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**The Determination of Behavior
Response Patterns in Fire
Situations, Project People II.
Final Report - Health Care**

September 1981

Sponsored by
**U.S. Department of Commerce
National Bureau of Standards
Washington, DC 20234**

and

**U.S. Department of Health and
Human Services
Washington, DC 20201**

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FINAL REPORT - HEALTH CARE**

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September 1981

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THE DETERMINATION OF BEHAVIOR RESPONSE
PATTERNS IN FIRE SITUATIONS, PROJECT PEOPLE II
FINAL REPORT - HEALTH CARE
by

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Prepared under Support from The Center for Fire Research
National Bureau of Standards, Program for Design Concepts

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August 31, 1981

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Notice

This report was prepared for the Center for Fire Research of the National Engineering Laboratory, National Bureau of Standards under Grant No. NB 8ONADA 1067. The statements and conclusions contained in this report are those of the authors and do not necessarily reflect the views of the National Bureau of Standards or the Center for Fire Research.

PREFACE

This report is a product of a joint effort of the Department of Health and Human Services (HHS) and the National Bureau of Standards (NBS) Center for Fire Research. The program is a continuation of an activity initiated in 1975. It consists of projects in the areas of: decision analysis, fire and smoke detection, smoke movement and control, automatic extinguishment, and behavior of institutional and other populations in fire situations.

This study was conducted under Grant No. NB8ONADA 1067, from the Center for Fire Research at the National Bureau of Standards. The research grant is titled: "The Determination of Behavior Response Patterns in Fire Situations, Project People II."

This report presents statistical analyses of the data obtained from the investigation of 59 fire incidents in health care facilities located in the State of Maryland, with one facility in Philadelphia. The variables analyzed include those pertaining to the buildings, the fire itself, and the actions of the participants in the fire incident. Individual summaries of each of these fire incidents can be found in an earlier companion report titled, "The Determination of Behavior Response Patterns in Fire Situations, Project People II," Report No. NBS-GCR-80-297.

Some comparisons are made between the findings of this study and a previous study titled, "Smoke as a Determinant of Human Behavior in Fire Situations, Project People," Report No. NBS-GCR-77-94. The majority of fire incidents in the latter study involved residential units.

The objective of the project study was to relate behavior in fire emergencies to previous training, to the degree of exhibited stress, to the fire protection features of the structure, and to the nature of the fire emergency.

An understanding of such relationships is of value in the development of effective fire safety plans for a variety of institutional and other buildings and in the choice of appropriate facility design and fire safety hardware.

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Abstract

This study involved the detailed investigation of 59 fire incidents in Health Care Facilities located in the State of Maryland, with one facility in Philadelphia. A total of 150 staff participants, 9 patients and 53 fire department personnel were interviewed relative to the fire and smoke development during the fire incident, and the human behavior responses of the participants during the fire incident. The analysis and study of the fire incident and interview data enabled the examination of the parameters of the fire incident including: area of fire origin, ignition and fuel characteristics, and the fire protection design features of the building. The human behavior variables of the fire incidents relative to the means of becoming aware of the fire incident, and the first three actions of the participants were compared to the variables of the fire and smoke development, previous training and fire experience of the participants, and with their belief in the safety of the building. Statistical analyses were performed indicating the relationships among the variables. The evacuation behavior was studied with the sequences of the actions adopted by the personnel.

I. INTRODUCTION

The understanding, observation and study of the behavior of individuals relative to their overt reactions in fire situations has been of concern to individual researchers, and society for many years. The principal investigator conducted his original investigation in this area, following an occurrence of extreme nonadaptive behavior in a fire incident at a church sponsored oyster roast in 1956 (3). The investigation by Wood (23), in 1972, and Bryan (4), in 1977 provided the conceptual and operational model for the design and development of this study.

This study known as Project People II (5) is an outgrowth and direct result of the previous project (4), completed on June 30, 1977 entitled: "Smoke as a Determinant of Human Behavior in Fire Situations," funded by the Center for Fire Research, National Bureau of Standards. This previous study known as "Project People," involved 335 fire incidents with the on site interviewing of 584 participants. The "Project People" population of participants was randomly biased by the various selective techniques adopted by the fire department personnel conducting the interviews and by the dominant type of residential fire incidents in the Baltimore-Washington metropolitan study area. The majority of the fire incidents, limited to occupied structures in the study, involved residential units consisting of 83.9 per cent of the occupancies of the study, with single family dwellings comprising 58.8 per cent of the occupancy study population.(4)

This study was an attempt to verify and conduct a detailed analysis of observed patterns of response behavior found to be present with diverse personnel in a variety of occupancies, primarily residential from the Project People Study (4) to the selected population of staff, visitor, and patient

personnel found in health care facilities. Selected critical information items were retained from the initial study to enable interpopulation comparisons and analyses. Such critical items included the information relative to the means of initial awareness of the fire incident, the response behaviors adopted, the effect of previous training or experience, the influence of fire prevention or protection devices, building construction features and variables of the fire incident, including fire severity and smoke propagation.

A financial grant was provided by the Center for Fire Research, National Bureau of Standards, effective September 1, 1977 for a two year study. Two, one year extensions were approved until August 31, 1981 for the inclusion of more fire incidents, more data, and to enable a complete analysis of the extensive study data collected. The Center for Fire Research project monitors on the study have consisted of Mr. Harold Nelson and Dr. Bernard Levin, while the study has been funded by the Office of Extramural Research currently under the direction of Dr. Robert Levine.

A. Study Objectives

The research objectives for the study were determined to involve the achievement of the following detailed examinations of the interaction of the following various study variables:

1. A verification of the information and data collect by Bryan (4) relative to the movement of personnel through smoke in the evacuation of a building.
2. A determination of the relationships of the demographic variables of the occupants of the buildings involved in the fire incidents.
3. An examination of the various physical and environmental features of the building affecting the evacuation behavior of the occupants

including, the configuration of the fire zone and in particular the egress routes.

4. The reported effectiveness of the evacuation signal, and a determination of the means of alerting the occupants utilized in the fire incidents.
5. The reported visual and olfactory indications of the fire incident relative to the generation, diffusion, velocity and color of the smoke involved in the fire incident, and the influence of the smoke on the determination of the evacuation behavior by the participants.

The analysis of the response behavior of the participants was conducted relative to both the sex and the age of the participants as previously attempted in the study of the behavior of the participants in the residential occupancies.⁽⁴⁾ This project People Study indicated a possible sexual differentiation in the behavioral response to the fire incident relative to fire fighting activity, notification of the fire department, and reentry activities. This concept of sexual differentiation is examined in Section V throughout this report.

Haber (10), found in her study relative to the individual's attitudes on tall buildings, there appeared to be differences relative to age and sex, with males indicating an overt fear of a fire occurrence less than the females. These reported sexual differences in attitudes toward fire incidents, and the exhibited response behavior are extensively analyzed in Section V, due to the predominantly female nature of the staff in many health care facilities.

Canter and Matthews (7), have indicated their belief that a needed study observation is the determination of the "effectiveness of the behavior" in specific circumstances.¹ Thus, they have indicated the possibility of

¹David Canter and Rowan Matthews, Behavior in Fires: The Possibilities for Research. Surrey: University of Surrey, 1975, p. 4.

developing an index of behavior, with weighted scores, to obtain a quantified measure of the effectiveness of the behavioral response in the fire incident situation. Quarantelli (18), has indicated that flight behavior of individuals from an immediate and extreme threat to physical survival is apparently caused by two contextual conditions, and three immediate conditions. These contextual conditions are a preconception of danger in a certain situation, and the absence of pre-crisis social ties. These contextual variables are examined in the study relative to the functional and social relationships between staff, patients, and visitors in the health care facilities. The three immediate conditions resulting in flight behavior according to Quarantelli involved: A perception of possible entrapment, a sense of powerlessness in the situation, and a feeling of social isolation in the crisis. These variables are examined in sections V, VI and VII.

The physical, sociological, and psychological environment of health care facilities relative to the fire incident involve unique, although related problems with fire incidents in other occupancies. Concerning hospitals, Spaulding (19), conducted a study of 75 hospitals varying in capacity from 50 to 600 beds in 1973, which indicated a high percentage of hospital fires are not reported and the majority of the fires were caused by the use of smoking materials. Spaulding also indicated guests were often involved due to their unfamiliarity with the hospital procedures, and nurses lounges were found to be the most common areas for the ignition of wastebasket fires. However, the National Fire Protection Association (14), reported approximately 55.2 per cent of hospital fires occur in patients rooms, 15.3 per cent occur in storage rooms, and 6.8 per cent occur in lounge rooms, for the three principal locations of fire incidents in hospitals. The National Fire Protection Association also indicated a total of approximately 16,800 reported hospital fires for 1974,

a 270 per cent increase from 1969. The variables describing the fire origin and spread are discussed in Section III of this report.

This study supplements the collection of data relative to the amount and type of the previous training received by the participants, in an attempt to evaluate the effectiveness of the training in the predisposition of the individual relative to the selection of behavior responses.

Relative to the staff personnel in nursing home facilities, Tomasetti (20), in his study concerned with the training of staff personnel, found a total turnover rate within five months of 43.6 per cent, for an initial population of 244 staff employees. Tomasetti also determined only 30 of the staff population, or approximately 12 per cent, had received training in the operation of fire extinguishers provided in the facilities. The effect of training on the general behavior and specifically the tendency to evacuate patients by staff members is presented in Section V and VI and VII.

Thus, the principle focus of this study was concerned with the influence of fire and smoke on the awareness of the individual as to the occurrence of the fire incident, perception of a threat, with the selection of, and initiation of the evacuation behavior.

B. Limitations of the Study:

1. The study was limited to the geographical area composed of the state of Maryland and one incident in Philadelphia, Pa.
2. The participants of the fire incidents were interviewed in varying time intervals following the fire incident dependent upon the notification of the study personnel and the arrangement of a mutually agreeable time for the facility personnel.
3. The fire incidents selected for inclusion in the study had to be reported to the study personnel, and secondly to be occupied at

the time of occurrence of the incident.

4. The incidents selected by the participating jurisdictions occurred between August 10, 1977 and June 25, 1980.
5. The interviews were conducted by study personnel with varying interview experience in the study.
6. The fire incidents were selected for inclusion in the study by two criteria:
 - a. The occurrence of a fire incident involving staff or fire department action in any health care institution.
 - b. The evacuation of more than 200 people due to a fire incident in any structure.

It should be noted that only the data acquired from the 59 fire incidents which occurred in health care facilities are discussed in this report. Data from the other 6 fire incidents involving evacuations of large populations will be documented in a supplemental report.

There are two significant problems associated with the conduct of a study of this type relative to the involvement of the participants in the fire incident. First, the accounts of the participants had to be accepted as accurate personal recollections of the fire incident despite their professional, personal or emotional involvement in the incident. Secondly, the problem of obtaining detailed information related to the fire incident was compounded by an extensive time delay in the interviewing of the participants after the fire incident. This time delay was typically 30 days although in two cases almost 150 days were involved.

II. STUDY PROCEDURE

This study was designed to be implemented with University of Maryland personnel conducting on site interviews of the critical personnel involved in the fire incident. Thus, tape interviews were conducted by the University of Maryland study personnel, unlike the studies by Wood (23) and Bryan (4) which utilized fire department personnel conducting structured questionnaire interviews. The Project People II (5) study utilized an open ended, individual interview technique, with one study project member interviewing one occupant in a private situation. A structured questionnaire was also utilized in the study to facilitate the collection of comparable data to the various fire incidents and the previous study conducted for The Center for Fire Research. (4) The questionnaire was administered to the participant individually at the beginning of the study following the unstructured verbal interview. Interviews were conducted by Dr. John L. Bryan, Philip J. DiNenno, James A. Milke, Calvin A. Staubus and Jeanne Fahrner. The interviews were initiated by providing a description of the project to the participant. This description is presented in Figure I.

A. The Interview Questionnaires

The structured questionnaire for this study was developed by revising and expanding the questionnaire used in the Project People Study. (4) Most of the revisions were necessitated by the change in occupancy class for the study population from residential to health care occupancies.

The questionnaire was divided into two categories: Part I, pertaining to the features of the facility and the fire incident. While Part II, examined the actions of each staff member determined to have been critical in the fire incident. There were three questionnaires utilized to obtain information about the facility and the fire incident. The Part I questionnaire

Figure I

PROJECT PEOPLE II

THE DETERMINATION OF BEHAVIOR RESPONSE PATTERNS IN FIRE SITUATIONS

PURPOSE - To determine the behavior of personnel in fire situations in Health Care Facilities throughout the State of Maryland. The intent is to interview the staff personnel, and patients when possible. Fire situations of interest to the study include fires in nursing homes, extended care facilities, and hospitals which involved staff procedural action, the evacuation of one or more rooms, the operation of a fire extinguisher, or any personnel injuries.

Of special interest to the study is the determination of the behavior exhibited in "successful fires". The successful fire being defined as the fire situation which has the damaging effects limited or alleviated by personnel behavior and action.

SPONSORS - The Department of Fire Protection Engineering, University of Maryland, with support from The Center for Fire Research, National Bureau of Standards, with the cooperation of The Maryland State Fire Marshal's Office. Research project personnel:

Project Director: Dr. John L. Bryan

Research Assistants: James A. Milke
Fire Protection Engineering
University of Maryland
College Park, Maryland 20742
(301) 454-2424

PROCEDURE - Administrative personnel for the facility will be contacted or may contact the project director to arrange for interviewing of personnel at the facility at their convenience. Interviews are recorded and take approximately 10 minutes per person. The interview is supplemented with a questionnaire. Interviews are conducted by research project personnel and the anonymity of all personnel participating in the study will be maintained. The information provided by interviewees will be kept confidential being used only in the total content and statistical analysis of the study.

RESULTS - It is expected this study will assist in the design of improved fire alerting, directional devices, evacuation procedures, and modified code requirements. Since existing requirements are primarily based on serious outstanding spectacular fire incidents, it is expected data on behavior in "successful fire" incidents should be of immense value.

entitled "The Building and the Fire" was used to obtain the essential resource information concerned with the physical environment of the building and the fire incident. There were a total of fifteen enumerated items on the form, although a total of 44 information elements were obtained from these fifteen enumerated items. This questionnaire is presented as figure II.

The second Part I questionnaire, presented in Figure III and entitled "Health Care Administration" was used to collect information about the facility organization, administration, staff and patients. This questionnaire contains nine enumerated items with a total of twenty-five information elements obtained by these nine items.

The Fire Safety Evaluation System (15), illustrated in Figure IV, was used in cooperation with the Center for Fire Research, National Bureau of Standards to summarize the attributes of the building, staff members and patients in addition to providing a comparison of the level of fire safety existant in the building with that suggested in the Life Safety Code . (13) This system contains seven inter-related tables with a total input of eighteen data elements in order to complete the form. The information entered on these evaluation forms was provided by administrators, safety personnel or staff supervisors.

The Part II questionnaire was administered to each staff member, patient or fire department member individually, following the nonstructured open ended interview. The questionnaire, presented in Figure V, was utilized to obtain information concerning the participant in a manner which would be suitable for data analysis. The Part II questionnaire contains a total of twelve enumerated items on the form, although a total of 54 information elements were required for these items.

Thus, a total of 87 data or information elements were collected to describe each facility and the fire incident and 54 data elements

Figure II

PROJECT PEOPLE II

The Building and The Fire Jurisdiction _____

Facility Name _____ Incident Identification _____

Address _____ Date of Fire _____

_____ Time of Fire _____

Weather: Temperature _____ Windy _____ Humid _____ Rain _____ Snow _____ Fair _____

1. Area or Room of Fire Origin _____ Source of Ignition _____

2. Material Ignited _____ Material Involved _____

3. Maximum Rooms or Area Involved in Fire _____

4. Maximum Extent of Visible Smoke Spread in Bldg. _____

5. Number of Stories in Bldg. _____ Interior Finish _____

6. Number of Alarms in Previous Year _____ Number of Fires _____

7. Type of Manual Fire Alarm: Bell _____ Horn _____ P.A. _____ Other _____ None _____

Connected to Fire Dept. Y _____ N _____ Number of Calls _____ Taped Y _____ N _____

8. Type of Detection-Protection Equipment _____

9. Activation of Detection-Protection Equipment _____

10. Smoke Fire Doors Y _____ N _____ Activation _____

11. Color of Exit Signs _____

12. Exits: Number _____ Number Area of Origin _____ Location _____

Widths: Stairs _____ Corridors _____ Doors _____

Travel Distance _____ Feet Evacuation Distance _____ Feet

13. Loss: Bldg. _____ Contents _____

14. Casualties: _____ Location _____

15. Total Number Evacuated _____ How _____

From: _____ To: _____

Evacuation Time: _____

Figure III

PROJECT PEOPLE II

HEALTH CARE ADMINISTRATION

1. Number of Beds _____
Number of Patients at Time of Incident _____
Number of Staff at Time of Incident _____
Nursing _____ Dietary _____ Housekeeping/Maintenance _____
Average Staff/Patient Ratio _____
2. Patient Population Characteristics
- | | | | |
|------------------|-------|-------------|-------|
| Mobile | _____ | Age Range | _____ |
| Not Mobile | _____ | Average Age | _____ |
| Not Movable | _____ | | |
| Limited Mobility | _____ | | |
3. Staff Training _____
Conducted By _____
Frequency _____
Content _____
4. Loss: Building _____ Contents _____
5. Casualties: _____ Location _____
6. Staff/Patient Routines in Fire Area _____
7. Total Number Evacuated _____ From: _____
To: _____
Evacuation Time: _____
8. Obtain Copy of Fire Safety Plan for Facility: _____
9. Fire Department Notified Y _____ N _____ Why _____

Figure IV

FIRE/SMOKE ZONE EVALUATION WORK SHEET FOR HEALTH CARE FACILITIES

FACILITY _____ BUILDING _____
 ZONE(S) EVALUATED _____ DATE _____
 EVALUATOR _____
 Complete this work sheet for each zone. Where conditions are the same in several zones, one work sheet can be used for those zones.

Step 1. Determine Occupancy Risk Parameter Factors - Use Table 1.
 A. For each Risk Parameter in Table 1, select and circle the appropriate risk factor value. Choose only one for each of the five Risk Parameters.

Table 1. OCCUPANCY RISK PARAMETER FACTORS		RISK FACTOR VALUES				
1. PATIENT MOBILITY (M)	MOBILITY STATUS	MOBILE	LIMITED MOBILITY	NOT MOBILE	NOT MOBILE	
	RISK FACTOR	1.0	1.6	3.2	4.5	
2. PATIENT DENSITY (D)	PATIENT	1-5	6-10	11-30	>30	
	RISK FACTOR	1.0	1.2	1.5	2.0	
3. ZONE LOCATION (L)	FLOOR	1ST	2ND OR 3RD	4TH TO 17TH AND BASE	18TH AND ABOVE	
	RISK FACTOR	1.1	1.2	1.4	1.6	
4. RATIO OF PATIENTS TO ATTENDANTS (T)	PATIENTS TO ATTENDANT	1.2	3.5	6.0	>11	
	RISK FACTOR	1.0	1.1	1.2	1.5	
5. PATIENT AVERAGE AGE (A)	AGE	UNDER 65 YEARS AND OVER 1 YEAR	65 YEARS & OVER 1 YEAR & YOUNGER			
	RISK FACTOR	1.0	1.2			

* RISK FACTOR OF 4.0 IS CHARGED TO ANY ZONE THAT HOUSES PATIENTS WITHOUT ANY STAFF IN IMMEDIATE ATTENDANCE

Step 2. Compute Occupancy Risk Factor (F) - Use Table 2.
 A. Transfer the circled risk factor values from Table 1 to the corresponding blocks in Table 2.
 B. Compute F by multiplying the risk factor values as indicated in Table 2.

Table 2. OCCUPANCY RISK FACTOR CALCULATION	
OCCUPANCY RISK	$M \times D \times L \times T \times A \times F$

Step 3. Compute Adjusted Building Status (R) - Use Table 3A or 3B.
 A. If building is classified as NEW use Table 3A. If building is classified as existing use Table 3B.
 B. Transfer the value of F from Table 2 to Table 3A or Table 3B as appropriate. Calculate "R."
 C. Transfer "R" to the block labeled "R" in Table 7 on page 4 of the work sheet.

Table 3A. (NEW BUILDINGS)		Table 3B. (EXISTING BUILDINGS)	
1.0^x	\times	0.5^x	\times
F	R	F	R
$\square = \square$	$\square = \square$	$\square = \square$	$\square = \square$

* FIRE/SMOKE ZONE is a space separated from all other spaces by floors, horizontal exits, or smoke barriers.

Step 6. Determine Mandatory Safety Requirement Values - Use Table 6.
 A. Using the classification of the building (i.e., New or Existing) and the floor where the zone is located, circle the appropriate value in each of the three columns in Table 6.
 B. Transfer the three circled values from Table 6 to the blocks marked S_a, S_b, and S_c in Table 7.

Table 6. MANDATORY SAFETY REQUIREMENTS					
ZONE LOCATION	CONTAINMENT S _a		EXTINGUISHMENT S _b		PEOPLE MOVEMENT S _c
	New	Exist.	New	Exist.	New
FIRST FLOOR	9.0	4.0	6.0	3.0	6.0
ABOVE FIRST FLOOR	14.0	8.0	8.0	5.0	9.0

Step 7. Evaluation Fire Safety Equivalency - Use Table 7.
 A. Perform the indicated subtractions in Table 7. Enter the differences in the appropriate answer blocks.
 B. For each row check "Yes" if the value in the answer block is zero or greater. Check "No" if the value in the answer block is a negative number.

Table 7. ZONE SAFETY EQUIVALENCY EVALUATION			YES			NO		
CONTAINMENT SAFETY (S ₁)	less	MANDATORY CONTAINMENT (S _a)	≥ 0	S ₁	-	S _a	=	C
EXTINGUISHMENT SAFETY (S ₂)	less	MANDATORY EXTINGUISHMENT (S _b)	≥ 0	S ₂	-	S _b	=	E
PEOPLE MOVEMENT SAFETY (S ₃)	less	MANDATORY PEOPLE MOVEMENT (S _c)	≥ 0	S ₃	-	S _c	=	P
GENERAL SAFETY (S _G)	less	OCCUPANCY RISK (R)	≥ 0	S _G	-	R	=	G

CONCLUSIONS:
 1. [] All of the checks in Table 7 are in the "Yes" column. The level of fire safety is at least equivalent to that prescribed by the Life Safety Code.
 2. [] One or more of the checks in Table 7 are in the "No" column. The level of fire safety is not shown by this system to be equivalent to that prescribed by the Life Safety Code.
 *The equivalency covered by this worksheet includes the majority of considerations covered by the Life Safety Code. There are a few considerations that are not evaluated by this method. These must be separately considered. These additional considerations are covered in the "Facility Fire Safety Requirements Worksheet." One copy of this separate worksheet is to be completed for each facility.

This form has been prepared by the Fire Safety Engineering Division, Center for Fire Research, NBS, as part of the HEW/NBS Life Safety/Fire Safety project.

June 27, 1977
 Revised March 15, 1978

Figure IV (cont'd.)

Step 4. Determine Safety Parameter Values - Use Table 4.

- A. Select and circle the safety value for each safety parameter in Table 4 that best describes the conditions in the zone. Choose only one value for each of the 13 parameters. If two or more appear to apply choose the one with the lowest print value.

PARAMETERS	SAFETY PARAMETERS VALUES									
	COMBUSTIBLE					NON-COMBUSTIBLE				
	WOOD FRAME		ORDINARY			WOOD FRAME		ORDINARY		
1. CONSTRUCTION	FLOOR OF ZONE	UNPROTECTED	PROTECTED	UNPROTECTED	PROTECTED	UNPROTECTED	PROTECTED	UNPROTECTED	PROTECTED	FIRE RESIST
		-2	0	-2	0	0	0	2	2	2
		-7	-2	-4	-2	-2	-2	2	4	4
		-9	-7	-9	-7	-7	-7	2	4	4
4TH & ABOVE	-13	-7	-13	-7	-9	-7	-7	-7	4	
2. INTERIOR FINISH (Corr. & Exit)	CLASS A	CLASS B	CLASS C	CLASS D	CLASS A	CLASS B	CLASS C	CLASS D		
	-5	0	3							
3. INTERIOR FINISH (Rooms)	CLASS A	CLASS B	CLASS C	CLASS D	CLASS A	CLASS B	CLASS C	CLASS D		
	-3	1	3							
4. CORRIDOR PARTITIONS/WALLS	NOE OR INCOMPLETE	1-3 HP	1-3-10 HP	1-10 HP	1-10 HP	1-10 HP	1-10 HP	1-10 HP	1-10 HP	1-10 HP
	-10	0	0	0	0	0	0	0	0	0
5. DOORS TO CORRIDOR	NO DOOR	1-10 MIN FR								
	10	0	0	0	0	0	0	0	0	0
6. ZONE DIMENSIONS	DEAD END MORE THAN 30 FT									
	6-10	4-10	2	0	0	0	0	0	0	0
7. VERTICAL OPENINGS	OPEN OR W/PE FLOORS									
	-14	-10	0	2	0	0	0	0	0	0
8. HAZARDOUS AREAS	NO DEFICIENCIES									
	-11	-5	-6	-2	0	0	0	0	0	0
9. SMOKE CONTROL	NO CONTROL	SMOKE PARTIAL								
	2-0	0	3	4	4	4	4	4	4	4
10. EMERGENCY MOVEMENT ROUTES	DEFICIENT CAPACITY									
	-8	-2	0	3	5	5	5	5	5	5
11. MANUAL FIRE ALARM	NO MANUAL FIRE ALARM	NO MANUAL FIRE ALARM	NO MANUAL FIRE ALARM	NO MANUAL FIRE ALARM	NO MANUAL FIRE ALARM	NO MANUAL FIRE ALARM	NO MANUAL FIRE ALARM	NO MANUAL FIRE ALARM	NO MANUAL FIRE ALARM	NO MANUAL FIRE ALARM
	-4	1	2	2	2	2	2	2	2	2
12. SMOKE DETECTION & ALARM	CORRIDOR ONLY									
	0	2	3	4	4	4	4	4	4	4
13. AUTOMATIC SPRINKLERS	NOE									
	0	2-10	8	10	10	10	10	10	10	10

NOTE: * Use 10 when item 5 is -10
 ** Use 10 when item 10 is 8
 *** Use 10 in zone with less than 31 patients in existing buildings
 * Use (B) when item 1 is based on first floor zone or an unprotected type of construction
 ** Use (D) when item 1 is based on an unprotected type of construction
 *** Use (E) when item 4 is -10

Table 5. INDIVIDUAL SAFETY EVALUATIONS

SAFETY PARAMETERS	CONTAINMENT SAFETY (S1)	EXTINGUISHMENT SAFETY (S2)	PEOPLE MOVEMENT SAFETY (S3)	GENERAL SAFETY (SG)
1. CONSTRUCTION				
2. INTERIOR FINISH (Corr. & Exit)				
3. INTERIOR FINISH (Rooms)				
4. CORRIDOR PARTITIONS/WALLS				
5. DOORS TO CORRIDOR				
6. ZONE DIMENSIONS				
7. VERTICAL OPENINGS				
8. HAZARDOUS AREAS				
9. SMOKE CONTROL				
10. EMERGENCY MOVEMENT ROUTES				
11. MANUAL FIRE ALARM				
12. SMOKE DETECTION & ALARM				
13. AUTOMATIC SPRINKLERS			÷ 2 =	
TOTAL VALUE	S1 =	S2 =	S3 =	SG =

- Step 5: Compute Individual Safety Evaluations - Use Table 5.
 A. Transfer each of the 13 circled Safety Parameter Value from Table 4 to every unshaded block in the line with the corresponding Safety Parameter in Table 5. For Safety Parameter 13 (Sprinklers) the value entered in the (People Movement Safety) is recorded in Table 5 as 1/2 the corresponding value circled in Table 4.
 B. Add the four columns, keeping in mind that any negative numbers deduct.
 C. Transfer the resulting total values for S1, S2, S3, S4 to the blocks labeled S1, S2, S3, S4 in Table 7 on page 4 of this sheet

for each staff member, patient and fire department member interviewed. All of the questionnaire forms were designed for the collection of information at the scene of the fire incident, and to facilitate the assimilation of information from staff members, patients and fire department personnel.

B. Nonstructured Open-ended Interview

The nonstructured, tape recorded, open-ended interview was utilized to obtain the individual's recalled perceptions of the fire incident, to correlate the behavioral activities of the patients, staff and fire department personnel. The interview was valuable in determining the time sequence and duration of the various realms of the fire propagation in addition to the episodes of the behavioral actions.

C. Data Analysis

The data analysis phase of this research project involved a complete analysis of the study population data with the predictors identified in the previous Project People Study. (4) The information obtained from the structured questionnaire and recorded open-ended interview was coded by James R. Beller and T. Kevin King following a coding manual developed by Philip J. DiNenno and revised by James A. Milke. The data processing and processing of the information was performed on the University of Maryland's UNIVAC 1140 and 1108 computer systems.

The statistical computations and comparisons were performed using the Statistical Package for the Social Science, (S.P.S.S.) version 6.02. (16) The following design objectives for the data analysis were considered in the design of the data analysis programs:

1. The horizontal transfer of the data analysis programs to participating researchers.

Figure V
PROJECT PEOPLE II
HEALTH CARE STAFF

Occupation _____ Incident Identification _____
Position at time of incident _____ Time at facility _____
National Origin _____ Sex _____ Age _____ Language Problem _____

1. Do you believe the building to be safe? Y _____ N _____ Why? _____
2. How did you first become aware there was a fire? _____
3. Where were you when you realized there was a fire? _____
How close were you to the fire? _____
4. What did you do when you realized there was a fire? 1. _____
2. _____ 3. _____
5. Did you evacuate any patients? Y _____ N _____ How many? _____ Did anyone assist you?
Y _____ N _____ Who? _____ From what area rooms? _____
How did you evacuate? _____
Condition of patients? _____ Ambulatory _____ Non ambulatory _____
Patients restrained Y _____ N _____ NBS Categories: Mobile _____ Not mobile _____
Not movable _____ Limited mobility _____ Where evacuated to? _____
_____ Was there any visible smoke? Y _____ N _____ Any odor? Y _____
N _____. Did you evacuate patients through smoke? Y _____ N _____ How far through smoke?
_____ feet. Any problems or aids in evacuation? _____
6. Did you return to the fire area Y _____ N _____ Before the fire was extinguished? Y _____
N _____ Why? _____
7. Did you try to move through the smoke? Y _____ N _____ Where _____. How far did you
try to move? _____ feet. How far could you see at the time _____ feet. Smoke
become thicker? Y _____ N _____ Did you see when you turned back? _____ feet.
8. Did you notice lighted exit signs? Y _____ N _____ Color of signs? _____
9. Did you hear the fire alarm or detectors operate? Y _____ N _____ When? _____
10. Did you see smoke or fire doors closing? Y _____ N _____ When? _____ Where? _____
11. Previous training on actions to take in a fire: Number of times taken? _____
Type? _____ Given by? _____ Last course? _____
12. Number of times involved in fire before? _____ Last previous occurrence? _____

2. Standardized methods of statistical analysis in the social sciences were utilized.
3. The development of new analytical techniques for illustrating and describing sequential behavior.

The questionnaire data were stored in sequential data files, established by Philip J. DiNenno and James A. Milke. James A. Milke, T. Kevin King and Robert C. Berry utilized the questionnaire data files with the SPSS program to conduct the data analysis.

The three questionnaire data files are described as follows:

1. Building Information - By separating the fire incidents from the accumulated data file, the Part I data was analyzed. This file was maintained in a two card format representing each fire incident containing information on the building and the fire incident.
2. People Information - The Part II questionnaire data was maintained in a sequential file to be analyzed by a SPSS program. Again a two card file format was utilized for the storage of the participant interview data.
3. Building and People Information - This data file interfaced the fire incident data from Part I of the questionnaire with the participant interview data from Part II of the questionnaire. The resulting sequential data file then consisted of a four card format with two cards of Part I data and two cards of Part II data. A SPSS program reads this sequential file and compared the data elements of Part I with Part II.

Use of the data files, Building Information, People Information and Building and People Information with the SPSS program produced the statistical analyses which were essential to the comparative understanding of the questionnaire data.

Frequency distributions of each variable were performed and outputted in tabular form, for examination and study. The comparison variables were developed using the cross tabulation features of the SPSS program. The data presented in Sections V-VII in this report were derived from these cross tabulations.

III. THE FIRE INCIDENT POPULATION

The incident population for this study consisted of a total of 59 fire incidents which occurred between August 10, 1977 and June 25, 1980. It should be noted that a total of 70 fire incidents were examined in the study, however 11 incidents which occurred within a 12 day period in one facility have not been included in the statistical analysis due to the lack of specific information about those individual 11 incidents. During these fire incidents a total of 150 staff participants in the fire incident were interviewed. The characteristics of this participant population will be examined and analyzed in Section IV of this report. The data for the incident population was primarily concerned with the characteristics of the fire incident building. However, the characteristics of fire development, including the smoke production within the building, and the observations of the fire department personnel upon their arrival and during the fire incident were also collected from the first Part I questionnaire form which was previously shown as Figure II of this report, and the nonstructured open ended interview.

A. The Fire Incidents

The various aspects of the incident population will now be examined to establish the critical and essential variables of this population to indicate the parameters of the population of the various buildings, relative to the types of fire incidents involved in this study. It should be remembered, the fire incident did not have to be reported to the fire department to become eligible for inclusion in the study. Thus, the minor, incipient, and the successfully extinguished fire without fire department notification, as studied in the Berkeley household fire survey, as conducted by Crossman, Zachary, and Pigman, have been included in this study. (8)

1. The Jurisdiction Distribution of Fire Incidents

The jurisdictional distribution of the 59 fire incidents are presented in Table I. It should be noted only one incident is included from Howard, Wicomico and Cecil Counties in Maryland and Philadelphia, Pennsylvania and the largest number of thirteen incidents were obtained from Baltimore County, Maryland.

2. The Incident Distribution by Months

The distribution of the fire incidents by the month of the occurrence of the fire incident are presented in Table II. It should be remembered due to the time interval of the study from August 10, 1977 until June 25, 1980 the frequency for the month of July would be expected to be lower than the other months of the study. This expectation is of course obvious by the inspection of Table II. The examination of the distribution of the fire incidents by the months provides an approximation of the weather conditions to be expected due to the seasonal variations. Data was collected on the first Part I questionnaire, relative to the approximate temperature and the general weather conditions at the time of the fire incident, however, is not presented in this report.

3. The Time of Occurrence of The Fire Incidents

The time of the occurrence of the fire incidents included in this study are presented in Table III. Upon examination of the data in Table III it appears the fire incidents included in the study were rather evenly distributed throughout the twenty-four hour period of the day. The distribution of the incidents for the various hours indicated a range from a low of zero incidents in the interval between 2-0300 and 7-0800, and a high of seven incidents between 9-1000. The time distribution of the incidents for the study was skewed toward the day time hours, between 0800 and 1800.

TABLE I

JURISDICTION DISTRIBUTION OF STUDY POPULATION

Jurisdiction	Participants	Per Cent	Incidents	Per Cent
Allegany County	6	4.0	2	3.4
Anne Arundel County	15	10.0	9	15.3
Baltimore City	6	4.0	4	6.8
Baltimore County	22	14.6	13	22.0
Harford County	10	6.7	3	5.1
Howard County	1	0.7	1	1.7
Montgomery County	48	32.0	12	20.3
Prince Georges Co.	24	16.0	10	16.9
Washington Co.	3	2.0	2	3.4
Wicomico County	6	4.0	1	1.7
Cecil County	1	0.7	1	1.7
Philadelphia, PA.	8	5.3	1	1.7
N=12	150	100.0	59	100.0

TABLE II

DISTRIBUTION OF FIRE INCIDENTS
MONTH OF YEAR

Month	Incidents	Per Cent
January	5	8.6
February	4	6.7
March	7	11.9
April	6	10.2
May	6	10.2
June	10	17.0
July	1	1.7
August	4	6.7
September	4	6.7
October	7	11.9
November	1	1.7
December	4	6.7
N=12	59	100.0
Incidents	M= 4.92	SE _m = 1.62
	SD= 5.37	SE _{SD} = 1.10

TABLE III

DISTRIBUTION OF FIRE INCIDENTS
TIME OF OCCURRENCE

Hour	Incidents	Per Cent	
0 - 0100	1	1.7	
1 - 0200	4	6.7	
2 - 0300	0	0.0	
3 - 0400	1	1.7	
4 - 0500	3	5.1	
5 - 0600	1	1.7	
6 - 0700	1	1.7	
7 - 0800	0	0.0	
8 - 0900	4	6.7	
9 - 1000	7	11.9	
10 - 1100	4	6.7	
11 - 1200	2	3.4	
12 - 1300	5	8.6	
13 - 1400	5	8.6	
14 - 1500	1	1.7	
15 - 1600	4	6.7	
16 - 1700	2	3.4	
17 - 1800	2	3.4	
18 - 1900	1	1.7	
19 - 2000	2	3.4	
20 - 2100	4	6.7	
21 - 2200	3	5.1	
22 - 2300	1	1.7	
23 - 2400	1	1.7	
N = 24	59	100.0	
M = 2.46	SD = 1.80	SE _M = 0.37	SE _{SD} = 0.26

4. Patient and Staff Casualties from Fire Incidents

There were a total of seventeen casualties of patients and staff members in ten different fire incidents, as presented in Table IV. The ten fire incidents represent 16.9 per cent of the fire incident population. Considering the seventeen casualties, five casualties were fatal in three incidents including two incidents with double fatalities. All five of the fatalities were patient occupants of the facility. A total of eight patients and four staff members suffered nonfatal injuries, for a total of thirteen patient casualties and four staff casualties.

