0.5	1.2
Age: 26-35	High: 152 Low: 98	2.1	0.2	1.9**	1.1	0.1	1.0**
Age: 26-35 Yrs. Pres. Job: 5-10	High: 146 Low: 81	2.1	0.2	1.9**	1.1	0.1	1.0**
Age: 26-35 Yrs. Pres. Job: 11-15	High: 6 Low: 14	1.5	0.3	1.2	1.0	0.1	0.9
Age: 26-35 Shift: First	High: 57 Low: 76	1.5	0.2	1.3**	0.4	0.1	0.3
Age: 26-35 Shift: Second	High: 50 Low: 7	1.5	0.5	1.0	1.8	0.5	1.3
Age: 26-35 Shift: Third	High: 45 Low: 11	3.5	1.0	2.5*	2.1	0.3	1.8
Age: 26-35 Marital Status: Single	High: 25 Low: 23	1.3	0.4	1.9*	1.8	0.1	1.7**
Age: 26-35 Marital Status: Married	High: 125 Low: 75	2.3	0.2	2.1**	1.0	0.1	0.9**
Age: 26-35 Occupation: Foreman	High: 8 Low: 25	1.3	0.4	0.9*	0.5	0.3	0.2
Age: 26-35 Occupation: Test & Inspect	High: 8 Low: 6	1.3	0.5	1.8	0.2	0.3	0.1
Age: 36-45	High: 88 Low: 133	1.4	0.3	1.1**	0.8	0.3	0.5**

Note: Statistically Significant Median Comparisons are Indicated by: * = .05 Level; and ** = .01 Level, as Noted in the Difference Columns.

Table 3-39. Comparison of Diagnosed Medical Problems Median Test Results, for High Noise Group vs Low Noise Group, 1969/1970 Data; and High Noise Group vs Low Noise Group, 1972/1973 Data (Cont.)

Group/Subgroup (Independent Factor)	Group Size (No. Wkrs.)	Median Values					
		1969/1970 Data			1972/1973 Data		
		High Noise Group	Low Noise Group	Difference	High Noise Group	Low Noise Group	Difference
Age: 36-45 Yrs. Pres. Job: 5-10	High: 66 Low: 91	1.5	0.3	1.2**	1.0	0.4	0.7**
Age: 36-45 Yrs. Pres. Job: 11-15	High: 10 Low: 22	1.5	0.7	0.8	0.2	0.1	0.1
Age: 36-45 Yrs. Pres. Job: 16-20	High: 12 Low: 14	0.8	0.2	0.6	0.3	0.2	0.1
Age: 36-45 Shift: First	High: 53 Low: 98	1.3	0.2	1.1**	0.6	0.2	0.4*
Age: 36-45 Shift: Second	High: 24 Low: 18	2.0	0.5	1.5	1.1	1.8	0.7
Age: 36-45 Shift: Third	High: 10 Low: 13	2.8	1.2	1.6	0.8	1.5	0.7
Age: 36-45 Marital Status: Married	High: 85 Low: 125	1.4	0.3	1.1**	0.7	0.3	0.4*
Age: 36-45 Occupation: Foreman	High: 5 Low: 43	1.0	1.1	0.1	3.0	1.6	1.4
Age: 36-45 Occupation: Test & Inspect	High: 18 Low: 12	1.5	0.8	0.7	0.8	0.4	0.4
Age: 46-55	High: 83 Low: 137	1.6	0.2	1.4**	0.3	0.2	0.1
Age: 46-55 Yrs. Pres. Job: 5-10	High: 41 Low: 63	1.7	0.2	1.5**	0.4	0.2	0.2
Age: 46-55 Yrs. Pres. Job: 11-15	High: 15 Low: 37	1.5	0.3	1.2*	0.3	0.3	0.0
Age: 46-55 Yrs. Pres. Job: 16-20	High: 20 Low: 17	1.7	0.3	1.4	0.3	0.3	0.0
Age: 46-55 Yrs. Pres. Job: Over 20	High: 7 Low: 20	2.0	0.1	1.9	0.3	0.1	0.2
Age: 46-55 Shift: First	High: 46 Low: 110	1.7	0.2	1.5**	0.3	0.2	0.1
Age: 46-55 Shift: Second	High: 25 Low: 11	1.3	0.8	0.5	0.3	1.2	0.9

Note: Statistically Significant Median Comparisons are Indicated by: * = .05 Level; and ** = .01 Level, as Noted in the Difference Columns.

Table 3-39. Comparison of Diagnosed Medical Problems Median Test Results, for High Noise Group vs Low Noise Group, 1969/1970 Data; and High Noise Group vs Low Noise Group, 1972/1973 Data (Cont.)

Group/Subgroup (Independent Factor)	Group Size (No. Wkrs.)	Median Values					
		1969/1970 Data			1972/1973 Data		
		High Noise Group	Low Noise Group	Difference	High Noise Group	Low Noise Group	Difference
Age: 46-55 Shift: Third	High: 11 Low: 9	1.5	1.1	0.4	1.0	1.8	0.8
Age: 46-55 Marital Status: Married	High: 80 Low: 128	1.7	0.2	1.5**	0.3	0.2	0.1
Age: 46-55 Occupation: Foreman	High: 9 Low: 41	1.2	0.6	0.6	0.0	0.6	0.6
Age: 46-55 Occupation: Test & Inspect	High: 11 Low: 16	1.0	0.4	0.6	0.3	0.7	0.4
Age: 56-65	High: 51 Low: 55	1.5	0.3	1.2**	0.2	0.1	0.1
Age: 56-65 Yrs. Pres. Job: 5-10	High: 21 Low: 16	1.8	0.5	1.3	0.3	0.1	0.2
Age: 56-65 Yrs. Pres. Job: 11-15	High: 10 Low: 24	1.5	0.3	1.2**	0.8	0.1	0.7*
Age: 56-65 Yrs. Pres. Job: 16-20	High: 7 Low: 7	2.5	0.3	2.2	0.2	0.3	0.1
Age: 56-65 Yrs. Pres. Job: Over 20	High: 13 Low: 8	1.0	0.3	0.7	0.1	0.1	0.0
Age: 56-65 Shift: First	High: 31 Low: 40	1.4	0.3	1.1**	0.2	0.1	0.1
Age: 56-65 Shift: Second	High: 13 Low: 10	3.0	0.3	2.7	0.4	0.5	0.1
Age: 56-65 Shift: Third	High: 6 Low: 4	1.5	1.0	0.5	0.3	0.0	0.3
Age: 56-65 Marital Status: Married	High: 50 Low: 51	1.5	0.3	1.2**	0.2	0.1	0.1
Age: 56-65 Occupation: Foreman	High: 10 Low: 24	2.5	0.5	2.0	0.2	0.2	0.0
Age: 56-65 Occupation: Administrator	High: 4 Low: 5	0.5	0.3	0.2	0.5	0.0	0.5
Total Number of Statis- tically Significant High/ Low Comparisons				21			10

Note: Statistically Significant Median Comparisons are Indicated by: * = .05 Level; and
** = .01 Level, as Noted in the Difference Columns.

Table 3-40. Comparison of Symptomatic Medical Problems Median Test Results, for High Noise Group vs Low Noise Group, 1969/1970 Data; and High Noise Group vs Low Noise Group, 1972/1973 Data

Group/Subgroup (Independent Factor)	Group Size (No. Wkrs.)	Median Values					
		1969/1970 Data			1972/1973 Data		
		High Noise Group	Low Noise Group	Difference	High Noise Group	Low Noise Group	Difference
Total Sample	High: 434 Low: 432	0.6	0.2	0.4**	0.8	0.2	0.6**
Age: Below 26	High: 60 Low: 9	0.9	0.1	0.8*	1.4	0.3	0.9
Age: Below 26 Yrs. Pres. Job: 5-10	High: 59 Low: 7	1.0	0.0	1.0**	1.5	0.3	1.2
Age: Below 26 Shift: First	High: 23 Low: 9	1.5	0.1	1.4**	1.3	0.3	1.0
Age: Below 26 Marital Status: Married	High: 30 Low: 8	0.9	0.1	0.8**	1.5	0.3	1.2
Age: 26-35	High: 152 Low: 98	1.2	0.2	1.0**	1.2	0.1	1.1**
Age: 26-35 Yrs. Pres. Job: 5-10	High: 146 Low: 81	1.3	0.2	1.1**	1.2	0.2	1.0**
Age: 26-35 Yrs. Pres. Job: 11-15	High: 6 Low: 14	0.3	0.1	0.2	1.0	0.1	0.9
Age: 26-35 Shift: First	High: 57 Low: 76	1.0	0.1	0.9**	0.9	0.1	0.8**
Age: 26-35 Shift: Second	High: 50 Low: 7	1.0	2.0	1.0	1.1	0.5	0.6
Age: 26-35 Shift: Third	High: 45 Low: 11	2.6	0.3	2.3*	2.0	1.0	1.0
Age: 26-35 Marital Status: Single	High: 25 Low: 23	1.2	0.2	1.0**	1.6	0.2	1.4**
Age: 26-35 Marital Status: Married	High: 125 Low: 15	1.3	0.2	1.1**	1.1	0.1	1.0**
Age: 26-35 Occupation: Foreman	High: 8 Low: 25	0.5	0.4	0.1	1.5	0.4	1.1
Age: 26-35 Occupation: Test & Inspect	High: 8 Low: 6	1.5	0.3	1.2	0.2	0.3	0.1
Age: 36-45	High: 88 Low: 133	0.4	0.2	0.2	0.8	0.3	0.5**

Note: Statistically Significant Median Comparisons are Indicated by: * = .05 Level; and
** = .01 Level, as Noted in the Difference Columns.

Table 3-40. Comparison of Symptomatic Medical Problems Median Test Results, for High Noise Group vs Low Noise Group, 1969/1970 Data; and High Noise Group vs Low Noise Group, 1972/1973 Data (Cont.)

Group/Subgroup (Independent Factor)	Group Size (No. Wkrs.)	Median Values					
		1969/1970 Data			1972/1973 Data		
		High Noise Group	Low Noise Group	Difference	High Noise Group	Low Noise Group	Difference
Age: 36-45 Yrs. Pres. Job: 5-10	High: 66 Low: 91	0.5	0.3	0.2	1.0	0.4	0.6**
Age: 36-45 Yrs. Pres. Job: 11-15	High: 10 Low: 22	0.5	0.1	0.4	1.0	0.1	0.9*
Age: 36-45 Yrs. Pres. Job: 16-20	High: 12 Low: 14	0.3	0.1	0.2	0.3	0.3	0.0
Age: 36-45 Shift: First	High: 53 Low: 98	0.4	0.2	0.2	0.6	0.2	0.4
Age: 36-45 Shift: Second	High: 24 Low: 18	0.4	0.7	0.3	0.9	0.4	0.5
Age: 36-45 Shift: Third	High: 10 Low: 13	1.9	1.2	0.7	1.5	1.3	1.2
Age: 36-45 Marital Status: Married	High: 85 Low: 125	0.4	0.2	0.2	0.8	0.3	0.5**
Age: 36-45 Occupation: Foreman	High: 5 Low: 43	1.0	1.2	0.2	1.5	1.0	0.5
Age: 36-45 Occupation: Test & Inspect	High: 18 Low: 12	0.4	0.3	0.1	0.7	0.3	0.4
Age: 46-55	High: 83 Low: 137	0.3	0.1	0.2	0.4	0.2	0.2
Age: 46-55 Yrs. Pres. Job: 5-10	High: 41 Low: 63	0.4	0.1	0.3	0.7	0.3	0.4
Age: 46-55 Yrs. Pres. Job: 11-15	High: 15 Low: 37	0.8	0.1	0.7	0.4	0.2	0.2
Age: 46-55 Yrs. Pres. Job: 16-20	High: 20 Low: 17	0.2	0.1	0.1	0.3	0.5	0.2
Age: 46-55 Yrs. Pres. Job: Over 20	High: 7 Low: 20	0.2	0.2	0.0	0.3	0.1	0.2
Age: 46-55 Shift: First	High: 46 Low: 110	0.2	0.1	0.1	0.4	0.2	0.2
Age: 46-55 Shift: Second	High: 25 Low: 11	0.4	1.5	1.1	0.5	0.5	0.0

Note: Statistically Significant Median Comparisons are Indicated by: * = .05 Level; and
** = .01 Level, as Noted in the Difference Columns.

Table 3-40. Comparison of Symptomatic Medical Problems Median Test Results, for High Noise Group vs Low Noise Group, 1969/1970 Data; and High Noise Group vs Low Noise Group, 1972/1973 Data (Cont.)