5. Estimated Direct Property Losses from Fire Incidents

As previously noted, this study examined numerous small or "successful fires". This is reflected in the reported direct property losses to the structure and contents from the fire incident, as illustrated in Table V. In twenty-nine incidents, or 49.2 per cent of the sample, no direct property loss occurred to the structure. It should also be noted, that direct loss to the contents was under \$100.00 in forty-one incidents, or 69.4 per cent of the fire incident population.

B. The Area, Ignition and Fuel Characteristics of the Incident

The type of fire incident relative to the amount of flame and smoke production is an essential aspect of the perception of the fire incident as a threat to the occupants of the building. Thus, information on the following critical features was collected relative to the flame and smoke production observed by the fire department staff members or patients: the area and floor level of fire origin, form heat of ignition, form and type of materials first ignited in the fire; and the ignition factor for the fire incident.

TABLE IV

PATIENT AND STAFF CASUALTIES

Fatalities	Patients		Fatalities	Staff	
	Incidents	Per Cent		Incidents	Per cent
0	56	94.9	0	59	100.0
1	1	1.7	0	0	0.0
4	2	3.4	0	0	0.0
5	59	100.0	0	59	100.0
Injuries			Injuries		
0	52	88.1	0	56	94.9
6	6	10.2	2	2	3.4
2	1	1.7	2	1	1.7
8	59	100.0	4	59	100.0

TABLE V

ESTIMATED DIRECT PROPERTY LOSSES

	Structure		Contents	
	Incidents	Per Cent	Incidents	Per Cent
\$1 - 99	29	49.2	8	13.5
\$100 - 999	9	15.2	33	55.9
\$1,000 - 9,999	2	3.4	6	10.2
Not Reported	17	28.8	5	8.5
N = 5	59	100.0	59	100.0

1. The Area of Fire Origin

The approximate area of fire origin was usually identified by staff members who often noticed the fire while still in its incipient stage. The area of origin was a patient room, (bedroom) in 45.6 per cent of the fire incidents. The distribution of the area of fire origin for the 59 incidents is presented in Table VI. The high percentage of fire incidents originating in a bedroom is in agreement with fire incident studies by Haber (10) and the previous Project People Study. (4)

2. The Floor Level of the Area of Fire Origin

The floor level of the area of fire origin as presented in Table VII, was primarily determined by the height of the buildings included in the study. The floor level of fire origin was the third floor or lower in 50 incidents or 84.6 per cent of the sample. The total number of floors of the building, as discussed later in this section, was three or less in 30 incidents, or 50.6 per cent of the sample. There were no incidents which originated below the ground floor level and only two (one each on the sixth and ninth floors) which originated above the fifth floor.

3. Form of Heat of Ignition

The probable heat of ignition for the fire incidents is presented in Table VIII, as reported by patients, facility staff or fire department. The probable heat of ignition was not reported in 16 incidents, or 27.1 per cent of the sample. In most of these unreported cases, the ignition source was not reported since it was unknown. Cigarettes and matches were the suspected heat of ignition in 19 incidents, comprising 32.1 per cent of the sample. It should be noted, this large portion of incidents related to smoking was observed despite "no smoking" regulations enforced in a majority of the health care facilities.

TABLE VI

AREA OF FIRE ORIGIN

Area	Incidents	Per Cent	
Corridor	1	1.7	
Lounge	4	6.7	
Bedroom (1-4 persons)	27	45.6	
Dining Area	2	3.4	
Kitchen	2	3.4	
Lavatory	5	8.6	
Laundry Area	5	8.6	
Office	4	6.7	
Nurses Station	1	1.7	
Closet	2	3.4	
Storage Room	1	1.7	
Duct	1	1.7	
Machinery Room	1	1.7	
Switchgear Room	1	1.7	
Incinerator Room	1	1.7	
Interstitial Space	1	1.7	
N = 16	59	100.0	
M = 3.69	SE _M = 1.60	SD = 6.19	SE = 1.09

TABLE VII
FLOOR LEVEL OF FIRE ORIGIN

Floor Area	Incidents	Per Cent	
1	26	44.1	
2	16	27.1	
3	8	13.4	
4	5	8.6	
5	2	3.4	
6	1	1.7	
9	1	1.7	
N = 7	59	100.0	
M = 8.43	SE _M = 3.55	SD = 8.70	SE = 2.32

TABLE VIII

FORM OF HEAT OF IGNITION

Source of Ignition	Incidents	Per Cent
Gas-Fuel Equipment	3	5.1
Electrical Equipment	2	3.4
Short Circuit	5	8.5
Overloaded Motor	4	6.8
Light Ballast	1	1.7
Overloaded Equipment	2	3.4
Cigarette	11	18.6
Match	8	13.5
Lighter	1	1.7
Heat-Hot Object	3	5.1
Spontaneous Ignition	1	1.7
Other	2	3.4
Not Reported	16	27.1
N = 13	59	100.0

4. Type of Material First Ignited

The probable type of material first ignited for the fire incidents as reported by patients, facility staff or the fire department is presented in Table IX. Natural fabrics were the most frequently reported material first ignited, occurring in 27.1 per cent of the incidents. Any type of fabric were reported as the first ignited in 33.9 per cent of the incidents. A combination of unclassified plastics, polyurethane, polyvinyl and polyester comprised 32.1 per cent of the materials first ignited in the fire incidents.

5. Form of Material First Ignited

The probable form of material first ignited in the fire incidents as reported by the patients, facility staff or fire department is presented in Table X. Electric wires and bedding were the most frequently reported form of material first ignited in nine fire incidents, consisting of 15.2 per cent of the incident population. However, bedding, linens, mattresses or pillows were reported as the material first ignited in 20 incidents, or approximately 33.8 per cent of the fire incidents in the study population.

6. Ignition Factor

The probable ignition factor for the fire incidents as reported by the patients, facility staff or fire department is presented in Table XI. Discarded cigarettes were the most frequently reported ignition factor in 12 incidents or 20.3 per cent of the sample. It should be noted, 10 fires were labelled as suspicious, with another nine incidents identified as incendiary fire. Haber's study (10) has indicated incendiary fire setting by patients or staff involved either emotionally troubled individuals or persons seeking attention through the fire incident.

TABLE IX
TYPE OF MATERIAL FIRST IGNITED

Type of Material	Incidents	Per Cent
Flammable Gas	1	1.7
Flammable-Combustible Liquid	2	3.4
Fat-Grease	2	3.4
Plastic	4	6.8
Polyurethane	7	11.8
Polyvinyl	7	11.8
Polyester	1	1.7
Cellulosics	1	1.7
Sawn Wood	1	1.7
Paper	6	10.2
Cardborad	1	1.7
Fabric-General	3	5.1
Man-Made Fabric	1	1.7
Natural Fabric	16	27.1
Not Applicable	2	3.4
Other	1	1.7
Not Reported	3	5.1
N = 17	59	100.0

TABLE X
FORM OF MATERIAL FIRST IGNITED

Form of Material	Incidents	Per Cent
Structural Member	1	1.7
Upholstered Furn	2	3.4
Cabinetry	1	1.7
Appliance Case	2	3.4
Furniture-General	2	3.4
Mattress-Pillow	8	13.5
Bedding	9	15.2
Linen-No Bedding	3	5.1
Clothes-Not Worn	4	6.8
Clothes-Worn	1	1.7
Box, Carton	1	1.7
Electric Wire	9	15.2
Trash	7	11.9
Cooking Material	4	6.8
Dust, Lint	1	1.7
Flammable Gas, Liquid	1	1.7
Multiple Objects	2	3.4
Other	1	1.7
N = 18	59	100.0

TABLE XI
IGNITION FACTOR

Factor	Incidents	Per Cent
Incendiary	9	15.3
Suspicious	10	16.9
Discarded Cigarettes	12	20.3
Misuse of Heat	3	5.1
Improper Fueling	1	1.7
Combustibles Near Heat	1	1.7
Mechanical Fail	1	1.7
Short Circuit	4	6.8
Electrical Failure-General	7	11.8
Overload	2	3.4
Spontaneous Heating	1	1.7
Improper Startup	1	1.7
Operational Defeciency	1	1.7
Other	1	1.7
Not Reported	5	8.5
 N = 15	 59	 100.0

C. The Characteristics of the Buildings in the Fire Incident Population

There would appear to be certain inherent characteristics of the buildings involved in the fire incidents which might have an influence on the physical environment and thus predetermine certain behavioral responses. The occupancy of the building determines the function or purpose of the structure, which usually determines the characteristics of the population which occupies the building. Cannon, (6) found the openings on the ground floor which provided natural light to the interior of department stores served to identify the exit locations for many patrons.

The characteristics of the buildings in this study have been examined in relation to the occupancy of the building; the number of stories in the building; and the number of fire alarms reported to the fire department during the year prior to the reported fire incident.

1. The Occupancies Within The Fire Incident Population

The occupancies of the buildings in which the fire incidents occurred in this study are presented in Table XII. The common occupancy classifications were nursing homes, general hospitals and mental institutes, comprising 39.0, 32.2 and 22.0 per cent of the study population, respectively. All of the nursing homes in this study were privately owned and operated. However, approximately half of the general hospitals were owned or operated by a governmental unit, either the State of Maryland, a county or a municipality. Twelve of thirteen mental institutes included in the study were owned and operated by the state of Maryland.

2. The Height of The Buildings in The Fire Incident Population.

The height of a building is usually a function of the location of the building and the occupancy of the building. Upon consideration of the

TABLE XII

OCCUPANCY OF BUILDINGS

Occupancy	Incidents	Per Cent	
ICF-Alcoholic	1	1.7	
Nursing Home	23	39.0	
Infant Home	1	1.7	
General Hospital	19	32.2	
Sanatorium	1	1.7	
Infirmary	1	1.7	
Mental Institute	13	22.0	
N = 7	59	100.0	
M = 8.43	SE _M = 3.67	SD = 8.99	SE _{SD} = 2.40

occupancies in the fire incident population it is expected the most prevalent height for the fire incident building would be approximately two to four stories, especially as representative of nursing homes and mental institutes, as indicated in Table XIII. The maximum height for any building included in the fire incident population was obtained with a fifteen story general hospital. Generally any building with a height exceeding seven stories is considered to be a "high rise building." Thus, Table XIII, indicates the fire incident population only included eight fire incidents in buildings exceeding seven stories in height, which is approximately 13.7 per cent of the fire incident population.

It should be noted, there were a total of 19 buildings with a height above four stories included in the fire incident population. The restricted heights of the buildings involved in the fire incident population of this study would appear to be a result of the construction requirements of building codes for high-rise, health care occupancy buildings.

3. Building Construction Type

The construction type of the buildings as reported by the Maryland State Fire Marshal's Office is presented in Table XIV. The large portion of buildings of fire resistive construction and the absence of any buildings of wood frame construction is attributed to the building and fire prevention code requirements for health-care occupancies within the state of Maryland.

4. The Number of Known Fire Alarms in The Building During The Previous Year.

This item relative to the number of known previous alarms in the building was an attempt to determine if prior conditioning due to numerous fire alarms or the absence of fire alarms might predetermine the response actions of the participants. However, the concept of known alarms was not readily

TABLE XIII

TOTAL NUMBER OF FLOORS IN BUILDING

Floors	Incidents	Per Cent	
1	7	11.9	
2	17	28.5	
3	6	10.2	
4	10	16.9	
5	4	6.8	
6	5	8.6	
7	2	3.4	
8	5	8.6	
12	1	1.7	
14	1	1.7	
15	1	1.7	
N = 11	59	100.0	
M = 5.36	SE _M = 0.61	SD = 1.92	SE _{SD} = 0.41

TABLE XIV

BUILDING CONSTRUCTION TYPE

Construction Type	Incidents	Per Cent
Fire Resistive	50	84.7
Non Combustible	1	1.7
Ordinary	6	10.2
Prot. Non-Comb.	2	3.4
N = 4	59	100.0
M = 14.75	SE _M = 11.80	SD = 20.44
		SE _{SD} = 7.23

defined for health-care occupancies due to the frequency of alarm malfunctions, false alarms and minor fires unreported to the fire department or this research study team. Virtually all of the buildings had at least one occurrence of an alarm within 12 months of the studied fire incident, with some facilities experiencing alarms on a monthly rather than an annual basis. The concept of previous fire experience conditioning will be examined in section IV of this report by a more accurate measure concerning the previous fire experience of each staff member.

D. Characteristics of the Patient Population

Fires in health-care facilities are unique due to the severe life hazard posed by the patients which are often physically or mentally incapable of responding efficiently or effectively to the threat from a fire incident. Thus, staff members need to be prepared to expend considerable time and energy removing threatened patients from the immediately exposing fire generated conditions or by conducting complete and total wing, floor or building evacuations. This expenditure of time and energy decreases the staff members' availability to alert others, attempt extinguishment and other actions directed at controlling the threat from fire. Therefore, a patient population which is capable of independently protecting itself relieves the staff members of performing many time-consuming tasks to protect the patients. Thus, fire control can be initiated or evacuation can be readily completed reducing the possibility of patient exposure to the combustion products.

1. Number of Patients in Building

The number of patients in the building when the fire was discovered is presented in Table XV, as reported by the facility administrators. The range for the sample was 35 to 864 patients with a mean of 214.00 and a

median of 170. The standard deviation for this distribution is 154.64. Thus, the mean and the standard deviation were computed for the patient population utilizing the following formulae from Garrett's Text:² For the computation of the Mean: $M = \frac{\sum fX}{N}$. The Standard Deviation was also computed with a formula taken from Garrett's test for utilization with original raw scores:³ $SD = \frac{\sqrt{N\sum X^2 - (\sum X)^2}}{N}$

The Standard Error of the Mean was computed for the mean, again by the utilization of a formula from Garrett's text:⁴ $SE_M = \frac{SD}{\sqrt{N}}$ The Standard Error of the Standard Deviation for the patient distribution was also computed utilizing the following from Garrett's text:⁵ $SE_{SD} = \frac{.71 SD}{\sqrt{N}}$ These formulas were also used for the identical components of the statistical computations in the tables presented in sections III, IV, V, VI and VII of this report.

2. Number of Patients in Fire Zone

The number of patients in the fire zone when the fire was discovered is presented in Table XVI. The most prevalent observed range for the number of patients in the zone of fire origin was 11 to 30 patients for 25 or 42.4 per cent of the fire incidents. A total of 34 fire zones contained 30 or less patients with 16 fire zones containing over 30 patients. It should be noted that 30 patients is the maximum number of patients permitted for each smoke zone according to the Life Safety Code (13).

3. Average Age of the Patients

The patient average age in the fire zone as reported by the facility staff

²Henry E. Garrett, Statistics in Psychology and Education, New York: Longmans, Green & Co., 4th edition, 1953, p. 29.

³Ibid. p. 55.

⁴Ibid. p. 182.

⁵Ibid. p. 195.

TABLE XV

PATIENTS IN BUILDINGS WHEN FIRE DISCOVERED

Number of Persons	Per Cent Population	Incidents	Per Cent
35	0.3	1	1.7
50	0.8	2	3.4
51	0.4	1	1.7
71	0.6	1	1.7
76	0.6	1	1.7
100	3.1	4	6.7
101	1.6	2	3.4
102	0.8	1	1.7
108	0.9	1	1.7
109	0.9	1	1.7
115	0.9	1	1.7
120	1.0	1	1.7
126	1.0	1	1.7
129	1.0	1	1.7
133	1.1	1	1.7
135	1.1	1	1.7
150	5.9	5	8.4
157	1.2	1	1.7
159	2.5	2	3.4
170	2.7	2	3.4
171	1.3	1	1.7
172	1.3	1	1.7
185	3.0	2	3.4
225	1.8	1	1.7
234	1.9	1	1.7
250	2.0	1	1.7
262	2.1	1	1.7
265	2.1	1	1.7
277	4.4	2	3.4
279	4.4	2	3.4
285	2.3	1	1.7
300	4.7	2	3.4
301	11.9	5	8.4
340	2.8	1	1.7
360	8.5	3	5.1
450	3.5	1	1.7
864	13.6	2	3.4
Total = 12,626 Range 35-864	100.0	59	100.0
M = 214.00	SE _M = 20.13	SD = 154.64	SE _{SD} = 14.24

TABLE XVI

DISTRIBUTION OF PATIENT DENSITY

Density	Incidents	Per Cent
1 - 5 Patients	1	1.7
6 - 10 Patients	8	13.6
11 - 30 Patients	25	42.4
Greater Than 30	16	27.1
Not Reported	9	15.3
N = 5	59	100.0

and administrators is indicated in Table XVII. Considering only the 52 incidents for which this data was reported, exactly half of the patients had an average age under 65 and the other half over 65 years.

4. Mobility of the Patients

Mobility of the patients in the fire zone as reported by the facility, staff and administrators and observed by the research study personnel is presented in Table XVIII. The mobility characteristics of all the patients in a fire zone was rarely homogeneous. Thus, the worst case was recorded, as suggested by Nelson and Shibe with the Fire Safety Evaluation System. (15) Considering this interpretation for data collection, 29 or 49.2 per cent of the incidents occurred in fire zones with at least one patient that was non-ambulatory.

5. Patient-Staff Ratio

The patient-staff ratio for the fire zone involved in the incident population is presented in Table XIX. The ratio was determined from a knowledge of the number of patients in the fire zone with the number of staff members on duty at the time of the fire incident. The number of staff members was modified, as necessary according to accounts by staff members of additional or fewer staff members being physically present in the zone at the instant of detection. As indicated in the table, a range of three to five patients to each staff member was the most commonly observed patient-staff ratio, being observed in 23 or 39.0 per cent of the incidents.

E. The Fire Protection Equipment of The Buildings

The fire protection equipment provided in the buildings involved in the fire incidents for this study were investigated and noted by the research study team personnel at the scene. It was hypothesized the amount and type

TABLE XVII

DISTRIBUTION OF THE PATIENT AVERAGE AGE

Age (Years)	Incidents	Per cent
1 - 65	26	44.1
Greater than 65	26	44.1
Not Reported	7	11.9
N = 3	59	100.0

TABLE XVIII

DISTRIBUTION OF PATIENTS MOBILITY

Mobility	Incidents	Per cent
Not Mobile	29	49.2
Limited Mobility	10	16.9
Mobile	12	20.3
Not Reported	8	13.6
N = 4	59	100.0

TABLE XIX

DISTRIBUTION OF PATIENT - STAFF RATIO

Patient - Staff Ratio	Incidents	Per cent
Less than 1	1	1.7
1 to 2	2	3.4
3 to 5	23	39.0
6 to 10	18	30.5
Greater than 11	7	11.9
Not Reported	8	13.6
N = 6	59	100.0

of fire protection equipment, might affect the occupant's formation of the concept of the building as being safe or unsafe. Data was collected on the type of manual fire alarm alerting devices utilized; the provision of fire extinguishers; the provision of standpipe hose; the buildings in which the fire protection equipment was utilized by the occupants; the type of automatic detectors provided in the buildings; the occupancies provided with automatic fire detectors; the operation of the automatic fire detectors; the occupancies equipped with automatic sprinkler systems; the sprinkler systems which operated the provision and type of smoke control systems and the determination of the occupancies in the fire incident population provided with exit signs relative to the color of the exit signs.

1. The Type of Manual Fire Alarm Alerting Device and The Connection of The Alarm System to The Fire Department.

Manual fire alarm systems were provided in all of the buildings involved in fire incidents, in this study. The information relative to the connection of manual fire alarm systems to the Fire Department is presented in Table XX. It should be noted, although only 20 of the fire alarm systems, or 33.9 per cent were connected to the fire department, many of those not connected had direct telephone lines to the fire department communications office.

2. Portable Fire Extinguishers

All of the 59 buildings were equipped with portable fire extinguishers. This observation was expected since health care facilities are usually required by local ordinance or state law to provide this type of fire protection equipment. Fire extinguishers are a type of manual fire fighting equipment, and this equipment requires activation and operation by the occupants of the structure. Thus, the initiative must be taken by the occupants to use the portable extinguishers to make them effective. Portable extinguishers were

TABLE XX

CONNECTION OF FIRE ALARM SYSTEM TO FIRE DEPARTMENT

Connection	Buildings	Per Cent
Yes	20	33.9
No	39	66.1
N = 2	59	100.0

used by staff members in 29 incidents, or 49.1 per cent of the study incidents as presented in Table XXI. A total of 52 portable extinguishers were used in the 29 incidents for an average of 1.8 extinguishers per incident with a maximum number of 15 extinguishers used in one incident.

Since use of the extinguishers requires fire fighting behavior by the participants, the data on extinguisher usage should be considered in conjunction with the data provided in Section V of this report related to actions of the participants.

3. The Occupancies Provided with Standpipe Hose.

A total of 26 buildings were provided with a standpipe hose system, which is approximately 44.1 per cent of the fire incident population for this study. Three of these standpipe systems were equipped with 1½ inch hose for occupant use. An attempt was made by occupants to utilize the standpipe hose with two of the three standpipe systems. However in both incidents water was not applied through this standpipe hose line because of untenable smoke and heat conditions in the corridor for the occupants.

4. Utilization of Fire Fighting Equipment by Occupants.

As previously indicated all the buildings were provided with fire extinguishers and a total of 26 buildings were provided with standpipe hose systems. Thus, the buildings in the fire incident population were provided with standard fire protection equipment requiring action by the participants to utilize the equipment. It is apparent the fire fighting behavior of the occupants of these buildings involves variables beyond the provision of the fire fighting equipment. These human behavior variables would involve the age, sex, previous training, and previous fire experience of the participants. A total of 30 fire incidents were involved in which the occupants engaged in fire fighting behavior. The fire fighting behavior

TABLE XXI

UTILIZATION OF PORTABLE FIRE EXTINGUISHERS

Quantity	Incidents	Per cent
1	23	79.3
2	4	13.8
>2	2	6.9
	29	100.0

Total Extinguishers Used = 52
 Per cent of Incident Population = 49.1

of the participants in these fire incidents was analyzed and is presented in Section V of this report.

5. The Types and Operation of Fire Detectors.

Table XXII presents the information on the types of automatic fire detectors provided in 52 buildings of the fire incident population. The most prevalent type of automatic fire detector was the smoke detector, which was located in 45 buildings. Heat detectors and smoke detectors were provided in seven buildings, as indicated in Table XXII.

It should be noted of the 52 buildings with automatic fire detectors in the buildings, nine of these buildings had detectors which operated in a fire incident as presented in Table XXIII. However, it should be noted that of the nine detectors which operated during a fire incident, only three detectors provided the first means of notification of the fire incident.

6. Presence, Coverage and Operation of Automatic Sprinklers

Table XXIV presents the data relative to the presence, coverage and operation of automatic sprinkler system in the facilities of this study. Provision of automatic sprinklers is typically specified by local or state code requirements, in relation to the height and construction of the building. A total of 55 fire incidents were in buildings with an automatic sprinkler system installed, consisting of 93.2 per cent of the study fire incidents. Considering those 55 fire incidents, 15 of the incidents were in buildings with total automatic sprinkler system protection, for 27.3 per cent of the fire incidents.

In five fire incidents, or 8.4 per cent of the total number of fire incidents the sprinkler systems activated. The five systems that activated consisted of four complete sprinkler systems and one partial sprinkler system. Thus, considering the complete systems provided four, or 26.7 per cent

TABLE XXII

TYPES OF AUTOMATIC DETECTORS IN BUILDINGS

Type	Incidents	Per Cent	
Smoke	45	76.2	
Smoke and Heat	7	11.9	
None	7	11.9	
N = 3	59	100.0	
M = 19.06	SE _M = 12.67	SD = 17.92	SE _{SD} = 7.32

TABLE XXIII

DETECTORS IN BUILDINGS AND OPERATION

Operation	Incidents	Per Cent
Yes	9	15.3
No	50	84.7
N = 2	59	100.0

TABLE XXIV

AUTOMATIC SPRINKLER COVERAGE IN BUILDINGS AND OPERATION

Coverage	Incidents	Per Cent	Operation	Per Cent
Complete	15	25.4	4	80.0
Partial	40	67.8	1	20.0
None	4	6.8	-	---
N = 3	59	100.0	5	100.0

activated compared to only one or 2.5 per cent of the partial sprinkler systems.

7. Smoke Control Systems

Either passive or dynamic smoke control systems were provided in most of the buildings included in the study, as indicated in Table XXV. Only four buildings or 6.8 per cent of the building population contained no smoke control system. Considering the 55 buildings provided with a smoke control system, only one building had a dynamic system. This system utilized a zonal design concept including the shutdown of air supply fans in the fire zone with the air supply to all other zones being comprised entirely of outside air, in addition to the passive smoke barriers. The 54 passive smoke control systems generally consisted of physical smoke barriers with smoke barrier doors which remained in the closed position or were closed upon activation of a smoke detector located adjacent to the doors or the building fire alarm system.

8. Additional Fire Protection Equipment

All of the buildings included in this study were equipped with illuminated exit signs and emergency lighting. This contrasts with the previous study, (4) primarily involving residential occupancies and is attributed to the change from residential to health care occupancies.

F. Fire Protection Related Design Parameters of the Fire Zones

Just as the fire protection equipment provided in a building may possibly affect the occupants' actions, the design and construction of the fire zone was also assumed to have an influence on the occupants behavior. The design parameters of interest in this study, were the fire resistance rating of partitions and doors; the interior finish characteristics of corridors or rooms; the number and configuration of the egress routes; the enclosure of

TABLE XXV

SMOKE CONTROL SYSTEM

System	Incidents	Per Cent
Mechanically Assisted, by Zone	1	1.7
Smoke Partition	54	91.5
None	4	6.8
N = 3	59	100.0

vertical openings; the protection of hazardous areas; and the overall evaluation of the fire safety as compared to that suggested in the Life Safety Code (13).

1. Fire Resistance Rating of Partition Walls and Room Doors

The fire resistance rating of partition walls in the fire zone is presented in Table XXVI. This data was collected by visual observation of the partition walls by the research study team and an interview of the facility administrative personnel. The design of the partition walls were not compared with specific listed fire endurance tested designs. As noted in Table XXVI, 34 of the fire zones had partition walls which appeared to have at least a one-hour fire resistance rating. Five incidents were located in building areas with no wall where an "open floor" design concept had been employed in the construction of the building.

The fire resistance rating of the doors from the corridor into the rooms is presented in Table XXVII. This information was obtained by locating labels affixed to the doors or through an examination of the door material and construction. A total of 52 fire zones contained room doors with at least a 20 minute rating or equivalent with three of these fire zones, equipped with doors with automatic closer devices. The five fire zones of open construction without walls as previously indicated in Table XXVI, as would be expected also had no doors.

2. Interior Finish Characteristics

The interior finish characteristics of the corridors and rooms of the fire zone is presented in Table XXVIII. These characteristics were determined by a visual inspection by the research study personnel and supplemented or confirmed by interviews with facility administrative personnel. All of the

TABLE XXVI

FIRE RESISTANCE RATING OF PARTITION WALLS
IN FIRE ZONE

Rating	Incidents	Per Cent
Greater 1 hour	34	57.6
20 minutes - 1 hour	19	32.2
Less than 20 minutes	1	1.7
No Wall	5	8.5
N = 4	59	100.0

TABLE XXVII

FIRE RESISTANCE RATING OF ROOM DOORS IN
FIRE ZONE

Rating	Incidents	Per Cent
> 20 minutes + Auto Closers	3	5.1
> 20 minutes	49	83.0
< 20 minutes	2	3.4
No Door	5	8.5
N = 4	59	100.0

TABLE XXVIII

INTERIOR FINISH CHARACTERISTICS IN FIRE ZONE

Class	Corridor		Room	
	Incidents	Per Cent	Incidents	Per Cent
A	58	98.3	52	88.1
B	1	1.7	7	11.9
N = 2	59	100.0	59	100.0

fire zone corridors, except one appeared to have a class A interior finish in both walls, ceiling and floor, with the one exception having a class B interior finish. A total of 52 of the fire zone patient rooms had a class A interior finish with the remaining seven zones having a class B interior finish.

3. Number and Configuration of Egress Routes

Table XXIX presents the information relative to the overall length of the largest dimension of the fire zone. This data provides information relative to the maximum travel distance in the zone. The most commonly observed length was in the 100 to 150 foot range. Only one zone was observed which had only one exit and thereby could be classified as a dead-end or single path of travel.

The number and arrangement of egress routes is presented in Table XXX. Direct, horizontal exits to the exterior of the building were observed in nine fire zones. Horizontal exits leading to other fire zones were the most commonly observed arrangement, comprising 67.8 per cent of the fire zones in the study population. The remainder of the egress routes classified as "Two Routes, None Horizontal" included exits from upper floors where a single fire zone comprised the entire upper floor level.

4. Enclosure of Vertical Openings

The data relative to the enclosure of vertical openings in the fire zone is presented in Table XXXI. This information was obtained via a visual inspection by the research study team and confirmed with the facility administrative personnel. The vertical openings considered by this parameter primarily included stairways, shafts for mechanical systems, elevators and laundry chutes. All of the vertical shafts observed in the fire zones were

TABLE XXIX

LENGTH OF FIRE ZONE

Length(feet)	Incidents	Per Cent
0 - 100	17	28.8
100-150	38	64.4
Greater than 150	3	5.1
30 - 100 (Deadend)	1	1.7
N = 4	59	100.0

TABLE XXX

EGRESS ROUTES IN FIRE ZONE

Routes	Incidents	Per Cent
Direct Exit	9	15.3
Horizontal Exit	40	67.8
2 Routes, Non Horizontal	10	16.9
N = 3	59	100.0

TABLE XXXI

ENCLOSURE OF VERTICAL OPENINGS IN FIRE ZONE

Enclosure	Incidents	Per Cent
Greater than 2 hour rated	32	54.2
1-2 hour rated	25	42.4
Less than 1 hour rated	2	3.4
N = 3	59	100.0

effectively enclosed. Only two of the fire zones contained enclosures for vertical openings which were considered to have less than a one-hour fire resistance rating. A total of 54.2 per cent of the fire zones had enclosed vertical openings with at least a two-hour fire resistance rating. As previously indicated with the fire resistance ratings of the partition wall parameter, no specific comparative evaluation was performed of the design of the enclosure with a standard listed assembly.

5. Protection of Hazardous Areas

The protection of hazardous areas located either in or out of the fire zone observed in the facilities is presented as Table XXXII. According to the Life Safety Code (13), hazardous areas include areas such as maintenance storage or shops, boiler rooms, laundries, and kitchens. These areas are recommended to be protected by the enclosure of these spaces or rooms with a fire resistive barrier and/or a automatic suppression system, depending on the severity of the hazard. A single deficiency would consist of the absence of either the barrier or the suppression system. The absence of both means of protection would constitute a double deficiency. Thus, 52 of the buildings, comprising 88.1 per cent of the fire incident sample had no deficiencies.

6. Analysis of Fire Safety

The level of fire safety provided in the fire zone was assessed utilizing the Fire Safety Evaluation System (15), as developed at the National Bureau of Standards for the Department of Health and Human Services. This technique previously presented in this report as figure IV utilizes much of the information presented in section III of this report relative to the building construction, fire protection equipment, fire protection design concepts and the patient population characteristics.

TABLE XXXII

PROTECTION OF HAZARDOUS AREAS IN FIRE ZONE*

Deficiencies**	Incidents	Per Cent
None	52	88.1
Single Deficiency, in zone	5	8.5
Single Deficiency, in adjacent zone	1	1.7
Double Deficiency outside zone	1	1.7
N = 4	59	100.0

* Hazardous areas are defined by the Life Safety Code (13).

** Deficiencies in enclosure and protection of hazardous areas according to the Life Safety Code (13).

The level of fire safety is evaluated for the fire zone on a comparative basis, being judged either inferior to or equivalent to the level of safety recommended by the Life Safety Code (13). The result of the application of this evaluation technique (15) for the fire zone population is presented in Table XXXIII. As evaluated by this technique, only three fire zones or 5.1 per cent of the sample had a level of fire safety evaluated to be inferior to the level recommended in the Life Safety Code (13).

TABLE XXXIII

ANALYSIS OF FIRE SAFETY ASPECTS OF FIRE ZONE

Equivalence*	Incidents	Per Cent
Yes	56	94.9
No	3	5.1
N = 2	59	100.0

* Equivalence of existing fire safety aspects of fire zone to Life Safety Code (13) as judged.

IV. THE PARTICIPANT POPULATION

The participant population of this study consisted of a total of 150 persons, who were staff members in the buildings involved in the fire incidents. In a few cases, the participants were outside of the building when they became aware of the fire incident. However, these persons were included in the study if they immediately entered the building, upon becoming aware of the fire incident. The primary data related to the participants was collected from the health care staff questionnaire, as previously illustrated in Figure V of this report on page 15. The characteristics and behavioral dynamics of the participant population were obtained from the observations of the research study team interviewer at the time of the interview at the fire scene and the responses of the participant.

A. Demographic Characteristics of the Participant Population.

The distribution of the participant population relative to their geographical distribution from the various jurisdictions involved in the study was previously presented in Table I on page 20. The range of participants varied from a maximum of 48 participants from Montgomery County, Maryland to the low of one individual from Cecil County, and Howard County, Maryland. The interviewing of participants varied with the involvement of the facility personnel in the fire incident and availability of the personnel at an arranged time after the incident. The greatest number of persons from a single fire incident consisted of nineteen persons interviewed at a nursing home fire incident. Obviously, the least number of participants interviewed at a single fire incident consisted of a single individual.

1. The Jurisdictional Distribution of the Participant Population.

It should be remembered the participants were not equally distributed throughout the jurisdictions due to differences in the notification of the research study team of the fire incidents. The greatest number of participants were interviewed in Montgomery County, Maryland. Cecil and Howard Counties in Maryland provided the smallest number of participant interviews. It should be noted from Table XXXIV the jurisdiction with the greatest number of fire incidents did not have the greatest number of participants in the study population. The compilation of the distribution of participants related to each fire incident in the various jurisdictions is provided in this table.

2. The Occupational Distribution of the Participant Population

The occupations of the members of the participant population are presented in Table XXXV. It is a reflection of the sexual distribution of the population presented in Table XXXVIII and the selection of fire incidents involving health-care occupancies. The personnel position or job title of the participants is presented in Table XXXVI, providing more detailed information relative to the educational background of the participants along with an implicit description of their facility related responsibilities.

3. The National Origin of the Participant Population

The national origin of the participants was obtained from observation and the participant's response to the questionnaire as verbally related to the interviewer. As would be expected, the majority of the participants were from North America and the United States as indicated in the distribution presented in Table XXXVII of this report. It should be observed only nine

TABLE XXXIV
 JURISDICTIONAL DISTRIBUTION OF PARTICIPANT POPULATION
 RELATED TO FIRE INCIDENTS

Jurisdiction	Participants	Incidents	Mean Number of Participants/Incident
Allegany County	6	2	3.00
Anne Arundel County	15	9	1.67
Baltimore City	6	4	1.50
Baltimore County	22	13	1.69
Cecil County	1	1	1.00
Harford County	10	3	3.33
Howard County	1	1	1.00
Montgomery County	48	12	4.00
Prince Georges County	24	10	2.40
Washington County	3	2	1.50
Wicomico County	6	1	6.00
Philadelphia, PA	8	1	8.00
N = 12	150	59	
Range =	1 - 48	1 - 13	1.00 - 8.00
M =	12.50	4.92	2.92
SD=	12.90	4.48	2.08
SE _M =	3.72	1.29	0.60
SE _{SD} =	2.64	0.92	0.43

TABLE XXXV

OCCUPATIONAL DISTRIBUTION OF PARTICIPANT POPULATION

Occupation	Participants	Per Cent
Staff	83	55.3
Registered Nurse	38	25.4
Licensed Practical Nurse	18	12.0
Security Guard	8	5.3
Medical Doctor	2	1.3
Not Reported	1	0.7
N = 6	150	100.0

TABLE XXXVI

FACILITY POSITION OF PARTICIPANT POPULATION

Facility Position	Participants	Per Cent
Staff Nurse	63	42.0
Charge Nurse	27	18.0
Maintenance	12	8.0
Administrator	11	7.2
Safety Officer	9	6.0
Director of Nursing	7	4.7
Technician	6	4.0
Dietary	4	2.7
Security Officer	4	2.7
Orderly	2	1.3
Medical Doctor	2	1.3
Nurses Aide	1	0.7
Mental Health Worker	1	0.7
Housekeeper	1	0.7
N = 14	150	100.0

TABLE XXXVII

NATIONAL ORIGIN OF PARTICIPANT POPULATION

National Origin	Participants	Per Cent	
United States	141	93.8	
Asian	3	2.0	
North American	1	0.7	
South American	1	0.7	
European	1	0.7	
African	1	0.7	
Australian	1	0.7	
Nigerian	1	0.7	
N = 8	150	100.0	
M = 18.75	SE _m = 17.47	SD = 46.21	SE _{SD} = 11.55

participants were from outside of North America, consisting of approximately 6.2 per cent of this population presented in Table XXXVII.

4. The Sexual Distribution of the Participant Population.

During the interview, the research study personnel classified the sexual type of the participant. The sexual distribution for all 150 of the participants is presented in Table XXXVIII. Given the predominant health-care type of occupancy involved in the study, the sexual distribution for the participant population is obviously skewed. There were 72 more female participants than male participants for a female population of 111 or approximately 74.0 per cent of the participant population.

5. The Age Distribution of the Participant Population.

The age distribution of the participant population was determined from the analysis of the data collected by the interviewers. The interviewers utilized both verbal responses of the participants, and their personal observations. The range of reported ages varied from a low of 18 years to a high of 60 years for the 150 participants included in the age distribution population. The data on the age distribution of the participants is presented in Table XXXIX. It should be noted the mean age of the participant population as presented in Table XXXIX was 32.49 years of age, with a standard deviation for this distribution of 8.85. The range of ages being limited essentially to mature adult individuals employed in the health-care facilities.