Group/Subgroup (Independent Factor)	Group Size (No. Wkrs.)	Median Values					
		1969/1970 Data			1972/1973 Data		
		High Noise Group	Low Noise Group	Difference	High Noise Group	Low Noise Group	Difference
Age: 46-55 Shift: Third	High: 11 Low: 9	1.2	1.5	0.3	0.8	0.8	0.0
Age: 46-55 Marital Status: Married	High: 80 Low: 128	0.3	0.1	0.2	0.4	0.2	0.2
Age: 46-55 Occupation: Foreman	High: 9 Low: 41	0.3	0.3	0.0	0.2	0.5	0.3
Age: 46-55 Occupation: Test & Inspect	High: 11 Low: 16	0.2	0.2	0.0	0.2	0.5	0.3
Age: 56-65	High: 51 Low: 55	0.3	0.1	0.2	0.2	0.2	0.0
Age: 56-65 Yrs. Pres. Job: 5-10	High: 21 Low: 16	0.2	0.1	0.1	0.3	0.2	0.1
Age: 56-65 Yrs. Pres. Job: 11-15	High: 10 Low: 24	0.2	0.1	0.1	0.3	0.1	0.2
Age: 56-65 Yrs. Pres. Job: 16-20	High: 7 Low: 7	1.0	0.3	0.8	0.3	0.2	0.1
Age: 56-65 Yrs. Pres. Job: Over 20	High: 13 Low: 8	0.4	0.1	0.3	0.1	0.3	0.2
Age: 56-65 Shift: First	High: 31 Low: 40	0.3	0.0	0.3	0.3	0.1	0.2
Age: 56-65 Shift: Second	High: 13 Low: 10	0.5	0.1	0.4	0.3	0.5	0.2
Age: 56-65 Shift: Third	High: 6 Low: 4	0.1	0.5	0.4	0.2	0.2	0.0
Age: 56-65 Marital Status: Married	High: 50 Low: 51	0.3	0.1	0.2	0.2	0.2	0.0
Age: 56-65 Occupation: Foreman	High: 10 Low: 24	0.3	0.1	0.2	0.2	0.2	0.0
Age: 56-65 Occupation: Administrator	High: 4 Low: 5	0.2	0.0	0.2	0.0	0.3	0.3
Total Number of Statistically Significant High/Low Comparisons				11			10

Note: Statistically Significant Median Comparisons are Indicated by: * = .05 Level; and ** = .01 Level, as Noted in the Difference Columns.

Table 3-41. Comparison of Number of Days Absent Median Test Results, for High Noise Group vs Low Noise Group, 1969/1970 Data; and High Noise Group vs Low Noise Group, 1972/1973 Data

Group/Subgroup (Independent Factor)	Group Size (No. Wkrs.)	Median Values					
		1969/1970 Data			1972/1973 Data		
		High Noise Group	Low Noise Group	Difference	High Noise Group	Low Noise Group	Difference
Total Sample	High: 434 Low: 432	19.7	2.8	16.9**	7.3	4.7	2.6**
Age: Below 26	High: 60 Low: 9	23.0	2.5	20.5	8.5	6.5	2.0
Age: Below 26 Yrs. Pres. Job: 5-10	High: 59 Low: 7	24.5	7.5	17.0	8.8	6.5	2.3
Age: Below 26 Shift: First	High: 23 Low: 9	21.5	2.5	19.0	8.5	6.5	2.0
Age: Below 26 Marital Status: Married	High: 30 Low: 8	15.5	2.5	13.0	7.0	6.0	1.0
Age: 26-35	High: 152 Low: 98	20.0	4.5	15.5**	7.8	4.3	3.5**
Age: 26-35 Yrs. Pres. Job: 5-10	High: 146 Low: 81	19.5	3.3	16.2**	7.5	4.0	3.5**
Age: 26-35 Yrs. Pres. Job: 11-15	High: 6 Low: 14	27.0	5.5	21.5**	13.5	6.5	7.0
Age: 26-35 Shift: First	High: 57 Low: 76	22.5	4.9	17.6**	11.2	4.5	6.7*
Age: 26-35 Shift: Second	High: 50 Low: 7	17.0	3.0	14.0**	5.8	8.5	2.7
Age: 26-35 Shift: Third	High: 45 Low: 11	19.0	3.0	16.0**	8.0	3.5	4.5**
Age: 26-35 Marital Status: Single	High: 25 Low: 23	33.5	3.5	30.0**	12.5	4.5	8.0
Age: 26-35 Marital Status: Married	High: 125 Low: 75	16.5	2.5	14.0**	6.8	4.3	2.5**
Age: 26-35 Occupation: Foreman	High: 8 Low: 25	0.3	0.4	0.1	0.5	3.5	3.0
Age: 26-35 Occupation: Test & Inspect	High: 8 Low: 6	5.5	3.5	2.0	5.2	3.0	2.2
Age: 36-45	High: 88 Low: 133	20.2	3.7	16.5**	6.6	4.6	2.0

Note: Statistically Significant Median Comparisons are Indicated by: * = .05 Level; and
** = .01 Level, as Noted in the Difference Columns.

Table 3-41. Comparison of Number of Days Absent Median Test Results, for High Noise Group vs Low Noise Group, 1969/1970 Data; and High Noise Group vs Low Noise Group, 1972/1973 Data (Cont.)

Group/Subgroup (Independent Factor)	Group Size (No. Wkrs.)	Median Values					
		1969/1970 Data			1972/1973 Data		
		High Noise Group	Low Noise Group	Difference	High Noise Group	Low Noise Group	Difference
Age: 46-55 Shift: Third	High: 11 Low: 9	8.0	0.5	7.5*	15.5	4.0	11.5
Age: 46-55 Marital Status: Married	High: 80 Low: 128	16.5	2.1	14.4**	8.8	5.0	3.8**
Age: 46-55 Occupation: Foreman	High: 9 Low: 41	3.5	0.5	3.0	8.0	5.0	3.0
Age: 46-55 Occupation: Test & Inspect	High: 11 Low: 16	6.5	5.0	1.5	15.5	5.5	10.0
Age: 56-65	High: 51 Low: 55	18.0	2.1	15.9**	4.5	4.8	0.3
Age: 56-65 Yrs. Pres. Job: 5-10	High: 21 Low: 16	15.0	0.8	14.2**	11.5	3.8	7.7*
Age: 56-65 Yrs. Pres. Job: 11-15	High: 10 Low: 24	11.5	3.5	8.0*	2.5	8.0	5.5
Age: 56-65 Yrs. Pres. Job: 16-20	High: 7 Low: 7	29.5	7.0	22.5	17.5	5.0	12.5
Age: 56-65 Yrs. Pres. Job: Over 20	High: 13 Low: 8	30.5	2.0	28.5	2.0	4.5	2.5
Age: 56-65 Shift: First	High: 31 Low: 40	27.5	2.0	25.5	7.0	4.7	2.3
Age: 56-65 Shift: Second	High: 13 Low: 10	12.0	2.5	17.5	11.0	4.0	7.0
Age: 56-65 Shift: Third	High: 6 Low: 4	7.0	7.5	0.5	1.0	19.5	18.5
Age: 56-65 Marital Status: Married	High: 50 Low: 51	18.0	2.1	15.9**	4.0	5.0	1.0
Age: 56-65 Occupation: Foreman	High: 10 Low: 24	11.5	2.0	9.5*	2.5	4.3	1.8
Age: 56-65 Occupation: Administrator	High: 4 Low: 5	1.5	1.5	0.0	12.5	4.0	8.5
Total Number of Statis- tically Significant High/ Low Comparisons				29			13

Note: Statistically Significant Median Comparisons are Indicated by: * = .05 Level; and
** = .01 Level, as Noted in the Difference Columns.

Table 3-41. Comparison of Number of Days Absent Median Test Results, for High Noise Group vs Low Noise Group, 1969/1970 Data; and High Noise Group vs Low Noise Group, 1972/1973 Data (Cont.)

Group/Subgroup (Independent Factor)	Group Size (No. Wkrs.)	Median Values					
		1969/1970 Data			1972/1973 Data		
		High Noise Group	Low Noise Group	Difference	High Noise Group	Low Noise Group	Difference
Age: 36-45 Yrs. Pres. Job: 5-10	High: 66 Low: 91	14.5	3.5	13.0**	6.0	5.3	0.7
Age: 36-45 Yrs. Pres. Job: 11-15	High: 10 Low: 22	28.5	3.0	25.5**	11.5	4.5	7.0
Age: 36-45 Yrs. Pres. Job: 16-20	High: 12 Low: 14	23.5	4.5	19.0*	8.0	2.0	6.0
Age: 36-45 Shift: First	High: 53 Low: 98	20.5	3.9	16.6**	7.5	4.4	3.1
Age: 36-45 Shift: Second	High: 24 Low: 18	14.0	2.5	11.5	4.7	5.0	0.3
Age: 36-45 Shift: Third	High: 10 Low: 13	22.0	3.5	18.5	7.3	5.5	1.8*
Age: 36-45 Marital Status: Married	High: 85 Low: 125	20.2	3.8	16.4**	6.8	4.6	2.2
Age: 36-45 Occupation: Foreman	High: 5 Low: 43	1.0	3.2	2.2	17.0	5.8	11.2
Age: 36-45 Occupation: Test & Inspect	High: 18 Low: 12	4.5	3.5	1.0	5.0	3.0	2.0
Age: 46-55	High: 83 Low: 137	16.5	1.9	14.6**	9.2	5.0	4.2**
Age: 46-55 Yrs. Pres. Job: 5-10	High: 41 Low: 63	30.5	1.5	29.0**	10.5	5.1	5.4
Age: 46-55 Yrs. Pres. Job: 11-15	High: 15 Low: 37	14.0	2.0	16.0**	7.0	4.8	2.2
Age: 46-55 Yrs. Pres. Job: 16-20	High: 20 Low: 17	13.5	4.0	9.5	10.5	4.5	6.0
Age: 46-55 Yrs. Pres. Job: Over 20	High: 7 Low: 20	26.5	4.5	22.0*	13.5	7.5	6.0
Age: 46-55 Shift: First	High: 46 Low: 110	16.5	1.7	14.8**	8.0	4.8	3.2**
Age: 46-55 Shift: Second	High: 25 Low: 11	18.5	8.0	10.5	9.5	7.5	2.0

Note: Statistically Significant Median Comparisons are Indicated by: * = .05 Level; and
** = .01 Level, as Noted in the Difference Columns.

Table 3-42. Comparison of Discrete Absences Median Test Results, for High Noise Group vs Low Noise Group, 1969/1970 Data; and High Noise Group vs Low Noise Group, 1972/1973 Data

Group/Subgroup (Independent Factor)	Group Size (No. Wkrs.)	Median Values					
		1969/1970 Data			1972/1973 Data		
		High Noise Group	Low Noise Group	Difference	High Noise Group	Low Noise Group	Difference
Total Sample	High: 434 Low: 432	12.4	1.5	10.9**	5.0	2.5	2.5**
Age: Below 26	High: 60 Low: 9	15.8	1.5	14.3**	6.5	5.5	1.0
Age: Below 26 Yrs. Pres. Job: 5-10	High: 59 Low: 9	16.2	3.5	12.7*	6.8	5.5	1.3
Age: Below 26 Shift: First	High: 23 Low: 9	16.5	1.5	15.0	6.5	5.5	1.0
Age: Below 26 Marital Status: Married	High: 30 Low: 8	12.5	1.5	11.0	6.0	5.5	0.5
Age: 26-35	High: 152 Low: 98	12.8	2.3	10.5**	5.0	2.8	2.2**
Age: 26-35 Yrs. Pres. Job: 5-10	High: 146 Low: 81	12.3	1.9	10.4**	5.0	2.8	2.2**
Age: 26-35 Yrs. Pres. Job: 11-15	High: 6 Low: 14	26.0	3.5	22.5**	5.0	3.5	1.5
Age: 26-35 Shift: First	High: 57 Low: 76	14.5	2.4	12.1**	6.8	3.2	3.6*
Age: 26-35 Shift: Second	High: 50 Low: 7	11.8	1.5	10.3**	4.0	2.5	1.5
Age: 26-35 Shift: Third	High: 45 Low: 11	19.0	2.0	17.0**	5.0	2.5	2.5*
Age: 26-35 Marital Status: Single	High: 25 Low: 23	24.5	2.0	22.5**	8.8	2.8	6.0*
Age: 26-35 Marital Status: Married	High: 125 Low: 75	11.0	2.5	8.5**	4.6	2.9	1.7
Age: 26-35 Occupation: Foreman	High: 8 Low: 25	0.3	0.4	0.1	0.5	2.3	1.8
Age: 26-35 Occupation: Test & Inspect	High: 8 Low: 6	4.0	2.0	2.0	3.0	3.0	0.0
Age: 36-45	High: 88 Low: 133	11.8	1.7	10.1**	4.9	2.6	2.3**

Note: Statistically Significant Median Comparisons are Indicated by: * = .05 Level; and
** = .01 Level, as Noted in the Difference Columns.

Table 3-42. Comparison of Discrete Absences Median Test Results, for High Noise Group vs Low Noise Group, 1969/1970 Data; and High Noise Group vs Low Noise Group, 1972/1973 Data (Cont.)

Group/Subgroup (Independent Factor)	Group Size (No. Wkrs.)	Median Values					
		1969/1970 Data			1972/1973 Data		
		High Noise Group	Low Noise Group	Difference	High Noise Group	Low Noise Group	Difference
Age: 36-45 Yrs. Pres. Job: 5-10	High: 66 Low: 91	11.2	1.7	9.5**	4.5	2.8	1.7
Age: 36-45 Yrs. Pres. Job: 11-15	High: 10 Low: 22	22.5	1.3	21.2**	6.0	2.6	3.4*
Age: 36-45 Yrs. Pres. Job: 16-20	High: 12 Low: 14	15.5	2.0	13.5**	5.5	1.5	4.0
Age: 36-45 Shift: First	High: 53 Low: 98	12.3	1.7	10.6**	5.5	2.6	2.9*
Age: 36-45 Shift: Second	High: 24 Low: 18	9.0	2.0	7.0	3.8	2.9	0.9
Age: 36-45 Shift: Third	High: 10 Low: 13	13.0	1.2	11.8**	6.5	2.2	4.3*
Age: 36-45 Marital Status: Married	High: 85 Low: 125	11.8	1.7	10.1**	5.0	2.7	2.3**
Age: 36-45 Occupation: Foreman	High: 5 Low: 43	1.0	1.5	0.5	2.5	2.7	0.2
Age: 36-45 Occupation: Test & Inspect	High: 18 Low: 12	3.5	2.5	1.0	2.5	1.5	1.0
Age: 46-55	High: 83 Low: 137	10.8	1.2	9.6**	5.4	2.6	2.8**
Age: 46-55 Yrs. Pres. Job: 5-10	High: 41 Low: 63	16.0	1.1	14.9**	6.8	2.6	4.2**
Age: 46-55 Yrs. Pres. Job: 11-15	High: 15 Low: 37	9.0	1.0	8.0	4.5	2.5	2.0
Age: 46-55 Yrs. Pres. Job: 16-20	High: 20 Low: 17	8.5	1.3	7.2	5.0	2.0	3.0**
Age: 46-55 Yrs. Pres. Job: Over 20	High: 7 Low: 20	24.0	2.1	21.9*	8.5	3.5	3.0
Age: 46-55 Shift: First	High: 46 Low: 110	10.5	1.1	9.4**	5.8	2.5	3.3**
Age: 46-55 Shift: Second	High: 25 Low: 11	12.0	2.5	9.5**	4.5	2.8	1.7

Note: Statistically Significant Median Comparisons are Indicated by: * = .05 Level; and
** = .01 Level, as Noted in the Difference Columns.

Table 3-42. Comparison of Discrete Absences Median Test Results, for High Noise Group vs Low Noise Group, 1969/1970 Data; and High Noise Group vs Low Noise Group, 1972/1973 Data (Cont.)

Group/Subgroup (Independent Factor)	Group Size (No. Wkrs.)	Median Values					
		1969/1970 Data			1972/1973 Data		
		High Noise Group	Low Noise Group	Difference	High Noise Group	Low Noise Group	Difference
Age: 46-55 Shift: Third	High: 11 Low: 9	8.0	0.5	6.5*	6.5	2.2	4.3**
Age: 46-55 Marital Status: Married	High: 80 Low: 128	10.8	1.2	9.6**	5.3	2.6	2.7**
Age: 46-55 Occupation: Foreman	High: 9 Low: 41	1.0	0.5	0.5	3.0	2.1	0.9
Age: 46-55 Occupation: Test & Inspect	High: 11 Low: 16	5.5	1.5	4.0	5.0	2.5	2.5
Age: 56-65	High: 51 Low: 55	11.5	1.4	10.1**	2.1	1.6	0.5
Age: 56-65 Yrs. Pres. Job: 5-10	High: 21 Low: 16	12.5	0.8	11.7**	6.0	1.4	4.6
Age: 56-65 Yrs. Pres. Job: 11-15	High: 10 Low: 24	6.0	1.5	4.5	1.5	2.8	1.3
Age: 56-65 Yrs. Pres. Job: 16-20	High: 7 Low: 7	15.0	2.5	12.5	6.0	1.2	4.8
Age: 56-65 Yrs. Pres. Job: Over 20	High: 13 Low: 8	17.0	1.8	15.2**	1.5	1.5	0.0
Age: 56-65 Shift: First	High: 31 Low: 40	18.5	1.5	17.0**	2.5	1.5	1.0
Age: 56-65 Shift: Second	High: 13 Low: 10	9.0	1.0	8.0	7.5	1.8	5.7
Age: 56-65 Shift: Third	High: 6 Low: 4	3.5	6.0	2.5	0.5	3.0	2.5
Age: 56-65 Marital Status: Married	High: 50 Low: 51	11.5	1.5	10.0**	2.0	1.6	0.4
Age: 56-65 Occupation: Foreman	High: 10 Low: 24	7.0	1.3	5.7*	1.2	1.5	0.3
Age: 56-65 Occupation: Administrator	High: 4 Low: 5	1.5	1.5	0.0	4.0	2.5	.5
Total Number of Statis- tically Significant High/ Low Comparisons				31			17

Note: Statistically Significant Median Comparisons are Indicated by: * = .05 Level; and
** = .01 Level, as Noted in the Difference Columns.



4. DISCUSSION

If high level noise was a contributor to the excess frequency of extra-auditory problems, originally seen in the plant workers records during the pre-hearing conservation phase of the study, then its reduction via use of ear protection in the post-hearing conservation phase should have reduced the numbers of such problems. This appears borne out by the results of this follow-on effort which supported rejection of the Gross-Level Null Hypothesis (H_0 : 1969/1970 record entries equivalent to those of 1972/1973 data), and acceptance of the Gross Level Test Hypothesis (H_1 : 1972/1973 record entries fewer than 1969/1970 data) for the accidents, diagnosed disorders and absence measures which were evaluated. For only symptomatic complaints were the results for the two time periods, before and after hearing conservation, found equivocal.

That record data from the same workers at the same jobs were utilized in this before-after evaluation lends confidence to the overall results through eliminating certain factors which questioned the findings from the original study and dictated this follow-up one. Quite obviously, however, a great deal of the validity of the conclusions of the present study is based on the presumption that the workers actually wore ear protectors during the 1972/1973 time period, and that still other factors which might have been responsible for the observed results had been adequately controlled.

Procedures were implemented which attempted to assess the degree to which ear protectors were worn by workers in the high noise areas. Using two (2) such procedures, a predominant number of workers were rated by their superiors and/or observed by the study director as wearing ear protectors currently and presumably too during the 1972/1973 period of data collection. As anticipated, the record data for these workers indicated increased use of ear protection to be associated with fewer extra-auditory problems, but orderly relationships between rated frequency of use ("always, frequently, infrequently, never") and the incidence of extra-auditory problems only partially emerged in the results. Indeed, in some instances rated "non-users" of ear protectors were

found to have reduced numbers of accidents, medical problems equal to the rated "users" of this equipment. These anomalies in the findings were believed to reflect shortcomings in the methods used to gauge ear protection usage, which while practical under the circumstances, had only questionable validity and reliability for the required post-hoc determinations.

Additional, and possibly stronger evidence, that the ear protectors were worn, was provided by the audiometric data also gathered from the worker records. Audiograms available on the plant workers before the advent of hearing conservation, had revealed poorer hearing for those in the High Noise Group relative to the low noise one which was indicative of the severity of the noise exposure in the former group. Without ear protection, continued exposures to these high level noise conditions would have produced some evidence of further deterioration in the hearing of the High Noise Group. Audiometric data obtained for the High Noise Group in 1972, however, showed no worsening of their hearing levels relative to the earlier reported results.

Efforts were made to seek out and control factors that might have accounted for the observed differences between the record data collected for the two time periods of this study. For example, all hygienic changes to the work environment made between 1970 and 1973 which could have affected employee health and safety (with the exception of the hearing conservation program), were carefully reviewed with the safety engineering staff of the industrial complex. As a result, several workers were eliminated from the study, because an oil-mist filter had been installed at their work station. No other significant changes to the work environment were identified.

Another extraneous factor, which could have had some effect on the results, was the postulated general increased concern on the part of management and workers on issues of job safety and health during the post 1970 period arising from passage of the Occupational Safety and Health Act of 1970.⁽²⁶⁾ The marked differences between the high and low noise group in separate comparisons of their record data for 1969/1970 versus 1972/1973 cast doubt on this factor in accounting for the results. That is, the observed differences for the high noise

group could not be attributed to some plant-wide change. Similarly, it is difficult to accept a Hawthorne-type explanation for the results, i. e., management's interest in hearing conservation could have led to more positive job attitudes among the workers in the high noise group, and these in some way could have reduced their previously elevated rates of extra-auditory problems. That worker attitudes can influence health and safety indicators to the same extent that they shape job productivity seems dubious.

Two findings of this study may be worth noting with regard to some popular views about using ear protectors. One is that none of the comparisons of the accident data before and after the advent of hearing conservation showed that the use of ear protectors increased the number of mishaps. This would seem counter to the notion that the wearing of ear protectors could increase the likelihood of an accident (through attenuating not only the noise but the audibility of sounds depicting danger). The second finding relates to the presumed discomfort attached to the use of ear protectors. That symptomatic complaint was the only measure of those evaluated which failed to show a reduction in frequency of occurrence after the establishment of the hearing conservation program may testify to such difficulties.

As already stated, there were several limitations or constraints to the data collected in this study. The retrospective nature of the data collection process provided little if any guarantee of the validity and reliability of the information contained in the worker records or any specific causal references to noise. Ratings of ear protection usage necessitated questionable assumptions, with current impressions being used to depict a situation existing 2-3 years before. As such, the overall findings still do not furnish conclusive causal evidence for excessive noise resulting in the extra-auditory problems in question. Prospective rather than retrospective studies may be necessary for this purpose. One could envision, for example, individual investigations of accidents in noisy workplaces, analyzing the scenarios to determine if noise was a contributing factor and in what way. Some adaptation of the strategy adopted by Powell et al⁽²⁵⁾ in accident observations may offer the basis for documenting noise as well as non-noise contributions to accident occurrences in industry. Similarly, ratings of emerging

job stress as perceived by new workers in noisy jobs, together with health measures, may provide some early clues to the increased morbidity that may occur as a result of protracted exposures to workplace noise.

5. SUMMARY

The present study was conducted as a logical extension of a previous National Institute for Occupational Safety and Health (NIOSH) contract effort which was performed to evaluate the hypothesis that prolonged exposure to high-intensity noise in the workplace would increase the incidence of various safety, health and attendance problems in exposed workers. Evidence to support this hypothesis was originally found in comparing relevant entries in the records of 500 workers from high noise work environments (95 dBA or above) with those for 500 matched workers from low noise work environments (80 dBA or below) in two plant complexes over a 5-year period. However, the study results were moderated to some extent, because of difficulties associated with precisely equating workers from high and low noise areas in terms of job type. That is, job types and work processes which produce high level noise may be intrinsically more dangerous and unhealthy than those which produce low level noise, and these differences could have accounted for the findings.

The present study, utilizing records data from the larger and more noisy plant complex from the original study, evaluated the effects of a hearing conservation program on noise-related extra-auditory disturbances in workers. More specifically, it addressed the question of whether or not the same workers, working first under the high noise condition and subsequently under an operationally-defined "reduced noise" condition (through wearing ear protectors), would exhibit a significant reduction in the incidence of these extra-auditory disturbances. This approach eliminated the previous difficulties associated with matching workers with respect to job category. The high noise condition was defined as work during the 1969/1970 time period (prior to the implementation of the hearing conservation program), while the reduced noise condition was defined as work during the 1972/1973 time period (after the implementation of the hearing conservation program). Data from the two time periods were statistically compared with respect to the various medical, accident and attendance factors, for both the High Noise Group, and an equivalent Low Noise Group. The latter comparisons furnished baseline control data which were evaluated against the results for the High Noise Group. In addition, data from the High Noise Group were

statistically compared with data from the Low Noise Group, independently, for each of the two time periods, to provide some indication of the extent to which a hearing conservation program could also reduce the incidence of extra-auditory problems.

Consistent with the test hypothesis, the overall results indicated fewer accidents, diagnosed medical disorders, and absences in the 1972/1973 record data than in the 1969/1970 data. Only symptomatic complaints exhibited equivocal results for the two time periods. Secondary comparisons were also made by various combinations of age, experience, shift, job-type and ratings of ear protector usage. Results shown here, for the most part, were consistent with the hypothesized changes. It had been anticipated, however, that a decreased frequency of medical accident and attendance problems would have been coincident with increased use of ear protectors. This expected relationship was observed in some cases and not in others. There were obvious shortcomings in the methods used to define ear protection use during the post-hearing conservation phase of this study which may have been responsible for this outcome.

In general, the results were interpreted as adding strong support to the hypothesis that prolonged exposure to high-intensity noise increases the incidence of various medical, accident and attendance problems. Recommendations for further study, emphasizing prospective rather than retrospective approaches were offered in the interest of obtaining more definitive causal data on noise in the occurrence of these problems.

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APPENDIX A

JOB DESCRIPTIONS

Occupational Title: NDT Assistant

General: Assists in any X-ray and/or gamma ray operations as directed, and performs routine, repetitive operations under direction of X-ray operator on X-ray and gamma ray equipment. Accessories include drum rolls on track, stencils, film identification characters. Uses miscellaneous hand tools, jib hoist and crane.

Duties: Receives and interprets instructions. Assists operator in setting up vessel in work area, laying out film spacing to cover area to be x-rayed, stenciling, making up job numbers, taping film identification characters in place, and repositioning of vessel. Prepares film for exposure by operator. Performs various other duties as assigned. May be required to load and unload cassettes. Production must meet specified quality and quantity requirements. Keeps work area clean and orderly.