B. The Fire Incident Building Populations.

The facility staff and administrative personnel provided information relative to the total population of persons in the fire incident building at

TABLE XXXVIII

SEX OF PARTICIPANT POPULATION

Sex	Number	Per Cent
Female	111	74.0
Male	39	26.0
N = 2	150	100.0

TABLE XXXIX

DISTRIBUTION OF AGE OF PARTICIPANT POPULATION

Age	Participants	Per Cent
18-20	9	6.0
21-25	30	20.0
26-30	39	26.0
31-35	20	13.4
36-40	14	9.3
41-45	12	8.0
46-50	4	2.7
51-55	2	1.3
56-60	2	1.3
Not Reported	18	12.0
N = 10	150	100.0
M = 32.49	SE _M = 0.77	SD = 8.85
		SE _{SD} = 0.55

the time of the fire incident, and some basic information related to the behavior of the total building population. This information is presented to provide an understanding of some of the essential characteristics of the building populations exposed to the fire incidents in this study. It should be remembered the participant population of this study was selected from the fire incident building population by the interviewer. The patient population in the facility at the time of the fire incident was presented previously in Table XV. The number of staff members present in the building is presented in Table XL.

C. Behavioral Frames of Reference of The Participant Population.

The participant population, consisting of the 150 persons interviewed at the fire scene, were questioned relative to their familiarity with the building as indicated by their length of employment at the facility, and their belief in the fire safety of the building. In addition, since Brown (2) indicated physical proximity was one of the critical factors relative to the individual's determination of a behavior mode of response, the participant's distance from the fire was determined. It was also considered to be important to determine the means by which the individual became aware of the fire incident. The persons who were alone at the time of the fire incident or the sociological and cultural roles of the other persons with the participant. Some of the most critical information developed in this section concerned the means by which the participant became aware of the occurrence of the fire incident. The means of awareness tended to vary depending on the physical location of the individual to the fire incident, their being alone or with others, and in some cases the nature of the fire incident.

TABLE XL

STAFF MEMBER POPULATION IN BUILDINGS WHEN
FIRE DISCOVERED

Number	Per Cent Population	Incidents	Per Cent
3	0.2	1	2.5
4	0.9	3	7.5
9	1.3	2	5.0
10	3.0	4	10.0
11-20	13.2	12	30.0
21-30	10.5	5	12.5
31-40	10.1	4	10.0
41-50	6.9	2	5.0
51	3.8	1	2.5
80	5.9	1	2.5
87	19.4	3	7.5
135	10.0	1	2.5
200	14.8	1	2.5
1,349	100.0	40	100.0
M = 33.72	SE _M = 61.7	SD = 39.00	SE _{SD} = 4.38
Range	3-200	Per Cent of Incident Population = 67.8	

1. Participants Presence in The Building.

The participants presence in the building in this study was related to their employment in the facility. This is in contrast with the previous study (4) which included as study participants people living and visiting in addition to persons employed in the building at the time of the fire incident.

2. Experience of Participant Population at the Facility.

The experience of the participant population is presented in Table XLI. The duration of employment varied from one week to 24 years, with a mean of 3.90 years.

3. Belief of Participants in The Safety of The Building.

The belief of the participants, relative to the safety of the building was noted in the structured questionnaire and elaborated on in the open-ended interview with the research study team member. Table XLII presents the responses of the participant population relative to their belief in the safety of the building. It should be noted, that 9 persons, or approximately 6.0 per cent of the total participant population believed the building was unsafe. It should be remembered, that all the participants were being interviewed, after the occurrence of a fire incident in the building.

Relative to the 112 members of the participant population who considered the building to be safe, the reasons given in response to the question of why they considered the building to be safe are presented in Table XLIIA. The reasons were classified as to the principle areas of observation for the participants, relative to the content of the statements. It should be noted the various features of the construction of the building were noted by 25 of the participants, personal experience in the facility was the second most

TABLE XLI

PARTICIPANT POPULATION BY EXPERIENCE AT FACILITY

Experience (Years)	Participants	Per Cent
0.0	7	4.6
0.1	11	7.3
0.2	3	2.0
0.3	7	4.6
0.5	4	2.7
0.6	1	0.7
0.7	1	0.7
0.8	4	2.7
0.9	1	0.7
1.0	10	6.7
1.1	2	1.3
1.2	2	1.3
1.3	3	2.0
1.5	2	1.3
1.7	1	0.7
1.8	1	0.7
2.0	13	8.6
2.1	1	0.7
2.2	4	2.7
2.5	8	5.3
2.9	1	0.7
3.0	6	4.0
3.2	1	0.7
3.5	3	2.0
4.0	6	4.0
4.5	1	0.7
5.0	11	7.3
5.5	2	1.3
6.0	3	2.0
7.0	3	2.0
8.0	2	1.3
9.0	3	2.0
10.0	7	4.6
11.0	5	3.3
12.0	3	2.0
14.0	1	0.7
15.0	1	0.7
16.0	2	1.3
17.0	1	0.7
18.0	1	0.7
24.0	1	0.7
N = 41	150	100.0
M = 3.90	SE _M = 0.36	SD = 4.43
		SE _{SD} = 0.26

TABLE XLII

PARTICIPANT POPULATION DISTRIBUTION RELATIVE TO
BELIEF IN THE SAFETY OF THE BUILDING

Safety Belief	Participants	Per Cent
Safe	112	74.7
Unsafe	9	6.0
Not Reported	29	19.3
N = 3	150	100.0

TABLE XLIIIA

DISTRIBUTION OF CONCERNS FOR BELIEF IN BUILDING
BEING SAFE BY THE PARTICIPANT POPULATION

Concerns	Participants	Per Cent	
Personal Experience	11	9.8	
Building Construction	25	22.3	
Alarm System	2	1.8	
Fire Codes	10	8.9	
Sprinkler System	3	2.7	
Staff Training	8	7.1	
Combustibles	2	1.8	
Protection Features	5	4.5	
Age of Building	3	2.7	
Not Reported	43	38.4	
N = 10	112	100.0	
M = 11.2	$SE_M = 4.16$	$SD = 12.47$	$SE_{SD} = 2.79$

frequently mentioned items by 11 of the participants, and fire codes were mentioned by 10 of the participants. Thus, 48 participants or approximately 43 per cent of the participants who believed the building to be safe were concerned with various construction features of the building.

4. Participant Population Awareness of The Fire.

The stimulus which first indicated to the participant the occurrence of the fire incident is recorded in Table XLIII. It should be noted there were eleven varied stimuli which tended to alert the participants as to the fire incident. The most prevalent means of awareness of the fire incident was hearing the alarm bells of the local alarm system. However, it should be noted the second most frequent means of awareness was the act of being notified by other participants of the fire incident. However, when this item of notification by others is combined with being notified by patients, telephone or anonymous screams, the procedure of being notified by another person becomes the most prevalent means of becoming aware of the fire incident for 52 members of the participant population which was approximately 35 per cent of this population. It should be noted under the third most frequent means of awareness that 28 individuals were alerted by announcements of the public address system within the building. Noticing the odor of smoke produced by the fire incident was also mentioned frequently.

Relatively to Table XLIII, it appears, the alerting action of other individuals upon the discovery of a fire incident may be a very important mechanism. The physical variables related to the occurrence of a fire incident consisting of the odor of the smoke, the sight of the smoke or the flame, and the sensing of the heat, accounted for the initial awareness of the fire incident for 36 participants, consisting of 24 per cent of the population

TABLE XLIII

DISTRIBUTION OF THE MEANS OF AWARENESS OF THE
FIRE INCIDENT FOR THE PARTICIPANT POPULATION

Means of Awareness	Participants	Per Cent	
Heard Alarm Bells	34	22.7	
Other Staff Informed	30	20.0	
Heard P.A. Announcement	28	18.6	
Smelled Smoke	19	12.7	
Patient Informed	11	7.3	
Telephone Call	9	6.0	
Saw Smoke	9	6.0	
Saw Fire	6	4.0	
Heard Screams	2	1.3	
Saw Water	1	0.7	
Saw Burn Marks	1	0.7	
N = 11	150	100.0	
M = 13.64	SE _M = 3.66	SD = 11.56	SE _{SD} = 2.47

represented in Table XLIII. The high percentage of persons informed of the fire by announcements via the public address system as well as the audible alarm bells as compared to the previous study (4) is attributed to the change in occupancy and the related change in the installation of communication and alarm equipment in the facilities.

The means of awareness by the participants for the fire incident was compared for the participants relative to their sexual identification. Thus, Table XLIIIA presents the means of awareness for both the male and female members of the participant population. It should be noted of the 150 members of the participant population involved in the means of awareness for the fire incident analysis, 39 were men and 111 were women, as noted previously in Table XXXVIII. The similarity in the means of awareness are evident for both the male and female members of the population. The three most frequent means of awareness for the men were announcement over the public address system, notification by others and receipt of a telephone call while the three most frequent means of awareness for the female members of the population were hearing alarm bells, notification by other staff members and the odor of smoke.

The differences in the percentage of the male and female populations for the various means of awareness were examined in Table XLIIIB, in an attempt to determine if any of these differences were statistically significant. As shown in Table XLIIIB, it is apparent that 5.1 per cent of the males as contrasted to 28.8 per cent of the females were alerted to the fire incident by hearing alarm bells. This difference was statistically significant above the one per cent level of confidence. In a similar manner, the fact that 38.5 per cent of the men were alerted by the announcement over the public address system as opposed to 11.7 per cent of the females, was also statistically significant above the one per cent level of confidence. In

TABLE XLIIIA

SEXUAL DISTRIBUTION OF PARTICIPANT POPULATION RELATIVE
TO THE AWARENESS OF THE FIRE

Means of Awareness	Female	Per Cent	Male	Per Cent	Total	Per Cent
Heard Alarm Bells	32	28.8	2	5.1	34	22.7
Other Staff Informed	22	19.9	8	20.5	30	20.0
Heard P.A. Announcement	13	11.7	15	38.5	28	18.6
Smelled Smoke	18	16.2	1	2.6	19	12.7
Patient Informed	10	9.0	1	2.6	11	7.3
Telephone Call	2	1.8	7	17.9	9	6.0
Saw Smoke	6	5.4	3	7.7	9	6.0
Saw Fire	4	3.6	2	5.1	6	4.0
Heard Screams	2	1.8	0	0.0	2	1.3
Saw Water	1	0.9	0	0.0	1	0.7
Saw Burn Marks	1	0.9	0	0.0	1	0.7
N = 11	111	100.0	39	100.0	150	100.0
Range = 1 -32	0 - 15					Per Cent of Participants = 100.0

TABLE XLIIIB

SIGNIFICANCE OF SEXUAL DIFFERENCES ON AWARENESS
OF FIRE FOR PARTICIPANT POPULATION

Means of Awareness	Female Per Cent	Male Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Heard Alarm Bells	28.8	5.1	23.7	7.80	<u>3.04**</u>
Other Staff Informed	19.9	20.5	0.6	7.45	0.08
Heard P.A. Announcement	11.7	38.5	26.8	7.26	<u>3.69**</u>
Smelled Smoke	16.2	2.6	13.6	6.20	<u>2.19*</u>
Patient Informed	9.0	2.6	6.4	4.84	1.32
Telephone Call	1.8	17.9	16.1	4.42	<u>3.64**</u>
Saw Smoke	5.4	7.7	2.3	4.42	0.52
Saw Fire	3.6	5.1	1.5	3.65	0.41
Heard Screams	1.8	0.0	1.8	2.11	0.85
Saw Water	0.9	0.0	0.9	1.55	0.58
Saw Burn Marks	0.9	0.0	0.9	1.55	0.58
N = 11	111	39			

*Critical ratios significant at or above the 5 per cent level of confidence.

**Critical ratios significant at or above the 1 per cent level of confidence.

addition, the receipt of a telephone call as a means of awareness was statistically significant above the one per cent level of confidence with 17.9 per cent of the males reported this means compared to only 1.8 per cent of the females. Finally, 16.2 per cent of the females contrasted with 2.6 per cent of the males reported an odor of smoke to be their means of awareness which was statistically significant above the five per cent level of confidence.

The Standard Error of the differences in the percentages was computed using the following formula:⁶ $SE_{P_1 - P_2} = \sqrt{PQ \left[\frac{1}{N_1} + \frac{1}{N_2} \right]}$ as developed in

Garrett's text. The formula for the Critical Ratio was obtained from the same text in the following formula:⁷ $CR = \frac{(P_1 - P_2) - 0}{SE_{P_1 - P_2}}$ The Significance

of the Critical Ratio was then determined from the Tables of t, for the reliability of Statistics.⁸

Relative to the sexual differences on the awareness of the fire it is interesting to note the women had a higher percentage of their population than the males becoming aware of the fire incident by the stimulus of, "hearing alarm bells", "smelled smoke," "patient informed", "heard screams", "saw water" and "saw burn marks". However, the male population had a higher percentage of awareness from the stimulus of "other staff informed", "heard public address announcement", "telephone call", "saw smoke" and "saw fire". It is readily apparent the location of the participant and the distance of the participant from the fire could influence their means

⁶ Garrett, Op. Cit. p. 237.

⁷ Ibid.

⁸ Ibid. p. 427

of awareness of the fire incident. It would appear the means of awareness directly related to the changes in the physical environment due to the fire incident, including the seeing of smoke or fire, and the experiencing of heat generally involved a close proximity to the fire incident.

5. Location of Participants When They Became Aware of The Fire.

It seems reasonable to assume, the closer an individual is to the location of the fire incident, the more threatening the fire may be to the individual, thereby affecting the response to the fire incident. Brown, (2) recognized the need for the study of the location of the individual relative to the perception and interpretation of the threat.

The individual's location in the building when the participant became aware of the fire was obtained in the open-ended interview. Table XLIV presents the locations of the participants at the time of their awareness of the fire incident. It should be noted, the most frequently noted locations of the participants were in another fire zone (on the same floor) and on another floor with 20 per cent of the participants noting each of these two locations. The third most frequently noted location was at the nurses' station in the fire zone. The large number of participants outside of the fire zone is attributed to the non-nursing staff members who responded to the fire zones which contained patient rooms in the majority of fire incident included in this study. In addition, the location of approximately 43 per cent of the participants gives some indication for the observation that only 24 per cent of the staff became aware of the fire incident by the perception of combustion products, including flames, heat or smoke as compared to the previous study (4) which reported that approximately 45 per cent of the occupants became aware of the fire incident by the perception of combustion products.

TABLE XLIV

LOCATION OF PARTICIPANT POPULATION WHEN AWARE OF FIRE

Location	Participants	Per Cent	
Other Zone	30	20.0	
Other Floor	30	20.0	
Nurses Station (Fire Zone)	29	19.4	
Corridor (Fire Zone)	17	11.3	
Room of Fire Origin	15	10.0	
Adjacent Room	11	7.3	
Outside of Building	10	6.7	
Same Zone (Fire Zone)	8	5.3	
N = 8	150	100.0	
M = 18.75	SE _M = 3.35	SD = 8.86	SE _{SD} = 2.21

From Table XLIV it should be noted that 10 participants were outside of the buildings when they became aware of the fire incident. Thus in conformance with the operational definition relative to the selection of participants for this study, these individuals had to subsequently enter the building, usually to assist in the notification or evacuation of the participants.

6. Distance of The Participants from The Fire.

Table XLV contains the responses of 148 participants, or 98.6 per cent of the total participant population relative to the individual participant's distance from the location of the fire incident. The research study personnel converted the responses of the participants to distance as measured in feet by the physical inspection and observation of the premises along with the building floor plan, when the individuals indicated a spatial location within the building.

Upon examination of Table XLV, it immediately becomes apparent the majority of the participants in this population were fairly distant from the fire incident when they became aware of the incident, often outside of the fire zone. It should be noted the mean distance for the 148 participants from the fire incident consisted of 106.49 feet, with a standard deviation of 122.67 feet. Thus, only 12.7 per cent of the study population were within 10 feet of the fire incident, and approximately 27 per cent of the participant population were within 20 feet of the fire incident. However, approximately 42 per cent of the participants were over 100 feet from the fire at the time of awareness. This contrasts with the previous study (4) which reported that study population to have a mean distance of 12.9 feet from the fire at the time of awareness. This large difference may be largely due to the size

TABLE XLV

DISTANCE OF PARTICIPANTS FROM FIRE AT THE TIME OF AWARENESS

Distance (Feet)	Participants	Per Cent	
3	4	2.7	
5	6	4.0	
8	1	0.7	
10	8	5.3	
12	2	1.3	
15	8	5.3	
16	2	1.3	
20	9	6.1	
25	2	1.3	
30	9	6.1	
40	5	3.3	
50	17	11.3	
60	6	4.0	
70	4	2.7	
80	2	1.3	
100	20	13.3	
120	4	2.7	
150	12	8.0	
190	2	1.3	
200	4	2.7	
250	8	5.3	
300	3	2.0	
400	3	2.0	
500	7	4.7	
Not Reported	2	1.3	
N = 25	150	100.0	
M = 106.49	SE _M = 10.08	SD = 122.67	SE _{SD} = 7.08

and occupancy of the buildings included in the two studies. The buildings in the first study were largely residential and thus small in size compared to this study involved with health-care facilities which are generally larger, with the staff population dispersed throughout the facility.

Thus, it would appear from the indicated responses, these 148 participants were not very intimately involved with the initiation, or ignition of the fire incident. It should be noted, the 10 participants indicated by Table XLIV as being outside of the building are included in the 63 participants which were farther than 100 feet from the location of the fire incident.

Withey, (22) has indicated the perception of the timing of the imminence of the threat is a critical factor in the individual's response selection of a behavioral reaction to the perceived threat. Thus, the location and proximity of the participant to the fire incident appears to be an important determining variable. The analysis of proximity relative to awareness is continued in this section, however, the effect of proximity on the actions of the participants is discussed in Section VI.

The distance from the fire for the participant population as presented in Table XLV, was classified into categories to facilitate the analysis. Table XLVA presents the distances from the fire for the 148 members of the participant population, with the distances classified into six categories: 10 feet and less, 11 to 20 feet, 21 to 30 feet, 31 to 50 feet, 51 to 100 feet, and above 100 feet. It should be remembered that only 27 per cent of this population consisting of 40 participants were within 20 feet of the fire, and 43 per cent over 100 feet from the fire when they became aware of the incident. Thus, the location of the participants is rather diverse.

The classification of the 148 members of the participant population relative to the six categories of distance are presented in Table XLVB as

TABLE XLVA

DISTRIBUTION OF THE DISTANCE OF PARTICIPANTS
FROM FIRE AT THE TIME OF AWARENESS

Distance - Feet	Participants	Per Cent
0-10	19	12.8
11-20	21	14.2
21-30	11	7.4
31-50	22	14.9
51-100	32	21.6
100>	43	29.1
N=6	148	100.0
Range = 3-500	11-43	7.4-29.1
Per Cent of Participant Population = 98.7		

TABLE XLVB

DISTANCE FROM FIRE RELATED TO AWARENESS OF FIRE

Means of Awareness	Feet						Unreported	Total	Per Cent
	0-10	11-20	21-30	31-50	51-100	100+			
Heard Alarm Bells		3	2	2	10	17		34	22.7
Other Staff Informed	1	4	5	12	6	2		30	20.0
Heard P.A. Announcement	1			2	8	17		28	18.6
Smelled Smoke	7	5	2	2	2	1		19	12.7
Patient Informed		3		3	5			11	7.3
Telephone Call					1	6	2	9	6.0
Saw Smoke	5	3		1				9	6.0
Saw Fire	3	2	1					6	4.0
Heard Screams		1	1					2	1.3
Saw Water	1							1	0.7
Saw Burn Marks	1							1	0.7
N = 11	19	21	11	22	32	43	2	150	100.0
Per Cent	12.7	14.0	7.3	14.7	21.3	28.7	1.3	100.0	

compared to the means of awareness of the fire incident as previously presented in Table XLVIII. It is of interest to note that individuals alerted by the physical stimuli of the fire incident were generally distributed closer to the fire incident than were the participants alerted by other individuals, or alarm devices. Table XLV C provides the same analysis as Table XLV B except the distance from the fire is categorized differently to examine the issue of means of awareness relative to proximity.

The significance of the distance of the participant from the fire as being under or over 20 feet is presented in Table XLV D. This significance of the differences in the percentages of the two populations was obtained from the formulas in Garrett for the standard error of the differences in the percentages and the Critical Ratio as previously presented.⁹ The differences in the percentage of the participants relative to the means of awareness of hearing alarm bells, hearing announcements over the public address system, smelling, seeing smoke and seeing the fire were all significant above the 1 per cent level of confidence.

D. Previous Training and Fire Experience Variables of The Participants.

It was assumed, the participants who had received training concerned with evacuation, alerting, or fire fighting procedures might behave with responses different from individuals without such training. Thus, information was collected for the type of previous training received by the participants, the agency or organization which provided the training, the frequency of the training, and the date of the last training course received by the participant. In a similar manner it was assumed that previous experience

⁹Garrett, Op. Cit., p. 236-237

TABLE XLVC

DISTRIBUTION OF THE DISTANCE UNDER AND OVER 20
FEET FROM THE FIRE OF THE PARTICIPANT POPULATION AT
THE TIME OF AWARENESS RELATIVE TO MEANS OF AWARENESS

Means of Awareness	0-20 Feet		Over 20 Feet		Total	Per Cent
	Participants	%	Participants	%		
Heard Alarm Bells	3	7.5	31	28.7	34	23.0
Other Staff Informed	5	12.5	25	23.1	30	20.3
Heard P.A. Announcements	1	2.5	27	25.0	28	18.9
Smelled Smoke	12	30.0	7	6.5	19	12.8
Patient Informed	3	7.5	8	7.5	11	7.4
Telephone Call	0	0.0	7	6.5	7	4.7
Saw Smoke	8	20.0	1	0.9	9	6.1
Saw Fire	5	12.5	1	0.9	6	4.0
Heard Screams	1	2.5	1	0.9	2	1.4
Saw Water	1	2.5	0	0.0	1	0.7
Saw Burn Marks	1	2.5	0	0.0	1	0.7
N = 11	40	100.0	108	100.0	148	100.0
Per Cent of Participant Population	26.7		72		98.7	

TABLE XLVD
SIGNIFICANCE OF THE DISTANCE UNDER AND
OVER 20 FEET FROM THE FIRE OF THE PARTICIPANTS
RELATIVE TO AWARENESS OF THE FIRE

Means of Awareness	0-20 Feet Per Cent	Over 20 Feet Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Heard Alarm Bells	7.5	28.7	21.2	7.75	<u>2.74**</u>
Other Staff Informed	12.5	23.1	10.6	7.40	1.43
Heard P.A. Announcements	2.5	25.0	22.5	7.22	<u>3.17**</u>
Smelled Smoke	30.0	6.5	23.5	6.16	<u>3.81**</u>
Patient Informed	7.5	7.5	0.0	4.81	0.00
Telephone Call	0.0	6.5	6.5	4.40	1.48
Saw Smoke	20.0	0.9	19.1	4.40	<u>4.43**</u>
Saw Fire	12.5	0.9	11.6	3.63	<u>3.20**</u>
Heard Screams	2.5	0.9	1.6	2.10	0.76
Saw Water	2.5	0.0	2.5	1.54	1.62
Saw Burn Marks	2.5	0.0	2.5	1.54	1.62
N = 11	40	108			

**Critical ratios significant at or above the 1 per cent of confidence.

in a fire incident, should have provided the participant with a learning situation in the fire environment. Thus, these individuals should behave with a different selection of response actions than participants without the presumed advantage of previous fire experience. The frequency of any previous experiences in fire incidents were determined, and the date of the individual's most recent fire experience for the participant population, were determined.

1. Type of Previous Training of Participant Population.

A total of 139 members of the participant population indicated they had received training prior to the occurrence of the fire incident as presented in Table XLVI. It should be noted that of the 11 staff members who had not received training, most of these individuals were new employees.

Table XLVII presents the types of training received by these participants, and the most frequent type of training consisted of fire drill procedures with orientation and in-service exercises, followed by fire drills and in-service exercises being the second most frequent modes of training received by the participants. The 11 participants noted as not reported are those which had received no training. The observation of 92.67 per cent of the participants having received training as well as the types of training are indicative of the health-care type of occupancy. Training of staff members was usually recommended or suggested by the facility, the local fire department, or was mandated by state law or local ordinance.

2. The Most Recent Training Course for Participants.

The most recent training course attended, prior to the occurrence of the fire incident was obtained from the questionnaires. Table XLVIII presents the time elapsed since the most recent training exercise for the 134 members of the participant population who provided this information.

TABLE XLVI

PREVIOUS TRAINING OF THE PARTICIPANT
POPULATION

Training	Participants	Per Cent
Yes	139	92.67
No	11	7.33
N = 2	150	100.0

TABLE XLVII

TYPE OF PREVIOUS TRAINING OF THE PARTICIPANT POPULATION

Type of Training	Participants	Per Cent
Orientation, Drills and In-Service	100	66.7
Drills and In-Service	24	16.0
Drills and Orientation	13	8.7
Drills	2	1.3
Not Reported	11	7.3
N = 5	150	100.0

TABLE XLVIII

TIME SINCE LAST TRAINING COURSE FOR PARTICIPANT POPULATION

Most Recent Training (Years)	Participants	Per Cent	
0.1	88	65.7	
0.2	13	9.7	
0.3	17	12.7	
0.4	1	0.7	
0.5	3	2.3	
0.8	1	0.7	
0.9	1	0.7	
1.0	3	2.3	
2.0	3	2.3	
2.5	1	0.7	
3.0	2	1.5	
3.5	1	0.7	
N = 12	134	100.0	
M = 0.31	SE _M = 0.04	SD = 0.48	SE _{SD} = 0.03

It is interesting to note that approximately 66 per cent of this population received their training within the month prior to the fire incident. Only approximately five per cent of those trained had received their last training session over one year before the fire incident.

3. The Previous Fire Experience of The Participant Population

Table XLIX presents the previous fire experience of 73 members of the participant population which is approximately 49 per cent of the total participant population, or one out of two participants, who had previously experienced a fire incident situation. The experience of the staff members ranged from fire incidents in their residence to fire incidents at their current or a previous health-care facility.

4. The Most Recent Fire Experience.

Table L presents the reported data on the 73 participants which is approximately 49 per cent of the total participant population relative to the time elapsed since their previously experienced fire incident. It should be noted that approximately 68 per cent of the previous fire experience was obtained approximately one year before the incident included in the study. Referring to Table XLVIII concerning their most recent training, it will be remembered that approximately 95 per cent of the previous training population received their training within the year prior to the incident.

It would thus appear for the participant population involved with previous training and previous fire experience, the majority of the training and the fire experience was obtained within the year prior to the fire incident included in the study. However, there is also the possibility that retention of the factors relative to the dates of the previous fire incidents, and the previous training may be affected by recall decay.

TABLE XLIX

PREVIOUS FIRE EXPERIENCE OF THE PARTICIPANT POPULATION

Fire Experience	Participants	Per Cent
Yes	73	48.7
No	74	49.3
Not Reported	3	2.0
N = 3	150	100.0

TABLE L

MOST RECENT FIRE EXPERIENCE OF THE PARTICIPANT POPULATION

Most Recent Experience (Years)	Participants	Per Cent	
0	10	13.7	
1	40	54.8	
2	2	2.7	
3	3	4.1	
4	1	1.4	
5	5	6.8	
6	2	2.7	
7	2	2.7	
10	2	2.7	
11	1	1.4	
15	1	1.4	
17	1	1.4	
20	1	1.4	
25	1	1.4	
30	1	1.4	
N = 15	73	100.0	
M = 3.37	SE _M = 0.51	SD = 4.34	SE _{SD} = 0.36

V. THE ACTIONS OF THE PARTICIPANT POPULATION

The documentation of the actions of the participants relative to their response to the perception and recognition of the occurrence of the fire incident was one of the objectives of this study. The research study team personnel at the fire scene attempted to obtain the first three actions of the participants in their sequential order of enactment. Often, more than three actions were indicated in the open-ended interviews and were noted in the interview transcripts. These additional actions have not been analyzed and evaluated for this report.

A. The Distribution of the First Actions of the Participant Population

The first, second and third actions of the participants were elicited in response to the question, "What did you do when you realized there was a fire?"

Table LI presents the first actions of the participant population with the data being presented as elicited from 149 participants which was approximately 99.3 per cent of the total participant population of 150 persons. These initial actions of the participants are presented as the action classifications. A total of 16 action classifications have been identified of which 13 were in Table LI. Thus, three action classifications were not observed as the first action for the participants but were observed as second or third actions.

From an examination of Table LI, it is apparent the most frequently initiated first action consisted of the investigation of ambiguous fire cues. Typically, the rationale given for the investigation was to determine the source of the ambiguous fire cue or to ascertain the validity of the fire cue. Thus, 45.0 per cent of the participant population was initially involved with investigation activities. It should be remembered that some of the fire incidents included

TABLE LI

DISTRIBUTION OF THE FIRST ACTIONS OF THE PARTICIPANT POPULATION

Action	Participants	Per Cent	
Investigated Cues	67	45.0	
Closed Doors	21	14.1	
Rescued Threatened Patients	10	6.7	
Discovered Fire	10	6.7	
Pulled Manual Fire Alarm	8	5.4	
Evacuated Patients	7	4.7	
Attempted Extinguishment	6	4.0	
Got Extinguisher	6	4.0	
Directed Operations	5	3.4	
Phoned Operator	4	2.7	
Ventilated	2	1.3	
Alerted Other Staff	2	1.3	
Called Fire Department	1	.7	
N = 13	149	100.0	
M = 11.46	SE _M = 4.91	SD = 17.02	SE _{SD} = 3.34
Range = 1-67	Per Cent of Participant Population = 99.3		

in this study were of a incipient nature at detection, thereby not being obvious and apparently justified investigation.

The second most frequently observed first action consisted of the closing of room doors. This procedure was in conformance with most of the facility emergency plans. This life preventative action can be expected to be initiated by staff in areas removed from the area of fire origin not immediately requiring other essential actions. The third most frequently observed first action of rescuing threatened patients, is one of the actions immediately initiated when the incident occurred within an occupied patient room. It should be remembered the staff is dispersed through the facility and the number of persons in the vicinity of the fire area is limited for the immediately required rescue actions. Both of the third most frequently reported first actions as presented in Table LI would be expected to be limited to those participants in the immediate vicinity of the fire incident. The apparent relationship between the priority of first actions and the location of the participant relative to the fire at the time of fire awareness will be discussed extensively later in this section.

The distribution of first actions as presented in Table LI for this study are notably different from the first actions observed in the previous study (4). The three most popular first actions in that study were "Notified Others", "Searched for Fire", and "Called Fire Department." Thus the three most popular actions in the Project People I study were the twelfth, first and thirteenth most frequently utilized first actions in this study. Only the actions related to investigating behavior were comparable in frequency amongst the first actions noted in both studies. Similarly, the first two most popular first actions in this study, "Investigated Cues" and "Closed Doors" ranked second and twenty-first respectively, with the third most popular action in this study of "Rescued

Threatened Patients" not being indicated, as would be expected, in the Project People I study (4) concerned with residential occupancies. Obviously some of the differences in the first actions are attributed to the type of occupancy in which the fire incident occurred. As an indication of this occupational differentiation typically more personnel were available to respond in a coordinated fashion in the health-care occupancies than in the residential occupancies. However, it is interesting that no personnel were involved in the residential occupancies with rescuing endangered occupants, which was an action performed by 6.7 per cent of the staff members in this health care study. Also, obviously residential occupancy determined actions not reported in this study were those actions relative to waking up, getting dressed, securing personal belongings, and checking on pets. The actions involving the family members noted throughout the Project People I study (4) are not observed, as expected, in this study. Instead, several actions were reported involving the rescue or evacuation of patients. Thus it is apparent that the motivation of cultural primary group family roles for performing actions noted in the residential situation is apparently replaced by a sense of professional responsibility to the patients.

1. Sexual Distribution of The First Actions of The Participant Population

The analysis of the differences in the first actions of the participant population relative to the male and female members of the population are presented in Table LIA. It should be noted the total identified male members of the participant population were 38 and the total number of female members were 111 for a total of 149 participants considered as to their first actions in Table LIA.

TABLE LIA

SEXUAL DISTRIBUTION OF THE PARTICIPANT POPULATION
RELATED TO FIRST ACTION

Action	Female	Per Cent	Male	Per Cent	Total	Per Cent
Investigated Cues	46	41.4	21	55.3	67	45.0
Closed Doors	20	18.0	1	2.6	21	14.1
Rescued Threatened Patients	9	8.2	1	2.6	10	6.7
Discovered Fire	10	9.0	0	0.0	10	6.7
Pulled Manual Fire Alarm	6	5.4	2	5.3	8	5.4
Evacuated Patients	6	5.4	1	2.6	7	4.7
Attempted Extinguishment	5	4.5	1	2.6	6	4.0
Got Extinguisher	1	0.9	5	13.2	6	4.0
Instructed Operations	4	3.6	1	2.6	5	3.4
Phoned Operator	2	1.8	2	5.3	4	2.7
Ventilated	0	0.0	2	5.3	2	1.3
Alerted Other Staff	2	1.8	0	0.0	2	1.3
Called Fire Department	0	0.0	1	2.6	1	0.7
N = 13	111	100.0	38	100.0	149	100.0
Range =	0 - 46		0 - 21		1 - 67	
Per Cent of Participant Population	74.0		25.3		99.3	

Relative to the possible identified cultural-sexual role differences in the behavioral actions as indicated in the reported first actions, it may be important that the most frequent first action: "Investigated Cues", appears to have little sexual differentiation. However, 13.2 per cent of the males "Got Extinguisher", as a first response as contrasted with only 0.9 per cent of the females. Conversely, the first actions of, "Closing Doors", "Rescued Patients", "Discovered Fire", and "Evacuated Patients", appeared to be predominantly first actions for the female population as opposed to the male population.

The statistical significance of the differences in the percentages of the male and the female populations relative to their first actions were determined and computed. The statistical procedures utilized for the comparison of the percentages of the various subpopulations of the participant population are identical to the procedures previously identified in percentage for the subpopulations, the computation of the standard error of the differences in the percentages, and the computation of a critical ratio. The significance of the critical ratio was determined with the t test for the level of confidence from Garrett's text.¹⁰

The significance of the differences in the first actions of the male and Female members of the participant population are presented in Table LIB. The difference in the 13.2 per cent of the male population that, "Got Extinguisher" as contrasted with 0.9 per cent of the female population was significant above the 1 per cent level of confidence. The other significant differences in the first actions in which the males dominated was the action of, "Ventilated", in which 5.3 per cent of the male population acted, as contrasted with 0 per cent of the female population, and this difference was significant at the 5

¹⁰Garrett, Op. Cit. P. 427.

TABLE LIB

SIGNIFICANCE OF SEXUAL DIFFERENCES ON FIRST
ACTION OF PARTICIPANT POPULATION

Action	Female Per Cent	Male Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Investigated Cues	41.4	55.3	13.9	9.35	1.49
Closed Doors	18.0	2.6	15.4	6.54	<u>2.35*</u>
Rescued Threatened Patients	8.2	2.6	5.6	4.70	1.19
Discovered Fire	9.0	0.0	9.0	4.70	1.91
Pulled Manual Fire Alarm	5.4	5.3	0.1	4.25	0.26
Evacuated Patients	5.4	2.6	2.8	3.98	0.70
Attempted Extinguishment	4.5	2.6	1.9	3.68	0.52
Got Extinguisher	0.9	13.2	12.3	3.68	<u>3.34**</u>
Instructed Operations	3.6	2.6	1.0	3.41	0.29
Called Operator	1.8	5.3	3.5	3.05	1.15
Ventilated	0.0	5.3	5.3	2.13	<u>2.49*</u>
Alerted Other Staff	1.8	0.0	1.8	2.13	0.85
Called Fire Department	0.0	2.6	2.6	1.57	1.66
N = 13	111	38			

* Critical ratios significant at or above the 5 per cent level of confidence.
 ** Critical ratios significant at or above the 1 per cent level of confidence.

per cent level of confidence. A statistically significant difference of first actions in which the females were more frequently involved was "Closed Doors", in which 18 per cent of the females and 2.6 per cent of the males were involved resulting in this difference being significant at the 5 per cent level of confidence.

As previously noted, these differences observed between female and male staff members may be more a function of established professional roles, as established in health care occupancies and the high frequency of fires in patient areas. The functional professional roles dictate the presence of nursing personnel, still predominately female, to be in patient occupied areas during the staff duty shift. If more male nurses had been present in facilities in the study population, the difference in behavior due to the cultural-sexual role might be examined and analysed with differing results.

Statistically significant differences in the first action of obtaining an extinguisher were also noted in the Project People I study (4), with the males again being predominate in that initial action. However, significant difference in the first action of "Searching for the Fire" was noted in the Project People I study (4) with the males more frequently engaging in the action. However, in this study, no significance difference between the male and female staff members was observed, since the action of "Investigated Cues", was the most frequent first action for all staff members as previously indicated in Table LIA.

2. The Influence of Previous Training on The First Actions of the Participant Population

The participant population contained 139 members of the population who had previously received fire related training, prior to the fire incident which initiated their inclusion in the participant population of this study. It was desired to examine the participant population relative to their first actions,

to determine if there were any significant differences in the first action responses of the 139 individuals who had received training to the 11 individuals who had not received any training. The type of training and the most recent training received by the members of the participant population have been previously presented in Section IV of this report in Tables XLVII and XLVIII.

The distribution of the first actions of the participant population as divided into the two subpopulations relative to previous training are presented in Table LIC. The 138 members of the participant population who had received training consisted of approximately 92 per cent of the total participant population. While the 11 individuals without training consisted of approximately 7 per cent of the total participant population.