Special Skills:

Mental:

Must exercise sound judgment in order to prevent any damage to equipment, product, or injury to personnel.

Physical:

Must possess physical strength necessary to handle heavy materials.

Occupational Title: Lathe Operator

General: Operates lathe to perform one of a series of operations such as turning, boring, threading, or facing of metal work pieces according to specifications on production basis.

Duties: Tends one or more previously set-up lathes. Lifts workpiece manually or with hoist and places and secures it in holding fixture or in automatic feed mechanism. Starts machine and turns handwheels to feed tools to workpiece, and engages automatic feed. Observes machining cycle. Verifies conformance of machined work to specifications using fixed gauges, calipers and micrometers. Changes worn tools, using wrenches. Adjusts controls to various speeds, feed rates, and depth of cut.

Special Skills:

Mental:

Ability to read and properly interpret specifications and exercise good judgment in assessing quality of product.

Physical:

Ability to handle heavy metal work pieces as necessary.

Occupational Title: Machine Tender

General: Performs variety of tasks associated with the particular equipment or machine being tended. Keeps machine operating to maximum effectiveness by performing necessary minor adjustments, maintenance and other operations.

Duties: Sets up and operates various machines. Installs dies, bushings, etc. on machines according to work order specifications using clamps, bolts, and hand tools. In the case of tending furnaces, sets thermostatic controls to obtain specified temperature level. Assists machine operator as necessary to insure optimum output and performance at all times. Observes machining cycle.

Special Skills:

Mental:

Constant vigilance and monitoring of machine performance. Ability to react quickly to take necessary corrective action in the event of machine failure.

Physical:

Ability to use a wide variety of manual tools and devices in the performance of task.

Occupational Title: Tool and Die Maker

- General:** Informally designs, develops, fabricates and repairs highly intricate tool dies, jigs, fixtures and gauges. Works from engineers' prints and sketches or may design tools based only on knowledge of part to be produced. Uses machine tools and precision hand tools to maintain extremely close tolerance. Work includes highly skilled fitting, timing and adjusting.
- Duties:** Plans entire procedure and sequence of operations with a minimum of supervision. Makes all necessary computations using algebra, geometry, trigonometry and pertinent formulae to solve complex dimensional problems of locations, compound angles and contours, and other irregular shapes. Lays out rough stock using precision measuring instruments. Relies on past experience and background knowledge to design tools, jigs, fixtures, and gauges without engineering specifications. Sets up machines, and selects, sharpens and prepares tools, cutters and drills. Designs and makes any special tools or fixtures and improvises complicated supplemental setups as necessary to complete a project. Does precision hand fitting such as details not specified on prints, interchangeable parts and alignment of punches and dies. Makes own tryouts. Work requires knowledge of working properties of metals such as tool steel, stainless and aluminum and ability to make proper allowance for distortion in heat treating operations. Typical operations include making complex production gauges, jigs and fixtures, progressive and compound dies, with many interrelated locations or irregular locations or irregular surfaces requiring tolerances of + .0001 inch or less on finishing operations. Analyzes intricate drawings and determines generally how work is to be laid out. Frequently required to develop and fabricate tools and dies to perform specified operations of parts, working without print or sketches with only the part itself as a reference. Often experimental nature of work requires that no readily measurable tolerance can be allowed.

Special Skills:

Mental:

Ability to understand instructions, perform mathematical calculations in solving design problems, plan and schedule work requirements, and determine quality of work.

Physical:

Must possess manual dexterity to control and set up equipment and materials and be able to operate and control bench lathes, engine lathes, shapers, mills, drill presses, die filers, Do-All saws, surface, cylindrical, and bench grinders and jig borers.

Must be able to use a complete set of bench and hand tools common to the trade; measuring equipment such as sine bars and plates, comparators, vernier calipers, micrometers, dial indicators, micro-limit gauges, height gauges and gauge blocks.

Occupational Title: Electrical Components Assembler

General: Works in progressive assembly line operations to assemble portions of electronic units. Work is normally processed but may perform flow line work which is not processed where close supervision is available. May assemble standardized sub-assemblies that are not set up on a flow line but are repetitive in nature.

Duties: Works from simple diagrams, process sheets or direct instructions to assemble panels, sockets, and fuse holders and electrical components such as resistors, capacitors, coils, relays, transformers and condensers. Inserts sleeving where necessary and solders both ends of components to their designated tie points using pliers, cutters, soldering iron and solder. Assembles panels where components may be in any combination and mounted on either side. Identifies components by sight comparisons and positions panels in jig where necessary. Assembles components such as plugs and connectors to cable leads, wrapping and soldering as required. When wrapping leads to terminal strip, reads simple blueprints or diagrams or refers to sample to determine which leads go to each lug on the terminal strip. Installs cables, stripping ends, wrapping around terminals and soldering as necessary. Assembles lug to designated cable leads as follows: Puts tinned lead through lug, squeezes lug into wire with long nose pliers, bends wire back, cuts off excess with wire cutters and reclamps wire and lug together. Solders wrapped joint. As necessary, adds coding sleeve with numbered code before assembling to lug or terminal strip. Frequently rebraids shielding on wire by pulling out wire braid with pick and rebraiding by hand, twisting ends and tinning on end to hold braid. May be required to assemble lugs to jumpers instead of to cable leads. As necessary, measures jumpers to length, strips and tins the ends to designated length before assembly to lugs or panels. Positions

sockets on assemblies and attaches as specified. Lays cable in chassis as required. Wraps and solders components such as bus wire, resistors or condensers to designated pins.

Special Skills:

Mental:

Ability to understand written or verbal instructions and to read and interpret simple diagrams and process sheets and identify components.

Physical:

Must possess manual dexterity to operate and control tools and equipments and be able to use hand soldering irons of all types, soldering pots, wire stripper, wire cutters, pliers, knife, scissors, pick, solder, flux, screwdriver, lacquer, small artist type brushes, scale, tweezers, soldering aid, heat sink, spintite wrenches and other miscellaneous hand tools.

Occupational Title: Machine Tool Operator

General: Operates a variety of shop equipment to perform production operations where machines are set up by higher rated employees. May perform routine setups on standardized, short cycle operations.

Duties: As required, makes minor adjustments to machine during operation where some understanding of the machining properties of metals is necessary. May change speeds and feeds as noted on process sheet. Performs routine tool changes as tools become worn, and sharpens tooling where dimensions can be maintained without difficulty. Utilizes inspection instruments to make routine dimensional checks on parts which have been machined. Utilizes hand tools to set up machines for standardized, short cycle operations. May assist higher rated operators in performing more difficult setups.

Special Skills:

Mental:

Ability to understand written and verbal instructions, interpret prints and process sheets.

Physical:

Must possess manual dexterity to utilize tools, materials, and equipment and to operate various types of lathes, milling machines, drill presses, grinders, borematic machines; various types of routine inspection instruments, and assorted hand tools.

Occupational Title: Mechanical Specialist

General: Specializes in installation, repair and test of all mechanical units.

Duties: Disconnects, removes and replaces malfunctioning unit(s). Disassembles unit and cleans functioning parts as necessary and inspects unit for wear or damage. Repairs, replaces or adjusts components, such as bolts, springs, cables, connectors, hoses, relays, etc. Tests magnetic, hydraulic and pneumatic control valves that are used to open or close units. Sets up test equipment and structures to evaluate performance of equipment/component when it has been reassembled.

Special Skills:

Mental:

Ability to understand and interpret mechanical relationships, isolate and diagnose mechanical failures.

Physical:

Ability to handle a wide variety of hand tools such as wrenches, screwdrivers, calipers, gauges, micrometers, and other mechanical test equipment.

Occupational Title: Graphics Coordinator

General: Coordinates and expedites flow of graphics materials including drawings, blueprints, illustrations, layouts, reference materials, etc.

Duties: Reviews requirements with requestor of graphics materials, establishes work schedules to insure timely development and completion of graphics materials. Confers with artists, illustrators and reproduction personnel, and makes work assignments based upon time, cost and capability considerations. Locates proper materials and arranges with requestors for proper transportation of materials when finished.

Special Skills:

Mental:

Ability to understand requestor's requirements and interpret these into specific job orders.

Physical:

None specifically required.

Occupational Title: Unit Assembler

- General:** Assembles functional parts or pieces to form a complete unit. Selects parts/pieces to be assembled and organizes and constructs them in the proper sequence to produce a totally integrated product.
- Duties:** Assembles metal products from parts as specified by work orders, diagrams and layouts. Aligns components in holding/handling devices, files or grinds edges, drills, cuts, rivets, crimps, or spot welds parts essential to molding these individual elements into a complete unit. Tests and inspects unit for proper operability or construction when assembly is completed.
- Special Skills:**
- Mental:
Proper ability to read and interpret blueprints, diagrams, work orders, etc. and visualize and interpret mechanical relationships.
- Physical:
Must be able to use a variety of manual tools and measuring instruments in the performance of the unit assembly operations.

Occupational Title: Foreman

General: Supervises and coordinates activities of a number of workers engaged in assembly, machine and other production operations such as chipping, grinding, welding and riveting on various materials and products.

Duties: Studies production schedules and estimates man-hour requirements for completion of job assignments. Interprets company policies to workers and enforces safety and health workspace regulations. Interprets specifications, blueprints, and job orders to workers and makes duty assignments. Establishes or adjusts work procedures to meet production schedules and initiates or suggests plans to motivate workers. Recommends or initiates personnel action such as promotions, transfers, discharges, and disciplinary measures. Maintains time and production records.

Special Skills:

Mental:

Requires in-depth knowledge of machine and equipment capabilities and capacities. Must possess ability to analyze work problems, assist workers in solving work problems and recommend measures to improve production methods, equipment performance, the quality of the product, and suggest changes to working conditions and use of equipment to increase efficiency of shop, department, or work crew. Must also have ability to estimate, requisition and inspect materials and train workers as necessary.

Physical:

Ability to set-up machines and equipment as required and be physically able to perform the same activities/operations as subordinates, should the need arise.

Occupational Title: Analyst

General: Analyzes product or equipment specifications and performance requirements to conceive practical designs which can be produced by existing manufacturing and erection facilities and methods.

Duties: Applies established engineering principles to design and develop mechanical, electrical, electronic, or chemical processing equipment, products, facilities or processes and prepares related installation, operation and maintenance specifications and instructions. Consults with customer representatives and company personnel in research, production, planning, product safety to resolve any design problems. Analyzes engineering proposals, process requirements and related technical data pertaining to industrial equipment. Determines feasibility and practicality of designing new equipment or modifying existing ones from the standpoint of costs, available space, time limitations, company planning, availability of standard equipment and other economic factors affecting engineering decisions.

Special Skills:

Mental:

Requires complex decision making skills such as the ability to compile and analyze operational data and direct or perform intricate tests and research to establish performance standards for newly designed or modified equipment or products. Must be able to read and interpret engineering literature to continually keep up with the engineering "state-of-the-art".

Physical:

None specifically required.

Occupational Title: Inspector

- General:** Under close supervision and work direction routinely performs tasks limited to moderately complex inspection functions within one or all of the various inspection areas of the Division.
- Duties:** Reads and studies blueprints, specifications, and inspection procedures in order to become thoroughly familiar with assignment. May accomplish simple sketches and drawings for use in the inspection of various types of materials and components.
- Sets up and operates various inspection tools, equipment, and machines. Determines if machine or equipment is operating properly. Performs preventative maintenance on same.
- Receives and performs in-process or final inspection of materials and fabricated products in accordance with level of responsibility. Checks for conformance to drawings, quality of workmanship and general specification limitations. Assures that any deviation from drawing or specification is covered by a waiver or is re-worked before item involved is released.
- Witnesses various test or production operations to verify accomplishment within required standards. Writes deviation reports and maintains records of inspection work accomplished.
- Accepts or rejects materials or fabricated products based on analyses of inspection findings as applied to specification and requirements within assigned scope of responsibility. Writes rejection reports outlining reasons for action as required.
- May on occasion work with and/or assist visiting or resident customer inspection personnel or may be required to travel to vendor plants to perform inspection duties. Consults with foreman or supervisor regarding discrepancies found.
- Performs other related duties as assigned.

Special Skills:

Mental:

Ability to make sound judgments concerning final quality of workmanship of final product.

Physical:

Must be able to operate a variety of hand tools, equipment and machines as required.

Occupational Title: Production Foreman

General: Under limited supervision, supervises and coordinates the activities of personnel in an assigned factory area on a particular shift. Responsible for the quality of workmanship, the maintenance of production schedules and the fabrication of products at a minimum cost consistent with good manufacturing practices. Administers the provisions of the union contract at the plant level.

Duties: Supervises the various manufacturing or associated operations in an assigned factory area, directing the flow of material for efficient use of machines and manpower.

Directs the sequence of operations in accordance with blueprints and fabrication instructions, making necessary changes in production schedules to economize on material, labor and to meet schedules.

Must be knowledgeable regarding highly complex operations, technical equipment, and processes such as hydrogen atmosphere heat treating furnaces, tube reducer machine and tooling.