Table LID presents the statistical analysis of the differences in the percentage of participants in the trained and nontrained subpopulations relative to the first actions. The differences of the two most frequently observed first actions of the participant population consisting of "Investigating Cues", and "Closed Doors" were not statistically significant for the trained and untrained staff members. However, for the third most frequently utilized first action, the difference in 36.4 per cent of the untrained participant compared to 4.3 per cent of the trained participants involved in the action of: "Rescued Threatened Patients", was statistically significant at the 1 per cent level of confidence. Another first action was dominated by the untrained participants, with the action of "Alerted Other Staff", with 9.1 per cent of the untrained staff compared to 0.7 per cent of the trained staff was observed to be significant at the 5 per cent level of confidence. The "Alerted Other Staff" first action significant difference was intuitively expected, since untrained personnel when confronted with a fire incident would be expected to have less confidence in their ability to properly react independently and would tend to notify other staff

TABLE LIC

DISTRIBUTION OF FIRST ACTIONS OF PARTICIPANT
POPULATION WITH AND WITHOUT PREVIOUS TRAINING

Action	Previous Training		No Previous Training		Total Per Cent	
	Participants	Per Cent	Participants	Per Cent		
Investigated Cues	63	45.9	4	36.4	67	45.0
Closed Doors	19	13.8	2	18.1	21	14.1
Rescued Threatened Patients	6	4.3	4	36.4	10	6.7
Discovered Fire	10	7.2	0	0.0	10	6.7
Pulled Manual Fire Alarm	8	5.8	0	0.0	8	5.4
Evacuated Patients	7	5.1	0	0.0	7	4.7
Attempted Extinguishment	6	4.3	0	0.0	6	4.0
Got Extinguisher	6	4.3	0	0.0	6	4.0
Instructed Operations	5	3.6	0	0.0	5	3.4
Phoned Operator	4	2.9	0	0.0	4	2.7
Ventilated	2	1.4	0	0.0	2	1.3
Alerted Other Staff	1	0.7	1	9.1	2	1.3
Called Fire Department	1	0.7	0	0.0	1	0.7
N = 13	138	100.0	11	100.0	149	100.0
Range =	1 - 63		0 - 4		1 - 67	
Per Cent of Participant Population	92.0		7.3		99.3	

TABLE LID

SIGNIFICANCE OF THE DIFFERENCE IN FIRST ACTIONS OF
PARTICIPANT POPULATION WITH AND WITHOUT PREVIOUS TRAINING

Actions	Previous Training Per Cent	No Previous Training Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Investigated Cues	45.9	36.4	9.5	15.59	0.61
Closed Doors	13.8	18.1	4.3	10.90	0.39
Rescued Threatened Patients	4.3	36.4	32.1	7.83	<u>4.10**</u>
Discovered Fire	7.2	0.0	7.2	7.83	0.92
Pulled Manual Fire Alarm	5.8	0.0	5.8	7.08	0.82
Evacuated Patients	5.1	0.0	5.1	6.63	0.77
Attempted Extinguishment	4.3	0.0	4.3	6.14	0.70
Got Extinguisher	4.3	0.0	4.3	6.14	0.70
Instructed Operations	3.6	0.0	3.6	5.68	0.63
Phoned Operator	2.9	0.0	2.9	5.06	0.57
Ventilated	1.4	0.0	1.4	3.55	0.38
Alerted Other Staff	0.7	9.1	8.4	3.55	<u>2.37*</u>
Called Fire Department	0.7	0.0	0.7	2.61	0.27
N = 13	138	11			

*Critical ratio significant at or above the 5 per cent level of confidence.

**Critical ratio significant at or above the 1 per cent level of confidence.

members to obtain assistance. Except for two noted significant differences, the other differences appeared to be statistically insignificant.

Comparing the influence of training on first actions in this study with the Project People I study (4), it should be remembered that approximately 24 per cent of the participant population of the Project People I study were trained as contrasted with 92 per cent of the participant population of this study. Significant differences between the subpopulations with and without training were observed in the Project People I study for the following three actions: "Got Family", "Got Extinguisher", and "Went to Fire Area". Two of these three actions are comparable to the first actions in this study of "Got Extinguisher" and "Investigated Cues". Neither of these comparable first actions had any statistical significant difference between the trained and untrained subpopulations.

3. The Effect of Previous Fire Experience on The First Actions of the Participant Population

It would appear the individuals in the participant population who had previously been involved in a fire incident might have their first action modified by the learning effect of the experience obtained in the previous fire incident. Thus, an analysis was conducted comparing the first actions of the 73 members of the participant population who had previous fire experience with the 73 individuals without previous fire experience. It should be remembered the distribution of the frequency of the previous fire experience, and the time elapsed since the last fire experience for the participant population was previously presented in Tables LXIX and L.

Table LIE presents the distribution of the first actions of the subpopulations with and without fire experience. It is apparent the most frequently utilized first action for both subpopulations consisted of "Investigated Cues".

TABLE LIE
 DISTRIBUTION OF FIRST ACTIONS OF PARTICIPANT POPULATION
 WITH AND WITHOUT PREVIOUS FIRE EXPERIENCE

Action	Previous Fire Experience		No Previous Fire Experience		Total	Per Cent
	Participants	Per Cent	Participants	Per Cent		
Investigated Cues	33	45.2	33	45.2	66	45.2
Closed Doors	13	17.7	6	8.2	19	13.0
Rescued Threatened Patients	1	1.4	9	12.3	10	6.8
Discovered Fire	4	5.6	6	8.2	10	6.8
Pulled Manual Fire Alarm	3	4.1	5	6.8	8	5.6
Evacuated Patients	4	5.5	3	4.1	7	4.8
Attempted Extinguishment	3	4.1	3	4.1	6	4.1
Got Extinguisher	2	2.7	4	5.5	6	4.1
Instructed Operations	4	5.5	1	1.4	5	3.4
Phoned Operator	3	4.1	1	1.4	4	2.7
Ventilated	1	1.4	1	1.4	2	1.4
Alerted Other Staff	1	1.4	1	1.4	2	1.4
Called Fire Department	1	1.4	0	0.0	1	0.7
N = 13	73	100.0	73	100.0	146	100.0
Range =	1 - 33		0 - 33		1 - 66	
Per Cent of Participant Population	48.7		48.7		97.4	

Following this action relative to frequency of utilization for the subpopulation with fire experience was "Closed Doors", with the participants evenly distributed among the other first actions. The second most prevalent first action of the no fire experience subpopulation consisted of "Rescued Threatened Patients", followed by the third actions of: "Closed Doors", and "Discovered Fire".

Table LIF presents the statistical analysis of the subpopulations of the participant population consisting of the members with previous fire experience and the members without previous fire experience relative to their first actions. The only difference indicated to be significant at the 1 per cent level of confidence in this table is the first action of "Rescued Threatened Patients", with 12.3 per cent of the members without fire experience and only 1.4 per cent of the members with fire experience being involved in this first action. No other differences were observed to be significant.

It should be noted, upon examination of the significance of previous training and fire experience, the subpopulations, including those participants without previous training and experience, were actively involved in controlling or limiting the threat from the fire. This active involvement included investigating the ambiguous cues, rescuing immediately threatened patients, or obtaining portable extinguishers. A possible explanation for this adaptive behavior despite the awareness of appropriate action to be initiated from training exercises or actual experience is the attitude and motivation of the health-care staff personnel concerning their responsibility to protect and care for the patients.

An examination of the statistically significant differences between the first actions of the participants with and without fire experience for the Project People I study (4) indicated there were no significant differences in the first actions of these participants. The Project People I fire experienced population consisted of 165 participants, or 28.3 per cent of the population, compared to

TABLE LIF

SIGNIFICANCE OF THE DIFFERENCE IN FIRST ACTIONS OF
PARTICIPANT POPULATION WITH AND WITHOUT PREVIOUS
FIRE EXPERIENCE

Action	Previous Fire Experience Per Cent	No Previous Fire Experience Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Investigated Cues	45.2	45.2	0.0	8.24	0.0
Closed Doors	17.7	8.2	9.5	5.57	1.72
Rescued Threatened Patients	1.4	12.3	10.9	4.17	<u>2.62**</u>
Discovered Fire	5.5	8.2	2.7	4.17	0.65
Pulled Manual Fire Alarm	4.1	6.8	2.7	3.77	0.72
Evacuated Patients	5.5	4.1	1.4	3.54	0.40
Attempted Extinguishment	4.1	4.1	0.0	3.28	0.0
Got Extinguisher	2.7	5.5	2.8	3.28	0.85
Instructed Operations	5.5	1.4	4.1	3.00	1.37
Phoned Operator	4.1	1.4	2.7	2.68	1.01
Ventilated	1.4	1.4	0.0	1.94	0.0
Alerted Other Staff	1.4	1.4	0.0	1.14	0.0
Called Fire Department	1.4	0	1.4	1.38	1.01
N = 3	73	73			

** Critical ratio significant at or above the 1 per cent level of confidence.

this study with 73 participants or 49 per cent of the total participant population.

4. The Relationship of The Belief in The Safety of The Building to The Participant's First Action

The participant population was dichotomized relative to their indicated belief in the safety of the building in which the fire incident occurred. It should be remembered from Table XLII in Section IV, that 9 participants, or approximately 6.0 per cent of the total participant population, believed the building was unsafe, and 111 of the participants, or 74.0 per cent of the total participant population believed the building was safe.

Table LIG presents the distribution of the first actions of the participant subpopulation relative to the member's elicited belief in the safety of the building. Table LIH presents the computation of the statistical significance of the differences in the percentage of the subpopulations participating in the various first action behavioral responses. Examination of Table LIH indicates the most frequent first action for both subpopulations was: "Investigated Cues", as utilized by 39.6 per cent of the participants believing the building to be safe, compared to 77.8 per cent of those believing the building to be unsafe. This difference was determined to be statistically significant at the 5 per cent level of confidence. Another substantial difference, though found not to be significant, concerned the first action of, "Closed Doors" with 18.9 per cent of the participants believing the building to be safe thus involved, compared to none of the other participants being involved in the closing of doors.

Only one significant difference was noted in the Project People I study (4) between the actions of participants with a belief in the safety of the building versus those believing the building to be unsafe. This one significant difference was determined for the action "Tried to Exit" for which there is no comparable

TABLE LIG

DISTRIBUTION OF BELIEF IN SAFETY OF BUILDING AND
FIRST ACTION OF PARTICIPANT POPULATION

Action	Belief Safe Participants	Per Cent	Belief Unsafe Participants	Per Cent	Total	Per Cent
Investigated Cues	44	39.6	7	77.8	51	42.4
Closed Doors	21	18.9	0	0.0	21	17.5
Rescued Threatened Patients	5	4.5	0	0.0	5	4.2
Discovered Fire	6	5.4	0	0.0	6	5.0
Pulled Manual Fire Alarm	7	6.4	0	0.0	7	5.8
Evacuated Patients	4	3.6	1	11.1	5	4.2
Attempted Extinguishment	6	5.4	0	0.0	6	5.0
Got Extinguisher	5	4.5	0	0.0	5	4.2
Instructed Operations	5	4.5	0	0.0	5	4.2
Phoned Operator	3	2.7	1	11.1	4	3.3
Ventilated	2	1.8	0	0.0	2	1.7
Alerted Other Staff	2	1.8	0	0.0	2	1.7
Called Fire Department	1	0.9	0	0.0	1	0.8
N = 13	111	100.0	9	100.0	120	100.0
Range =	1 - 44		0 - 7		1 - 51	
Per cent of Participant Population =	74.0		6.0		80.0	

TABLE LIH

SIGNIFICANCE OF DIFFERENCES IN FIRST ACTION BY
 BELIEF IN SAFETY OF BUILDING BY PARTICIPANT
 POPULATION

Action	Belief Safe Per Cent	Belief Unsafe Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Investigated Cues	39.6	77.8	37.8	17.13	<u>2.21*</u>
Closed Doors	18.9	0.0	18.9	13.17	1.44
Rescued Threatened Patients	4.5	0.0	4.5	6.95	0.65
Discovered Fire	5.4	0.0	5.4	7.55	0.71
Pulled Manual Fire Alarm	6.4	0.0	6.3	8.10	0.78
Evacuated Patients	3.6	11.1	7.5	6.95	1.08
Attempted Extinguishment	5.4	0.0	5.4	7.55	0.72
Got Extinguisher	4.5	0.0	4.5	6.95	0.65
Instructed Operations	4.5	0.0	4.5	6.95	0.65
Phoned Operator	2.7	11.1	8.4	6.19	1.36
Ventilated	1.8	0.0	1.8	4.48	0.40
Alerted Other Staff	1.8	0.0	1.8	4.48	0.40
Called Fire Department	0.9	0.0	0.9	3.09	0.29
N = 13	111	9			

* Critical ratio significant at or above the 5 per cent level of confidence.

action in this study. The action for which a significant difference was observed in this study, "Investigated Cues" was determined not to be significant in the Project People I study. It should be noted approximately 80 per cent of the participant population considered the building to be safe in the Project People I study as compared to 74 per cent of the participants in this study.

5. The Relationship of The Distance From The Fire to The First Action of The Participant Population

It was assumed the physical distance of the participant from the actual source of the flame, heat, and smoke might effect the selection of their first action. Table LIJ presents the distribution of the participant population with their first actions, and the distance from the fire stratified into six classifications ranging from 0 to 10 feet, to over 100 feet. Information was obtained on the distance from the fire for 148 participants, or approximately 98.7 per cent of the total participant population at the time they became aware of the fire incident. It appears that 19 individuals were within 10 feet of the fire, and a total of 40 participants consisting of approximately 27 per cent of the total participant population were within 20 feet of the fire. Apparently, these 40 participants may be considered to have been within the immediate proximity of the area of fire origin, being either in the room of origin or adjacent spaces.

This distribution of the participants relative to distance from the fire contrasts with the distribution reported in the Project People I study (4). In that study approximately 61 per cent of the participants were reported to be within 20 feet of the fire. Thus, it is apparent these individuals were probably within the residential unit or the occupancy area of fire origin.

Table LIK presents the 148 participants relative to their first actions, dichotomized into two subpopulations established on their being within 20 feet of the fire, or their being farther than 20 feet from the fire. It is obvious

TABLE LIJ

DISTRIBUTION OF THE DISTANCE FROM THE FIRE AT THE TIME OF AWARENESS
RELATIVE TO THE FIRST ACTION OF THE PARTICIPANT POPULATION

Action	Distance From Fire (Feet)						Not Reported	Total	Per Cent
	0-10	11-20	21-30	31-51	51-100	100+			
Investigated Cues	8	8	5	9	13	23	1	67	45.0
Closed Doors	0	2	1	1	10	7	0	21	14.1
Rescued Threatened Patients	2	2	1	1	2	2	0	10	6.7
Discovered Fire	4	2	1	3	0	0	0	10	6.7
Pulled Manual Fire Alarm	1	2	1	1	0	3	0	8	5.4
Evacuated Patients	0	1	2	0	2	2	0	7	4.7
Attempted Extinguishment	2	1	0	1	2	0	0	6	4.0
Got Extinguisher	1	2	0	2	1	0	0	6	4.0
Instructed Operations	0	0	0	2	1	2	0	5	3.4
Phoned Operator	0	0	0	2	2	0	0	4	2.7
Ventilated	0	0	0	0	0	2	0	2	1.3
Alerted Other Staff	1	1	0	0	0	0	0	2	1.3
Called Fire Department	0	0	0	0	0	1	0	1	0.7
N = 13	19	21	11	22	33	42	1	149	100.0
Per Cent	12.8	14.2	7.4	14.9	22.3	28.4	-	148	100.0

TABLE LIK

DISTRIBUTION OF THE DISTANCE WITHIN AND OVER 20 FEET
FROM THE FIRE AT THE TIME OF AWARENESS
OF THE PARTICIPANT POPULATION RELATIVE TO THE FIRST ACTION

Action	Distance From Fire (Feet)		Distance From Fire (Feet)		Total	Per Cent
	0-20	Per Cent	20+	Per Cent		
Investigated Cues	16	40.0	50	45.6	66	44.6
Closed Doors	2	5.0	19	17.5	21	14.2
Rescued Threatened Patients	4	10.0	6	5.5	10	6.8
Discovered Fire	6	15.0	4	3.7	10	6.8
Pulled Manual Fire Alarm	3	7.5	5	4.6	8	5.4
Evacuated Patients	1	2.5	6	5.5	7	4.7
Attempted Extinguishment	3	7.5	3	2.8	6	4.1
Got Extinguisher	3	7.5	3	2.8	6	4.1
Instructed Operations	0	0.0	5	4.6	5	3.4
Phoned Operator	0	0.0	4	3.7	4	2.7
Ventilated	0	0.0	2	1.9	2	1.4
Alerted Other Staff	2	5.0	0	0.0	2	1.4
Called Fire Department	0	0.0	1	0.9	1	0.7
N = 13	40	100.0	108	100.0	148	100.0
Range =	0 - 16		0 - 50		1 - 66	
Per Cent of Participant Population	26.7		72.0		98.7	

some apparent differences in the selection of the first action may occur when one is farther than 20 feet from the location of the fire. The three most popular first actions of the subpopulation located within 20 feet of the fire were as follows: "Investigated Cues", "Discovered Fire" and "Rescued Threatened Patients". The three most popular first actions of the participant subpopulation located farther than 20 feet from the fire were as follows: "Investigated Cues", "Closed Doors", and both "Evacuated Patients" and "Rescued Threatened Patients". The subpopulation located farther than 20 feet from the fire consisted of 108 participants, which was approximately 72 per cent of the total participant population.

The first three actions of the participant subpopulation located within 20 feet from the Project People I study (4) were, "Notified Others", "Called Fire Department", and "Searched for Fire". Thus, the investigation or searching activity was popular in both studies for those participants located within 20 feet of the fire at the time of fire awareness. Considering the participants located farther than 20 feet from the fire in the Project People I study (4), the three most utilized actions were, "Searched for Fire", "Notified Others", and "Got Dressed". The action of "Searched for Fire", was the most popular first action for the participants located farther than 20 feet from the fire. As previously noted, the action of "Got Dressed" was not observed in this study. "Notified Others" was the tenth most popular action for the subpopulation over 20 feet from the fire.

Table LII presents the computation of the statistical significance of the differences in the two subpopulations relative to the percentage of the populations engaging in the various first action responses relative to the location of the participants within or farther than 20 feet from the fire. An examination of this table indicates that two of the differences were significant above the 1 per cent level of confidence. The difference between the 15.0 per cent of the

TABLE LII

SIGNIFICANCE OF THE DISTANCE WITHIN AND OVER 20 FEET FROM
THE FIRE AT THE TIME OF AWARENESS OF THE
PARTICIPANT POPULATION RELATIVE TO THE FIRST ACTION

Action	Distance From Fire (Feet)		P_{1-P_2}	$SE_{P_{1-P_2}}$	C.R.
	0-20 Per Cent	20+ Per Cent			
Investigated Cues	40.0	45.6	5.6	9.20	0.61
Closed Doors	5.0	17.5	12.5	6.46	1.93
Rescued Threatened Patients	10.0	5.5	4.5	4.66	0.97
Discovered Fire	15.0	3.7	11.3	4.66	<u>2.42**</u>
Pulled Manual Fire Alarm	7.5	4.6	2.9	4.18	0.69
Evacuated Patients	2.5	5.5	3.0	3.92	0.76
Attempted Extinguishment	7.5	2.8	4.7	3.67	1.28
Got Extinguisher	7.5	2.8	4.7	3.67	1.28
Instructed Operator	0.0	4.6	4.6	3.35	1.37
Phoned Operator	0.0	3.7	3.7	3.00	1.23
Ventilated	0.0	1.9	1.9	2.17	0.87
Alerted Other Staff	5.0	0.0	5.0	2.17	<u>2.30**</u>
Called Fire Department	0.0	0.9	0.9	1.54	0.58
N = 13	40	108			

**Critical ratio significant at or above the 1 per cent level of confidence.

population within 20 feet and the 3.7 per cent of the population farther than 20 feet with the first action of: "Discovered Fire" was one significant difference that would be intuitively expected. The 5.0 per cent of the population within 20 feet compared to none of the staff over 20 feet being involved in the first action of: "Alerted Other Staff" was also significant. Another difference, nearly significant at the 5 per cent level of confidence as indicated in Table LII relates to the first action of "Closed Doors", where 5.0 of the population within 20 feet and 17.5 per cent of the population over 20 feet were involved in this action.

The significant differences in the actions of the participants within and over 20 feet from the fire in the Project People I study (4) were observed for the first actions of "Nothing" and "Tried to Exit". No comparable staff actions were reported in this study. The two actions with significant differences noted in this study were determined to be not statistically significant in the Project People I study.

B. The Distribution of The Second Actions of The Participant Population

The elicited second actions of the participant population are presented in Table LIII with a second action population consisting of 136 individuals which is approximately 90.7 per cent of the total participant population. The most frequently initiated response as a second action involved the action of "Evacuated Patients", as reported by 26 of the participants consisting of approximately 19.3 per cent of the population. The next most frequent response as a second action involved the behavioral response of "Closed Doors". This response was selected by 14 persons or approximately 10.3 per cent of the second action population. The third most frequent behavior exhibited as a second action involved the "Attempted Extinguishment", action. The fourth most popular response

TABLE LII

DISTRIBUTION OF THE SECOND ACTIONS OF THE PARTICIPANT
POPULATION

Action	Participants	Per Cent	
Evacuated Patients	26	19.3	
Closed Doors	14	10.3	
Attempted Extinguishment	13	9.6	
Called Fire Department	12	8.8	
Discovered Fire	12	8.8	
Pulled Manual Fire Alarm	9	6.6	
Investigated Cues	9	6.6	
Rescued Threatened Patients	8	5.9	
Stood By	8	5.9	
Phoned Operator	7	5.1	
Got Extinguisher	6	4.4	
Alerted Other Staff	6	4.4	
Attempted Rescue	3	2.2	
Ventilated	1	0.7	
Performed First Aid	1	0.7	
Instructed Operations	1	0.7	
N = 16	136	100.0	
M = 8.50	SE _m = 1.58	SD = 6.10	SE _{SD} = 1.08

as a second action involved the behavioral actions of "Called Fire Department" and "Discovered Fire". "Investigated Cues", the most frequently reported first action, as indicated in Table LI, was the seventh most frequently reported second action.

Examination of the distribution of second actions for the participant population of the Project People I study (4) indicated the first four most popular actions were: "Left Building", "Called Fire Department", "Notified Others", and "Got Family". Thus, the behavioral activity relating to evacuation was prevalent in both studies, although in the residential study, the evacuation action consisted of the unassisted evacuation of an ambulatory individual. However, the evacuation noted in this study consisted of the staff member assisting both ambulatory and nonambulatory patients. The action of "Called Fire Department" was popular as a second action in both studies. However, the second action of, "Notification of Others", was the twelfth most popular second action in this study. In addition, as would be expected all the actions related to family members were observed only in the Project People I study (4) involving residential occupancies.

1. The Significance of The Differences Between The First and Second Actions of The Participant Population.

The percentages of the participant population relative to their utilization of first and second action responses were compared for their statistical significance. It should be remembered the total first action population consisted of 149 participants. The comparison of the first and second action responses of the participant population are presented in Table LIIA. The most popular first action response was the action of: "Investigated Cues", while the most utilized second action was the behavior of "Evacuated Patients". Analysis of the statistical significance of the differences between the first and second actions resulted

TABLE LIIA

SIGNIFICANCE OF DIFFERENCES BETWEEN FIRST
AND SECOND ACTIONS OF PARTICIPANT POPULATION

Action	1st Action Per Cent	2nd Action Per Cent	P_{1-P_2}	SE_{P1-P2}	C.R.
Evacuated Patients	4.7	19.3	14.6	3.80	<u>3.84**</u>
Closed Doors	14.1	10.3	3.8	3.90	0.98
Attempted Extinguishment	4.0	9.6	5.6	2.97	1.89
Called Fire Department	0.7	8.8	8.1	2.48	<u>3.26**</u>
Discovered Fire	6.7	8.8	2.1	3.16	0.66
Pulled Manual Fire Alarm	5.4	6.6	1.2	2.82	0.43
Investigated Cues	45.0	6.6	38.4	5.25	<u>7.31**</u>
Rescued Threatened Patients	6.7	5.9	0.8	2.88	0.28
Stood By	0.0	5.9	5.9	1.96	<u>3.02**</u>
Phoned Operator	2.7	5.1	2.4	2.30	1.05
Got Extinguisher	4.0	4.4	0.4	2.38	0.17
Alerted Other Staff	1.3	4.4	3.1	1.96	1.58
Attempted Rescue	0.0	2.2	2.2	1.24	1.78
Ventilated	1.3	0.7	0.6	1.24	0.48
Performed First Aid	0.0	0.7	0.7	0.99	0.71
Instructed Operations	3.4	0.7	2.7	1.70	1.59
N = 16	149	136			

**Critical ratios significant at or above the 1 per cent level of confidence.

in four differences being determined to be significant at the 1 per cent level of confidence. The differences at the 1 per cent level of confidence were for the first and second actions of "Evacuated Patients" performed by 4.7 per cent of the participants as a first action and 19.3 per cent of the participants as a second action; "Called Fire Department", performed by 0.7 per cent of the participants as a first action and 8.8 per cent of the participants as a second action; and "Stood By", performed by no staff personnel as a first action and 5.9 per cent of the participants as a second action. The difference in the action of "Investigated Cues" being indicated as a first action by 45.0 per cent of the participants and as a second action of 6.6 per cent of the participants was significant at the 1 per cent level of confidence.

Considering a common sequence as intuitively expected for a fire incident in a health care facility, most of the differences between the first and second actions would be expected. The ambiguous fire cues are apparently investigated to determine the nature and severity of the fire threat. After investigation, actions to alert other staff members and protect patients with notification of the fire department and actions to control the fire threat and prepare for evacuation were observed as indicated in Tables LII and LIIA.

Numerous significant differences were noted in the Project People I study (4) between the first and second actions of the participant population. These differences included the actions of "Left Building", "Called Fire Department", "Searched for Fire", and "Nothing", which appear comparable to the actions noted in this study as being significantly different, including: "Evacuated Patients", "Called Fire Department", "Investigated Cues", and "Stood By".

A decrease of the percentage of participants involved in "Investigated Cues" from the first to second actions in this study was similarly observed with the action of: "Searched for Fire" in the Project People I study (4). Conversely,

the actions of: "Evacuated Patients", "Called Fire Department", and "Stood By", in this study all increased in the percentage of participants involved in these actions from the first to second action. Other actions noted in the Project People I study (4) to have significant differences from the first to the second action in the percentage of participants involved were: "Notified Others", "Got Dressed" and "Woke Up". The latter two actions have no comparable actions in this study. However the comparable action to "Notified Others" in this study was: "Alerted Other Staff", which did not exhibit a significant difference from the first to second action and instead increased from the first to second action rather than decreased as observed in the Project People I study (4).

2. Sexual Distribution of The Second Actions of The Participant Population.

The distribution of the male and female subpopulations related to their second actions is presented in Table LIIB. Relative to these second actions responses, four of the five most popular second actions of "Evacuated Patients", "Closed Doors", "Called Fire Department", and "Discovered Fire" were also the four most popular second actions for the female subpopulation. The most frequently reported second action by the male population of "Attempted Extinguishment" was the third most popular second action for the entire participant population, as previously indicated in Table LII.

The statistical significance of the differences in the selection of the second action responses by the male and female subpopulations is presented in Table LIIC. Examination of this table indicates the only differences between the men and women relative to their selection of second actions, that were significant above the 1 per cent level of confidence were the difference between the 13.3 per cent of the male subpopulation which "Got Extinguisher", and the 1.9 per cent of the female population and the difference between the 23.4

TABLE LIIB

SEXUAL DISTRIBUTION OF THE PARTICIPANT POPULATION
RELATED TO SECOND ACTION

Action	Female Per Cent		Male Per Cent		Total	Per Cent
Evacuated Patients	22	20.8	4	13.3	26	19.1
Closed Doors	12	11.3	2	6.7	14	10.3
Attempted Extinguishment	6	5.7	7	23.4	13	9.6
Called Fire Department	10	9.4	2	6.7	12	8.9
Discovered Fire	11	10.4	1	3.3	12	8.9
Pulled Manual Fire Alarm	8	7.5	1	3.3	9	6.6
Investigated Cues	6	5.7	3	10.0	9	6.6
Rescued Threatened Patients	6	5.7	2	6.7	8	5.9
Stood By	7	6.6	1	3.3	8	5.9
Phoned Operator	5	4.7	2	6.7	7	5.1
Got Extinguisher	2	1.9	4	13.3	6	4.4
Alerted Other Staff	6	5.7	0	0.0	6	4.4
Attempted Rescue	2	1.9	1	3.3	3	2.2
Ventilated	1	0.9	0	0.0	1	0.7
Performed First Aid	1	0.9	0	0.0	1	0.7
Instructed Operations	1	0.9	0	0.0	1	0.7
N = 16	106	77.9	30	22.1	136	100.0
Range =	1 - 22		0 - 7		1 - 26	
Per Cent of Participant Population	70.7		20.0		90.7	

TABLE LIIC

SIGNIFICANCE OF SEXUAL DIFFERENCES ON SECOND
ACTION OF PARTICIPANT POPULATION

Action	Female Per Cent	Male Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Evacuated Patients	20.8	13.3	7.5	8.13	0.92
Closed Doors	11.3	6.7	4.6	6.29	0.73
Attempted Extinguishment	5.7	23.4	17.6	6.09	<u>2.89**</u>
Called Fire Department	9.4	6.7	2.7	5.86	0.46
Discovered Fire	10.4	3.3	7.1	5.86	1.21
Pulled Manual Fire Alarm	7.5	3.3	4.2	5.13	0.82
Investigated Cues	5.7	10.0	4.3	5.13	0.83
Rescued Threatened Patients	5.7	6.7	1.0	4.87	0.21
Stood By	6.6	3.3	3.4	4.87	0.70
Phoned Operator	4.7	6.7	2.0	4.55	0.44
Got Extinguisher	1.9	13.3	11.4	4.24	<u>2.69**</u>
Alerted Other Staff	5.7	0.0	5.7	4.24	1.34
Attempted Rescue	1.9	3.3	1.4	3.03	0.46
Ventilated	0.9	0.0	0.9	1.72	0.52
Performed First Aid	0.9	0.0	0.9	1.72	0.52
Instructed Operators	0.9	0.0	0.9	1.72	0.52
N = 16	106	30			

** Critical ratios significant at or above the 1 per cent level of confidence.

per cent of the males who "Attempted Extinguishment" and the 5.7 per cent of the females.

It should be observed these are the second actions in which the differences between the male and female members of the participant population were statistically compared in detail later in this section in Tables LVI, LVII, LVIIIA and LVIIIB, related to the fire fighting actions.

Comparing the significance of the sexual differences between the second actions for this study and the Project People I study (4) participant population illustrates some apparent similarities. All of the significant differences noted in the Project People I study (4) were fire fighting type of actions, including: "Fought Fire", "Got Extinguisher", and "Removed Fuel". As observed in this study, the male participants were predominate in each of the three fire fighting actions.

C. The Distribution of The Third Actions of The Participant Population.

The distribution of the third actions of the participant population are presented in Table LIII. Third actions were engaged in by 104 members of the participant population which consisted of approximately 69.3 per cent of the total participant population. It should be remembered, 149 individuals were involved with first actions, which was approximately 99.3 per cent of the total participant population. Thus, the number of participants had decreased by approximately one third from the first to the third action. The first three most frequent third actions were the same as the first three most frequent second actions, though not in the same exact order, with the most frequent action, for both the third and second actions being "Evacuated Patients". The next two behavioral responses most frequently utilized as third actions were: "Attempted Extinguishment" and "Closed Doors". The most utilized three actions were selected by a total of 63 participants, or approximately 60 per cent of the participant

TABLE LIII

DISTRIBUTION OF THE THIRD ACTIONS OF THE
PARTICIPANT POPULATION

Action	Participants	Per Cent	
Evacuated Patients	37	35.7	
Attempted Extinguishment	16	15.4	
Closed Doors	10	9.6	
Called Fire Department	6	5.8	
Phoned Operator	5	4.8	
Stood By	5	4.8	
Got Extinguisher	4	3.8	
Attempted Rescue	4	3.8	
Alerted Other Staff	4	3.8	
Pulled Manual Fire Alarm	3	2.9	
Rescued Threatened Patients	3	2.9	
Investigated Cues	3	2.9	
Ventilated	2	1.9	
Instructed Operations	2	1.9	
N = 14	104	100.0	
M = 7.43	SE _m = 2.48	SD = 8.95	SE _{SD} = 1.69

population involved with third actions. "Investigated Cues", the most popular first action was utilized by only 2.9 per cent of the participant population as a third action as would be expected, since by the third action the nature of the cue has been defined. The first three most prevalent third actions reported in the Project People I study (4) were "Left Building", "Called Fire Department" and "Fought Fire". The comparable actions in this study to these three third actions ranked first, fourth and second, respectively. As noted previously, the action of "Left Building" is considered as comparable to "Evacuated Patients" since both are evacuation behavioral modes.

1. Significance of The Differences Between the First and the Third Actions of the Participant Population.

The statistical significance in the differences in the selection of the various actions between the first and third actions of the participant population are presented in Table LIIIA. It should be observed that four of these differences were significant above the 1 per cent level of confidence. Of the five differences that were significant, three of the actions were responses that were predominant for the third action population as follows: "Evacuated Patients", "Attempted Extinguishment" and "Called Fire Department". The most significant of these three actions was the difference for "Evacuated Patients", with 35.7 per cent of the third action participant population and 4.7 per cent of the first action participant population involved in the "Evacuated Patients" action.

The remaining two significant differences between the first and third actions of the participant population involved actions with a higher percentage of selection as first actions with the following actions: "Investigated Cues" and "Discovered Fire". It is apparent upon examination of Table LIIIA the significant differences in the first and third actions were essentially related

TABLE LIIIA

SIGNIFICANCE OF DIFFERENCES BETWEEN FIRST AND
THIRD ACTIONS OF PARTICIPANT POPULATION

Action	1st Action Per Cent	3rd Action Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Evacuated Patients	4.7	35.7	31.0	4.84	<u>6.40**</u>
Attempted Extinguishment	4.0	15.4	11.4	4.20	<u>2.72**</u>
Closed Doors	14.1	9.6	4.5	3.60	<u>1.25</u>
Called Fire Department	0.7	5.8	5.1	2.11	<u>2.42*</u>
Phoned Operator	2.7	4.8	2.1	2.50	0.84
Stood By	0.0	4.8	4.8	2.59	1.85
Got Extinguisher	4.0	3.8	0.2	5.72	0.03
Attempted Rescue	0.0	3.8	3.8	2.81	1.35
Alerted Other Staff	1.3	3.8	2.5	1.79	1.40
Pulled Manual Fire Alarm	5.4	2.9	2.5	2.38	1.05
Rescued Threatened Patients	6.7	2.9	3.8	1.96	1.94
Investigated Cues	45.0	2.9	42.1	1.60	<u>26.20**</u>
Ventilated	1.3	1.9	0.6	1.60	0.38
Instructed Operations	3.4	1.9	1.5	0.81	1.86
Discovered Fire	6.7	0.0	6.7	2.11	<u>3.18**</u>

N = 15

150

104

*Critical ratios significant at or above the 5 per cent level of confidence.

**Critical ratios significant at or above the 1 per cent level of confidence.

to investigating the fire cues and the actions related to protecting the patients and reducing the threat from the fire.

The magnitude of the significant differences between the first and the third actions were varied from a difference of 5.1 for the action of "Called Fire Department", to a difference of 42.1 for the action of, "Investigated Cues".

Fourteen differences between the first and third actions were noted as being significant in the Project People I study (4). Of the 14 differences that were significant, five of the actions were responses that were predominant for the third action population as follows: "Leaving the Building", "Fighting the Fire", "Awaiting the Fire Department Arrival", "Going to the Balcony", and "Removed by the Fire Department". These five actions were utilized by 55.3 per cent of the third action population. The remaining nine significant differences between the first and third actions of the participant population involved actions with a higher percentage of selection as first actions in the following classifications: "Notification of Others", "Searched for Fire", "Got Dressed", "Got Family", "Got an Extinguisher", "Left the Fire Area", "Woke Up", "Nothing", and "Went to the Fire Area". In comparing the five significant differences in this study with the fourteen differences from the Project People I study, three of the actions included in this study have comparable actions with "Evacuated Patients" and "Attempted Extinguishment", being comparable to the actions of "Left Building" and "Fought Fire", which all increased in utilization from the first to the third actions. However, both "Investigated Cues" and the comparable action of: "Searched for Fire", both decreased in utilization from the first to third actions. The remaining two actions noted as differing significantly in this study but not in the Project People I study were: "Called Fire Department" and "Discovered Fire". The action of: "Called

Fire Department" increased substantially from the first to the third actions in the Project People I study (4), but was not significant.

2. The Significance of the Differences Between the Third and the Second Actions of the Participant Population.

There were only two statistically significance differences in the selection of actions between the second and third actions as indicated in Table LIIIB. Both of these differences were significant above the 1 per cent level of confidence. The difference in which the third action was dominant was for the action: "Evacuated Patients", with 35.7 per cent of the third action participants compared to 19.3 per cent of the second action participants performing this activity. The difference in the action, "Discovered Fire" was also significant with 8.8 per cent of the second action participants and none of the third action participants utilizing this behavior.

There were eleven statistically significant differences in the selection of actions between the second and third actions in the Project People I study (4). The five predominant third actions of "Left Building", "Fought Fire", "Awaiting the Arrival of the Fire Department", "Going to the Balcony", and "Removed by the Fire Department" had significant differences in their percentage of utilization between the third and second action populations.

The six predominant second action significant differences involved the actions of "Notification of Other Persons", "Got Dressed", "Got Family Members", "Got an Extinguisher", "Got Personal Property", and "Tried Exit". Considering the two selected actions for which significant differences were determined between the second and third action in this study, only "Evacuated Patients" has a comparable action among the eleven significant differences noted in the Project People I study, since there is no comparable action for "Discovered Fire" in the Project People I study. In both studies, the evacuation behavior increased from the second to third actions.

TABLE LIII B

SIGNIFICANCE OF DIFFERENCES BETWEEN SECOND AND
THIRD ACTIONS OF PARTICIPANT POPULATION

Action	2nd Action Per Cent	3rd Action Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Evacuated Patients	19.3	35.7	16.4	5.73	2.86**
Attempted Extinguishment	9.6	15.4	5.8	3.91	1.48
Closed Doors	10.3	9.6	0.7	4.25	0.16
Called Fire Department	8.8	5.8	3.0	3.43	0.87
Phoned Operator	5.1	4.8	0.3	2.84	0.11
Stood By	5.9	4.8	1.1	2.84	0.39
Got Extinguisher	4.4	3.8	0.6	2.84	0.21
Attempted Rescue	2.2	3.8	1.6	2.73	0.59
Alerted Other Staff	4.4	3.8	0.6	2.94	0.20
Pulled Manual Fire Alarm	6.6	2.9	3.7	2.84	1.30
Rescued Threatened Patients	5.9	2.9	3.0	2.61	1.15
Investigated Cues	6.6	2.9	3.7	2.61	1.42
Ventilated	0.7	1.9	0.8	1.19	0.37
Instructed Operations	0.7	1.9	0.8	1.42	0.56
Discovered Fire	8.8	0.0	8.8	0.82	10.70**
Performed First Aid	0.7	0.0	0.7	1.42	0.49
N = 16	136	104			

** Critical ratios significant at or above the 1 per cent level of confidence.

3. The Sexual Distribution of the Participant Population Relative to the Third Actions.

As previously indicated in Table LIII, the most popular response adopted as a third action by the participant population was "Evacuated Patients". The response of evacuating patients was the most frequently utilized response for the female subpopulation and second most frequently utilized response for the male subpopulation with 40.7 and 17.5 per cent of the females and males respectively as presented in Table LIIIC. The second most popular response, "Attempted Extinguishment", for the total participant population was the most frequently selected action for the male subpopulation with 30.4 per cent of the males, and the second most frequently selected action for the female subpopulation with 11.1 per cent of the females. The action of "Closed Doors", the third most popular response for the participant population was the second most popular for males and third most popular for female staff members.

The significance of the differences relative to the selection of the third actions were statistically examined between the male and female subpopulations, with the computations presented in Table LIIID, with 81 females and 23 males comprising the two subpopulations. Upon examination of this table, it is apparent the two actions for which the differences were significant were also the two most popular actions reported for the third action participant population, as previously presented in Table LIII. The difference in the utilization of the third action of "Evacuated Patients" by 40.7 per cent of the female subpopulation and 17.5 per cent of the male subpopulation was significant at the 5 per cent level of confidence. Also significant at the 5 per cent level of confidence was the difference in the third action of "Attempted Extinguishment" by 11.1 per cent of the females and 30.4 per cent of the males.

When one compares the sexual differences of the first, second, and third actions of the participant population, it is apparent the males predominate

TABLE LIIIC

SEXUAL DISTRIBUTION OF THE PARTICIPANT POPULATION
RELATED TO THIRD ACTION

Action	Female	Per Cent	Male	Per Cent	Total	Per Cent
Evacuated Patients	33	40.7	4	17.5	37	35.6
Attempted Extinguishment	9	11.1	7	30.4	16	15.5
Closed Doors	6	7.3	4	17.5	10	9.6
Called Fire Department	5	6.2	1	4.3	6	5.8
Phoned Operator	5	6.2	0	0.0	5	4.8
Stood By	5	6.2	0	0.0	5	4.8
Got Extinguisher	3	3.7	1	4.3	4	3.8
Attempted Rescue	2	2.5	2	8.7	4	3.8
Alerted Other Staff	2	2.5	2	8.7	4	3.8
Pulled Manual Fire Alarm	2	2.5	1	4.3	3	2.9
Rescued Threatened Patients	3	3.7	0	0.0	3	2.9
Investigated Cues	3	3.7	0	0.0	3	2.9
Ventilated	1	1.2	1	4.3	2	1.9
Instructed Operations	2	2.5	0	0.0	2	1.9
N = 14	81	100.0	23	100.0	104	100.0
Range =	1 - 33		0 - 7		2 - 37	
Per Cent of Participant Population	54.0		15.3		69.3	

TABLE LIIID

SIGNIFICANCE OF SEXUAL DIFFERENCES ON THIRD
ACTION OF PARTICIPANT POPULATION

Action	Female Per Cent	Male Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Evacuated Patients	40.7	17.5	23.4	11.31	2.06*
Attempted Extinguishment	11.1	30.4	19.3	8.53	2.22*
Closed Doors	7.3	17.5	10.2	6.96	1.44
Called Fire Department	6.2	4.3	1.9	5.52	0.34
Called Operator	6.2	0.0	6.2	5.05	1.23
Stood By	6.2	0.0	6.2	5.05	1.23
Got Extinguisher	3.7	4.3	0.6	4.52	0.13
Attempted Rescue	2.5	8.7	6.2	4.52	1.37
Alerted Other Staff	2.5	8.7	6.2	4.52	1.37
Pulled Manual Fire Alarm	2.5	4.3	1.3	3.96	0.45
Rescued Threatened Patients	3.7	0.0	3.7	3.96	0.93
Investigated	3.7	0.0	3.7	3.96	0.93
Ventilated	1.2	4.3	3.1	3.23	0.96
Instructed Operations	2.5	0.0	2.5	3.23	0.77
N = 16	81	23			

*Critical ratios significant at or above the 5 per cent level of confidence.

with investigation and the fire fighting activities, while the females predominate with the evacuation of patients, closing of doors, the fire discovery and the alerting of others. This dominance is especially evident in the second and third actions, though not as apparent in the first action where females were involved in extinguishment activities. It should be remembered from Tables LIB and LIIC the male subpopulation dominated and was significantly different from the female population with the first and second actions of "Got Extinguisher". As previously indicated in Tables LIIC and LIIID, the male subpopulation dominated and was significantly different from the female subpopulation on the second and third actions of "Attempted Extinguishment". Conversely, the female subpopulation was dominate and significantly different from the male population in the first action of "Closed Doors" and third action of "Evacuated Patients". Some of the differences in the selection of responses to the fire incident by the male and female subpopulations may be attributed to the health-care facility fire emergency plans and staff training which emphasizes a coordinated effort to minimize the threat of the fire. The nursing staff (predominately female) are directed to protect or evacuate patients, while security and maintenance personnel, (predominately male) are trained to minimize the fire threat, including the extinguishment of the fire.

Comparison of the significance of the sexual differences in the third actions for this study and the Project People I study (4) indicates one common significant difference. The only significant sexual difference noted in the Project People I study was the action of: "Fought Fire" with the male subpopulation dominate, as determined in this study for the comparable action of: "Attempted Extinguishment". The Action "Evacuated Patients" and the comparable action in the Project People I study of "Left Building" were both dominated by the female subpopulations, but was only determined to be statisically significant in this health care study.

The first, second and third actions of the participant population are summarized in Table LIV relative to the selection of these actions by the members of the participant population. The apparent trends relative to the participants from the first to third actions may be compared. The trend of decreased utilization from the first to the third actions with the actions of "Investigated Cues", "Closed Doors", and "Rescued Threatened Patients", should be noted. Conversely, the increasing use from the first to the third actions with the actions of "Evacuated Patients", "Attempted Extinguishment" and "Attempted Rescue" is readily apparent. Some actions increased in frequency of utilization from the first to the second action, and then decreased from the second to the third action, including the actions of: "Discovered Fire", "Pulled Manual Fire Alarm", "Called Fire Department", and "Stood By". The actions which exhibited no appreciable change through the first, second and third actions included "Got Extinguisher" and "Ventilated".

It must be remembered in comparing the first three actions for the staff personnel, the time sequence of the actions for each of the individual participants varied widely. In most of the fire incidents, some of the participants initiated their first three actions prior to the time other participants became aware of the fire incident. In the general sense, the first action was dominated by investigating the fire cues and defining the threat created by the fire incident with the later actions involving patient protection, patient evacuation or fire and smoke control, confinement and suppression activities.

Many of the increasing and decreasing trends in the utilization of actions noted in this study were also noted in the Project People I study. As an example, considering the actions indicating a decreasing trend, "Investigated Cues" and "Closed Doors" both had comparable actions in the Project People I study with a decreasing utilization trend. Similarly, the increasing trend

TABLE LIV

SUMMARY OF THE FIRST, SECOND AND THIRD ACTIONS
OF THE PARTICIPANT POPULATION

Actions	1st Action Per Cent	2nd Action Per Cent	3rd Action Per Cent
Investigated Cues	45.0	6.6	2.9
Closed Doors	14.1	10.3	9.6
Rescued Threatened Patients	6.7	5.9	2.9
Discovered Fire	6.7	8.8	0.0
Pulled Manual Fire Alarm	5.4	6.6	2.9
Evacuated Patients	4.7	19.3	35.7
Attempted Extinguishment	4.0	9.6	15.4
Got Extinguisher	4.0	4.4	3.8
Instructed Operations	3.4	0.7	1.9
Phoned Operator	2.7	5.1	4.8
Ventilated	1.3	0.7	1.9
Alerted Other Staff	1.3	4.4	3.8
Called Fire Department	0.7	8.8	5.8
Stood By	0.0	5.9	4.8
Attempted Rescue	0.0	2.2	3.8
Performed First Aid	0.0	0.7	0.0
N = 16	149	136	104
Range =	0 - 67	1 - 26	0 - 37
Per Cent of Participant Population	99.3	90.7	69.3

observed for "Evacuated Patients" and "Attempted Extinguishment" both had comparable actions in the Project People I study, with an increasing utilization trend. Considering the actions that had the maximum percentage of participants in the second action, only "Called Fire Department" had a comparable action in the Project People I study which also peaked as a second action. Obviously, in both studies the phenomenon of multiple calls to the fire department was not a behavioral action utilized by the participants.

D. Varied Critical Actions of the Participant Population.

Additional actions contained within the first, second, and third actions of the participant population were examined due to the unique nature of the actions or the assumed impact of these actions on the design of this study. It should be realized all of the actions related to the movement of the participants through smoke, and the effect of fire and smoke on the responses of the participants will be reviewed in section VI of this report. Thus, the actions examined and compared in detail in this section of the report consisted of the actions the reentry behavior of the participant population, and the relationship of the actions of the participants concerned with fighting the fire, evacuating patients, and calling the fire department.

1. The Distribution of The Participant Population Relative to The Reentry Behavior of The Participants.

The reentry behavior for this study was defined as entering the zone of the fire incident after voluntarily or nonvoluntarily leaving the zone, without permission of the fire department personnel, if on the scene, or before the premises were considered suitable and safe for entry to the occupants. A total of 55 participants or 36.7 per cent of the total population indicated they had engaged in reentry behavior as noted in Table LV. It should be recognized that several fire incidents occurred with multiple reentry by the participants.

TABLE LV

DISTRIBUTION OF THE PARTICIPANT POPULATION
RELATIVE TO REENTRY TO FIRE AREA

Re-entry	Participants	Per Cent
Yes	55	36.7
No	91	60.6
Not Reported	4	2.7
N = 3	150	100.0

It should be noted that 163 participants, or 27.9 per cent of the participant population exhibited reentry behavior in the Project People I study (4).

While a limited number of participants were observed to reenter the building in both studies, the rationale for reentry appeared to be somewhat similar. As noted in the Project People I study, fire fighting was the most frequently reported reason for reentry behavior. Other reasons such as "Assisting Fire Department", "Notify Others", and "Assisting Evacuation" were also reported in principle, in this study. However, the motivation for reentry appeared to be different, where participants in the Project People I study (4) reentered to assist family members, retrieve personal belongings or fight the fire to protect family members or personal property. In this study, participants appeared to be motivated by professional responsibilities to the patient population in the facility, and more specifically their patients as defined by their normal functional duty assignments and locations.

The analysis of the differences in reentry behavior of the participants relative to the male and female members of the population are presented in Table LVA. The percentage of males and females participating in the reentry behavior is approximately the same. Thus, the indication of no significance in the difference in the reentry behavior for the male and female subpopulations in Table LVB is to be expected.

The sexual differences observed in the Project People I study (4) relative to the reentry behavior also appeared to not be statistically significant.

The reentry behavior was analyzed relative to previous training, with the analysis presented in Table LVC. Thus, 39.3 per cent of the participants with training reentered the fire zone compared to 18.2 per cent of the participants without training. This difference was determined to not be statistically significant, as presented in Table LVD. Further analysis of the reentry

TABLE LVA

SEXUAL DISTRIBUTION OF PARTICIPANT POPULATION
RELATIVE TO REENTRY TO FIRE AREA

Reentry	Female Participants	%	Male Participants	%	Total	Per Cent
Yes	41	38.0	14	36.8	55	37.7
No	67	62.0	24	63.2	91	62.3
N = 2	108	100.0	38	100.0	146	100.0
Per Cent of Participant Population = 97.3						

TABLE LVB

SIGNIFICANCE OF SEXUAL DIFFERENCES ON REENTRY
TO FIRE AREA FOR PARTICIPANT POPULATION

Reentry	Female Per Cent	Male Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Yes	38.0	36.8	1.2	9.14	0.13
No	62.0	63.2	1.2	0.14	0.13
N = 2	108	38			

TABLE LVC

DISTRIBUTION OF REENTRY TO FIRE AREA
RELATIVE TO PREVIOUS TRAINING

Reentry	Previous Training		No Previous Training		Total	Per Cent
	Participants	%	Participants	%		
Yes	53	39.3	2	18.2	55	37.7
No	82	60.7	9	81.8	91	62.3
Total	135	100.0	11	100.0	146	100.0
Per Cent of Participant Population	90.0		7.3		97.3	

TABLE LVD

SIGNIFICANCE OF DIFFERENCES IN REENTRY TO
FIRE AREA RELATIVE TO PREVIOUS TRAINING

Reentry	Training Per Cent	No Training Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Yes	39.3	18.2	21.1	15.20	1.39
No	60.7	81.8	21.1	15.20	1.39
N = 2	135	11			

behavior relative to the time elapsed since the participant had last received training is presented in Table LVE. Examination of this table indicates only a slight increase in the frequency of reentry behavior with an increased time decay period since the last training session.

Lastly, the reentry behavior was examined relative to previous fire experience, with the summary of the results of this examination presented in Table LVF. Reentry behavior was exhibited by 44.4 per cent of the participants without fire experience as compared to 28.2 per cent of the participants with fire experience. This difference of 16.2 per cent was found to be significant at the 5 per cent level of confidence, as indicated in Table LVG. A possible explanation for this difference could relate to the unfamiliarity of the non-fire experience personnel with the rapid deterioration of conditions which may occur in a fire incident. This type of experience is difficult to convey in training sessions and therefore may encourage an attitude of invulnerability by the nonfire experience staff personnel.

2. The Distribution of The Participant Population Relative to The Fire Fighting Behavior of The Participants.

As indicated previously in this section, specifically in Table LIA, related to the first actions, Table LIIB, related to second actions, and Table LIIIC, concerned with third actions, there were significant statistical differences in the actions related to fire fighting behavior when compared for the male and female subpopulations. These statistical significant differences occurred in the action categories of "Got Extinguisher", and "Attempted Extinguishment". All of these fire fighting related behavioral actions were predominately male actions. The action of, "Evacuated Patients", was statistically significant in the third action with the female members of the participant population being predominant in utilizing this action response. It was thus, considered to be

TABLE LVE

DISTRIBUTION OF REENTRY TO FIRE AREA RELATIVE
TO MOST RECENT TRAINING

Reentry	0-.2 Years		.3-1.0 Years		>1.0 Years		Total	Per Cent
	Participants	%	Participants	%	Participants	%		
Yes	35	35.7	11	44.0	4	44.4	50	37.9
No	63	64.3	14	56.0	5	55.6	82	62.1
N = 2	98	100.0	25	100.0	9	100.0	132	100.0
Per Cent of Participant Population	65.3		16.7		6.0		88.0	

TABLE LVF

DISTRIBUTION OF REENTRY TO FIRE AREA RELATIVE
TO PREVIOUS FIRE EXPERIENCE

Reentry	Previous Fire Experience		No Previous Fire Experience		Total	Per Cent
	Participants	%	Participants	%		
Yes	20	28.2	32	44.4	52	36.4
No	51	71.8	40	55.6	91	63.6
N = 2	72	100.0	72	100.0	143	100.0
Per Cent of Participant Population		47.3		48.0		95.3

TABLE LVG

SIGNIFICANCE OF DIFFERENCES IN REENTRY TO
FIRE AREA RELATIVE TO PREVIOUS FIRE EXPERIENCE

Reentry	Fire Experience Per Cent	No Fire Experience Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Yes	28.2	44.4	16.2	8.05	<u>2.01*</u>
No	71.8	55.6	16.2	8.05	<u>2.01*</u>
N = 2	71	72			

*Critical ratios significant at or above the 5 per cent level of confidence.

useful and possibly of some significance to examine the distribution of the participant population relative to the evacuation mode of behavior as contrasted to the behavioral mode of fighting the fire. In addition, the alerting mode of behavior was included in this analysis since the alerting action is a prerequisite for both the evacuation and fire fighting modes.

Table LVI, presents the distribution of the participant population actions relative to the behavior modes of fighting the fire, alerting or evacuation. It should be understood the first, second, and third actions identified under the classifications of "Got Extinguisher", and "Attempted Extinguishment" were all considered under the behavioral mode of fire fighting. The first, second, and third action responses identified under the classification in the action analysis in this study of, "Called Fire Department", "Pulled Manual Fire Alarm", "Alerted Other Staff", and "Phoned Operator" were all considered in the alerting mode of behavior. Finally, the evacuation behavioral mode consisted of the first, second, and third action responses identified under the classification of: "Rescued Threatened Patients", "Evacuated Patients", and "Attempted Rescue". Relative to Table LVI, it is apparent the behavioral mode of evacuation was only slightly dominate for the first and second action responses, but was strongly dominate for the third action response. The frequency of the alerting mode of behavior increased from the first to second action then decreased from the second to third action, while the frequency of the fire fighting mode of behavior increased from the first to third actions.

The evacuation behavior mode was utilized in 98 of the action responses for 25.2 per cent of the responses involved in this analysis.

The fire fighting behavioral mode was selected in 51 of the action responses of the participants for 13.1 per cent of the responses, while the alerting behavioral mode was involved with 67 of the responses for 17.2 per cent of the first, second, or third actions.

TABLE LVI

DISTRIBUTION OF PARTICIPANT POPULATION ACTIONS
RELATIVE TO FIRE FIGHTING, ALERTING
AND EVACUATION MODES

Action	1st Action		2nd Action		3rd Action		Total	
	Parti- cipant	Per Cent	Parti- cipant	Per Cent	Parti- cipant	Per Cent	Parti- cipant	Per Cent
Fire Fighting	12	8.1	19	8.0	20	19.2	51	13.1
Alerting	15	10.1	34	25.0	18	17.3	67	17.2
Evacuation	17	11.4	37	27.2	44	42.3	98	25.2
N = 3	44	29.6	90	66.2	82	78.8	216	55.5

(Note: Per cents based on 149 first actions, 136 second actions and 104 third actions for 389 total actions (1st, 2nd and 3rd)).

In the Project People I study, (4) the fire fighting mode of behavior was dominate over the alerting mode only in the first action comparison. In this study, the percentage of participants engaged in fire fighting behavior was less than the percentage of participants engaged in alerting behavior in the first, second and third actions.

Table LVII presents the distribution of the sexual status of the participants who engaged in the action responses consisting of the fire fighting behavioral mode, as previously presented in Table LVI. It should be recognized these 51 participants only had to participate in one of the two identified action classifications, under the first, second, or third action to be identified as having engaged in fire fighting behavior. The fire fighting behavior was thus, fairly evenly divided between 26 females engaging in this behavior, which was approximately 51.0 per cent of the fire fighting population or 6.7 per cent of the total participant population actions and 25 males for approximately 49.0 per cent of the fire fighting population and 6.4 per cent of the total participant population.

Table LVII also presents the distribution of the 51 members of the fire fighting population relative to their ages. It is interesting, that fire fighting behavior was initiated by participants as young as 18 years of age and as old as 50. It should also be noted that 86.3 per cent of the individuals engaged in the fire fighting actions were between the ages of 18 and 47 years of age. It should be noted, that participants as young as 7 years of age and as old as 80 were recorded as being involved in firefighting behavior in the Project People I study (4). This greater age range is attributed to the restricted age range of this study being established by the ages of employed professionals in health care occupancies.

TABLE LVII
 FIRE FIGHTING BEHAVIOR OF THE PARTICIPANT
 POPULATION

Sex	Participants	Per Cent
Male	25	49.0
Female	26	51.0
Total	51	100.0

Age	Participants	Per Cent
18-27	15	29.4
28-37	23	45.1
38-47	6	11.8
48-57	5	9.8
58-67	0	0.0
Not Reported	2	3.9
Total	51	100.0

Per Cent of Participant Population = 34.0

The sexual distribution of the participants relative to the action classifications constituting the fire fighting behavior mode evacuation behavior mode and the alerting behavior mode are presented in Table LVIIA. In the action classifications for the fire fighting behavior mode, the males were dominant for every classification. Relative to the classifications in the alerting behavior mode, the female participants were predominate for every classification except for the action of "Phoned Operator". Lastly, the females were predominant in the evacuation mode of behavior except for the action of "Attempted Rescue".

The dominance of males in the fire fighting actions of "Got Extinguisher" and "Attempted Extinguishment", and the females in the alerting mode of behavior was also observed in the Project People I study (4).

The statistical significance of the differences between the male and female subpopulations relative to their utilization of the action classifications under the behavior modes of fighting the fire, alerting and evacuation were computed and presented in Table LVIIIB. The statistically significant differences were found throughout the fire fighting behavior mode and for one action in the evacuation mode. One action, "Evacuated Patients" in the evacuation behavioral mode for which the sexual differences was determined to be significant at the 5 per cent level of confidence was predominated by females. The sexual differences for the total fire fighting mode were also determined to be significant, with the male subpopulation predominate in the fire fighting mode and the female subpopulation in the evacuation mode. Sexual differences in the actions ranged from 0.4 to 10.6 per cent.

The sexual differences in the fire fighting behavioral mode was significant at the 1 per cent level of confidence in the Project People I study.

TABLE LVIIA

DISTRIBUTION OF THE SEXUAL DIFFERENCES OF THE
PARTICIPANT POPULATION RELATIVE TO FIRE FIGHTING,
ALERTING AND EVACUATION ACTIONS

Action	Female Participant	Per Cent	Male Participant	Per Cent	Total Participant	Per Cent
Got Extinguisher	6	2.0	10	11.0	16	4.1
Attempted Extinguishment	20	6.8	15	16.5	35	9.0
N = 3	26	8.7	25	27.5	51	13.1
Pulled Manual Fire Alarm	16	5.4	4	4.4	20	5.1
Alerted Other Staff	10	3.4	2	2.2	12	3.1
Phoned Operator	12	4.0	4	4.4	16	4.1
Called Fire Department	15	5.0	4	4.4	19	4.9
N = 4	53	17.8	14	15.4	67	17.2
Attempted Rescue	4	1.3	3	3.3	7	1.8
Rescued Threatened Patients	18	6.0	3	3.3	21	5.4
Evacuated Patients	61	20.5	9	9.9	70	18.0
N = 3	83	27.8	15	16.5	98	25.2

(Note: Per Cents based on 298 total female actions, 91 male actions for 389 total actions (1st, 2nd and 3rd))

TABLE LVIIB

SIGNIFICANCE OF THE SEXUAL DIFFERENCES OF THE
PARTICIPANT POPULATION RELATIVE TO FIRE FIGHTING,
ALERTING AND EVACUATION ACTIONS

Action	Female Per Cent	Male Per Cent	P_{1-P_2}	$SE_{P_{1-P_2}}$	CR
Got Extinguisher	2.0	11.0	9.0	5.55	1.62
Attempted Extinguishment	6.8	16.5	9.7	8.02	1.21
Total	8.7	27.5	18.8	9.45	<u>1.99*</u>
N = 3	26	25			
Pulled Manual Fire Alarm	5.4	4.4	1.0	2.63	0.38
Alerted Other Staff	3.4	2.2	1.2	2.08	0.58
Called Operator	4.0	4.4	0.4	2.37	0.16
Called Fire Department	5.0	4.4	0.6	2.59	0.23
Total	17.8	15.4	2.4	4.52	0.53
N = 4	53	14			
Attempted Rescue	1.3	3.3	2.0	1.59	1.25
Rescued Threatened Patients	5.0	3.3	2.7	2.71	1.00
Evacuated Patients	20.5	9.9	10.6	4.60	<u>2.30*</u>
Total	27.8	16.5	11.3	5.20	<u>2.17*</u>
N = 3	83	15			

*Critical ratios significant at or above the 5 per cent level of confidence.

E. The Sequences of Actions of The Participant Population.

During the analysis of the data received on the questionnaires for this study, it was realized the comparison of the actions relative to the total participant population did not provide an understanding of the relationship between the first, second, and third actions. It was possible the preceding actions might have an important predetermining influence on the subsequent actions. Thus, it was considered important to investigate possible methods by which the sequences of actions of the participants population could be quantified and described in relation to the transitional aspects of the actions.

In this type of analysis where numerous action sequences of sequential relationships are being examined, critical action trends can be difficult to identify if the diagrams employed are not clear and concise. Thus, in the interest of comprehension, the sixteen categories of actions, were classified into five types of behavior as noted in Figure VI.

1. Action Sequences

The commonly occurring action sequences utilizing the five behavioral modes, identified in Figure VI are presented in Figure VII. The decimal numbers relate to the percentage of the participant population exhibiting this mode of behavior for a specific action. For example, 52 per cent of the participants were involved in an investigating type of behavior, type "D" as a first action. The most frequent behavioral types for second actions for those participants involved in investigating in their first action consisted of evacuation type "C", for 15 per cent of the participant population involved in second actions. Considering the type of third actions which the participants were involved in whose first action response was in the investigating type of behavior, the only commonly occurring type was in the

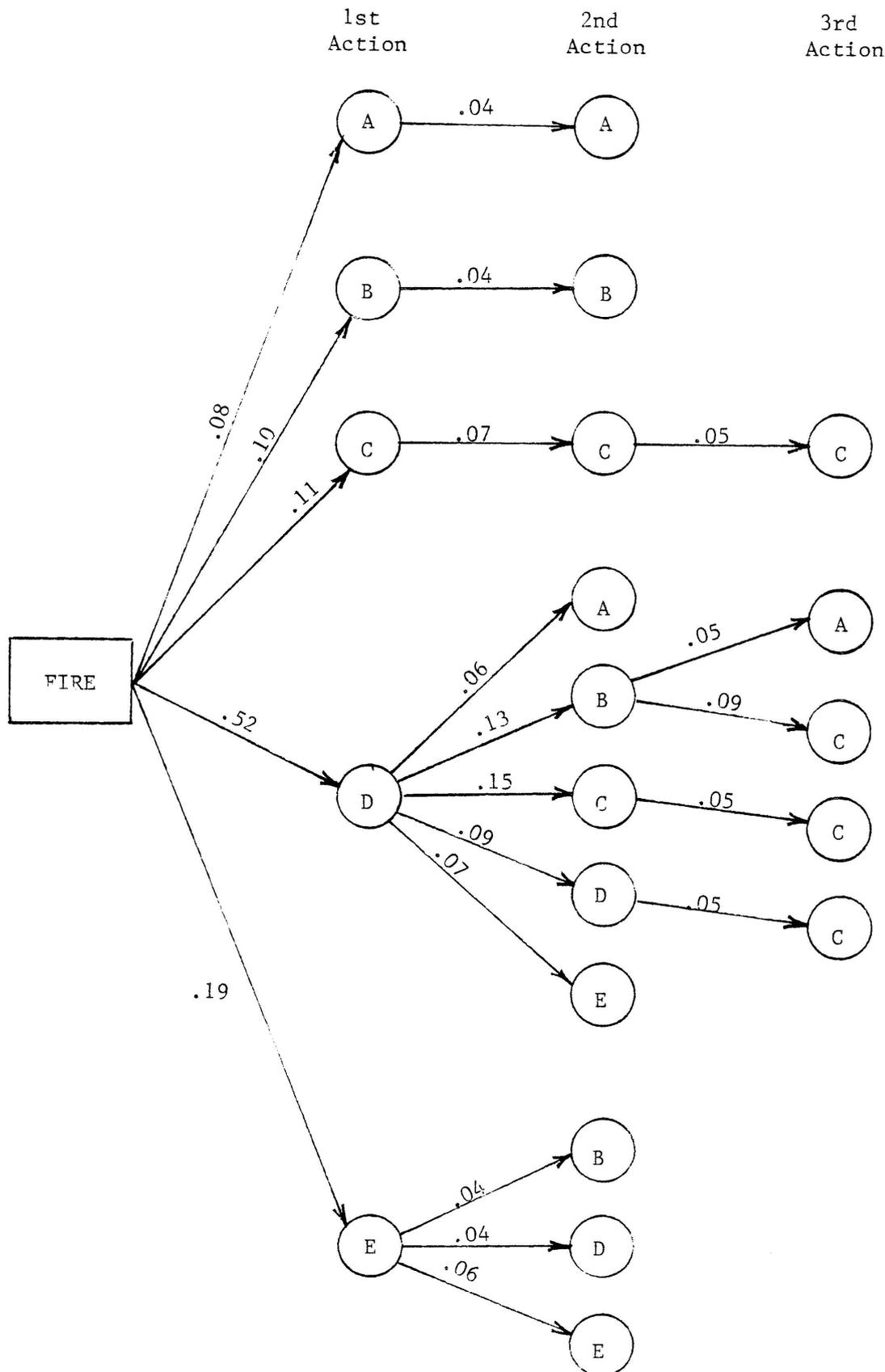
FIGURE VI

BEHAVIORAL MODES FOR THE 16 ACTIONS

<u>Behavioral Mode</u>	<u>Action</u>
A. Fire Fighting	Attempt Extinguishment Got Extinguisher
B. Alerting	Pulled Manual Fire Alarm Called Operator Called Fire Department Alerted Other Staff
C. Evacuation	Rescued Threatened Patients Evacuated Patients Attempted Rescue
D. Investigating	Investigated Cues Discovered Fire
E. Following Facility Emergency Plan	Closed Doors Instructed Operations Stood By Ventilated

FIGURE VII

ACTION SEQUENCES OF THE BEHAVIORAL MODES FOR THE PARTICIPANT POPULATION



Decimal numbers relate to per cents based on 149 first actions, 136 second actions and 104 third actions.

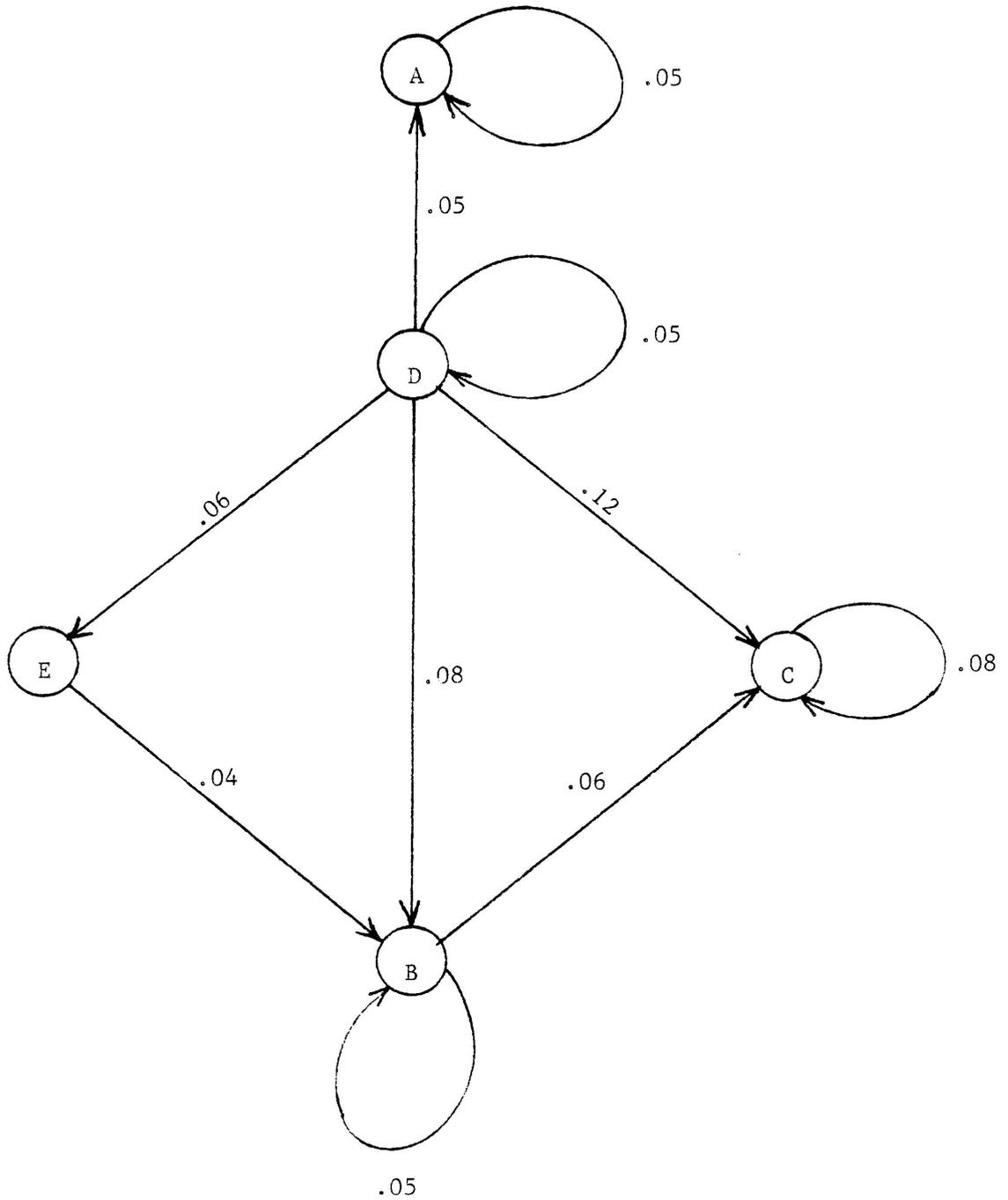
evacuation behavioral mode or type "C". In the interest of comprehension, all the behavioral modes with an observed frequency under 5 (1 per cent) were eliminated and not considered in Figure VII. It should be noted that for those individuals whose first action was related to evacuation their most commonly occurring second and third actions were also in the evacuation type of behavior. Those individuals whose initial response was an investigation mode of behavior, performed the evacuation mode most frequently as a second and third response to the fire incident. Other popular action sequences beginning with investigation were investigating, alerting, fire fighting, investigating, alerting, evacuation; and investigating, investigating and evacuation.

2. The Weighted Diagraph.

The weighted diagraph also was found to be an acceptable means of presenting the action sequences of the individual participants and is presented in Figure VIII. Each action taken by the participant represents a discrete state in the flow diagram, with the weighted diagraph indicating the behavioral mode of each action by an encircled code letter. The code letter was the identical letter utilized in Figure VI and VII. In this case, the decimal numbers relate to the probability of a particular sequence occurring based on the 240 transitions from first action to second action and second action to third action. The directional arrows indicate the direction of the sequences for the types of behavior. For example, a transition from behavioral mode "D", investigating to behavioral mode "B", alerting, was noted in 8 per cent of the action transitions. However, the reverse transition from alerting to investigating was not commonly observed. It should be noted, in the interest of comprehension, transitions with an observed frequency under

FIGURE VIII

WEIGHTED DIAGRAPH OF THE
PROBABILITY OF ACTIONS



Decimal numbers related to per cents based on 240 action transitions.

10, or less than 4 per cent of all transitions, were neglected. After reviewing Figure VII and VIII several trends may be noted. First, the investigating mode of behavior precedes all other modes, with the performance of none of the other four modes of behavior usually preceding the investigation activity. The alerting mode of behavior is usually preceded by all investigation activities in conformance with the facility plan. Alerting commonly preceded the activity of evacuation. The fire fighting mode of behavior, type A, was commonly preceded by investigation, type D. The evacuation mode of behavior was usually preceded either by the alerting, investigating, or evacuation mode and did not usually precede any other behavioral mode. The most frequently observed transition, which occurred in 12 per cent of all the transitions, was the transition from the investigation mode to the evacuation mode.

VI THE EFFECT AND INFLUENCE OF FIRE DEVELOPMENT AND SMOKE PROPAGATION ON THE BEHAVIOR OF THE PARTICIPANT POPULATION

One of the primary objectives of this study was to assess the influence of the severity of the fire, the proximity of the participants to the fire and the visual observations of smoke on the behavior of the participant population. It should be remembered, the variables pertaining to the ignition mechanism of the fire incident, the results of the fire relative to the casualties and the loss estimates, were previously presented in Section III of this report.

In addition to examining the behavior of the participants relative to the overall fire severity, of equal interest was the fire and smoke conditions to which participants were exposed in reacting to the fire incident. Thus, in each of the incident reports compiled for this study, (5) a temporal sequence was established by which a relationship could be established between the fire realms and the behavioral episodes. The concepts of the fire realms with critical events have been adapted for this study following the procedures from Lerup.(12)

Lerup has defined a fire realm and critical event in the following manner:¹¹

A realm is defined as an internally consistent state or condition of fire behavior within a time period, e.g., fire spreading within a room. The beginning and end of such a realm is marked by a critical event, a pivotal point that changes the development of the fire, e.g., the same fire's entering an adjacent room.

In addition, the movement and actions of critical personnel are described by Lerup (12) with the conceptual term of episodes, coinciding with the temporal pattern of the staff, patients, and fire department personnel movement.

Lerup has defined the concept of an episode as follows:¹²

Human behavior during a fire can be ascribed in a manner analogous to the physical events in a fire. Any individual is involved in a

¹¹Lerup, Lars, People in Fires: A Manual for Mapping. Washington, D.C.: Center for Fire Research, National Bureau of Standards, NBS-GCR-77-106, 1977 p.23.

¹²Op. Cit. , Lerup, p.21.

continuous stream of behavior, but this stream has discrete units called episodes, defined at start and end by decision points. An episode, for example, could be a nurse rescuing patients, defined at start by decision point "decision to rescue" and defined at finish by decision point "decision to stop rescue because of smoke density."