Assumes complete responsibility for the safety and well being of all manpower and equipment under his direction.

Administers the provisions of the union contracts at the plant level, making recommendations to management to improve labor relations and situations not covered by the contract.

Offers suggestions to superiors for improving machines or methods and, in most cases, furnishes detailed information for cost improvement.

Establishes or assists in the establishment and maintenance of policies, methods, safety programs and work standards for his particular area.

Accepts special assignments from engineering and management for production or cost improvements.

Special Skills:

Mental:

Must be able to:

- Administer and interpret established practices and policies to cover problems and solutions that affect quality and quantity of workmanship to a considerable degree.
- Supervise hourly shop personnel and the equipment used in various manufacturing operations.
- Administer the provisions of the union contracts at the plant level and assist management in solving labor-management problems.
- Coordinate factors of manpower, materials, and equipment in such a way as to achieve timely production at a reasonable cost and at a certain standard.

Must be knowledgeable of manufacturing operations equivalent to two years beyond the high school level and must have special training in supervisory skills. Experience in manufacturing in a heavy metals or related industry is required. Should have some understanding of a job shop operation using engineering drawings and process operation travelers as a manufacturing guide.

Must present proper image of management to the union worker, as he is the only member of management that many hourly workers ever personally interact with.

Physical:

Ability to set up machines as required and be physically adept in performing the same activities/operations of subordinates should the need arise.

Occupational Title: Supervisor

General: Supervises, directs, coordinates and controls activities of a group of workers engaged chiefly in one type of machine function or plant/department operation.

Duties: Determines work procedures. Issues both written and oral instructions. Assigns duties to workers and examines work for exactness and neatness. Prepares composite reports of subordinates. Maintains harmony among workers. Adjusts errors and complaints. May be called upon to perform essentially same duties as other workers, or to assist subordinates in performing duties. Monitors time reports and other personnel records. Has responsibility for making employment requisitions, training and discharging workers as necessary.

Special Skills:

Mental:

Ability to assume responsibility for other workers performance. Coordinate efforts with other supervisors and management.

Physical:

Ability to perform same physical demanding operations as workers he supervises.

Occupational Title: Electrician

Duties: Plans and performs a variety of plant functions having to do with electricity, including installation and repair of wiring and electrical fixtures, apparatus and controls. Prepares diagrams and sketches showing location of wiring and equipments or follows blueprints prepared by others to insure that wiring is in proper conformance with these requirements. Measures, cuts, bends, threads, assembles and installs electrical conduit using such tools as hacksaw, and conduit bender. Pulls wiring through conduit, splices wires by stripping insulation from ends with knife or pliers, twisting or soldering wires together, and applying tape or terminal caps. Connects wires at proper points using hand tools. Installs central and distribution apparatus, such as switches, relays, circuit breaker panels, fastening them in place with screws or bolts using drills, wrench, etc. Connects power cables to equipment motors and installs grounding leads. Tests continuity of circuit to insure electrical compatibility and safety of all components, using standard instruments, such as ohmmeter, battery, and buzzer and oscilloscope. Observes functioning of installed equipment or system to detect hazards or need for adjustments, relocation or replacement.

Special Skills:

Mental:

Ability to read complex blueprints, wiring diagrams, etc. and make electrical connections in accordance with standard practices and regulations.

Physical:

Ability to effectively utilize a wide range of hand tools and test equipment in the installation and checkout of electrical systems.

Occupational Title: Guard

General: Provides protection and enforces security to industrial property and personnel, and maintains law and order within the facility or plant.

Duties: Stands guard or walks about premises of the industrial establishment to prevent theft, violence, or infractions of rules, to direct patrons or employees, and to answer questions relative to the services of establishment. Patrols assigned area or sits or stands at post to watch for suspicious persons or activities. Warns violators of rule infractions, such as loitering, smoking, or carrying forbidden articles such as guns, cameras, tape recorders, etc. Reports irregular activities or apprehends or expels individuals. Keeps order to prevent disturbances. Answers questions and gives directions on request. May guard shipments of valuables or classified material between establishments and other locations. Examines credentials at entrance to facility and grants or denies entry to personnel.

Special Skills:

Mental:

Ability to understand, retain and interpret rules and regulations and exercise good judgment based upon this information.

Physical:

Ability to physically handle violators if necessary including use of firearms and other weapons.

Occupational Title: Reproduction Worker

- General:** Operates numerous types of reproduction equipment which duplicates (by photographic process) printed material, such as photographic positives and negatives, tracings, and documents, on sensitized paper, cloth, or film.
- Duties:** Places original or sensitized material in vacuum frame. Sets controls to regulate exposure time according to line density of original and type of sensitized material. Turns on arc lights to expose sensitized material, imprinting original on material. Develops exposed material. Touches up reprint by tracing broken lines and removing spots and blurs, using chemicals, brushes and pens. May enlarge prints or reprint original in sections and piece sections together.
- Special Skills:**
- Mental:**
Ability to read and interpret job order requests and determine best method of reproducing material.
- Physical:**
Ability to operate and/or maintain equipment including filling the machine with paper and fluid and making minor adjustments to improve quality using a variety of hand tools/devices. Must be able to feed paper at rapid rate.

Occupational Title: Building Supervisor

General: Directs operation and maintenance of plant buildings and other structures.

Duties: Hires, trains and supervises building personnel such as maintenance men, electricians, plumbers, carpenters, painters, janitors, receptionists, and guards. Plans proper sequence of maintenance work. Inspects property and confers with subordinates to determine condition of property, and alterations or repairs required. Determines work that can be performed by building personnel or obtains bids from outside contractors. Prepares construction specifications or plans, obtaining advice from engineering consultants. Assembles and analyzes contract bids. Submits bids and recommendations to supervisors. Supervises contracted projects to verify their adherence to specifications. Purchases building and maintenance supplies, machinery, equipment, and furniture. Plans and administers building departmental budget.

Special Skills:

Mental:

Must exercise good judgment in arriving at most cost-effective way to handle alternations/repairs.

Physical:

None specifically required.

Occupational Title: Welder

General: Performs all types of manual welding, gas electric arc, submerged arc, gas shielded arc (heli-arc, airconatic arc, etc.). Required to pass any qualification test (A.S.M.E., A.B.S., U.S.C.G., U.S.N., etc.) required by customer. Expected to be familiar with best technique for welding familiar material and acquire new techniques without repeated instructions. Must exercise sound judgment in order to prevent any equipment, product, or injury to personnel.

Duties: Receives and interprets instructions, prints, etc. Plans welding procedure in order to perform activities requiring a working knowledge of the welding properties of various types of metal, a wide variety of consumable electrodes and rods, welding heats, and the effect of shrinkage, warpage, and expansion. Checks and/or adjusts voltage and amperage of power source in order to meet prescribed welding procedures. Does open-arc cladding. Preheats material to specified temperature or keeps material cool. Uses gas shielded arc equipment. Does burning, brazing, etc., as required. Cleans own welds, and peens if necessary. Works in fitup and assembly as directed, to include routine, repetitive, or jig-type fitup, and/or assists fitup personnel, as necessary. Production must meet specified quality and quantity requirements. Keeps work area clean and orderly. Moves material into, through, and away from process.

Special Skills:

Mental:

Ability to understand written and verbal instructions, to read and interpret prints, to plan and schedule work process, and to select proper procedures for the work.

Physical:

Must possess manual dexterity to operate various types of electric and gas welding equipment with assessories, air-arc equipment, burning equipment, clamps, handling and positioning equipment, heating and ventilating equipment, hand tools, measuring instruments, and control materials.

Occupational Title: Specialist

General: Sets up and operates assigned equipment. Exercises sound judgment in order to prevent any damage to equipment, product, or injury to personnel.

Duties: Receives and interprets instructions. Sets up and operates equipment to perform any operation within their capacity. Work is usually of a routine nature. Prepares test plates and coupons for test purposes, heat treating tubes by electrical resistance or local heat treating, peg fin cutting. Operates aluminum pot and casting machine (includes preheating and melting aluminum and alloys and cleaning material with acid or steam), and performs other various assigned operations.

Moves material into, through, and away from process. Performs minor lubrication, such as lubricating dies, etc.

Production must meet specified quality and quantity requirements. Keeps work area clean and orderly.

Special Skills:

Mental:

Ability to understand written and verbal instructions and to plan and schedule work process.

Physical:

Must possess manual dexterity to control and operate equipment and handle materials. He also must be able to utilize arc welding and electric ac transformer equipment and accessories, small stamping press, aluminum pot and casting machine, acid container, cleaning equipment, rigging gear, etc., gas burners, air and water cooling systems, furnaces, pyrometers, tables, graphs, grinders, chipping hammers, hand tools, measuring instruments, jib hoist and crane.

Occupational Title: Truck Operator

General: Operates and services trailer truck. Knows and abides by public and company traffic regulations. Responsible for specified paperwork procedures. Exercises sound judgment in order to prevent any damage to equipment, product, or injury to personnel.

Duties: Receives and interprets instructions. Operates trailer trucks as assigned to move materials and products between and within storage areas and shop.

Loads and unloads vehicles manually or with available material handling equipment. Maintains proper load placement and distribution. Hooks and unhooks material. Services equipment regularly and reports any need for maintenance between regular inspections. Assists in repair of automotive equipment, as directed.

Special Skills:

Mental:

Ability to understand written and verbal instructions/regulations and to plan and schedule work process.

Physical:

Must possess manual dexterity to operate and control equipment and handle materials. He must be able to utilize various sizes and makes of trailer trucks with controls and accessories, hand tools, jib hoist, and crane.

Occupational Title: Blast Operator

- General: Cleans metal surfaces with grit or shot blast. Operates machines and handles blast to get surface cleaned thoroughly and uniformly, being careful to avoid holding stream in one place long enough to erode or groove material. Exercises sound judgment in order to prevent any damage to equipment, product, or injury to personnel.
- Duties: Receives and interprets instructions. Locates and moves material into, through and away from process. Sets up vessel on car or arranges small pieces in blasting room, starts machine, and sprays surfaces with grit or shot to clean as required. Reports any need for electrical or mechanical repairs of equipment in the system.
- Always wears protective equipment during blast operations. Keeps equipment and area clean and orderly at all times, putting surplus grit and shot in specified containers or placing back in system as directed. May be required to direct helper, if assigned. Production must meet specified quality and quantity requirements.
- Special Skills:
- Mental:
- Ability to understand written and verbal instructions, plan and schedule work progress, and to determine quality of work.
- Physical:
- Must possess manual dexterity to operate and control equipment and material. He also must be able to utilize portable and stationary grit blast and shot blast machines, protective equipment, i.e. helmet, gloves, etc., hose, nozzle, light, handling and positioning equipment, jib hoist, and crane.

Occupational Title: Crane Operator

General: Operates overhead traveling cranes. Responsible for safety of personnel, equipment, and materials, and must exercise extreme care to see that load is properly slung, elevation clears floor machines, and men are cleared from path of travel. Must be in good physical condition, have excellent vision and coordination, and exercise sound judgment.

Duties: Receives and interprets instructions. Operates overhead crane to transport materials within and between various shop departments. Uses overhead crane, loads and unloads trucks, cars, and other vehicles. Sets up and re-positions material in process and makes various other lifts as required, working in response to verbal and hand signals from floor. Actuates safety warning equipment when moving crane. Observes operating condition of crane motors, controls, switches, brakes, and safety devices, and notifies maintenance personnel of any irregularity. May be required to assist in electrical or mechanical repairs to crane.

Special Skills:

Mental:

Ability to understand written and verbal instructions; to understand hand signals; and to determine distances, clearances, and safe procedures.

Physical:

Must possess manual dexterity to operate and control equipment and possess visual acuity to control materials. Must be able to operate various sizes and types of overhead cranes (all cab models except double crane) with attached equipment and controls.

Occupational Title: Press Operator

General: Performs any press work and hand forming activities. Reads blueprints and is thoroughly familiar with characteristics of material and its reaction to hot and cold forming operations. Responsible for safe and effective performance in order to prevent any damage to equipment, product, or injury to personnel.

Duties: Receives and interprets instructions, prints, sketches, etc. Performs any hot or cold press work within the capacity of the equipment, checks setup of dies in press and measures progress of forming when not setup for positive stop or complete stroke operation. May be required to direct helper(s) if assigned. Moves material into, through, and away from process. Production must meet specified quality and quantity requirements. Keeps work area clean and orderly. May be required to perform minor lubrication. Due to work load fluctuations, may be assigned to other duties, as needed.

Specific Skills:

Mental:

Ability to understand written and verbal instructions and to read and interpret prints and sketches and to plan and schedule work progress and to determine quality of work.

Physical:

Must possess manual dexterity to operate and control equipment and material. Must be able to operate 6,000 ton beam press with auxiliary equipment, 2,000 ton flange press with auxiliary equipment, bending plate, hand tools, measuring instruments and jib hoist, crane.

Occupational Title: Grinder

General: Performs grinding operations and exercises sound judgment in order to prevent any damage to equipment, product, or injury to personnel.

Duties: Receives and interprets instructions. Performs any grinding jobs assigned, repositioning material for accessibility if necessary. Selects proper size and type of grinder and finishes weld crown or other surfaces as directed. Marks any weld defects uncovered while grinding and cleans surface irregularities. May work from dimensioned templates or sketches, making own pattern or measurements on material when necessary. Grinds any weld design and finishes weld crown or other surfaces to specified or acceptable contour and finish. Removes any grinding residue from surface of material. Moves material or work piece into, through, and away from process. May be required to deburr work piece.

Production must meet specified quality and quantity requirements. Keep work area clean and orderly.

Special Skills:

Mental:

Ability to understand written and verbal instructions, to read and interpret sketches, to plan and schedule work process and to determine quality of work.

Physical:

Must possess manual dexterity to operate and control equipment and material. Must be able to operate and manipulate a wide diversity of grinding equipments including: powered sanders or grinders, de-burr tools, various types and sizes of abrasives and attachments, handling and positioning equipment, hand tools, measuring instruments, jib hoist and crane.

Occupational Title: Floorworker

General: Assists in and/or performs fabricating and/or service operations as assigned. Exercises sound judgment in order to prevent any damage to equipment, product, or injury to personnel.

Duties: Receives and interprets instructions. Works as helper moving material into, through, and away from a machine or process, or performs auxiliary operations independently, as assigned. May be required to assist in moving and setting up equipment, when necessary. Assists in setup and repositioning of heavy products for welding or other stages of fabrication, as required. Performs routine duties independently, to include cleaning, grinding induction welds, shearing fins, simple assembly, forming, or cutting, etc.

Production must meet specified quality and quantity requirements. Keeps work area clean and orderly.

Special Skills:

Mental:

Ability to understand written and verbal instructions and to judge quality of work.

Physical:

Must possess manual dexterity to operate equipment and control materials. Also must be able to utilize various hand and power tools, measuring instruments, installed and portable equipments for cleaning systems, furnaces, testing, bending, pressing and forming equipments; cutting off and squaring machines, grinders, rigging and moving equipment, crane, and job hoist.

Occupational Title: Magnaflux Operator

General: Performs magnetic tests and localized stress-relieving operations. Responsible for careful inspection of magnafluxed area and reporting results thereof. Must exercise extreme care for safety of material while stress-relieving welds and handling heavy materials in order to prevent any damage to equipment, product, or injury to personnel.

Must pass Navy written and operational tests, when required.

Duties: Receives and interprets instructions. Prepares and performs magnaflux magnetic particle tests on any magnetic materials and welded pressure parts such as socket welded tube nipples, nozzles, girth seams, long seams, welded tube ends, and seal welded-end plugs. Keeps record of all materials inspected, and marks any flaws discovered for chipping and rewelding. Moves work piece into, through, and away from process. Performs heat treating and localized stress relieving, and maintains temperatures as indicated by fusible crayon marks on material or thermocouples attached to recorder.

Usually assigned to other duties including, but not limited to, the following examples, checking straightness of headers, helping plug headers, cleaning and grinding, helping load furnace, etc., as work load fluctuations dictate.

Production must meet specified quality and quantity requirements. Keeps work area clean and orderly. May direct helper, if assigned.

Special Skills:

Ability to understand written and verbal instructions, plan and schedule work process, determine quality of work, and ability to determine safety limits.

Physical:

Must possess manual dexterity to operate and control equipment and materials and be able to utilize magnaflux equipment, powder and accessories, thermocouples, recorder, light, induction, heating equipment, fusible temperature indicators, and positioning equipment (jib hoist and crane).

Occupational Title: Equipment Operator

General: Operates power saws. Exercises sound judgment in order to prevent any damage to equipment, product, or injury to personnel. Keeps pertinent records concerning materials used and tests conducted.

Duties: Receives and interprets instructions. Marks off and cuts material according to specifications or cuts material previously laid out. Removes burrs from cut material. Squares tube ends and machines weld bevel on ends of tubes. Adjusts scarfing machine to provide specified bevel and counterbores. Changes abrasive discs and saw blades when necessary. Prepares and keeps accurate records on induction, hand, and qualifying weld joint tests.

Production must meet specified quality and quantity requirements. Keeps work area neat and orderly.

Special Skills:

Mental:

Ability to understand written and verbal instructions and to read and interpret specifications.

Physical:

Must possess manual dexterity to operate and control equipment and materials. Utilizes swing-cut abrasive disc, cut-off machine band saw, scarfing machine, bar shears with allied equipment and accessories, hand tools, measuring instruments, grinders, files, and jib hoist.

Occupational Title: Union-Melt Machine Operator

- General: Sets up and operates automatic and semi-automatic submerged arc welding equipment. Proficient at manual welding to weld a sound root pass in joint, as necessary. Varies machine settings for most efficient operation. Maintains specified temperatures of preheat. Must exercise sound judgment in order to prevent any damage to equipment, product or injury to personnel.
- Duties: Receives and interprets instructions. Locates and moves material to area. Sets up and operates submerged arc welding machine to perform any work within capacity of machine. Material is positioned on rolls where it is checked for balance and alignment. Powered and idler rolls are moved to accomodate length of material and clear any attachments during rotation. Manually welds test plates and starting blocks and/or tabs at end of seam or welds root pass in groove, when necessary, and cleans groove thoroughly. Checks and/or adjusts amperage and voltage at power source to meet required procedures. Adjusts current, roll speed, electrode feed, machine head and maintains proper voltage to insure proper weld. Obtains wire and flux to refill flux hopper and electrode reel, as necessary. Cleans own weld after each pass. Preheats material to specified temperature when necessary. Performs open arc and/or submerged arc cladding. Moves work piece into, through, and away from process. Production must meet specified quality and quantity requirements. Keeps work area clean and orderly.
- Special Skills:
- Mental:
- Ability to understand written and verbal instructions and determine quality of work.
- Physical:
- Must be capable of lifting and handling heavy materials as required.

Must possess manual dexterity to control and operate equipment and control material; utilize and operate automatic and semi-automatic submerged arc weld machine and auxiliary equipment, tools, scaffold, manual welding equipment, heaters, hammer, miscellaneous hand tools, instruments, jib hoist and crane.

Occupational Title: Chipper

- General:** Performs chipping and grinding operations. Grinds chisels for best performance and control cut to maintain specified contour or line. Exercises sound judgment in order to prevent any damage to equipment, product, or injury to personnel.
- Duties:** Receives and interprets instructions. Moves material into, through, and away from process. Performs various chipping and grinding operations such as removing backing bead and root pass from deep nozzle welds, removing crown of weld seams, removing clips and braces. Chips panels to specified width, cleans up openings, and grooves and shapes irregular welds. Cuts grease grooves, chips and grinds various weld designs and performs miscellaneous chipping and grinding as assigned. Removes chipping and grinding residue from material. May perform tube rolling, riveting, or other operations as production requirements dictate.
- Production must meet specified quality and quantity requirements. Keeps work area clean and orderly. May be required to deburr work piece, if necessary.
- Special Skills:**
- Mental:**
- Ability to understand written and verbal instructions and to determine quality and quantity of work.
- Physical:**
- Must possess manual dexterity to operate and control equipment and to control materials. Utilizes portable chipping hammers and grinders, hoses, tube rollers, expander, etc., chisels, measuring and marking instruments miscellaneous power tools, reamers, and any other equipment necessary to carry out assigned job.

Occupational Title: Utility Man

General: Assists operators on various tube fabricating machines. Co-operates with others in crew to assure safe and effective performance. Exercises sound judgment in order to prevent any damage to equipment, product, or injury to personnel.

Duties: Receives and interprets instructions. Works in crew as helper on tube shop operations to include fin welding, sawing and scarfing, sinking, upsetting, squeezing, operating fin shears, roto-blast, and hydrotest, straightening, buffing, and panel welding, etc.

Usually works under more or less direct supervision, handling and helping to handle tubes or other material into and out of machines, and through processes. Also polishes tube ends, when necessary. Production must meet specified quality and quantity requirements. May be assigned to intra-plant material handling. Keeps work area clean and orderly.

Special Skills:

Mental:

Ability to understand written and verbal instructions and to determine quality and quantity of work.

Physical:

Must possess manual dexterity to operate and control equipment and to control materials; use racks, slings, hoist, hammers, wrenches, miscellaneous hand tools, jib hoist and crane.

Occupational Title: Spinning Machine Operator

- General:** Sets up and operates tube sizing and tube swaging machines. Checks to see that machines are properly set up, material is properly heated and specified amount of reduction on end of tube is maintained. Exercises sound judgment in order to prevent any damage to equipment, product, or injury to personnel.
- Duties:** Receives and interprets instructions, prints, etc. Sets up machine by changing dies, fixtures and makes adjustments for specified tube diameter and adjusting stroke setting. Moves material into, through, and away from process. Heats material in furnace to specified temperature and performs other operations necessary to size and swage tubes to specifications. Paints identification numbers on finished pieces. May be required to keep certain records.
- Production must meet specified quality and quantity requirements. Keeps work area clean and orderly.
- Special Skills:**
- Mental:**
Ability to understand written and verbal instructions and to read and interpret prints and determine quality and quantity of work.
- Physical:**
Must possess manual dexterity to operate and control equipment and materials, be able to operate tube sizing and tube swaging machines, hand tools, measuring instruments, jib hoist and crane.

Occupational Title: Coating Machine Operator

General: Sets up and operates machine for extruding coating on welding electrodes. Provides properly coated electrodes of numerous sizes and types, requiring a thorough understanding of coating machine and auxiliary equipment. Should avoid waste of coating material by maintaining alert observation of quality of product. Must exercise sound judgment in order to prevent any damage to equipment, product, or injury to personnel.

Duties: Receives and interprets instructions. Sets up machine for each size and type of rod to be coated, changing extrusion dies and other internal components. Packs plastic coating mixture in cylinder of extrusion press, and adjusts hydraulic pressure control. Sets or checks automatic oven controls for specified drying conditions, and starts conveyors. Aligns extrusion die to provide concentric coating on electrode, checks at intervals with a dial micrometer gauge.

Production must meet specified quality and quantity requirements. Keeps work area clean and orderly; cleans machine and may perform minor lubrication.

Special Skills:

Mental:

Ability to understand written and verbal instructions to determine quality and quantity of work, and to plan and schedule work process.

Physical:

Must possess manual dexterity to operate and to control equipment; be able to operate and utilize rod coating machine with auxiliary equipment and electric oven, dies, miscellaneous hand tools, measuring instruments, micrometer gauge, jib hoist and crane.

Occupational Title: Fit-up Worker

- General:** Assists in fit-up and assembly operations. Has sufficient acquaintance with the tools and techniques of the fit-up trade to be fully useful to mechanic and be able to replace him temporarily. Must have a thorough knowledge of shop math and blueprint reading and be able to make sound tack welds and use all tools safely and effectively in order to prevent any damage to equipment, product, or injury to personnel.
- Duties:** Receives and interprets instructions. Assists fit-up personnel, as needed, on all types of fit-up and assembly. Obtains tools and moves material to, through, and away from process. Checks parts, bolts, or tack welds components together and performs any chipping and grinding assigned. Performs independent preparatory or sub-assembly operations of a routine nature. Cleans own welds. May be required to de-burr work piece.
- Due to workload fluctuations, may be assigned to other duties. Production must meet specified quality and quantity requirements. Keeps work area clean and orderly.
- Special Skills:**
- Mental:**
- Ability to understand written and verbal instructions, to read and interpret prints, to use shop mathematics, and to determine quality of work.
- Physical:**
- Must possess manual dexterity to operate equipment and utilize tools and control materials including hand and power tools, measuring instruments, flame cutting equipment, electric welding equipment, heating equipment, grinders, handling and positioning equipment, and face plates.

Occupational Title: Systems Analyst

- General:** Under limited supervision, conducts studies to determine the adequacy of existing EDP systems and the needs for new systems. Responsible for the completion of all work on an assigned system including the analysis, flow diagrams, programming, proper operation and indoctrination program of employees involved in the system.
- Duties:** Develops new and modified systems by analyzing existing systems; prepares flow diagrams, programs, assembles computer project folder, and prepares final forms; tests routines and makes preliminary analyses in the determination of the adequacy of the program. Conducts studies of the work flow of complex operations such as production control, inventory control, purchasing, payroll, timekeeping, accounting, etc. Directs the indoctrination and educational programs of employees involved in new systems or systems modifications to insure that the operations are performed as designed. Prepares clear and concise reports, proposals, procedures, manuals, and flow-charts in the implementation of data processing techniques, and designs documents, reports, IBM cards, and other forms to present information relative to the system being designed. Make recommendations to supervisor based upon review and evaluation of assigned duties, and periodically reviews systems to assure operation of systems as they were originally designed.
- Special Skills:**
- Mental:**
- Must make decisions and interpret problem areas in order to systemize operations for application to machine activity. Provides for optimum use of data processing equipment by proper analysis of project to the mechanical equipment. Has broad knowledge of the Electronic Data Processing, systems design, and application fields equivalent to a bachelor's degree in Business Administration,

Industrial Management, Accounting, or Math. Minimum one year experience in analysis, interpretation, and application of various industrial activities to computer mechanization.

Physical:

None specifically required.