These two concepts of fire realms and behavioral episodes were graphically depicted in the study incident reports (5) by a mapping technique, also utilized by Lerup (12). Thus, the fire and smoke conditions were established through the description of fire realms from the staff participants and fire department personnel. The fire realm conditions were then related to the actions of the participants and their proximity to these fire realm conditions in the description of the behavioral episodes.

The fire conditions were categorized according to the following five stages of fire development:

Preignition - pertaining to the smoldering stage with no visible flame.

Ignition - relating to a small, incipient fire with visible flame

Preflashover - indicating the fire had fully involved at least one object.

Postflashover - relating to a fully developed fire in the space or compartment following flashover.

Post Extinguishment - the conditions from the fire immediately following flame extinguishment.

The preflashover and postflashover fire realm stages can be considered to be the life threatening stages, whereas the remaining three stages are considered to be nonthreatening. The smoke conditions were classified according to the resulting visual obscuration, as reported by the health-care staff members and verified by fire department personnel. The four smoke condition stages for this study were defined as follows:

None - indicating no visible smoke, but does include an odor of smoke.

Light Smoke - Relative to a slight reduction in visibility.

Moderate Smoke - describing the condition with visibility substantially reduced to approximately 10 feet.

Heavy Smoke - indicating visibility is extremely limited, under 3 feet.

A. First Actions of the Participant Population Related to the Fire and Smoke Conditions.

1. Fire Conditions and First Actions

The first action of the participant population relative to existing fire conditions is presented in Table LVIII. The first action population as utilized in this table consisted of 149 persons, or 99.3 per cent of the total participant population. As indicated in the table, approximately 39 per cent of the staff were in the life threatening fire stages of preflashover or post flashover. It should be noted 55 participants or 36.9 per cent of the first action participant population were engaged in their first response to the fire incident while the fire was in the ignition stage of development.

The first actions for the previously described life threatening and nonthreatening fire stages, are presented in Table LVIIIA. A total of 91 participants were involved in first actions while the fire was in a non-threatening stage and 58 participants were involved in first actions while the fire was in a life threatening stage. The three most frequently reported actions for participants performing first actions while the fire was in a nonthreatening stage were "Investigated Cues", "Pulled Manual Fire Alarm", and "Attempted Extinguishment". Conversely, the three most frequently reported actions for participants engaged in first actions while the fire was in a life threatening stage consisted of "Investigated Cues", "Closed Doors", and "Rescue Threatened Patients". Table LVIIIB presents the computations of the statistical significance of the differences in the first actions related

TABLE LVIII
 DISTRIBUTION OF FIRST ACTIONS RELATIVE TO FIRE CONDITIONS
 DURING FIRST ACTION

Action	Pre- Ignition	Ignition	Pre- Flash- Over	Post- Flash- Over	Post- Extin- guishment	Total	Per Cent
Called Operator	0	2	2	0	0	4	2.7
Called Fire Dept.	1	0	0	0	0	1	0.7
Pulled Manual Fire Alarm	2	4	2	0	0	8	5.4
Closed Doors	2	1	18	0	0	21	14.1
Evacuated Patients	3	2	1	1	0	7	4.7
Attempted Extinguishment	3	3	0	0	0	6	4.0
Ventilated	0	0	0	0	2	2	1.3
Investigated Cues	12	31	16	7	1	67	45.0
Discovered Fire	6	4	0	0	0	10	6.7
Got Extinguisher	0	5	1	0	0	6	4.0
Alerted Staff	1	0	1	0	0	2	1.3
Instructed Operation	1	0	3	0	1	5	3.4
Rescue Threatened Patients	1	3	2	4	0	10	6.7
N = 13	32	55	46	12	4	149	100.0
Per Cent	21.5	36.9	30.9	8.0	2.7	100.0	

TABLE LVIIIA
 DISTRIBUTION OF FIRST ACTIONS RELATIVE TO
 FIRE CONDITIONS DURING FIRST ACTION

Action	Non-Threatening Fire		Threatening Fire		Total	Per Cent
	Participants	%	Participants	%		
Called Operator	2	2.2	2	3.4	4	2.7
Called Fire Dept.	1	1.1	0	0.0	1	0.7
Pulled Manual Fire Alarm	6	6.6	2	3.4	8	5.4
Closed Doors	3	3.3	18	31.1	21	14.1
Evacuated Patients	5	5.5	2	3.4	7	4.7
Attempted Extinguishment	6	6.6	0	0.0	6	4.0
Ventilated	2	2.2	0	0.0	2	1.3
Investigated Cues	44	48.4	23	39.7	67	45.0
Discovered Fire	10	10.9	0	0.0	10	6.7
Got Extinguisher	5	5.5	1	1.7	6	4.0
Alerted Staff	1	1.1	1	1.7	2	1.3
Instructed Operation	2	2.2	3	5.2	5	3.4
Rescue Threatened Patients	4	4.4	6	10.4	10	6.7
N = 3	91	100.0	58	100.0	149	100.0

TABLE LVIII B
SIGNIFICANCE OF DIFFERENCES OF FIRST ACTIONS
RELATIVE TO FIRE CONDITIONS

Action	Non- Threatening Fire Per Cent	Threatening Fire Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Called Operator	2.2	3.4	1.2	2.72	0.40
Called Fire Dept.	1.1	0.0	1.1	1.40	0.79
Pulled Manual Fire Alarm	6.6	3.4	3.2	3.80	0.84
Closed Doors	3.3	31.1	27.8	5.85	<u>4.75**</u>
Evacuated Patients	5.5	3.4	2.1	3.56	0.59
Attempted Extinguishment	6.6	0.0	6.6	3.29	<u>2.00*</u>
Ventilated	2.2	0.0	2.2	1.90	1.16
Investigated Cues	38.4	39.7	8.7	8.36	1.04
Discovered Fire	10.9	0.0	10.9	4.20	<u>2.59**</u>
Got Extinguisher	5.5	1.7	3.8	3.29	1.15
Alerted Staff	1.1	1.7	0.6	1.90	0.32
Instructed Operation	2.2	5.2	3.0	3.04	0.99
Rescue Threatened Patients	4.4	10.4	6.0	4.20	1.43
N = 13	91	58			

* Critical Ratio Significant at or above the 5 per cent level of confidence.

** Critical Ratio Significant at or above the 1 per cent level of confidence.

to the fire conditions. Two actions for which differences were observed to be significant with the nonthreatening fire dominate were "Discovered Fire", and "Attempted Extinguishment". Considering the action "Discovered Fire" for which the difference was determined to be significant at the 1 per cent level of confidence, 10.9 per cent of the participants performed this action with the fire in a nonthreatening stage compared to no participants with the fire in a life threatening stage as would be expected with the fires discovered prior to reaching the life threatening stages. Also, as would be expected 6.6 per cent of the staff attempted extinguishment with the fire in a nonthreatening stage contrasted with no one involved in extinguishment attempts when the fire was in a life threatening stage for a difference which was calculated to be significant at the 5 per cent level of confidence. The third significant difference, pertaining to the action of "Closed Doors", was significant at the 1 per cent level of confidence with 31.1 per cent of the participants engaged in this activity with the fire in a life threatening stage as compared to only 3.3 per cent of the participants with the fire in a nonthreatening stage. The differences in the first actions of the participants for the threatening and nonthreatening stages of fire ranged from 0.6 to 27.8 per cent.

2. Smoke Conditions and First Actions

An analysis of the first actions relative to the smoke condition stages is presented in Table LIX. A total of 149 participants included in the first action participant population as previously presented in Table LI are utilized in this table. For approximately 50 per cent of the participants, no visible smoke was present in the location where the participants were involved in their respective first actions.

TABLE LIX
 DISTRIBUTION OF FIRST ACTIONS RELATIVE TO SMOKE
 CONDITIONS DURING FIRST ACTION

Action	None	Light	Moderate	Heavy	Total	Per Cent
Called Operator	2	0	2	0	4	2.7
Called Fire Dept.	1	0	0	0	1	0.7
Pulled Manual Fire Alarm	7	1	0	0	8	5.4
Closed Doors	9	11	0	1	21	14.1
Evacuated Patients	3	4	0	0	7	4.7
Attempted Extinguishment	2	2	1	1	6	4.0
Ventilated	0	2	0	0	2	1.3
Investigated Cues	41	13	7	6	67	45.0
Discovered Fire	1	9	0	0	10	6.7
Got Extinguisher	3	3	0	0	6	4.0
Alerted Staff	1	1	0	0	2	1.3
Instructed Operation	2	3	0	0	5	3.4
Rescue Threatened Patients	2	4	0	4	10	6.7
N = 13	74	53	10	12	149	100.0
Per Cent	49.7	35.6	6.7	8.0	100.0	

The first actions are related to a dichotomized classification of smoke condition stages in Table LIXA, with the smoke condition stages classified according to the no or light smoke stages and the moderate or heavy smoke stages. The three most frequently observed first actions for the participants exposed to no or light smoke stages were "Investigated Cues", "Closed Doors", and "Discovered Fire". However, the three most frequently reported first actions for participants exposed to moderate or heavy smoke stages consisted of "Investigated Cues", "Rescued Threatened Patients" and both "Called Operator" and "Attempted Extinguishment". The analysis of the differences in the first actions relative to smoke conditions for statistical significance is presented in Table LIXB. The two differences determined to be significant at the 5 per cent level of confidence were for the actions of "Called Operator" and "Rescue Threatened Patients" for both of these differences, and the percentage of participants performing these actions while exposed to moderate or heavy smoke was dominate. In the case of "Called Operator", 9.1 per cent of the participants were in areas with moderate or heavy smoke versus 1.6 per cent of the participants in areas with no or light smoke conditions. The differences in the first actions relative to the smoke conditions ranged from 0.8 to 16.6 per cent.

3. Proximity to the Fire And First Actions.

The distribution of the first actions and the participant population relative to their proximity to the fire while performing their first action is presented in Table LX. As indicated in the table, the total participant population appeared to be fairly evenly distributed with respect to their proximity to the fire. Grouping of the distances in two categories of under 20 feet and over 20 feet from the fire versus first action was performed and

TABLE LIXA
DISTRIBUTION OF FIRST ACTIONS RELATIVE TO
SMOKE CONDITIONS

Action	None or Light Participants %		Moderate or Heavy Participants %		Total	Per Cent
Called Operator	2	1.6	2	9.1	4	2.7
Called Fire Dept.	1	0.8	0	0.0	1	0.7
Pulled Manual Fire Alarm	8	6.3	0	0.0	8	5.4
Closed Doors	20	15.8	1	4.5	21	14.1
Evacuated Patients	7	5.5	0	0.0	7	4.7
Attempted Extinguishment	4	3.1	2	9.1	6	4.0
Ventilated	2	1.6	0	0.0	2	1.3
Investigated Cues	54	42.5	13	59.1	67	45.0
Discovered Fire	10	7.9	0	0.0	10	6.7
Got Extinguisher	6	4.7	0	0.0	6	4.0
Alerted Staff	2	1.6	0	0.0	2	1.3
Instructed Operation	5	3.9	0	0.0	5	3.4
Rescue Threatened Patients	6	4.7	4	18.2	10	6.7
N = 13	127	100.0	22	100.0	149	100.0

TABLE LIXB
SIGNIFICANCE OF DIFFERENCES OF FIRST ACTION RELATIVE
TO SMOKE CONDITIONS

Action	None or Light Per Cent	Moderate or Heavy Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Called Operator	1.6	9.1	7.5	3.74	<u>2.00*</u>
Called Fire Dept.	0.8	0.0	0.8	2.06	0.39
Pulled Manual Fire Alarm	6.3	0.0	6.3	5.22	1.21
Closed Doors	15.8	4.5	11.3	8.04	1.41
Evacuated Patients	5.5	0.0	5.5	4.89	1.13
Attempted Extinguishment	3.1	9.1	6.0	4.52	1.33
Ventilated	1.6	0.0	1.6	2.62	0.61
Investigated Cues	42.5	59.1	16.6	11.49	1.44
Discovered Fire	7.9	0.0	7.9	5.77	1.37
Got Extinguisher	4.7	0.0	4.7	4.52	1.04
Alerted Staff	1.6	0.0	1.6	2.62	0.61
Instructed Operation	3.9	0.0	3.9	4.19	0.93
Rescue Threatened Patients	4.7	18.2	13.5	4.77	<u>2.34*</u>
N = 13	127	22			

*Critical Ratios Significant at or above the 5 per cent level of confidence.

TABLE LX
 DISTRIBUTION OF FIRST ACTIONS RELATIVE TO PROXIMITY TO
 FIRE DURING FIRST ACTION

Action	Distance (Feet)					Total	Per Cent
	1-10	11-20	21-50	51-100	100+		
Called Operator	1	1	1	1		4	2.7
Called Fire Dept.					1	1	0.7
Pulled Manual Fire Alarm		1	3	1	3	8	5.3
Closed Doors		2	1	7	11	21	14.1
Evacuated Patients		1	3	1	2	7	4.7
Attempted Extinguishment	6					6	4.0
Ventilated	2					2	1.4
Investigated Cues	15	12	14	9	17	67	45.0
Discovered Fire	5	3	2			10	6.7
Got Extinguisher		3	1	1	1	6	4.0
Alerted Staff	1		1			2	1.4
Instructed Operation			2	1	2	5	3.4
Rescue Threatened Patients	4		4	2		10	6.7
N = 13	34	23	32	23	37	149	100.0
Per Cent	22.8	15.4	21.5	15.4	24.9	100.0	
Per Cent of Participants = 99.3							

is presented in Table LXA. After reviewing this table, the even distribution of actions relative to distance is no longer evident. The three most frequent first actions for the participants within 20 feet of the fire were "Investigated Cues", "Discovered Fire" and "Attempted Extinguishment". Considering the participants over 20 feet from the fire, the three most frequent first actions were "Investigated Cues", "Closed Doors", and "Pulled Manual Fire Alarm". Results of the computation of the statistical significance of the differences in the first actions for participants within and over 20 feet are presented in Table LXB. Three differences were observed to be statistically significant at the 1 per cent level of confidence.

Two significant differences, for which the participants within 20 feet were dominate, included "Attempted Extinguishment" and "Discovered Fire". The action of "Attempted Extinguishment" was performed by 10.5 per cent of the participants located within 20 feet of the fire and no participants over 20 feet. Similarly, 14.0 per cent of the participants within 20 feet "Discovered Fire" compared to 2.2 per cent of the participants over 20 feet. These two significant differences are intuitively expected, as both actions, "Attempted Extinguishment" and "Discovered Fire" require individuals to be relatively close to the fire. The third action for which a significant difference was identified with the participants located over 20 feet from the fire dominate was "Closed Doors". The range of the differences for the first actions relative to the distance from the fire was 0.7 to 1. per cent.

B. Second Actions of the Participant Population and the Fire and Smoke Conditions.

1. Fire Conditions and Second Actions.

The second actions of the participant population relative to the fire conditions while the second action was being conducted is presented in Table

TABLE LXA

DISTRIBUTION OF FIRST ACTIONS WITHIN AND OVER 20
FEET FROM FIRE

Action	0-20 Feet Participants	%	Over 20 Feet Participants	%	Total	Per Cent
Called Operator	2	3.5	2	2.2	4	2.7
Called Fire Dept.	0	0.0	1	1.1	1	0.7
Pulled Manual Fire Alarm	1	1.8	7	7.6	8	5.3
Closed Doors	2	3.5	19	20.6	21	14.1
Evacuated Patients	1	1.8	6	6.5	7	4.7
Attempted Extinguishment	6	10.5	0	0.0	6	4.0
Ventilated	2	3.5	0	0.0	2	1.4
Investigated Cues	27	47.3	40	43.5	67	45.0
Discovered Fire	8	14.0	2	2.2	10	6.7
Got Extinguisher	3	5.3	3	3.3	6	4.0
Alerted Staff	1	1.8	1	1.1	2	1.4
Instructed Operation	0	0.0	5	5.4	5	3.4
Rescue Threatened Patients	4	7.0	6	6.5	10	6.7
N = 13	57	100.0	92	100.0	149	100.0

TABLE LXB

SIGNIFICANCE OF DIFFERENCES OF FIRST ACTION
WITHIN AND OVER 20 FEET FROM FIRE

Action	0-20 Feet Per Cent	Over 20 Feet Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Called Operator	3.5	2.2	1.3	2.73	0.48
Called Fire Dept.	0.0	1.1	1.1	1.41	0.78
Pulled Manual Fire Alarm	1.8	7.6	5.8	3.78	1.54
Closed Doors	3.5	20.6	17.1	5.87	<u>2.91**</u>
Evacuated Patients	1.8	6.5	4.7	3.57	1.32
Attempted Extinguishment	10.5	0.0	10.5	3.30	<u>3.18**</u>
Ventilated	3.5	0.0	3.5	1.98	1.77
Investigated Cues	47.3	43.5	3.8	8.39	0.45
Discovered Fire	14.0	2.2	11.8	4.21	<u>2.80**</u>
Got Extinguisher	5.3	3.3	2.0	3.30	0.61
Alerted Staff	1.8	1.1	0.7	1.98	0.35
Instructed Operation	0.0	5.4	5.4	3.05	1.77
Rescue Threatened Patients	7.0	6.5	0.5	4.21	0.12
N = 13	57	92			

** Critical Ratios Significant at or above the 1 per cent level of confidence.

LXI. A total participant population of 136 persons is included in this table. The most frequently reported fire conditions during performance of the second action were the fire realm stages of ignition and preflashover, comprising 36.8 and 30.1 per cent of the total participants.

Analysis of the second actions relative to the nonthreatening and life threatening fire stages is presented in Table LXIA. As indicated in this table the three most frequently reported second actions for the participants while the fire was in a nonthreatening stage were "Attempted Extinguishment", "Evacuate Patients", and "Discovered Fire". In comparison, "Evacuate Patients", "Stood By", and "Closed Doors" were the three most frequent second actions by the participants while the fire was in a threatening stage. An examination of the statistical significance of the differences in the second actions relative to fire conditions is presented in Table LXIB. As indicated in this table, the three differences computed to be statistically significant were for the actions of "Stood By", "Evacuate Patients", and "Pulled Manual Fire Alarm". These differences were significant at the 1 per cent level of confidence for the action "Stood By" and at the 5 per cent level of confidence for the other two actions. The significant differences for "Evacuate Patients" and "Stood By" were both dominated by participants performing the action with the fire in a life threatening stage with 29.6 per cent of the participants evacuating patients with the fire in a life threatening stage compared to 12.2 per cent of the participants with the fire in a nonthreatening stage. A total of 14.8 of the participants were involved with the second action of "Stood By", with the fire in a life threatening stage compared to no participants when the fire was in a nonthreatening stage. Both of these trends are to be expected, since the evacuation of patients becomes more necessary with a life threatening fire as compared to a

TABLE LXI
DISTRIBUTION OF SECOND ACTIONS RELATIVE TO FIRE CONDITIONS
DURING SECOND ACTION

Action	Pre- Ignition	Ignition	Pre- Flash- Over	Post- Flash- Over	Post- Extin- guishment	Total	Per Cent
Called Operator	3	2	2	0	0	7	5.2
Called Fire Dept.	3	4	4	0	1	12	8.8
Pulled Manual Fire Alarm	4	5	0	0	0	9	6.6
Rescued Threatened Patients	2	2	1	2	1	8	5.9
Closed Doors	4	4	5	1	0	14	10.3
Evacuate Patients	4	3	8	8	3	26	19.2
Attempted Extinguishment	3	8	2	0	0	13	9.6
Ventilated	0	1	0	0	0	1	0.7
Investigated Cues	1	3	5	0	0	9	6.6
Discovered Fire	1	9	0	2	0	12	8.8
Got Extinguisher	0	5	1	0	0	6	4.4
Attempt Rescue	0	1	2	0	0	3	2.2
Stood By	0	0	8	0	0	8	5.9
Alerted Staff	1	3	2	0	0	6	4.4
Perform First Aid	0	0	1	0	0	1	0.7
Instructed Operation	1	0	0	0	0	1	0.7
N = 16	27	50	41	13	5	136	100.0
Per Cent	19.8	36.8	30.1	9.6	3.7	100.0	

TABLE LXIA
 DISTRIBUTION OF SECOND ACTIONS RELATIVE TO
 FIRE CONDITIONS DURING SECOND ACTION

Action	Non- Threatening Participants	Fire %	Threatening Participants	Fire %	Total	Per Cent
Called Operator	5	6.1	2	3.7	7	5.2
Called Fire Dept.	8	9.8	4	7.4	12	8.8
Pulled Manual Fire Alarm	9	10.9	0	0.0	9	6.6
Rescue Threatened Patients	5	6.1	3	5.5	8	5.9
Closed Doors	8	9.8	6	11.1	14	10.3
Evacuated Patients	10	12.2	16	29.6	26	19.2
Attempted Extinguishment	11	13.4	2	3.7	13	9.6
Ventilated	1	1.2	0	0.0	1	0.7
Investigated Cues	4	4.9	5	9.3	9	6.6
Discovered Fire	10	12.2	2	3.7	12	8.8
Got Extinguisher	5	6.1	1	1.9	6	4.4
Attempt Rescue	1	1.2	2	3.7	3	2.2
Stood By	0	0.0	8	14.8	8	5.9
Alerted Staff	4	4.9	2	3.7	6	4.4
Perform First Aid	0	0.0	1	1.9	1	0.7
Instructed Operation	1	1.2	0	0.0	1	0.7
N = 16	82	100.0	54	100.0	136	100.0

TABLE LXIB
SIGNIFICANCE OF DIFFERENCES OF SECOND ACTIONS
RELATIVE TO FIRE CONDITIONS

Action	Non- Threatening Fire Per Cent	Threatening Fire Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Called Operator	6.1	3.7	2.4	2.89	0.62
Called Fire Dept.	9.8	7.4	2.4	4.96	0.48
Pulled Manual Fire Alarm	10.9	0.0	10.9	4.35	<u>2.30*</u>
Rescue Threatened Patients	6.1	5.5	0.6	4.13	0.15
Closed Doors	9.8	11.1	1.3	5.33	0.24
Evacuate Patients	12.2	29.6	17.4	6.90	<u>2.52*</u>
Attempted Extinguishment	13.4	3.7	9.7	5.16	1.88
Ventilated	1.2	0.0	1.2	1.46	0.82
Investigated Cues	4.9	9.3	4.4	4.35	1.01
Discovered Fire	12.2	3.7	8.5	4.96	1.71
Got Extinguisher	6.1	1.9	4.2	3.59	1.17
Attempt Rescue	1.2	3.7	2.5	2.57	0.97
Stood By	0.0	14.8	14.8	4.13	<u>3.58**</u>
Alerted Staff	4.9	3.7	1.2	3.59	0.33
Perform First Aid	0.0	1.9	1.9	1.46	1.30
Instructed Operation	1.2	0.0	1.2	1.46	0.82
N = 16	82	54			

* Critical Ratios Significant at or above the 5 per cent level of confidence.
 **Critical Ratios Significant at or above the 1 per cent level of confidence.

nonthreatening fire. The activity of "Stood By" typically involved waiting for the fire department and becomes more frequent if the fire has progressed to a stage for which extinguishment is beyond the capability of the facility staff. The second action for which a significant difference was identified with the nonthreatening fire participants dominated was "Pulled Manual Fire Alarm" for which 10.9 per cent of the participants were involved with a nonthreatening fire compared to no participants with a life threatening fire. The range of differences for the second actions of the participants relative to the fire conditions was 0.6 to 17.4 per cent.

2. Smoke Conditions and Second Actions

An examination of the second actions relative to the smoke conditions observed by the participants while performing their second action is presented in Table LXII. As indicated in this table, 30.9 per cent and 39.7 per cent of the second action participants observed no or light smoke, while engaged in their second actions, thereby comprising approximately 70 per cent of the total participants.

An examination of the second actions relative to the no or light smoke and the moderate or heavy smoke condition stages is presented in Table LXIIA. As indicated in this table, 96 participants performed second actions while exposed to no or light smoke while 40 participants performed actions while exposed to moderate or heavy smoke. The three most frequent second actions of the participants with no or light smoke conditions were "Evacuate Patients", "Called Fire Department", and "Attempted Extinguishment". Considering those participants exposed to moderate or heavy smoke, the three most frequently reported second actions consisted of "Evacuate Patients", "Closed Doors", and the following three: "Rescue Threatened Patients", "Attempted

TABLE LXII

DISTRIBUTION OF SECOND ACTIONS RELATIVE TO SMOKE
CONDITIONS DURING SECOND ACTION

Action	None	Light	Moderate	Heavy	Total	Per Cent
Called Operator	5	1	1	0	7	5.2
Called Fire Dept.	8	2	1	1	12	8.8
Pulled Manual Fire Alarm	4	4	0	1	9	6.6
Rescue Threatened Patients	0	4	1	3	8	5.9
Closed Doors	5	3	4	2	14	10.3
Evacuate Patients	7	9	7	3	26	19.2
Attempted Extinguishment	2	7	0	4	13	9.6
Ventilated	0	1	0	0	1	0.7
Investigated Cues	2	5	1	1	9	6.6
Discovered Fire	2	6	4	0	12	8.8
Got Extinguisher	1	2	2	1	6	4.4
Attempt Rescue	0	0	0	3	3	2.2
Stood By	2	6	0	0	8	5.9
Alerted Staff	4	2	0	0	6	4.4
Perform First Aid	0	1	0	0	1	0.7
Instructed Operation	0	1	0	0	1	0.7
N = 16	42	54	21	19	136	100.0
Per Cent	30.9	39.7	15.4	14.0	100.0	

TABLE LXIIA
 DISTRIBUTION OF SECOND ACTIONS RELATIVE
 TO SMOKE CONDITIONS DURING SECOND ACTION

Action	None or Light Participants %		Moderate or Heavy Participants %		Total	Per Cent
Called Operator	6	6.3	1	2.5	7	5.2
Called Fire Dept.	10	10.4	2	5.0	12	8.8
Pulled Manual Fire Alarm	8	8.3	1	2.5	9	6.6
Rescue Threatened Patients	4	4.2	4	10.0	8	5.9
Closed Doors	8	8.3	6	15.0	14	10.3
Evacuate Patients	16	16.7	10	25.0	26	19.2
Attempted Extinguishment	9	9.4	4	10.0	13	9.6
Ventilated	1	1.1	0	0.0	1	0.7
Investigated Cues	7	7.3	2	5.0	9	6.6
Discovered Fire	8	8.3	4	10.0	12	8.8
Got Extinguisher	3	3.1	3	7.5	6	4.4
Attempt Rescue	0	0.0	3	7.5	3	2.2
Stood By	8	8.3	0	0.0	8	5.9
Alerted Staff	6	6.2	0	0.0	6	4.4
Perform First Aid	1	1.1	0	0.0	1	0.7
Instructed Operation	1	1.1	0	0.0	1	0.7
N = 16	96	100.0	40	100.0	136	100.0

Extinguishment", and "Discovered Fire". The statistical significance of the differences in the second actions relative to the smoke conditions was analyzed and is presented in Table LXIIB. Only one second action, "Attempt Rescue" was observed as having a difference statistically significant at the 1 per cent level of confidence. The second action of "Attempt Rescue" was performed by 7.5 per cent of the participants exposed to moderate or heavy smoke as compared to no participants exposed to no or light smoke. This difference can be explained through an examination of the second action category of "Attempt Rescue". This action category refers to the attempted, although unsuccessful rescue attempt, in contrast with the second action category of "Rescue Threatened Patients" which is indicative of a successful rescue. Thus, it is not surprising, there would be a greater percentage of unsuccessful rescue actions in the moderate and heavy smoke stage where the participants visibility is restricted to less than ten feet.

3. Proximity to the Fire and Second Actions

A tabulation of the second actions of the participants relative to the participants' proximity to the fire is presented in Table LXIII. The most frequently determined distance ranges were under ten feet and 21 to 50 feet from the fire, both with 39 or 28.7 per cent of the participants performing their second actions within ten feet of the fire. The distribution of second actions relative to the participants within and over 20 feet from the fire is presented in Table LXIIIA. Considering the participants within 20 feet of the fire while conducting second actions, the two most frequently reported second actions were "Attempted Extinguishment" and "Discovered Fire". As previously noted with respect to the distribution of fire conditions and the distance from the fire, these two actions virtually require participants to

TABLE LXIIB
SIGNIFICANCE IN DIFFERENCES OF SECOND ACTION
RELATIVE TO SMOKE CONDITIONS

Action	None or Light Smoke Per Cent	Moderate or Heavy Smoke Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Called Operator	6.3	2.5	3.8	4.18	0.91
Called Fire Dept.	10.4	5.0	5.4	5.33	1.01
Pulled Manual Fire Alarm	8.3	2.5	5.8	4.67	1.24
Rescue Threatened Patients	4.2	10.0	5.8	4.43	1.31
Closed Doors	8.3	15.0	6.7	5.72	1.17
Evacuate Patients	16.7	25.0	8.3	7.41	1.12
Attempted Extinguishment	9.4	10.0	0.6	5.54	0.11
Ventilated	1.1	0.0	1.1	1.57	0.70
Investigated Cues	7.3	5.0	2.3	4.67	0.49
Discovered Fire	8.3	10.0	1.7	5.33	0.32
Got Extinguisher	3.1	7.5	4.4	3.86	1.14
Attempt Rescue	0.0	7.5	7.5	2.76	<u>2.72**</u>
Stood By	8.3	0.0	8.3	4.43	1.87
Alerted Staff	6.2	0.0	6.2	3.86	1.61
Perform First Aid	1.1	0.0	1.1	1.57	0.70
Instructed Operation	1.1	0.0	1.1	1.57	0.70
N = 16	96	40			

**Critical Ratio Significant at or above the 1 per cent level of confidence.

TABLE LXIII

DISTRIBUTION OF SECOND ACTION RELATIVE TO PROXIMITY TO
FIRE DURING SECOND ACTION

Action	Distance (Feet)					Total	Per Cent
	1-10	11-20	21-50	51-100	100+		
Called Operator	1		3	2	1	7	5.1
Called Fire Dept.		2	3	6	1	12	8.8
Pulled Manual Fire Alarm	3		3	1	2	9	6.6
Rescued Threatened Patients	5	1	1		1	8	5.9
Closed Doors	3	3	6		2	14	10.3
Evacuate Patients	1	2	11	9	3	26	19.1
Attempted Extinguishment	12	1				13	9.5
Ventilated			1			1	0.7
Investigated Cues	6			2	1	9	6.6
Discovered Fire	6	3		3		12	8.8
Got Extinguisher		2	4			6	4.5
Attempt Rescue	1		2			3	2.2
Stood By				2	6	8	5.9
Alerted Staff		1	3	2		6	4.5
Perform First Aid		1				1	0.7
Instructed Operation	1					1	0.7
N = 16	39	16	39	26	16	136	100.0
Per Cent	28.7	11.8	28.7	19.0	11.8	100.0	
Per Cent of Participant Population = 90.7							

TABLE LXIIIA
 DISTRIBUTION OF SECOND ACTION WITHIN AND
 OVER 20 FEET FROM FIRE

Action	0-20 Feet		Over 20 Feet		Total	Per Cent
	Participants	%	Participants	%		
Called Operator	1	1.8	6	7.4	7	5.1
Called Fire Dept.	2	3.6	10	12.3	12	8.8
Pulled Manual Fire Alarm	3	5.5	6	7.4	9	6.6
Rescue Threatened Patients	6	10.9	2	2.5	8	5.9
Closed Doors	6	10.9	8	9.9	14	10.3
Evacuate Patients	3	5.5	23	28.4	26	19.1
Attempted Extinguishment	13	23.7	0	0.0	13	9.5
Ventilated	0	0.0	1	1.2	1	0.7
Investigated Cues	6	10.9	3	3.7	9	6.6
Discovered Fire	9	16.4	3	3.7	12	8.8
Got Extinguisher	2	3.6	4	4.9	6	4.5
Attempt Rescue	1	1.8	2	2.5	3	2.2
Stood By	0	0.0	8	9.9	8	5.9
Alerted Staff	1	1.8	5	6.2	6	4.5
Perform First Aid	1	1.8	0	0.0	1	0.7
Instructed Operation	1	1.8	0	0.0	1	0.7
N = 16	55	100.0	81	100.0	136	100.0

be in the immediate vicinity of the fire. In contrast, the two most frequently noted second actions for the participants over 20 feet from the fire are "Evacuate Patients" and "Called Fire Department". The analysis of statistical significance of the differences of second actions relative to distance from the fire resulted in the identification of five significant differences, as indicated in Table LXIIIB. The differences in the actions of "Evacuate Patients", "Attempted Extinguishment", and "Discovered Fire" were all observed to be significant at the 1 per cent level of confidence. As expected, the participants within 20 feet were dominate in attempting extinguishment with all of the participants performing this action being within 20 feet. However, considering the action of "Evacuate Patients", 29.8 per cent of the participants over 20 feet performed this action compared to 5.1 per cent of the participants within 20 feet. Two actions, "Rescue Threatened Patients" and "Stood By", had differences which were significant at the 5 per cent level of confidence, with the participants farther than 20 feet being dominate for standing by and participants within 20 feet being dominate for rescuing patients. The differences in the second actions relative to the distance of the participants from the fire ranged from 0.7 to 23.7 per cent.

C. Third Actions of the Participant Population and the Fire and Smoke Conditions.

1. Fire Conditions and Third Actions.

An examination of the distribution of third actions relative to the fire conditions during the performance of the actions is presented in Table LXIV. As is evident in this table, ignition was the most frequently noted fire condition for the third actions, being the fire condition for 40

TABLE LXIII B

SIGNIFICANCE OF DIFFERENCES OF SECOND ACTION
WITHIN AND OVER 20 FEET FROM FIRE

Action	0-20 Feet Per Cent	Over 20 Feet Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Called Operator	1.8	7.4	5.6	3.84	1.46
Called Fire Dept.	3.6	12.3	8.7	4.95	1.76
Pulled Manual Fire Alarm	5.5	7.4	1.9	4.34	0.44
Rescue Threatened Patients	10.9	2.5	8.4	4.12	<u>2.04*</u>
Closed Doors	10.9	9.9	1.0	5.31	0.19
Evacuate Patients	5.5	28.4	22.9	6.87	<u>3.33**</u>
Attempted Extinguishment	23.7	0.0	23.7	5.12	<u>4.63**</u>
Ventilated	0.0	1.2	1.2	1.46	0.82
Investigated Cues	10.9	3.7	7.2	4.34	1.66
Discovered Fire	16.4	3.7	12.7	4.95	<u>2.57**</u>
Got Extinguisher	3.6	4.9	1.3	3.62	0.36
Attempt Rescue	1.8	2.5	0.7	2.56	0.27
Stood By	0.0	9.9	9.9	4.12	<u>2.40*</u>
Alerted Staff	1.8	6.2	4.4	3.41	1.29
Perform First Aid	1.8	0.0	1.8	1.46	1.23
Instructed Operation	1.8	0.0	1.8	1.46	1.23
N = 16	55	81			

*Critical Ratios Significant at or above the 5 per cent level of confidence.
 **Critical Ratios Significant at or above the 1 per cent level of confidence.

TABLE LXIV

DISTRIBUTION OF THIRD ACTIONS RELATIVE TO FIRE
CONDITIONS DURING THIRD ACTION

Action	Pre- Ignition	Ignition	Pre- Flash- over	Post- Flash- over	Post- Extin- guishment	Total	Per Cent
Called Operator	4	1	0	0	0	5	4.9
Called Fire Dept.	1	4	0	0	0	5	4.9
Pulled Manual Fire Alarm	1	2	0	0	0	3	2.9
Rescue Threatened Patients	0	3	0	0	0	3	2.9
Closed Doors	2	3	4	1	0	10	9.7
Evacuated Patients	3	8	8	11	7	37	35.9
Attempted Extinguishment	3	10	1	0	2	16	15.5
Ventilated	0	2	0	0	0	2	1.9
Investigated Cues	0	2	1	0	0	3	2.9
Got Extinguisher	1	2	0	0	1	4	3.9
Attempted Rescue	0	0	3	1	0	4	3.9
Stood By	0	0	0	0	5	5	4.9
Alerted Staff	0	2	0	2	0	4	3.9
Instructed Operation	0	1	1	0	0	2	1.9
N = 14	15	40	18	15	15	103	100.0
Per Cent	14.6	38.8	17.4	14.6	14.6	100.0	

participants or 38.8 per cent of the 103 participants performing a third action. Analysis of the third action with the life threatening and nonthreatening fire stages is presented in Table LXIVA. "Evacuate Patients" was the most frequently observed third action for both the life threatening and nonthreatening fire stages. The second most frequently noted third action for a life threatening fire stage was "Closed Doors", but for a nonthreatening fire stage was "Attempted Extinguishment". The significance of the differences in third actions relative to fire conditions is presented in Table LXIVB. As indicated in this table, three differences were identified as being statistically significant. Considering the two actions for which the differences were calculated to be significant at the 1 per cent level of confidence, both "Evacuate Patients" and "Attempted Rescue" were dominated by participants in the life threatening fire stage. This result is in agreement with expectations, since the necessity of evacuation activities increases proportionally to the increase in fire severity. The difference in the third action of "Attempted Extinguishment" was dominated by the participants performing in a nonthreatening fire stage, and was observed to be significant at the 5 per cent level of confidence. This dominance by participants in the nonthreatening fire stage is also logical since the extinguishment capabilities of health-care facility members is limited essentially to fires classified in this study as nonthreatening. The differences in the third actions relative to the fire conditions range from 0.1 to 31.8 per cent.