Occupational Title: Clerk

General: Under immediate supervision prepares, records and compiles data, and maintains a variety of records and reports of a non-routine nature. May also receive visitors to the department and assist them as necessary.

Duties: Assists in the development and maintenance of accurate departmental records by performing such actions as verifying reports, locating, investigating, and determining causes of discrepancies in paperwork. Classifies, accumulates, and posts information as required for particular assignment. Receives and opens mail correspondence, etc. and takes appropriate action or passes on to authorized person for action. Initiates correspondence not requiring attention of the supervisor and receives or initiates telephone calls within boundaries of assigned responsibility. Operates typewriter, calculator, and other office machines in performance of related work. Performs other related duties as required.

Special Skills:

Mental:

None specifically required.

Physical:

None specifically required.

Occupational Title: Contract Analyst

General: Under general direction and guidance of the superintendent of production control, plans and coordinates the activities related to the contract and maintains an up-to-date contract schedule. Determines the effects of design and/or customer request changes on production schedules and completion dates.

Duties: Prepares and maintains a contract schedule for individual contracts in order to graphically identify the requirements for materials, customer releases, fabrication sequences, tooling, dies, jigs, fixtures and major inspection points. Expedites and coordinates activities on contract schedules to insure schedules and commitments will be met. Continuously reviews correspondence and internal communications to evaluate corrections and/or changes. Prepares regular status reports, critical items reports, price requests, and up-to-date schedules. Contacts customer to provide manufacturing status. Identifies and initiates necessary subletting work. Works closely with others to resolve problems which may impede in any way the fulfillment of contract schedules and expedites engineering with regard to requisitions and issuance of purchase orders, drawings and procedures.

Special Skills:

Mental:

Maintains an up-to-date status schedule on each assigned contract and represents management in contact with customers on contract status. Works under conditions involving a high degree of pressure. Has broad knowledge of a professional field equivalent to a Bachelor's Degree in mathematics or computer science. Basic abilities of planning and organizing, mechanical comprehension, ability and desire to work with and through people to get a job done. Has minimum one year's experience in the engineering computer programming or related fields such as proposal estimating.

Physical:

None specifically required.

Occupational Title: Draftsman

General: Under general supervision prepares production drawings of assembly and details of components and integral parts.

Duties: Works under direction of design project engineer, team leader, design draftsman and checker, or other assigned supervisor. Works from general arrangement drawings, sketches, layouts, and specifications furnished by supervisor. From information furnished, prepares production drawings of assembly and details of parts, specifying correct allowances, tolerances, etc. Checks his work for conformance with overall design with regard to clearances, arrangement, etc. Recommends modifications and changes to checker or assigned supervisor to improve or simplify design or facilities fabrication. May be assigned duties of checking drawings prepared by other draftsmen.

Special Skills:

Mental:

Must be able to visualize entire job and relationship of one component to another in order to provide best arrangement from sketches and layouts provided, and must have a general knowledge of drafting, manufacturing standards, and general knowledge of shop fabricating. Makes routine algebraic, trigonometric, geometric, and logarithmic calculations necessary to determine size, distances, and locations, and have a knowledge of information necessary to show on drawings for proper fabrication in shop.

Physical:

Ability to use a wide range of specialized drafting tools, French curve, slide rule, etc.

Occupational Title: Laboratory Technician

General: Under the close supervision of Technician II or Engineer I, assists in setting up assemblies, operates test equipment, and assists in recording and reporting the results.

Duties: Assists in the assembly and erection of equipment, performs routine tests and analyses, assists in the recording and reporting of test data, performs routine preventative maintenance on equipment, and performs other related duties as assigned.

Special Skills:

Mental:

Ability to use good common sense in handling dangerous materials, conducting, testing, and operating laboratory equipment. Knowledge of Physics/Chemistry required.

Physical:

Ability to operate the variety of test equipments, gauges, calibrators, etc.

Occupational Title: Expediter

General: Expedites and moves materials between steps in fabrication. Reads blueprints and determines identity and stage of fabrication of materials. Responsible for proper handling of material and specified paper work procedures.

Duties: Receives and interprets instructions and keeps records of materials, sub-assemblies, and component parts from the time they leave stock or storage status, until ready for shipment or storage. Expedites and moves materials between and within departments as schedule checking identity, status, and quantity of each item when necessary, and making out move orders for transfer to next stage of fabrication by material handling personnel, or moves material directly by use of fork trucks, bug, etc. Returns vehicle to designated area at end of shift. Due to workload fluctuations, may be assigned to other duties as needed.

Special Skills:

Mental:

Ability to understand written and verbal instructions and to read and interpret blueprints, determine stages of fabrication, and plan and schedule work procedures.

Physical:

Must possess manual dexterity to operate and control equipment and be able to handle and control blueprints, bills of material, various material records, orders, and reports, hand tools, measuring instruments, hand, electric, or gas trucks, slings, chains, cars.



APPENDIX B

SAMPLE DATA COLLECTION FORMS

Form A1

Company Hearing Protection Program
Noise-Related Effects Study

Subject
Number: _____

Item:
Personal History Data

1. Employee Clock Number: _____
2. Age: _____
3. Total Years Experience: _____
4. Years at Present Job: _____
5. Plant/Bay or Other Area Designation: _____
(indicate only if changed)
6. Job Title/Classification: _____
(indicate only if changed)
7. Shift: _____
(indicate only if changed)

Item:
Attendance Data

8. Number of Discrete Absences
 - A. 1972 _____
 - B. 1973 _____
9. Total Number of Days Absent
 - A. 1972 _____
 - B. 1973 _____

Subject
Number: _____

Item:
Accident Data

10. Occupational (Job)-Related Accidents.
(Itemize each accident description e.g. type,
source, nature and extent of injury, etc.)
Use a separate line for each accident type,
and indicate number of occurrences of a
particular type.

A. 1972 _____

B. 1973 _____

Subject
Number: _____

Item:
Medical/Health Data

11. Number of dispensary visits and nature of illness
(Do not include repeat visits for continued treatment or medication).

[illegible]

Subject
Number: _____

Item:
Hearing Conservation Program Data
(Latest (post-1970) Audiometric (Hearing Test)
Data Only)

12. Date of Test: _____

13. Hearing Data:

<u>Frequency (hertz)</u>	<u>Threshold</u>	
	<u>Left Ear</u>	<u>Right Ear</u>
500		
1000		
2000		
3000		
4000		
6000		

Yes

No

14. Hearing Protection Provided: _____

15. Date Issued: _____

16. A. Type of Protector:
(check only one block below)

Muff Type	Custom Molded	Inserts Standard Plugs	Valve Type	Swedish Wool	Integral Helmet Type	Other	Un- known

B. Make/Model:
(indicate) _____

AUDIOIMETRIC DATA																																																																															
LEFT EAR										RIGHT EAR																																																																					
SUBJECT ID	AGE	YEARS EXPER.	YEARS PREST.	BAY	LOCAT	JOCC	500	1000	2000	3000	4000	500	1000	2000	3000	4000	5000	6000	7000	8000																																																											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

ACCIDENT DATA																																																																															
ATTENDANCE DATA					INJURY TYPE					BODY PART AFFECTED																																																																					
SUBJECT ID	YEAR	MONTH	DAY	TIME	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6																																																															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

HEALTH DATA																																																																															
DIAGNOSTIC					SYMPTOMATIC																																																																										
SUBJECT ID	YEAR	MONTH	DAY	TIME	NE	DI	CV	OA	AD	RS	GL	UR	MS	BLANK																																																																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

APPENDIX C

SUMMARY DESCRIPTION OF COMPUTER SOFTWARE

Summary of Computer Programs and Data Processing

Data processing was accomplished by a series of computer main programs and specialized subroutines, each coded in the FORTRAN language. All programming activities utilized the IBM 370-155 computer system. These activities are best described as a logical sequence of tasks with a description of the programs and data flow involved in each task:

Task 1

Sorting and editing of new accident, attendance, and medical data for 1972/1973, collation with the original sample (larger plant complex) from 1966 - 1970, and production of tape files for new processing.

Input consisted of five punch cards for each of the subject workers containing pertinent study data from the 1972/1973 period.

Program 1A was used to check for errors in the preparation of the new data and produce a tape of valid information in a format suitable for further processing.

Program 1B collated that tape with the master tape of 1966 - 1970 data used in the original study to delete workers no longer included and produced two tapes; (1) a tape of the reduced sample containing 1966 - 1970 data and (2) a tape of the reduced sample containing the new 1972/1973 data but with control information applicable to sort categories from the 1966 - 1970 master tape.

Program 1C took the reduced sample tape of 1966 - 1970 data and produced a similar tape but for 1969 - 1970 only.

Program 1D matched the reduced sample tape of 1969 - 1970 data against the similar tape of 1972 - 1973 data and produced a tape containing differences between 1969 - 1970 and 1972 - 1973 frequencies by subject number. This tape was used in the subsequent Wilcoxon tests.

Task 2

Recomputation of original study data (not including Median tests) using the reduced high and low noise samples.

Program 2A formed frequency distributions for the high- and low-noise reduced samples.

Program 2B used the distributions produced by Program 2A to print out comprehensive listings for high- and low-noise samples in the original study format showing total number of workers, total frequencies and median frequencies of occurrence for each of the study dependent factors for the years 1966 - 1970 according to prescribed sort categories.

Task 3

Repetition of Task 2 with the reduced samples using only 1969 - 1970 data and the two year totals; production of the same type outputs using 1972 - 1973 data; execution of the Median tests on high noise vs low noise, 1969 - 1970 data, and high-noise vs low-noise, 1972 - 1973 data.

Program 2AA performed the same functions as 2A only utilizing two year data as input.

Program 2BB performed the same functions as 2B confined to a two year format and in addition produced the necessary input for Program 3.

Program 3 used the output of program 2BB and performed the Median tests using the FISHER and CHI - SQUARE tests. It provided listings of the test results according to sort category and also produced a tape of the same output.

Program 7 took the tape from program 3 and produced the same listings of Median test results but in a format more amenable to visual study.

The 1969/1970 and 1972/1973 data sets were handled independently as two complete replications of programs 2AA, 2BB, 3 and 7.

Task 4

Using the high noise sample only with 1972/1973 data, production of the same type data listings as in Task 3 only subject numbers arranged according to additional sort categories utilizing levels of hearing protection device usage.

Program 2AAA performed the same functions as 2AA but used only the high noise-sample of 1972/1973 data and sorted into the new device usage combinations.

Program 2BBB performed the same functions as 2BB using the new sort categories but did not produce any input for Median tests.

Task 5

Execution of Wilcoxon tests (1969/70 vs 1972/73 data for high-noise and low-noise samples to include hearing device usage categories; production of summary listings for use in optional manual statistical analyses (to be performed by NIOSH)).

Program 5 used the tape produced by program 1D to produce the Wilcoxon tests and summary listings for both high- and low-noise sample. It also made a tape of Wilcoxon results for use by program 6.

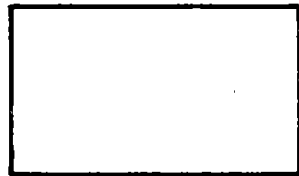
Program 6 reformatted the Wilcoxon test output into listings more amenable to visual analysis.

<u>Number</u>	<u>Name</u>
000317	RAW7273
003031	DATAMANE
006762	DATAMNCE
003092	DATA7273
008591	DATA6970
003135	DATAACOMB
003654	MEDN7273
002787	MEDN6970
001698	WILCOXON

LEGEND OF FLOW DIAGRAM SYMBOLS



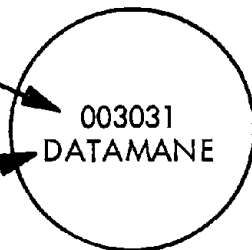
PUNCHED CARD INPUT



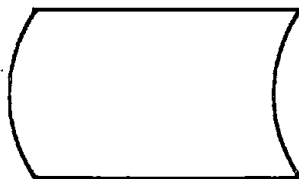
PROGRAM/ROUTINE/SUBROUTINE
USED IN PROCESSING OPERATION

TAPE NUMBER

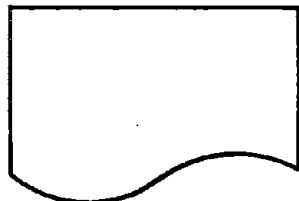
NAME OF TAPE



MAGNETIC TAPE FILE

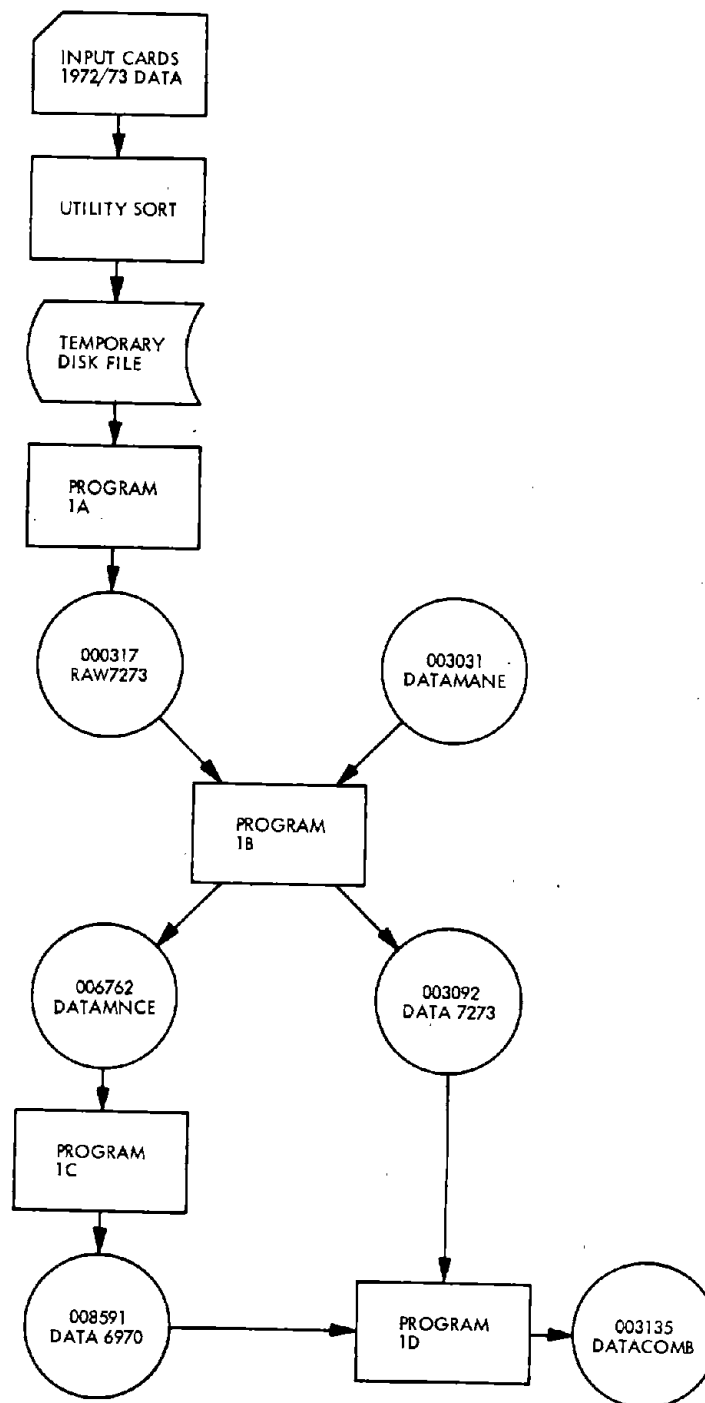


DISK FILE (USED FOR TEMPORARY
STORAGE OF DATA DURING PROGRAM
EXECUTION)

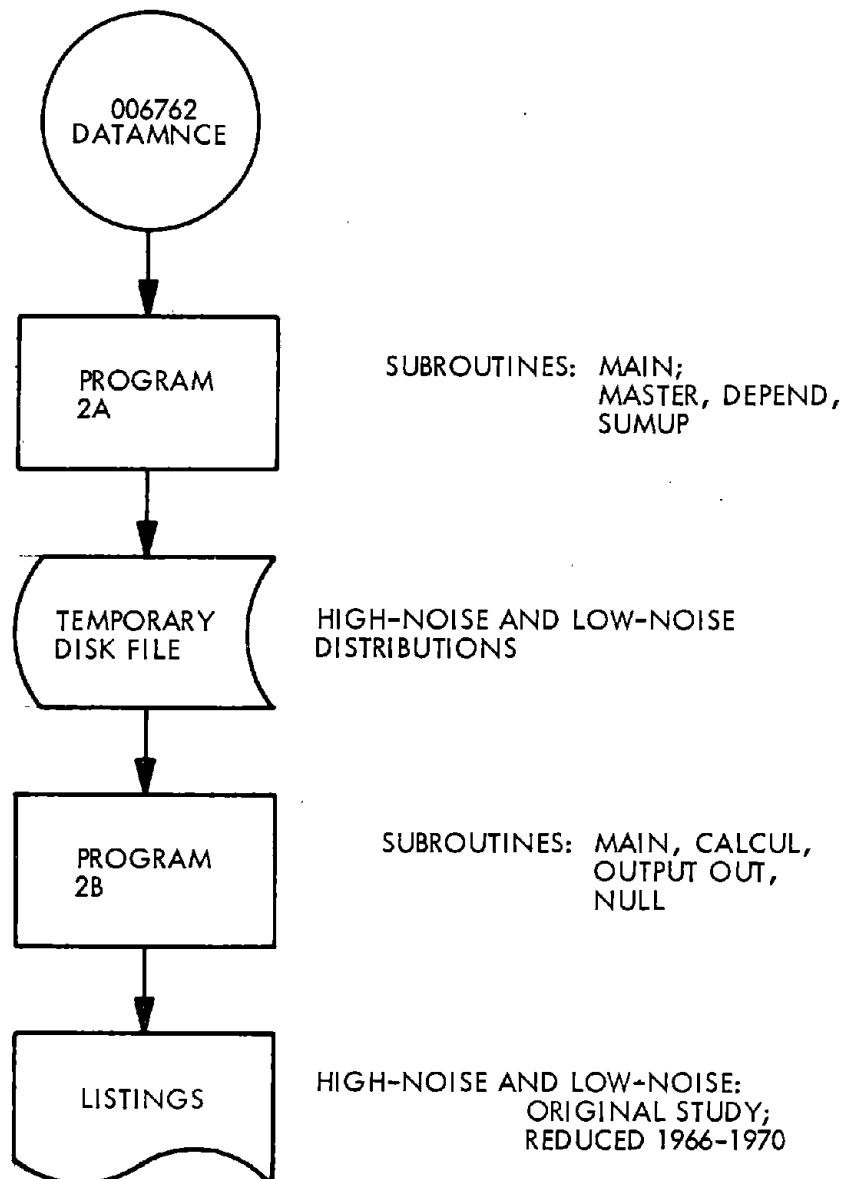


OUTPUT LISTING (PRODUCED ON MULTI-
COPY PAPER WHEN A VITAL REPORT)

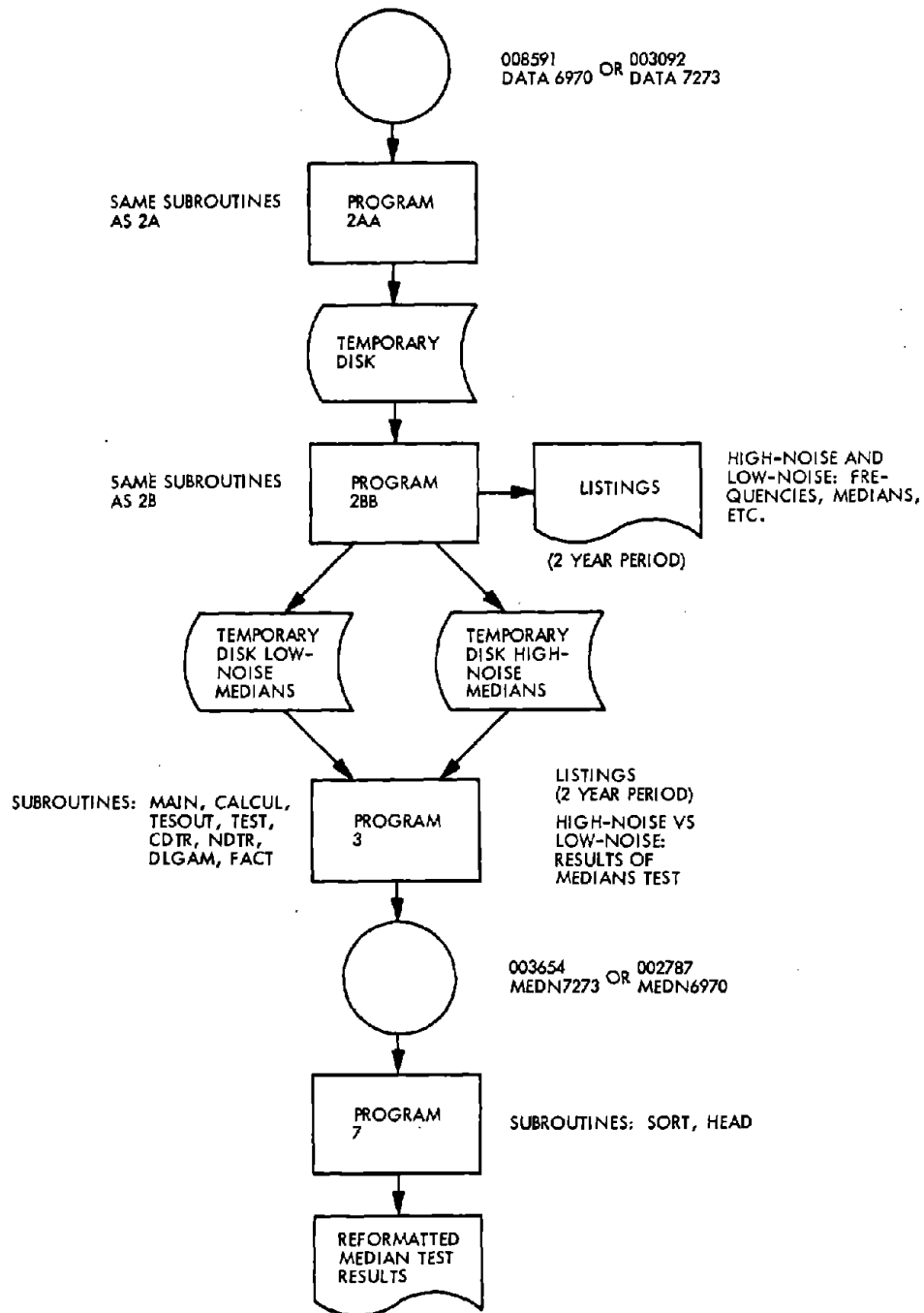
TASK 1



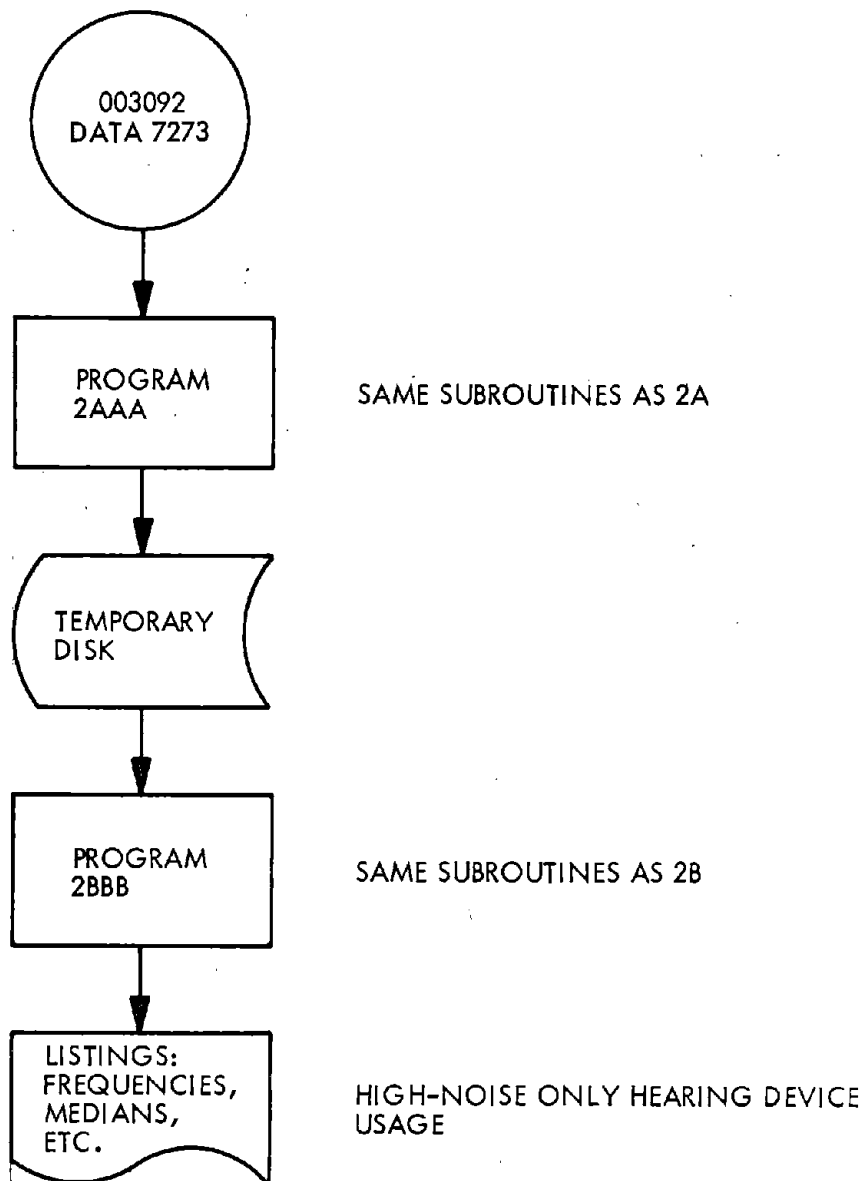
TASK 2



TASK 3: 2 REPLICATIONS (1969/1970 AND 1972/1973)



TASK 4



~~RO404~~
RO913

TASK 5