2. Smoke Conditions and Third Actions.

The distribution of third actions relative to the four smoke conditions based on the obscuration of the visibility of the participants is presented in Table LXV. As indicated in this table, light smoke conditions were the

TABLE LXIVA
 DISTRIBUTION OF THIRD ACTIONS RELATIVE TO
 FIRE CONDITIONS

Action	Non- Threatening Fire Participants	%	Threatening Fire Participants	%	Total	Per Cent
Called Operator	5	7.1	0	0.0	5	4.9
Called Fire Dept.	5	7.1	0	0.0	5	4.9
Pulled Manual Fire Alarm	3	4.3	0	0.0	3	2.9
Rescue Threatened Patients	3	4.3	0	0.0	3	2.9
Closed Doors	5	7.1	5	15.2	10	9.7
Evacuated Patients	18	25.8	19	57.6	37	35.9
Attempted Extinguishment	15	21.4	1	3.0	16	15.5
Ventilated	2	2.9	0	0.0	2	1.9
Investigated Cues	2	2.9	1	3.0	3	2.9
Got Extinguisher	4	5.7	0	0.0	4	3.9
Attempted Rescue	0	0.0	4	12.1	4	3.9
Stood By	5	7.1	0	0.0	5	4.9
Alerted Staff	2	2.9	2	6.1	4	3.9
Instructed Operation	1	1.4	1	3.0	2	1.9
N = 14	70	100.0	33	100.0	103	100.0

TABLE LXIVB
SIGNIFICANCE OF DIFFERENCES OF THIRD ACTION
RELATIVE TO FIRE CONDITION

Action	Non- Threatening Fire Per Cent	Threatening Fire Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Called Operator	7.1	0.0	7.1	4.56	1.56
Called Fire Dept.	7.1	0.0	7.1	4.56	1.56
Pulled Manual Fire Alarm	4.3	0.0	4.3	3.54	1.21
Rescue Threatened Patients	4.3	0.0	4.3	3.54	1.21
Closed Doors	7.1	15.2	8.1	6.25	1.30
Evacuated Patients	25.8	57.6	31.8	10.13	<u>3.14**</u>
Attempted Extinguishment	21.4	3.0	18.4	7.64	<u>2.41*</u>
Ventilated	2.9	0.0	2.9	2.88	1.01
Investigated Cues	2.9	3.0	0.1	3.54	0.03
Got Extinguisher	5.7	0.0	5.7	4.09	1.39
Attempted Rescue	0.0	12.1	12.1	4.09	<u>2.96**</u>
Stood By	7.1	0.0	7.1	4.56	1.56
Alerted Staff	2.9	6.1	3.2	4.09	0.78
Instructed Operation	1.4	3.0	1.6	2.88	0.56
N = 14	70	33			

* Critical Ratio Significant at or above the 5 per cent level of confidence.
 **Critical Ratio Significant at or above the 1 per cent level of confidence.

TABLE LXV
 DISTRIBUTION OF THIRD ACTIONS RELATIVE TO SMOKE
 CONDITIONS DURING THIRD ACTION

Action	None	Light	Moderate	Light	Total	Per Cent
Called Operator	3	2	0	0	5	4.9
Called Fire Dept.	4	1	0	0	5	4.9
Pulled Manual Fire Alarm	2	1	0	0	3	2.9
Rescue Threatened Patients	0	3	0	0	3	2.9
Closed Doors	4	2	1	3	10	9.7
Evacuated Patients	6	13	8	10	37	35.9
Attempted Extinguishment	2	4	7	3	16	15.5
Ventilated	0	1	0	1	2	1.9
Investigated Cues	2	0	1	0	3	2.9
Got Extinguisher	1	2	0	1	4	3.9
Attempted Rescue	0	0	0	4	4	3.9
Stood By	0	4	0	1	5	4.9
Alerted Staff	1	1	0	2	4	3.9
Instructed Operation	1	1	0	0	2	1.9
N = 14	26	35	17	25	103	100.0
Per Cent	25.2	34.0	16.5	24.3	100.0	

most prevalent condition exposing the third action participant population with 35 or 34.0 per cent of the participants involved in the smoke stage. Comparison of the third actions by the participants in no or light smoke and moderate or heavy smoke stages is presented in Table LXVA. The most frequent third action for participants under both groups of smoke conditions was "Evacuated Patients". The second most frequently reported third action for participants under the no or light smoke conditions were both "Closed Doors" and "Attempted Extinguishment".

The second most frequently reported action of the participants exposed to moderate or heavy smoke was "Attempted Extinguishment". The results of the analysis of the differences in the third actions relative to smoke conditions for statistical significance is presented in Table LXVB. Only the difference for "Attempted Rescue" was determined to be significant at the 5 per cent level of confidence. Thus, 9.5 per cent of the participants exposed to moderate or heavy smoke and no participants exposed to light or no smoke engaged in this third action. The range of differences in participation in the third actions relative to the smoke conditions was 0.3 to 14.0 per cent.

3. Proximity to The Fire and Third Actions.

The distribution of third actions relative to the proximity of the third action participants to the fire is presented in Table LXVI. The distance range of 51 to 100 feet was noted by 25.2 per cent of the participants, being the most frequently noted distance as indicated in this table. The comparison of the fourteen third actions for the distance within and over 20 feet from the fire is presented in Table LXVIA. "Evacuated Patients" was the most commonly noted third action for participants within

TABLE LXVA

DISTRIBUTION OF THIRD ACTIONS RELATIVE TO
SMOKE CONDITIONS

Action	None or Light Participants	%	Moderate or Heavy Participants	%	Total	Per Cent
Called Operator	5	8.2	0	0.0	5	4.9
Called Fire Dept.	5	8.2	0	0.0	5	4.9
Pulled Manual Fire Alarm	3	4.9	0	0.0	3	2.9
Rescue Threatened Patients	3	4.9	0	0.0	3	2.9
Closed Doors	6	9.8	4	9.5	10	9.7
Evacuated Patients	19	31.2	18	42.8	37	35.9
Attempted Extinguishment	6	9.8	10	23.8	16	15.5
Ventilated	1	1.6	1	2.4	2	1.9
Investigated Cues	2	3.3	1	2.4	3	2.9
Got Extinguisher	3	4.9	1	2.4	4	4.9
Attempted Rescue	0	0.0	4	9.5	4	3.9
Stood By	4	6.6	1	2.4	5	4.9
Alerted Staff	2	3.3	2	4.8	4	3.9
Instructed Operation	2	3.3	0	0.0	2	1.9
N = 14	61	100.0	42	100.0	103	100.0

TABLE LXVB
SIGNIFICANCE OF DIFFERENCES IN THIRD ACTION
RELATIVE TO SMOKE SPREAD

Action	None or Light Per Cent	Moderate or Heavy Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Called Operator	8.2	0.0	8.2	4.33	1.89
Called Fire Dept.	8.2	0.0	8.2	4.33	1.89
Pulled Manual Fire Alarm	4.9	0.0	4.9	3.36	1.46
Rescue Threatened Patients	4.9	0.0	4.9	3.36	1.46
Closed Doors	9.8	9.5	0.3	5.93	0.02
Evacuated Patients	31.2	42.8	11.6	9.62	1.21
Attempted Extinguishment	9.8	23.8	14.0	7.26	1.93
Ventilated	1.6	2.4	0.8	2.74	0.29
Investigated Cues	3.3	2.4	0.9	3.36	0.27
Got Extinguisher	4.9	2.4	2.5	4.43	0.56
Attempted Rescue	0.0	9.5	9.5	3.88	<u>2.45*</u>
Stood By	6.6	2.4	4.2	4.33	0.97
Alerted Staff	3.3	4.8	1.5	3.88	0.39
Instructed Operation	3.3	0.0	3.3	2.74	1.20
N = 14	61	42			

* Critical Ratio significant at or above the 5 per cent level of confidence.

TABLE LXVI

DISTRIBUTION OF THIRD ACTION RELATIVE TO PROXIMITY TO
FIRE DURING THIRD ACTION

Action	Distance (Feet)					Not Reported	Total	Per Cent
	1-10	11-20	21-50	51-100	100+			
Called Operator	1		1	3			5	4.9
Called Fire Dept.			1	2	2	1	6	5.8
Pulled Manual Fire Alarm		1	1	1			3	2.9
Rescue Threatened Patients	3						3	2.9
Closed Doors	1	2	3	4			10	9.7
Evacuated Patients	4	12	8	10	3		37	35.9
Attempted Extinguishment	13	1				1	15	14.6
Ventilated	1	1					2	1.9
Investigated Cues			1	1	1		3	2.9
Got Extinguisher		2	2				4	3.9
Attempted Rescue			3	1			4	3.9
Stood By			3		2		5	4.9
Alerted Staff		1		3			4	3.9
Instructed Operation	1			1			2	1.9
N = 14	24	20	23	26	8	2	103	100.0
Per Cent	23.3	19.4	22.4	25.2	7.8	1.9	100.0	
Per Cent of Participant Population = 68.7								

TABLE LXVI A

DISTRIBUTION OF THIRD ACTIONS WITHIN AND
OVER 20 FEET FROM FIRE

Action	0-20 Feet Participants	%	Over 20 Feet Participants	%	Total	Per Cent
Called Operator	1	2.3	4	7.0	5	4.9
Called Fire Dept.	0	0.0	5	8.8	5	4.9
Pulled Manual Fire Alarm	1	2.3	2	3.5	3	3.0
Rescue Threatened Patients	3	6.8	0	0.0	3	3.0
Closed Doors	3	6.8	7	12.3	10	9.9
Evacuated Patients	16	36.4	21	36.7	37	36.5
Attempted Extinguishment	14	31.8	0	0.0	14	13.9
Ventilated	2	4.5	0	0.0	2	2.0
Investigated Cues	0	0.0	3	5.3	3	3.0
Got Extinguisher	2	4.5	2	3.5	4	4.0
Attempted Rescue	0	0.0	4	7.0	4	4.0
Stood By	0	0.0	5	8.8	5	4.9
Alerted Staff	1	2.3	3	5.3	4	4.0
Instructed Operation	1	2.3	1	1.8	2	2.0
N = 14	44	100.0	57	100.0	101	100.0

and over 20 feet from the fire. However, the second most frequently indicated third action was "Attempted Extinguishment" for participants within 20 feet of the fire and "Closed Doors" for participants farther than 20 feet from the fire. The statistical significance of the differences in third actions relative to the distance within and over 20 feet from the fire of the participants while performing third actions is presented in Table LXVIB. "Attempted Extinguishment" is the one action for which the difference was observed to be statistically significant at the 1 per cent level of confidence. All of the participants involved in this action were within 20 feet of the fire, as would be expected.

Three actions, "Called Fire Department", "Rescue Threatened Patients" and "Stood By", were observed to have significant differences at the 5 per cent level of confidence. For the calling and standing by actions, 9.3 per cent of the participants located over 20 feet from the fire were involved in the actions, compared to no one within 20 feet. The action of rescuing patients was performed by 6.8 per cent of the participants within 20 feet and no one over 20 feet. The predominance of participants over 20 feet being involved in the third action of, "Stood By", can be explained by their being sufficiently removed from the location of the fire, that no further actions were immediately necessary. The range of differences for the third actions relative to the proximity of the participants to the fire is 0.3 to 31.8 per cent.

D. Actions and the Maximum Extent of Smoke Spread

In addition to examining the actions relative to the smoke conditions to which the participants were exposed while performing the actions, an examination of the actions relative to the maximum extent of smoke spread is of interest.

TABLE LXVI B

SIGNIFICANCE OF DIFFERENCES OF THIRD ACTIONS
WITHIN AND OVER 20 FEET FROM FIRE

Action	0-20 Feet Per Cent	Over 20 Feet Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Called Operator	2.3	7.0	4.7	4.33	1.08
Called Fire Dept.	0.0	8.8	8.8	4.33	<u>2.03*</u>
Pulled Manual Fire Alarm	2.3	3.5	1.2	3.42	0.35
Rescue Threatened Patients	6.8	0.0	6.8	3.42	<u>1.99*</u>
Closed Doors	6.8	12.3	5.5	5.99	0.92
Evacuated Patients	36.4	36.7	0.3	9.66	0.03
Attempted Extinguishment	31.8	0.0	31.8	6.94	<u>4.58**</u>
Ventilated	4.5	0.0	4.5	2.81	1.60
Investigated	0.0	5.3	5.3	3.42	1.55
Got Extinguisher	4.5	3.5	1.0	3.93	0.25
Attempted Rescue	0.0	7.0	7.0	3.93	1.78
Stood By	0.0	8.8	8.8	4.33	<u>2.03*</u>
Alerted Staff	2.3	5.3	3.0	3.93	0.76
Instructed Operation	2.3	1.8	0.5	2.81	0.18
N = 14	44	57			

*Critical Ratio Significant at or above the 5 per cent level of confidence.

**Critical Ratio Significant at or above the 1 per cent level of confidence.

In the maximum extent analysis, presented in this section, the smoke spread is described in spatial terms, as compared to the description of smoke in terms of visual obscuration as presented in the previous analysis. The smoke spread is divided into incidents in which the smoke spread was limited to one room, area or space and incidents in which smoke propagated into more than one space.

1. First Actions and Smoke Spread.

The distribution of the first actions of the participants relative to the maximum extent of smoke spread for the participant first action population is presented in Table LXVII. As indicated in this table, 55 participants performed first actions in incidents in which the maximum smoke spread was limited to one space as compared to 94 participants who performed first actions in incidents in which the maximum smoke spread extended beyond one room. "Investigated Cues" and "Closed Doors" were the two most frequently reported first actions for both of the categories of smoke spread. Only one difference in the actions as examined by smoke spread categories was determined to be significant, as indicated in Table LXVII A. The first action of, "Pulled Manual Fire Alarm" was computed to have a significant difference at the 5 per cent level of confidence. Thus, 10.9 per cent of the participants engaged in this first action, when the smoke spread was limited to one room compared to only 2.1 per cent of the participants when the smoke spread extended beyond one room. The differences in the first actions according to the maximum extent of smoke spread ranged from 0.4 to 11.8 per cent.

2. Second Actions and Smoke Spread.

The actions of the 136 second action participants was divided according to the maximum extent of smoke spread as presented in Table LXVIII. Considering

TABLE LXVII

DISTRIBUTION OF FIRST ACTION RELATIVE TO
EXTENT OF SMOKE SPREAD

Action	One Room		Multiple Rooms			
	Participants	Per Cent	Participants	Per Cent	Total	Per Cent
Called Operator	0	0.0	4	4.3	4	2.7
Called Fire Dept.	0	0.0	1	1.1	1	0.7
Pulled Manual Fire Alarm	6	10.9	2	2.1	8	5.4
Closed Doors	7	12.7	14	14.9	21	14.1
Evacuated Patients	2	3.6	5	5.3	7	4.7
Attempted Extinguishment	3	5.6	2	2.1	5	3.4
Ventilated	0	0.0	2	2.1	2	1.3
Investigated Cues	21	38.2	47	50.0	68	45.6
Discovered Fire	5	9.1	5	5.3	10	6.7
Got Extinguisher	2	3.6	4	4.3	6	4.0
Alerted Staff	2	3.6	0	0.0	2	1.3
Instructed Operation	2	3.6	3	3.2	5	3.4
Rescue Threatened Patients	5	9.1	5	5.3	10	6.7
N = 13	55	100.0	94	100.0	149	100.0
Per Cent of Participant Population	36.9		63.1			

TABLE LXVII A

SIGNIFICANCE OF DIFFERENCES OF FIRST ACTION RELATIVE
TO EXTENT OF SMOKE SPREAD

Action	One Room Per Cent	Multiple Rooms Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Called Operator	0.0	4.3	4.3	2.75	1.56
Called Fire Dept.	0.0	1.1	1.1	1.42	0.78
Pulled Manual Fire Alarm	10.9	2.1	8.8	3.84	<u>2.29*</u>
Closed Doors	12.7	14.9	2.2	5.91	0.37
Evacuated Patients	3.6	5.3	1.7	3.59	0.47
Attempted Extinguishment	5.6	2.1	3.5	3.08	1.14
Ventilated	0.0	2.1	2.1	1.92	1.09
Investigated Cues	38.2	50.0	11.8	8.46	1.40
Discovered Fire	9.1	5.3	3.8	4.24	0.90
Got Extinguisher	3.6	4.3	0.7	3.33	0.21
Alerted Staff	3.6	0.0	3.6	1.92	1.88
Instructed Operation	3.6	3.2	0.4	3.08	0.13
Rescue Threatened Patients	9.1	5.3	3.8	4.24	0.90

N = 13

*Critical ratio significant at or above the 5 per cent level of confidence.

TABLE LXVIII

DISTRIBUTION OF SECOND ACTION RELATIVE TO EXTENT
OF SMOKE SPREAD

Action	One Room		Multiple Rooms		Total	Per Cent
	Partici- pants	Per Cent	Partici- pants	Per Cent		
Called Operator	3	4.8	4	4.8	7	5.1
Called Fire Dept.	4	7.7	8	9.5	12	8.9
Pulled Manual Fire Alarm	5	9.6	4	4.8	9	6.6
Rescued Threatened Patients	1	1.9	7	8.3	8	5.9
Closed Doors	4	7.7	10	11.8	14	10.3
Evacuate Patients	9	17.2	17	20.2	26	19.1
Attempted Extinguishment	7	13.5	6	7.1	13	9.6
Ventilated	0	0.0	1	1.2	1	0.7
Investigated Cues	3	5.8	6	7.1	9	6.6
Discovered Fire	7	13.5	5	6.0	12	8.9
Got Extinguisher	3	5.8	3	3.6	6	4.4
Attempt Rescue	0	0.0	3	3.6	3	2.2
Stood By	4	7.7	4	4.8	8	5.9
Alerted Staff	1	1.9	5	6.0	6	4.4
Perform First Aid	0	0.0	1	1.2	1	0.7
Instructed Operation	1	1.9	0	0.0	1	0.7
N = 16	52	100.0	84	100.0	136	100.0
Per Cent of Participant Population	38.2		61.8			

the 136 participants, 52 participants performed second actions in incidents where the visible smoke spread was limited to one room compared to 84 participants who were engaged in second actions in incidents where the visible smoke spread extended beyond one room. The most frequently performed second actions for both categories of smoke spread was "Evacuate Patients". However, the second and third most frequently reported second actions for incidents in which the smoke spread was contained to one room were "Attempted Extinguishment" and "Discovered Fire" as compared to "Closed Doors" and "Called Fire Department" in incidents where the smoke propagated to multiple rooms. As noted in Table LXVIII A, the differences in the second actions for the two categories of spatial smoke spread ranged from 1.2 to 7.5 per cent, with none of these differences determined to be statistically significant.

3. Third Actions and Smoke Spread

The distribution of the 104 third action participants relative to the maximum extent of smoke propagation is presented in Table LXIX. As indicated in this table the third action of, "Evacuate Patients" was the most frequently reported third action for both the categories of smoke spread. The second most frequent third actions were both "Closed Doors" and "Attempted Extinguishment", for the participants in multiple space smoke spread fire incidents. However, for the participants in the incidents in which smoke spread was limited to a single space, the second most frequent third action was "Attempted Extinguishment". The results of the analysis of the statistical significance of the differences in the third actions relative to smoke spread is presented in Table LXIX A. The third actions of, "Called Operator" and "Closed Doors" were the two actions for which the differences were determined to be significant at the 5 per cent level of confidence. However, maximum smoke spread of one

TABLE LXVIII A

SIGNIFICANCE OF DIFFERENCES OF SECOND ACTION RELATIVE TO
EXTENT OF SMOKE SPREAD

Action	One Room Per Cent	Multiple Rooms Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Called Operator	5.8	4.8	1.0	3.88	0.26
Called Fire Dept.	7.7	9.5	1.8	5.02	0.36
Pulled Manual Fire Alarm	9.6	4.8	4.8	4.38	1.10
Rescued Threatened Patients	1.9	8.3	6.4	4.16	1.54
Closed Doors	7.7	11.8	4.1	5.36	0.76
Evacuate Patients	17.2	20.2	3.0	6.94	0.43
Attempted Extinguishment	13.5	7.1	6.4	5.20	1.23
Ventilated	0.0	1.2	1.2	1.47	0.82
Investigated Cues	5.8	7.1	1.3	4.38	0.30
Discovered Fire	13.5	6.0	7.5	5.02	1.49
Got Extinguisher	5.8	3.6	2.2	3.62	0.61
Attempt Rescue	0.0	3.6	3.6	2.59	1.39
Stood By	7.7	4.8	2.9	4.16	0.70
Alerted Staff	1.9	6.0	4.1	3.62	1.13
Perform First Aid	0.0	1.2	1.2	1.47	0.82
Instructed Operation	1.9	0.0	1.9	1.47	1.29

N = 16

TABLE LXIX

DISTRIBUTION OF THIRD ACTION RELATIVE TO EXTENT
OF SMOKE SPREAD

Action	One Room		Multiple Rooms		Total	Per Cent
	Participants	Per Cent	Participants	Per Cent		
Called Operator	5	11.9	1	1.6	6	5.8
Called Fire Dept.	3	7.2	3	4.9	6	5.8
Pulled Manual Fire Alarm	1	2.4	2	3.2	3	2.9
Rescue Threatened Patients	1	2.4	2	3.2	3	2.9
Closed Doors	1	2.4	9	14.5	10	9.6
Evacuated Patients	14	33.3	22	35.5	36	34.6
Attempted Extinguishment	7	16.7	9	14.5	16	15.4
Ventilated	1	2.4	1	1.6	2	1.9
Investigated Cues	2	4.7	1	1.6	3	2.9
Got Extinguisher	2	4.7	2	3.2	4	3.8
Attempted Rescue	0	0.0	4	6.5	4	3.8
Stood By	4	9.5	1	1.6	5	4.8
Alerted Staff	0	0.0	4	6.5	4	3.8
Instructed Operation	1	2.4	1	1.6	2	1.9
N = 14	42	100.0	62	100.0	104	100.0
Per Cent of Participant Population	40.4		59.6			

TABLE LXIX A

SIGNIFICANCE OF DIFFERENCES OF THIRD ACTION RELATIVE
TO EXTENT OF SMOKE SPREAD

Action	One Room Per Cent	Multiple Rooms Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Called Operator	11.9	1.6	10.3	4.67	<u>2.20*</u>
Called Fire Dept.	7.2	4.9	2.3	4.67	0.49
Pulled Manual Fire Alarm	2.4	3.2	0.8	3.35	0.24
Rescue Threatened Patients	2.4	3.2	0.8	3.35	0.24
Closed Doors	2.4	14.5	12.1	5.89	<u>2.06*</u>
Evacuated Patients	33.3	35.5	2.2	9.51	0.23
Attempted Extinguishment	16.7	14.5	2.2	7.21	0.30
Ventilated	2.4	1.6	0.8	2.73	0.29
Investigated Cues	4.7	1.6	3.1	3.35	0.93
Got Extinguisher	4.7	3.2	1.5	3.82	0.39
Attempted Rescue	0.0	6.5	6.5	3.82	1.70
Stood By	9.5	1.6	7.9	4.27	1.85
Alerted Staff	0.0	6.5	6.5	3.82	1.70
Instructed Operation	2.4	1.6	0.8	2.73	0.29
N = 14	42	62			

*Critical ratios significant at or above the 5 per cent level of confidence.

room only was dominate in the third actions of, "Called Operator", although not for the third action of "Closed Doors". The range of the differences in the third actions relative to the maximum extent of smoke spread was 0.8 to 12.1 per cent.

E. Movement Through Smoke.

Movement of the participants through smoke was examined in detail in the Project People I study. (4) As indicated in Table LXX, a total of 79 participants in the study population reported they moved through visible smoke. The distribution of the distance moved through smoke appeared to be relatively short in fourteen cases, less than 10 feet, although seventeen participants' movement through smoke involved distances exceeding 50 feet. As noted in this table, the mean distance travelled through smoke by the participants was 42.25 feet with a standard deviation of 33.85 feet.

1. Sexual Distribution of Participants and Movement Through Smoke.

The sexual distribution of 69 of the participants who moved through smoke is presented in Table LXXI. The mean distances travelled through smoke for the female and male populations were 62.47 and 43.80 feet, respectively. The statistical significance of the sexual differences relative to distance is presented in Table LXXIA. It is apparent, that none of the differences were identified as significant for the range of differences of 2.2 to 20.5 per cent.

2. Previous Training of Participants and Movement Through Smoke.

The distance moved through smoke as a function of previous training is presented in Table LXXII. The distance range most frequently travelled

TABLE LXX

DISTRIBUTION OF PARTICIPANT POPULATION
RELATIVE TO DISTANCE MOVED THROUGH SMOKE

Distance Feet	Participants	Per Cent
0 - 10	14	17.7
11 - 20	10	12.7
21 - 30	4	5.1
31 - 50	11	13.9
51 - 100	15	19.0
> 100	2	2.5
Not Reported	23	29.1
 N = 7	 79	 100.0
M = 42.25 SD = 33.85 SE _m = 4.52 SE _{SD} = 3.21		

TABLE LXXI

SEXUAL DISTRIBUTION OF PARTICIPANT POPULATION RELATIVE TO
DISTANCE MOVED THROUGH SMOKE

Distance Feet	Female Participants	%	Male Participants	%	Total	Per Cent
0 - 10	8	16.3	4	20.0	12	17.4
11 - 20	9	18.4	3	15.0	12	17.4
21 - 30	3	6.1	0	0.0	3	4.3
31 - 50	12	24.5	9	45.0	21	30.4
51 - 99	6	12.2	2	10.0	8	11.6
100 +	11	22.5	2	10.0	13	18.9
N = 6	49	100.0	20	100.0	69	100.0
M = 62.47	SD = 77.14		M = 43.80	SD = 29.33		
SE _m = 11.02	SE _{SD} = 7.82		SE _m = 6.73	SE _{SD} = 4.78		
Per Cent Of Participant Population	32.7		13.3		46.0	

TABLE LXXIA

SIGNIFICANCE OF SEXUAL DIFFERENCES OF
THE PARTICIPANT POPULATION RELATIVE
TO DISTANCE MOVED THROUGH SMOKE

Distance Feet	Female Per Cent	Male Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
0 - 10	16.3	20.0	3.7	10.06	0.37
11 - 20	18.4	15.0	3.4	10.06	0.34
21 - 30	6.1	0.0	6.1	5.38	1.13
31 - 50	24.5	45.0	20.5	12.21	1.68
51 - 99	12.2	10.0	2.2	8.50	0.26
100+	22.5	10.0	12.5	11.01	1.14
N = 6	49	20			

TABLE LXXII

DISTRIBUTION OF DISTANCE STAFF MEMBERS MOVED THROUGH
SMOKE RELATIVE TO PREVIOUS TRAINING

Distance Feet	Previous Training Participant	%	No Previous Training Participant	%	Total	Per Cent
0 - 10	90	64.7	3	27.3	93	62.0
11 - 20	11	7.9	1	9.1	12	8.0
21 - 30	3	2.2	0	0.0	3	2.0
31 - 50	17	12.2	4	36.3	21	14.0
51 - 100	10	7.2	3	27.3	13	8.7
> 100	8	5.8	0	0.0	8	5.3
N = 6	139	100.0	11	100.0	150	100.0
Per Cent of Participant Population	92.7		7.3			100.0

through smoke by the participants with previous training was 0 to 10 feet, however for the participants without training, the most frequently observed distance range was 31 to 50 feet. The significance of the differences in the distance travelled through smoke by the participants relative to previous training is presented in Table LXXIIA. Differences for the distance ranges of 0 to 10, 31 to 50, and 51 to 100 feet were determined to be significant at the 5 per cent level of confidence. The participants with training were dominate in the 0 to 10 foot range, however the participants without training were dominate in the other two significant distance ranges of 30 to 50 feet and 51 to 100 feet. The range of these differences moved through smoke was 1.2 to 37.4 per cent.

3. Fire Experience of the Participants and Movement Through Smoke.

The effect of previous fire experience on the distance travelled through smoke by the participants is presented in Table LXXIII. The distance range of 0 to 10 feet was the most frequently observed range for both the participants with and without previous fire experience. However, the second most frequent range for the participants with fire experience was 51 to 100 feet whereas for the nonfire experienced participants the range was 31 to 50 feet. Only one difference was observed to be significant at the five per cent level of confidence as presented in Table LXXIIIA. Thus, 13.7 per cent of the participants with fire experience were reported to have travelled 51 to 100 feet through smoke compared to only 4.1 per cent of the nonfire experienced participants for a significant difference at the 5 per cent level of confidence. Differences in the distance ranges relative to fire experience of the participants ranged from 1.3 to 9.6 per cent.

TABLE LXXIIA

SIGNIFICANCE OF DIFFERENCES IN DISTANCE
STAFF MEMBERS MOVED THROUGH SMOKE
RELATIVE TO PREVIOUS TRAINING

Distance	Training Per Cent	No Training Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
0 - 10	64.7	27.3	37.4	15.20	<u>2.46*</u>
11 - 20	7.9	9.1	1.2	8.50	0.14
21 - 30	2.2	0.0	2.2	4.38	0.50
31 - 50	12.2	36.3	24.1	10.87	<u>2.22*</u>
51 - 100	7.2	27.3	20.1	8.83	<u>2.28*</u>
> 100	5.8	0.0	5.8	7.02	0.83
N = 6	139	11			

* Critical ratios significant at or above the 5 per cent level of confidence.

TABLE LXXIII

DISTRIBUTION OF DISTANCE STAFF MEMBERS MOVED THROUGH
SMOKE RELATIVE TO PREVIOUS FIRE EXPERIENCE

Distance Feet	Fire Experience Participants	%	No Fire Experience Participants	%	Total	Per Cent
0 - 10	48	65.8	45	60.8	93	63.3
11 - 20	5	6.8	7	9.5	12	8.2
21 - 30	1	1.4	2	2.7	3	2.0
31 - 50	7	9.6	11	14.8	18	12.3
51 - 100	10	13.7	3	4.1	13	8.8
> 100	2	2.7	6	8.1	8	5.4
N = 6	73	100.0	74	100.0	147	100.0
Per Cent of Participant Population		47.3		51.7		99.0

TABLE LXXIII A

SIGNIFICANCE OF DIFFERENCES IN DISTANCE STAFF
MEMBERS MOVED THROUGH SMOKE RELATIVE TO
PREVIOUS FIRE EXPERIENCE

Distance	Fire Experience Per Cent	No Fire Experience Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
0 - 10	65.8	60.8	5.0	7.95	0.63
11 - 20	6.8	9.5	2.7	4.53	0.60
21 - 30	1.4	2.7	1.3	2.31	0.56
31 - 50	9.6	14.8	5.2	5.42	0.96
51 - 100	13.7	4.1	9.6	4.67	<u>2.05*</u>
> 100	2.7	8.1	5.4	3.73	1.45
N = 6	73	74			

* Critical ratio significant at or above the 5 per cent level of confidence

4. Turned Back Behavior

Another type of behavior examined in the Project People I Study (4), was the behavior of turning back. This behavior is identified by the blockage of the movement of participants. This blockage was primarily due to smoke and other effects of the fire, such as heat, causing the participant to perceive a particular travel path as being no longer tenable. As indicated in Table LXXIV, a total of 29 participants, or 19.3 per cent of the participant population exhibited the turned back behavior. The distribution of the visibility distance at the point of turning back for the 29 participants who exhibited this behavior is presented in Table LXXIVA. As indicated in this table, a total of 16 participants or 37.9 per cent of the participant sub-population who turned back, noted visibility to be at least 100 feet. This magnitude of visibility indicates the smoke density not to be very severe, thereby indicating that some other reason for turning back probably existed such as thermal effects or physiological eye or throat irritation.

TABLE LXXIV

DISTRIBUTION OF PARTICIPANT POPULATION
RELATIVE TO TURNED BACK BEHAVIOR

	Participants	Per Cent
Turned Back	29	19.3
Did Not Turn Back	121	80.7
N = 2	150	100.0

TABLE LXXIV A

DISTRIBUTION OF VISIBILITY DISTANCE OF
PARTICIPANT POPULATION UPON TURNING BACK

Feet	Participants	Per Cent
1	3	10.3
5	4	13.8
10	2	6.9
15	1	3.5
30	1	3.5
60	2	6.9
100	8	27.5
300	1	3.5
Unlimited	7	24.1
<hr/>		
N = 9	29	100.0

VII EVACUATION BEHAVIOR OF THE PARTICIPANT POPULATION

As indicated in previous sections of this report, evacuation of patients was a critical activity by the health care staff personnel. Included in the reports on the individual incidents (5) are numerous accounts of staff members exposing themselves to heat and smoke in order to conduct the evacuation of patients from areas perceived to be untenable for personnel from the fire. Apparently, the professional responsibility of the staff members for the safety of the patients was a primary motivating factor. Included in this section is a discussion of the evacuation activities of the participant population with respect to the staff members sex, age, previous training and previous fire experience.

A. Evacuation Distance and Time

1. Evacuation of Patients by All Staff Members

Patients were evacuated by staff members in 40 incidents, comprising 67.8 per cent of the incident population. The distribution of the number of patients evacuated in the 40 incidents is presented in Table LXXV. As indicated in this table, a total of 1,213 patients were evacuated in forty incidents for a mean of 30.32 patients with a standard deviation of 47.91. The most frequent number of patients evacuated was one, with the evacuation of a single patient occurring in six incidents, comprising 15 per cent of the patient evacuation incident population. The range of the number of patients evacuated was from 1 to 242.

The time required to complete the necessary evacuation of the patients as compared to the number evacuated is presented in Table LXXVI. It would appear, in 70 per cent of the incidents in which the evacuation of patients was initiated, the evacuation was completed in less than five minutes after fire detection. As noted in the table, the evacuation of over 25 patients was completed in

TABLE LXXV

PATIENTS EVACUATED DURING FIRE INCIDENTS

Number of Patients	Per Cent Population	Incidents	Per Cent
1	0.5	6	15.0
2	0.3	2	5.0
3	0.5	2	5.0
6	0.5	1	2.5
7	0.6	1	2.5
8	0.7	1	2.5
9	0.7	1	2.5
10	4.1	5	12.5
11-20	7.0	5	12.5
21-30	10.2	5	12.5
31-40	14.6	5	12.5
47	3.9	1	2.5
51	4.2	1	2.5
100	8.2	1	2.5
120	9.9	1	2.5
171	14.1	1	2.5
242	20.0	1	2.5
Total = 1,213	100.0	40	100.0
M = 30.32	SE _M = 6.24	SD = 47.91	SE _{SD} = 4.41

TABLE LXXVI

NUMBER OF PATIENTS EVACUATED AS RELATED TO EVACUATION TIME

Evacuation Time (Min.)	Patients Evacuated				Total	Per Cent
	1 - 5	6 - 10	11 - 25	> 25		
1 - 5	10	7	6	5	28	70.0
6 - 10	0	2	3	3	8	20.0
> 10	0	0	0	4	4	10.0
N = 3	10	9	9	12	40	100.0
Per Cent	25.0	22.5	22.5	30.0	100.0	

five incidents within five minutes. The only incidents requiring more than ten minutes to complete the evacuation consisted of incidents where more than 25 patients were evacuated.

Table LXXVII presents the distribution of time required to complete evacuation in the forty incidents relative to the maximum extent of smoke spread. Thus, 24 incidents or 60 per cent of the incident population requiring evacuation included smoke spread beyond one room. Considering the sixteen incidents in which the smoke was contained in one room, only one incident included an evacuation process which took longer than ten minutes, and only one other incident required 6 to 10 minutes to complete the evacuation.

2. Evacuation of Patients by Individual Staff Members

A total of 74 staff members were directly involved in the evacuation of patients in the forty incidents where evacuation was initiated. Thus, an average of 1.85 staff members performed evacuation activities in the fire incidents which required evacuation. The number of patients evacuated by an individual staff member ranged from 1 patient to over 10 patients. It should be noted that "Evacuation Activities" being described in this section usually included leading a group of ambulatory patients from the fire zone, thereby making the apparently large number of patients evacuated for a specific staff member possible.

The number of patients evacuated by a specific staff member versus the time to complete the evacuation is presented in Table LXXVIII. Considering the 70 staff members for whom this information was provided, comprising 94.6 per cent of the staff members involved in evacuation, 52 staff members or 74.3 per cent of the participant subpopulation involved in evacuation completed the necessary evacuations within 5 minutes. Forty staff members or 57.1 per cent of the participant subpopulation evacuated 5 or less patients. In addition,

TABLE LXXVII

EVACUATION TIME AS RELATED
TO AREA OF MAXIMUM SMOKE SPREAD

Area	Time (Min.)			Total	Per Cent
	1 - 5	6 - 10	> 10		
Lounge	3	0	0	3	7.5
Bedroom (1-4 Person)	11	0	0	11	27.5
Bedroom (5+ Person)	0	0	1	1	2.5
Office	0	1	0	1	2.5
Multiple Space	14	7	3	24	60.0
N = 6	28	8	4	40	100.0
Per Cent	70.0	20.0	10.0	100.0	

TABLE LXXVIII

NUMBER OF PATIENTS EVACUATED AS
RELATED TO STAFF-PATIENT EVACUATION TIME

Patients Evacuated	Time (Min.)			Total	Per Cent
	1 - 5	6 - 10	> 10		
1 - 5	35	4	1	40	57.1
6 - 10	11	1	2	14	20.0
> 10	6	7	3	16	22.9
N = 3	52	12	6	70	100.0
Per Cent	74.3	17.1	8.6	100.0	

35 or half of the participant subpopulation evacuated less than 5 patients in less than 5 minutes.

A distribution of the time required for evacuation versus the evacuation distance is presented in Table LXXIX. Typically, the distance of evacuation was dependent on the area endangered by the fire, the extent of smoke spread and the distance of the egress path from the fire zone from which the patients were being evacuated. As noted in this table, the mean evacuation time by the staff members was 5.21 minutes with a standard deviation of 6.20 minutes, indicative of a skewed distribution. The range of time required for evacuation was from 1 to 40 minutes. As noted in this table, the one staff member who performed evacuation activities for 40 minutes was evacuating patients a distance over 100 feet. The mean evacuation distance by the staff members was 75.92 feet with a standard deviation of 49.38 feet. The most frequently observed evacuation time and distance was 3 minutes and 46 to 99 feet for eight staff members.

B. Sex and Age of Staff Members

1. Sexual Distribution

Considering the 73 staff members of the participant subpopulation involved in patient evacuation, 13 were male and 60 were female. Thus, the 13 males comprised 33.3 per cent of the total male participation population, whereas the 60 females comprised 54.1 per cent of the total female participant population.

Table LXXX presents the sexual distribution of staff members involved in the evacuation actions relative to the number of patients evacuated. The most frequently reported range of patients evacuated for both females and males was one to five patients. No males were involved in the evacuation of more than twenty patients, whereas five females were reported to have evacuated over twenty patients. The statistical significance of the sexual differences is

TABLE LXXIX
 DISTRIBUTION OF PARTICIPANT POPULATION RELATIVE TO PATIENT
 EVACUATION DISTANCE AND PATIENT EVACUATION TIME

Evacuation Time (Min.)	Evacuation Distance (Feet)					Total	Per Cent of Participant Population
	1-15	16-25	26-45	46-99	100+		
1.0	3	4		1	1	9	12.2
2.0		4	4	5	3	16	21.7
3.0		2		8	7	17	23.0
4.0			2	5	3	10	13.5
5.0				2	1	3	4.1
6.0					2	2	2.7
7.0				1	1	2	2.7
9.0				2	1	3	4.1
10.0				3	2	5	6.8
12.0		1				1	1.3
15.0					2	2	2.7
18.0					1	1	1.3
30.0					1	1	1.3
40.0					1	1	1.3
Not Reported				1		1	1.3
N = 14	3	11	6	28	26	74	100.0
Per Cent Of Participant Population	4.1	14.9	8.1	37.8	35.1	100.0	
M = 5.21 SE _M = 0.73	SD = 6.20 SE _{SD} = 0.52	M = 75.92 SE _m = 5.74	SD = 49.38 SE _{SD} = 4.08				

TABLE LXXX

SEXUAL DISTRIBUTION OF PARTICIPANT
POPULATION RELATIVE TO NUMBER OF PATIENTS
EVACUATED

Number Evacuated	Female Participants	%	Male Participants	%	Total	Per Cent
1 - 5	35	59.3	6	50.0	41	57.7
6 - 10	12	20.3	2	16.7	14	19.7
11 - 20	7	11.9	4	33.3	11	15.5
> 20	5	8.5	0	0.0	5	7.1
N = 4	59	100.0	12	100.0	71	100.0
Per Cent of Participant Population	39.3		8.0		47.3	

presented in Table LXXXA. As is evident in this table, none of these differences were determined to be statistically significant with the differences ranging from 3.6 to 21.4 per cent.

The sexual distribution relative to the evacuation time is presented in Table LXXXI. The time range from one to five minutes was the most frequently observed range for both males and females. However, the time range of over 10 minutes was the only range for which the differences were analyzed as being statistically significant, as indicated in Table LXXXIA. The males were dominant in this time range with the difference being significant at the 1 per cent level of confidence. The range of differences for the evacuation times relative to the sexual distribution was 10.6 to 27.5 per cent.

The sexual distribution of the method of evacuation utilized is presented in Table LXXXII. A combination of methods was observed as being the most frequently utilized method by both males and females. As indicated in this table, the evacuation method of, "Assist Walk" was the second most frequently utilized method which generally consisted of leading ambulatory patients. As noted in Table LXXXIIA, none of the differences in the evacuation methods relative to the sexual distribution were observed to be significant. The range of the differences was 0.6 to 13.5 per cent.

2. Staff Age

The distribution of staff age relative to the number of patients evacuated is presented in Table LXXXIII. The age range most commonly engaged in evacuation activities was the 28 to 37 year old range, comprising 38.7 per cent of the evacuation participant subpopulation. The age range of the total participant population was presented previously in Table XXXIX.

TABLE LXXXA

SIGNIFICANCE OF DIFFERENCES IN SEXUAL
DISTRIBUTION RELATIVE TO NUMBER OF PATIENTS
EVACUATED

Number Evacuated	Female Per Cent	Male Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
1 - 5	59.3	50.0	9.3	15.63	0.59
6 - 10	20.3	16.7	3.6	12.59	0.29
11 - 20	11.9	33.3	21.4	11.46	1.87
> 20	8.5	0.0	8.5	8.13	1.05
N = 4	59	12			

TABLE LXXXI

SEXUAL DISTRIBUTION OF PARTICIPANT POPULATION
RELATIVE TO TIME REQUIRED FOR EVACUATION

Time Minutes	Female Participants	%	Male Participants	%	Total	Per Cent
1 - 5	47	78.4	8	61.5	55	75.3
6 - 10	11	18.3	1	7.7	12	16.4
> 10	2	3.3	4	30.8	6	8.3
N = 3	60	100.0	13	100.0	73	100.0
Per Cent of Participant Population	40.0		8.7		48.7	

TABLE LXXXIA

SIGNIFICANCE OF DIFFERENCES IN SEXUAL
DISTRIBUTION RELATIVE TO TIME REQUIRED FOR
EVACUATION

Time Minutes	Female Per Cent	Male Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
1 - 5	78.4	61.5	16.9	13.19	1.28
6 - 10	18.3	7.7	10.6	11.33	0.94
> 10	3.3	30.8	27.5	8.44	<u>3.26**</u>
N = 3	60	13			

**Critical Ratio Significant at or above the 1 per cent level of confidence.

TABLE LXXXII

SEXUAL DISTRIBUTION RELATIVE TO METHOD OF EVACUATION

Method	Female		Male		Total	Per Cent
	Participants	%	Participants	%		
Carry	2	3.2	2	16.7	4	5.4
Drag	3	4.8	0	0.0	3	4.1
Assist Walk	19	30.6	3	25.0	22	29.7
Wheelchair	10	16.1	2	16.7	12	16.2
Bed	8	12.9	1	8.3	9	12.2
Combination	20	32.3	4	33.3	24	32.4
N = 6	62	100.0	12	100.0	74	100.0
Per Cent	41.3		8.0		49.3	

TABLE LXXXIIA

SIGNIFICANCE OF DIFFERENCES OF SEXUAL
DISTRIBUTION RELATIVE TO METHOD OF EVACUATION

Method	Female Per Cent	Male Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Carry	3.2	16.7	13.5	7.13	1.89
Drag	4.8	0.0	4.8	6.25	0.77
Assist Walk	30.6	25.0	5.6	14.41	0.39
Wheelchair	16.1	16.7	0.6	11.62	0.05
Bed	12.9	8.3	4.6	10.32	0.45
Combination	32.3	33.3	1.0	14.76	0.07
N = 6	62	12			

TABLE LXXXIII

NUMBER OF PATIENTS EVACUATED AS RELATED TO STAFF AGE

Age (Years)	1 - 5	6 - 10	> 10	Total	Per Cent
18 - 27	11	6	3	20	32.3
28 - 37	14	3	7	24	38.7
38 - 47	6	3	3	12	19.4
48 - 57	3	1	0	4	6.5
58 - 67	1	0	1	2	3.2
N = 5	35	13	14	62	100.0
Per Cent	56.5	21.0	22.5	100.0	

C. Previous Training

The impact of previous training on the evacuation behavior of the staff members involved in the participant population is examined in this section. The attendance or absence of the participants in fire related training sessions was previously described in Section IV along with the time elapsed since the training was received. It should be remembered that 139 of the participants or 9.27 per cent of the participant population had received previous training.

The participation of the participant population in evacuation activities relative to previous training is presented in Table LXXXIV. A total of 74 participants were involved in evacuating patients, comprising half of the participants for whom the activity of evacuation and receipt of training was known. Considering only the participants with previous training, there is apparently little difference in their involvement in evacuating patients. However, for the participants without training, approximately 82 per cent of the participants were involved in evacuation, and 18 per cent were not involved. The significance of the differences in evacuation relative to previous training is examined in Table LXXXIVA. As noted in this table, the difference of 34.4 per cent between the trained and untrained staff is significant at the 5 per cent level of confidence.

Table LXXXIVB presents the involvement in evacuation relative to the time elapsed since the last training course was received by the participants. As indicated in this table, the percentage involvement in evacuation for the range of time over 1 year since the last training approximates the levels observed for the participants who had not received any training as previously presented in Table LXXXIV.

The number of patients evacuated by the individual staff members relative to their previous training of the participants is presented in Table LXXXV. As

TABLE LXXXIV

DISTRIBUTION OF PATIENT EVACUATION BY STAFF MEMBERS
RELATIVE TO PREVIOUS TRAINING

Evacuate Patients	Previous Training Participants	%	No Previous Training Participants	%	Total	Per Cent
Yes	65	47.4	9	81.8	74	50.0
No	72	52.6	2	18.2	74	50.0
N = 2	137	100.0	11	100.0	148	100.0
Per Cent of Participant Population	91.3		7.4		98.7	

TABLE LXXXIVA

SIGNIFICANCE OF DIFFERENCES IN PATIENT EVACUATION
BY STAFF MEMBERS RELATIVE TO PREVIOUS TRAINING

Evacuate Patients	Training Per Cent	No Training Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Yes	47.4	81.8	34.4	15.67	<u>2.20*</u>
No	52.6	18.2	34.4	15.67	<u>2.20*</u>
N = 2	137	11			

*Critical ratios significant at or above the 5 per cent level of confidence.

TABLE LXXXIVB

DISTRIBUTION OF PATIENT EVACUATION BY STAFF MEMBERS
RELATIVE TO MOST RECENT TRAINING

Evacuate Patients	0-.2 Years		.3-1.0 Years		>1.0 Years		Total	Per Cent
	Participants	%	Participants	%	Participants	%		
Yes	50	48.1	10	38.5	5	71.4	65	47.4
No	54	51.9	16	61.5	2	28.6	72	52.6
N = 2	104	100.0	26	100.0	7	100.0	137	100.0
Per Cent of Participant Population		69.3		17.3		4.7		91.3

TABLE LXXXV

DISTRIBUTION OF NUMBER OF PATIENTS EVACUATED BY STAFF MEMBERS
RELATIVE TO PREVIOUS TRAINING

Number Evacuated	Previous Training		No Previous Training		Total	Per Cent
	Participants	%	Participants	%		
1 - 5	37	59.7	4	44.4	41	57.8
6 - 10	13	21.0	1	11.2	14	19.7
> 10	12	19.3	4	44.4	16	22.5
N = 3	62	100.0	9	100.0	71	100.0
Per Cent of Participant Population		41.3		6.0		47.3

noted in this table, for the nine participants without training, there was a tendency to be involved in either the evacuation of a small or large number of patients. The range of patients evacuated most frequently by trained participants was 1 to 5 patients, which was also the most frequent range for all the participants. The computation of the statistical significance of the differences in the number of patients evacuated for trained and untrained participants yielded the result of none of the differences being significant as presented in Table LXXXVA. The range of differences was 9.8 to 25.1 per cent with the trained participants being dominate in all ranges except for the range involving the evacuation of over 10 patients. The number of patients evacuated was also examined relative to the time elapsed since the receipt of the last training session as presented in Table LXXXVB. Considering the fourteen participants whose attendance at a training session was at least 0.3 to 1 years prior to the fire incident, these participants were engaged in evacuating either under 5 or over 10 patients. This distribution is similar to that presented for the number of patients evacuated by participants without any training, as previously presented in Table LXXXV.

The distribution of the evacuation method utilized as a function of the training of the participants is presented in Table LXXXVI. As noted in this table, the evacuation method of "Assist Walk" and a combination of two methods were the most frequently used evacuation methods utilized by the participants. The use of these two most popular methods by the untrained participants is especially apparent, while a variety of methods were utilized by the trained participants. The statistical significance of the differences in method of evacuation for training is presented in Table LXXXVIA. The difference in the combination of two evacuation methods was determined to be significant at the 1 per cent level of confidence. As noted in this table, 66.7 per cent of the untrained participants utilized this technique compared to only 21.4 per cent

TABLE LXXXVA

SIGNIFICANCE OF DIFFERENCES OF NUMBER OF PATIENTS EVACUATED BY
STAFF MEMBERS RELATIVE TO PREVIOUS TRAINING

Number Evacuated	Training Per Cent	No Training Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
1 - 5	59.7	44.4	15.3	17.6	0.87
6 - 10	21.0	11.2	9.8	14.2	0.69
> 10	19.3	44.4	25.1	14.9	1.69
N = 3	62	9			

TABLE LXXXVB

DISTRIBUTION OF NUMBER OF PATIENTS EVACUATED BY STAFF
MEMBERS RELATIVE TO MOST RECENT TRAINING

Number Evacuated	0 - .2 Years		.3 - 1.0 Years		>1.0 Years		Total	Per Cent
	Participants	%	Participants	%	Participants	%		
1 - 5	28	54.9	7	70.0	3	75.0	38	58.5
6 - 10	12	23.5	0	0.0	0	0	12	18.5
> 10	11	21.6	3	30.0	1	25.0	15	23.0
N = 3	51	100.0	10	100.0	4	100.0	65	100.0
Per Cent of Participant Population		34.0		6.6		2.7		43.3

TABLE LXXXVI

DISTRIBUTION OF METHOD OF EVACUATION BY STAFF MEMBERS
RELATIVE TO PREVIOUS TRAINING

Method	Previous Training		No Previous Training		Total	Per Cent
	Parti- cipants	%	Parti- cipants	%		
Carry	4	6.2	0	0.0	4	5.4
Drag	3	4.6	0	0.0	3	4.0
Assist Walk	19	29.2	3	33.3	22	29.7
Wheelchair	12	18.5	0	0.0	12	16.2
Bed	9	13.9	0	0.0	9	12.1
Combination - Two Methods	14	21.4	6	66.7	20	27.2
Combination - Over Two Methods	4	6.2	0	0.0	4	5.4
N = 7	65	100.0	9	100.0	74	100.0
Per Cent Of Participant Population	43.3		6.0		49.3	

TABLE LXXXVIA

SIGNIFICANCE OF DIFFERENCES IN METHOD
OF EVACUATION BY STAFF MEMBERS RELATIVE
TO PREVIOUS TRAINING

Method	Training Per Cent	No Training Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Carry	6.2	0.0	6.2	8.04	0.77
Drag	4.6	0.0	4.6	6.97	0.66
Assist Walk	29.2	33.3	4.1	16.25	0.25
Wheelchair	18.5	0.0	18.5	13.10	1.41
Bed	13.9	0.0	13.9	11.60	1.20
Combination-Two Methods	21.4	66.7	45.3	15.83	<u>2.86**</u>
Combination-Over Two Methods	6.2	0.0	6.2	8.04	0.77
N = 7	65	9			

** Critical ratio significant at or above the 1 per cent level of confidence

of the trained participants. The 45.3 per cent difference was the maximum difference determined with the minimum difference being 4.6 per cent. An analysis of the time period since the participants were last trained is presented in Table LXXXVIB. The distribution of evacuation methods utilized by the trained participants is apparently independent of the time since last being trained.

D. Fire Experience

The evacuation of patients by staff members may be affected by the previous experience of the staff members. The assessment of successful or unsuccessful actions in previous fire incidents may impact on the behavior of the staff members, as analyzed in Sections V and VI of this report.

The evacuation of patients by the participants relative to previous fire experience is presented in Table LXXXVII. Information was analyzed on the evacuation behavior and fire experience for 145 participants, approximately 96.6 per cent of the participant population. As noted in this table, the number of participants with fire experience who evacuated patients was similar to the number of participants without fire experience who evacuated patients. Thus, as would be expected, no significant differences were determined for the evacuation of patients by the participants with and without fire experience, as presented in Table LXXXVIIA.

The number of patients evacuated for the participants with and without fire experience is presented in Table LXXXVIII. Participants with fire experience most frequently evacuated over 10 patients. However, the participants without fire experience tended to evacuate less than five patients. As is evident in this table, the number of participants involved in the evacuation of patients decreases as the number of patients increases as would be expected. The statistical significance of the number of patients evacuated

TABLE LXXXVIB

DISTRIBUTION OF METHOD OF EVACUATION BY STAFF MEMBERS
RELATIVE TO MOST RECENT TRAINING

Method	0-.2 Years		.3-1.0 Years		>1.0 Years		Total	Per Cent
	Parti- cipant	%	Parti- cipant	%	Parti- cipant	%		
Carry	2	4.0	2	20.0	0	0.0	4	6.2
Drag	2	4.0	1	10.0	0	0.0	3	4.6
Assist Walk	16	32.0	2	20.0	1	20.0	19	29.2
Wheelchair	9	18.0	1	10.0	2	40.0	12	18.5
Bed	6	12.0	3	30.0	0	0.0	9	13.8
Combination - Two Methods	11	22.0	1	10.0	2	40.0	14	21.5
Combination - Over Two Methods	4	8.0	0	0.0	0	0.0	4	5.2
N = 7	50	100.0	10	100.0	5	100.0	65	100.0
Per Cent Of Participant Population	33.3		6.7		3.3		43.3	

TABLE LXXXVII

DISTRIBUTION OF PATIENT EVACUATION BY STAFF MEMBERS
RELATIVE TO PREVIOUS FIRE EXPERIENCE

Evacuate Patients	Fire Experience Participants	%	No Fire Experience Participants	%	Total	Per Cent
Yes	32	45.1	39	52.7	71	49.0
No	39	54.9	35	47.3	74	51.0
N = 2	71	100.0	74	100.0	145	100.0
Per Cent of Participant Population		47.3		49.3		96.6

TABLE LXXXVIIA

SIGNIFICANCE OF DIFFERENCES IN PATIENT EVACUATION
BY STAFF MEMBERS RELATIVE TO FIRE EXPERIENCE

Evacuate Patients	Fire Experience Per Cent	No Fire Experience Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Yes	45.1	52.7	7.6	8.30	0.92
No	54.9	47.3	7.6	8.30	0.92
N = 2	71	74			

TABLE LXXXVIII

DISTRIBUTION OF NUMBER OF PATIENTS EVACUATED BY STAFF MEMBERS
RELATIVE TO PREVIOUS FIRE EXPERIENCE

Number Evacuated	Fire Experience		No Fire Experience		Total	Per Cent
	Participants	%	Participants	%		
1 - 5	12	38.7	26	70.3	38	55.9
6 - 10	6	19.4	8	21.6	14	20.6
> 10	13	41.9	3	8.1	16	23.5
N = 3	31	100.0	37	100.0	68	100.0
Per Cent of Participant Population		20.6		24.7	45.3	

relative to the previous fire experience of the participants is presented in Table LXXXVIII A. As indicated in this table the differences in the evacuation of less than 5 patients and more than 10 patients were observed to be significant at the 1 per cent level of confidence.

Thus, 70.3 per cent of the participants without fire experience were involved in evacuating less than five patients as compared to only 38.7 per cent of the participants with previous fire experience. However, for the range of over 10 patients evacuated, 41.9 per cent of the participants with fire experience were involved as contrasted with only 8.1 per cent of the participants without fire experience. The range of differences was a minimum of 2.2 per cent for the range of 6 to 10 patients evacuated and a maximum of 33.8 per cent for the range of over 10 patients evacuated.

The distribution of the method of evacuation utilized by the participants relative to previous fire experience is presented in Table LXXXIX. The evacuation methods utilized by the no previous fire experience subpopulation were fairly evenly distributed. However for the subpopulation of participants with previous fire experience, the evacuation method of, "Assist Walk" and the combination of two methods were utilized more frequently than the other evacuation methods. The statistical significance of the differences in the methods utilized to evacuate patients by the staff members is presented in Table LXXXIX A. No significant differences were identified for the range of differences from 2.0 to 17.5 per cent.

TABLE LXXXVIII

SIGNIFICANCE OF DIFFERENCES OF NUMBER OF PATIENTS EVACUATED
BY STAFF MEMBERS RELATIVE TO PREVIOUS FIRE EXPERIENCE

Number Evacuated	Fire Experience Per Cent	No Fire Experience Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
1 - 5	38.7	70.3	31.6	12.1	<u>2.61**</u>
6 - 10	19.4	21.6	2.2	9.8	0.22
> 10	41.9	8.1	33.8	10.3	<u>3.27**</u>
N = 3	31	37			

** Critical ratios significant at or above the 1 per cent level of confidence

TABLE LXXXIX

DISTRIBUTION OF METHOD OF EVACUATION BY STAFF MEMBERS
RELATIVE TO PREVIOUS FIRE EXPERIENCE

Method	Fire Experience		No Fire Experience		Total	Per Cent
	Participant	%	Participant	%		
Carry	0	0.0	4	10.3	4	5.7
Drag	1	3.1	2	5.1	3	4.2
Assist Walk	13	40.6	9	23.1	22	30.9
Wheelchair	3	9.4	9	23.1	12	16.9
Bed	3	9.4	6	15.4	9	12.7
Combination - Two Methods	10	31.3	7	17.9	17	23.9
Combination - Over Two Methods	2	6.2	2	5.1	4	5.7
N = 7	32	100.0	39	100.0	71	100.0
Per Cent Of Participant Population	21.3		26.0		47.3	

TABLE LXXXIXA

SIGNIFICANCE OF DIFFERENCES IN METHOD OF
EVACUATION BY STAFF MEMBERS RELATIVE TO
PREVIOUS FIRE EXPERIENCE

Method	Fire Experience Per Cent	No Fire Experience Per Cent	$P_1 - P_2$	$SE_{P_1 - P_2}$	C.R.
Carry	0.0	10.3	10.3	5.53	1.86
Drag	3.1	5.1	2.0	4.78	0.42
Assist Walk	40.6	23.1	17.5	11.02	1.59
Wheelchair	9.4	23.1	13.7	8.94	1.53
Bed	9.4	15.4	6.0	7.94	0.76
Combination-Two Method	31.3	17.9	13.4	10.17	1.32
Combination-Over Two Methods	6.2	5.1	1.1	5.53	0.20
N = 7	32	39			

VIII. SUMMARY AND CONCLUSIONS

This section of the report involves a summary of the study procedures with the analysis processes followed by the conclusions formulated from the study data.

A. Summary of The Study

This study involved the interviewing of 150 staff participants by the University of Maryland study team personnel in a private, one to one person situation. The indepth open ended, tape recorded interview was followed with the completion of the structured questionnaire shown in Figure V of this report. The study involved 59 fire incidents in nursing homes, general hospitals, and mental institutes from thirteen jurisdictions, including the cities of Philadelphia, Baltimore and Annapolis. The counties involved in the study population were all located in the State of Maryland and consisted of the following jurisdictions: Allegany, Anne Arundel, Baltimore, Harford, Howard, Montgomery, Prince Georges, Washington, Wicomico, and Cecil counties. The fire incidents included in this study population occurred between August 10, 1977 and June 25, 1980.

The analysis and study of the data from the 150 facility staff participants, the 53 fire department personnel and the 9 patients interviewed provided data relative to the critical variables involved with the buildings, and the fire incident, primarily the determination of the smoke and fire development in the realms. The variables related to the facility provision of detectors and sprinklers, the egress routes and the overall fire protection of the building were evaluated by the National Bureau of Standards-Health and Human Services Fire Safety Evaluation System.(15)

The fire incident parameters examined in the study involved a consideration of the following critical variables: The occurrence of fire incidents by time,

month, the floor involved, the area of fire origin, the ignition factor and the material ignited. In addition, the use of fire extinguishers, the activation of detection or suppression systems, and the extent of smoke spread within the facility.

The staff member participant population parameters were determined relative to the following demographic and empirical variables: The participants sex, age, location in the facility, previous training relative to fire situations, belief in the safety of the building, the means by which the participants became aware of the fire incident and the length of experience by the participant at the facility.

The first, second and third actions of the participants after becoming aware of the fire incident were analyzed and compared relative to differences in the selection and utilization of the first, second, and third actions. The variables of the participants relative to their distance from the fire, their belief in the safety of the building, the number of previous alarms in the building, and extent of smoke spread were all compared with the selection of first actions. The selection and utilization of first actions were also compared relative to the participant's previous fire experience, and their previous training for fire incidents. The first, second, and third actions of the participants were also analyzed relative to any differences in the actions of the participants according to the sexual distribution of the participant population.

The various aspects of the participants movements through the smoke in the fire incidents were analyzed and compared. The first actions of the participants were considered relative to the smoke spread in the fire incident building. The evacuation time and distance of evacuation movement for the total participant population and the participants that moved through smoke were compared.

The evacuation distance relative to the time of occurrence of the evacuation were also compared. The distance of the participants movements through smoke were compared for the participants with and without previous fire experience, the participants with and without previous training, and the sexual distribution of the participants. The number of the participants who were forced to turn back in their movement through the smoke were compared. The actions of the participants were analyzed relative to the fire and smoke conditions at the time of the actions. The visibility distance of the participants was also compared with the movement through smoke and the turned back behavior of the participants.

The evacuation behavior of the participant population was analysed relative to the evacuation methods adopted, the distance patients were moved, and the time involved in evacuation. The previous training, previous fire experience and the sexual classification of the participants was examined relative to their evacuation actions.

B. Limitations of the Study.

As previously indicated on page 5 of this report the study was limited by variables concerned with the selection of the fire incident, the participant population for the study and the study procedures. These limitations are presented again as follows:

1. The study was limited to the geographical area composed of the state of Maryland and one incident in Philadelphia, Pa.
2. The participants of the fire incidents were interviewed in varying time intervals following the fire incident dependent upon the notification of the study personnel and the arrangement of a mutually agreeable time for the facility personnel.

3. The fire incidents selected for inclusion in the study had to be reported to the study personnel, and secondly to be in an occupied building at the time of occurrence of the incident.
4. The incidents selected by the participating jurisdictions occurred between August 10, 1977 and June 25, 1980.
5. The interviews were conducted by study personnel with varying interview experience in the study.
6. The fire incidents were selected for inclusion in the study by two criteria:
 - a. The occurrence of a fire incident involving staff or fire department action in any health care institution.
 - b. The evacuation of more than 200 people due to a fire incident in any structure.

C. Conclusions of The Study

The following conclusions have been developed and formulated from the results of this study as previously presented in this report. These conclusions are concerned with the following study elements: The Participant Population; The Behavioral Actions of the Participant Population; The Effect and Influence of the fire and smoke on the Behavior; and the Evacuation Behavior of the Participant Population.

1. The Participant Population

- a. The most frequent participant from the staff of the facility in the 59 fire incidents was a female, between 26 and 30 years of age, who was a United States citizen. The participant had been employed at the facility four years, had been trained relative to fire safety and believed the building to be safe.

b. The four most frequent means of awareness of the fire incident for the participant population in rank order consisted of hearing the facility alarm bells, being told by other persons, by hearing the announcement on the facility public address system, and by smelling smoke.

c. The only statistically significant differences between the male and female members of the participant population relative to the means of awareness of the fire incident involved the male participants being dominant in the hearing of the alarm bells and the smelling of smoke. The female participants were dominant in being notified by a telephone call and being told by other staff members.

d. The participants located within twenty feet from the fire incident were dominant in becoming aware of the fire incident by the physical indications of the fire incident involving the means of awareness of: "Smelled Smoke", "Saw Smoke", and "Saw Fire". Conversely, the participants located further than twenty feet from the fire had a greater percentage of the participants becoming aware of the fire by the facility alarm system and the facility public address system announcements.

2. The Behavioral Actions of The Participant Population

a. The five most popular first actions of the participant population in rank order were: "Investigated Cues", "Closed Doors", "Rescued Threatened Patients", "Discovered Fire", and "Pulled Manual Fire Alarm". The first actions appeared to be primarily concerned with the detection or discovery of the fire which involved investigative actions, the protection of the patients, and the notification of others.

b. The statistically significant differences in the selection of their first actions by the females in the participant population involved the first action of: "Closed Doors". The male members of the participant population

had a greater percentage of utilization of the first actions of "Got Extinguisher" and "Ventilated". Obviously, both of these first actions are involved with the fire control and suppression activities. It should be noted while the males in the population were involved with the fire control operations as a first action, the females were providing for the protection of the patients by closing doors.

c. The participants with previous training, consisting of 92 per cent of the participant population were dominant with a significant difference from the participants without training in the first action of: "Alerted Other Staff", while the participants without training were dominant with a significant difference in the first action of: "Rescued Threatened Patients".

d. The only significant difference in the first action behavior of the participants with and without previous fire experience involved a greater percentage of the participants without fire experience being involved with the first action of: "Rescued Threatened Patients".

e. The only statistically significant difference in the first actions of the participants who believed the building to be unsafe or safe, consisted of a greater percentage of the participants who believed the building to be unsafe, being involved in the first action of "Investigated Cues". It should be noted, due to the small size of this population involving nine individuals, these persons believing the building to be unsafe were only involved in two additional first actions: "Evacuated Patients" and "Phoned Operator".

f. The five most frequent second actions of the participant population were the following actions in rank order: "Evacuated Patients", "Closed Doors", "Attempted Extinguishment", "Called Fire Department", and "Discovered Fire".

g. There were four statistically significant differences in the participant utilization of second actions as compared with their utilization of the first actions. These significant differences involved the greater frequency

of use of the second actions of "Evacuated Patients", "Called Fire Department", and "Stoodby" with a reduced selection as a second action, of the action of: "Investigated Cues".

h. The statistically significant differences in the second actions of the participant population relative to the sexual classification involved the greater participation by the males in the second actions of: "Attempted Extinguishment", and "Got Extinguisher". Thus, the trend in the first action with the males dominating in the fire fighting type of actions was continued with the second actions, constituting the only significant differences in their second actions between the male and female members of the participant population.

i. The five most popular third actions of the participant population in rank order were as follows: "Evacuated Patients", "Attempted Extinguishment", "Closed Doors", "Called Fire Department", and "Phoned Operator". It should be noticed by the third actions the evacuation of the patients is of primary concern, while the control or confinement of the threat and the alerting of others for more formal assistance is being implemented.

j. There are five statistically significant differences between the first and the third actions of the participant population, with the third actions of: "Evacuated Patients", "Attempted Extinguishment" and "Called Fire Department" being utilized more as third than as first actions. Conversely the actions of "Investigated Cues" and "Discovered Fire" were indicated with a lesser frequency as a third action than as a first action as might be expected.

k. There were only two statistically significant differences between the second and third actions of the participant population. The third action of "Evacuated Patients" was used more than as a second action, while the third action of "Discovered Fire" was used less as a third action by the participant population.

l. The two statistically significant differences in the third actions between the male and female members of the participant population continued the dichotomy of actions indicated in the sexual classification of the first actions. The males were dominant with the third action of "Attempted Extinguishment", while the females were dominant with the third action of "Evacuated Patients".

m. Approximately 36 per cent of the participant population consisting of 55 persons engaged in reentry behavior into the fire zone. When the participant population was considered relative to their sexual classification and previous training there were no significant differences relative to the reentry behavior. However, a greater percentage of the staff participant population without previous fire experience engaged in the reentry behavior than the population with previous fire experience, with this difference being significant at the five per cent level of confidence.

n. The examination of the total of the three actions for the participant population relative to the fire fighting, the alerting and the evacuation behavior indicated the evacuation behavior was most frequent, followed by the fire fighting and the alerting behavior. The significant differences by the sexual classification of the participants indicated the males were dominant with the fire fighting actions and the females with the evacuation actions.

o. The actions of the participant population when examined from the analysis of the sequence of the actions indicated five sequence of actions for the first, second, and third actions which were the most popular in their rank order as follows:

<u>Rank</u>	<u>First action</u>		<u>Second action</u>		<u>Third action</u>
1	Investigate	-	Evacuate	-	Evacuate
2	Investigate	-	Alert	-	Evacuate

3	Investigate	-	Alert	-	Fight Fire
4	Investigate	-	Investigate	-	Evacuate
5	Evacuate	-	Evacuate	-	Evacuate

3. Relationship of Fire and Smoke on the Behavior

The classification of the fire incident, by the fire development as a pre- or postflashover fire being a life threatening fire incident was examined for the participant population relative to their selection of first, second and third actions. The distance of the participant from the fire at the time of becoming aware of the fire incident was also examined. Approximately 58 participants, 39 per cent of the participant population were involved in life threatening fire incidents.

a. The participants involved in a nonthreatening fire incident tended to engage in the fire fighting type of activities, while the participants involved in a life threatening fire incident tended to engage in the evacuation actions and the actions which tend to increase the protection of the patients. The participants involved in a life threatening fire were dominant in the first action of "Closed Doors". In the other two significant differences, the non-threatening fire incident participants were dominant with the first actions of "Attempted Extinguishment" and "Discovered Fire".

b. There were also three significant differences between the participants involved in a life threatening fire and those involved in a nonthreatening fire relative to their selection of second actions. The participants involved in a life threatening fire incident were dominant in the actions of "Evacuated Patients" and "Stood By", while the participants involved in the fire incident classed as nonthreatening were dominant in the second actions of "Pulled Manual Fire Alarm".

c. Relative to the third actions, the participants involved in a life threatening fire were dominant in the third actions of "Evacuated Patients"

and "Attempted Rescue". The participants involved in a nonthreatening fire incident were dominant in their selection of the third action of "Attempted Extinguishment". All of these differences between the participants who were involved in a life threatening fire and those involved in nonthreatening fire were statistically significant at the 1 and 5 per cent levels of confidence.

d. The production of smoke from the fire incident was classified as none or light smoke, and moderate or heavy smoke, when the actions were selected by the participants. When the first actions were analysed according to the participants being exposed to no or only light smoke as opposed to moderate or heavy smoke there were two statistically significant differences. Both of these differences were in first actions dominated by the participants in moderate or heavy smoke and involved the first actions of "Called Operator" and "Rescued Threatened Patients". It should be noted all of the significant differences with all the actions were dominated by the participants exposed to the moderate or heavy smoke conditions.

e. The second and third actions were characterized by only one significant difference in the actions of "Attempt Rescue" with the participants exposed to the moderate or heavy smoke dominant in the selection of this action.

f. The proximity of the participants to the fire at the time they became aware of the fire was analyzed relative to the first, second and third actions. The participants within twenty feet of the fire were dominant with the actions of "Attempted Extinguishment", "Discovered Fire", and "Rescued Threatened Patients" within the total of the three actions. While the participants further than twenty feet from the fire were dominant with the actions of "Closed Doors", "Evacuate Patients", "Called Fire Department" and "Stood By" within all three actions.

g. Relative to the movement through smoke for the participant population, there was movement through smoke by 79 members of the participant population or approximately 53 per cent of the population. There were no significant differences relative to the sexual classification of the participants and the distance moved through the smoke. There were three significant differences in the distances moved through smoke relative to the participants with previous training and those without previous training. The participants with the previous training were dominant in the movement through smoke up to a distance of 10 feet. The participants without training were dominant in the movement through smoke between 31 to 50 feet, and 51 to 100 feet. However, it should be remembered the nontrained population was extremely small consisting of only nine staff members. There was only one statistically significant difference in the movement through smoke for the participants with fire experience, when they were compared to the participants without fire experience. The participants with fire experience dominated in the movement through smoke for the distance from 51 to 100 feet.

4. The Evacuation Behavior of the Participant Population

The general effective, efficient and prompt evacuation of patients in the fire incidents of this study appears to be the result of the training of the staff participant population and the professional relationship which exists between the staff and the patients in health care facilities.

a. A total of 1,213 patients were evacuated in 40 of the 59 fire incidents by staff and fire department personnel. Thus, the average number of patients evacuated was 30 patients. The smallest evacuation involved one patient being evacuated in six fire incidents, with 242 patients being evacuated in one fire incident for the largest patient evacuation.

b. The time for the patient evacuations ranged from one to forty minutes, with the average mean evacuation time being 5.21 minutes for this fire incident population. Approximately 70 per cent of the evacuations in this study were completed within 5 minutes.

c. The distance of the evacuation movement appeared to be determined by the area perceived to be endanger by the fire incident, the extent of the smoke spread and the distance of the egress path from the fire zone. The mean average evacuation distance was approximately 75 feet, and the most frequently observed evacuation distance was 46 to 99 feet, as indicated by eight staff members. The age range of the staff members most frequently involved in the patient evacuation activities ranged from 28 to 37 years.

d. A greater percentage of the participant population without training were in the evacuation activities than the participants with training, with this difference statistically significant. The only significant differences between the staff members with previous fire experience and those without previous fire experience and their evacuation actions, were indicated by the participants without fire experience evacuating five or fewer patients, and the participants with fire experience evacuating greater than ten patients.

e. As would be expected from the frequency of the evacuation activities reported in the actions of the participant population, 74 members of the population, consisting of 49 per cent of the study population were involved in the evacuation of patients. The staff apparently evacuated patients through smoke with no significant reduction in the number of patients evacuated or the evacuation time.

f. The evacuation of patients increased in frequency from the first to the third action of the participant population, becoming the most frequent activity in the third action. The patient characteristics do not appear to

affect the evacuation performance. Apparently the patient characteristics, age and the extent of smoke spread are the three major variables which determine the evacuation method utilized.

g. The evacuations conducted with both staff members and fire department personnel in the life threatening fire incidents, indicated the staff personnel prepared the patients for movement, indicating the evacuation method and the fire department personnel conducted the evacuation in the majority of these incidents.

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10. SUPPLEMENTARY NOTES Sponsored by the HHS/NBS Life/Fire Safety Program <input type="checkbox"/> Document describes a computer program; SF-185, FIPS Software Summary, is attached.			
11. ABSTRACT <i>(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here)</i> This study involved the detailed investigation of 59 fire incidents in Health Care Facilities located in the State of Maryland, with one facility in Philadelphia. A total of 150 staff participants, 9 patients and 53 fire department personnel were interviewed relative to the fire and smoke development during the fire incident, and the human behavior responses of the participants during the fire incident. The analysis and study of the fire incident and interview data enabled the examination of the parameters of the fire incident including: area of fire origin, ignition and fuel characteristics, and the fire protection design features of the building. The human behavior variables of the fire incidents relative to the means of becoming aware of the fire incident, and the first three actions of the participants were compared to the variables of the fire and smoke development, previous training and fire experience of the participants, and with their belief in the safety of the building. Statistical analyses were performed indicating the relationships among the variables. The evacuation behavior was studied with the sequences of the actions adopted by the personnel.			
12. KEY WORDS <i>(Six to twelve entries; alphabetical order; capitalize only proper names; and separate key words by semicolons)</i> Doors; evacuation; fire alarm systems; fire departments; fire extinguishers; fire investigations; hospitals; nursing homes; nursing staff; smoke; smoke detectors; sprinkler systems.			
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